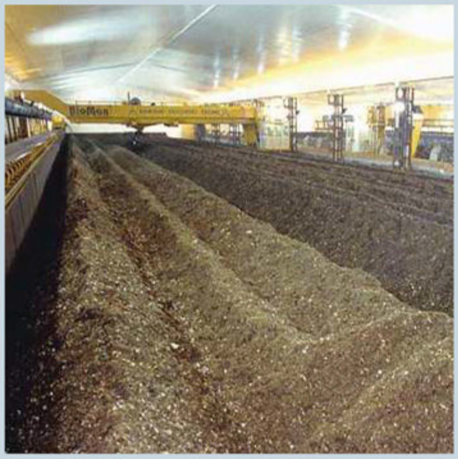
New York City Department of Sanitation
John J. Doherty, Commissioner

New York City MSW Composting Report

Summary of Research Project and Conceptual Pilot Facility Design



Prepared by
Bureau of Waste Prevention, Reuse and Recycling
Robert Lange, Director
January 2004

Director's Note

The *New York City MSW Composting Report: Summary of Research Project and Conceptual Pilot Facility Design* follows a series of research reports, issued by the NYC Department of Sanitation's Bureau of Waste Prevention, Reuse and Recycling (BWPRR), whose collective goal is to enhance and inform the public dialogue surrounding the management of New York City's waste stream.

Because of the varying and frequently disparate viewpoints concerning the best way for New York City to manage its waste, it is important that all those involved in the debate—from policy makers to concerned citizens—have access to well-researched and documented information on the subject. Presenting such information represents one of the primary goals behind BWPRR's research efforts over the last few years (see Table 1).

Outside of recycling and composting operations, New York City is now entirely reliant on landfills and waste-to-energy facilities beyond its borders to dispose of solid waste. Because of the high cost of export, the City needs to examine cost-effective, yet proven, alternative methods for waste disposal. BWPRR's latest report, *New York City MSW Composting Report,* builds upon the *Mixed Waste Processing* report (see Table 1) by exploring how mixed-waste processing and composting together—using technology specifically geared towards the recovery of recyclable and degradable material—can potentially be incorporated into existing City waste-management and recycling strategies. The report is based upon extensive research that explores the state of municipal solid waste (MSW) composting technology, examines the quality of compost produced from this technology, and presents a theoretical proposal for how such technology can be further tested within New York City.

As the following pages will describe, the technology presents some promising opportunities because it can exist alongside existing recycling operations, take advantage of certain collection efficiencies, and recover recyclables discarded with trash. But most importantly, this technology can recover nearly all of the degradable material, which composes over 50 percent of the residential waste stream, and turn it into a usable end product.

Of course, key questions remain regarding the feasibility of employing such technology within the context of New York City. Will it be possible to site such an MSW-composting facility (even a pilot test facility) within the City's borders, given the public's concerns about living near solid-waste operations? If the facility is located outside of the City, will it still be possible to keep transportation costs to and from such a facility low? What is the long-term marketability of the final compost produced from this process, and most important of all, what will the actual real-world costs per ton be to operate this waste-management system?

While it does not provide all the answers, I hope that this report will further the public discussion regarding waste-management alternatives for New York City by presenting BWPRR's latest research efforts.

Robert Lange, Director
DSNY Bureau of Waste Prevention, Reuse and Recycling

Table 1

Summary of Previously Issued Reports by the DSNY Bureau of Waste Prevention, Reuse and Recycling

All of BWPRR's reports are available on the DSNY website at the following location: http://www.nyc.gov/html/dos/html/recywprpts.html.

Backyard Composting in New York City: A Pilot Test Evaluation (issued in June 1999) presents the results of a yearlong Backyard Composting Pilot Program. This program involved working extensively with New York City's Botanical Gardens to implement backyard composting in four test neighborhoods and evaluating the resulting receptivity, participation rates, and waste-composition impacts. The report showed that while backyard composting contributes to greater environmental and recycling awareness, it could not be counted on as a major waste-minimization strategy for the City.

Mixed Waste Processing in New York City: A Pilot Test Evaluation (released in October 1999) describes BWPRR's pilot program to measure the effectiveness of mixed-waste processing in recovering recyclables from collection districts with low recycling diversion rates. Using an economic model with a range of scenarios, the report concludes that under certain co-collection scenarios (recyclables collected with trash), mixed-waste processing can lead to cost savings because it reduces the number of overall collections.

Collectively, **Recycling: What Do New Yorkers Think? Five Years of Market Research** and **NYC Recycles: More Than a Decade of Outreach Activities by the NYC Department of Sanitation** (both issued in the fall of 1999) summarize the extensive survey and focus group research conducted to measure New Yorkers receptivity towards, and the effectiveness of, BWPRR's public education efforts in the areas of recycling, waste prevention, and composting.

New York City Recycling in Context: A Comprehensive Analysis of Recycling in Major U.S. Cities (issued in August 2001) explains how various cities calculate recycling diversion rates in order to better understand and situate NYC's achievement of a twenty percent residential recycling rate (in the year 2000) within a national context.

Composting in New York City: A Complete Program History (issued in August 2001) summarizes BWPRR's efforts through a number of pilot and ongoing programs to recover the degradable fraction of the residential and institutional waste stream.

Acknowledgments

The Department of Sanitation Bureau of Waste Prevention, Reuse and Recycling would like to acknowledge the contributions of the following individuals and groups, who helped to bring this project and report to fruition.

First and foremost is Venetia Lannon (former BWPRR Deputy Director, Composting) whose idea it was to pursue this project and carefully oversaw every aspect from beginning to end. Marni Aaron (BWPRR Deputy Director, Public Education) worked closely with Venetia over the past year to edit the report in order to make it more accessible to the general public.

Others who contributed to the project include Robert LaValva (former BWPRR Deputy Director, Composting); Thomas Outerbridge and Paul Turci of City Green, Inc.; Dr. William Brinton and Eric Evans of Woods End Research Laboratory, Inc.; Robert Spencer, General Manager, and the staff of the Bedminster Marlborough, LLC Facility (now owned and operated by WeCare Environmental, LLC); Hugh Ettinger of Hugh Ettinger Associates, Ltd; Mack Rugg of Camp, Dresser and McKee, Inc.; R. Stephen Lynch of R.S. Lynch and Company; and Dr. Sally Rowland of the New York State Department of Environmental Conservation.

The management and operating staff of the four MSW-composting facilities surveyed for this report were very supportive in providing information and access to their plants for purposes of evaluation. These included: Waste Options Atlantic, LLC; Groupe Conporec, Inc.; TransAlta; and the City of Rapid City, Office of Solid Waste Operations. The City of Marlborough, Massachusetts and Waste Options provided further services in dedicating a portion of the Marlborough Facility for processing New York City waste for the duration of the Composting Trials.

Graphic design by Anne Garland; all illustrations by Imario Susilo.

Partial funding for the commercial-waste portion of this project was provided by the Environmental Services Unit of Empire State Development.

Abbreviations and Definitions

active composting	The intensive phase of managed, aerobic decomposition of organic materials, where the addition of oxygen and moisture (if necessary) are maximized.
aeration floor, air floor	Location in MSW-composting facility where material continues to actively compost after it is discharged from the digester drum(s).
aerobic/ anaerobic	In the presence of oxygen/ Without the presence of oxygen
air-classification, air classifier	Process or machinery designed to separate particulate material according to its aerodynamic properties; typically used in the solid-waste materials-recovery field to separate out plastic from other heavier items.
ANOVA	Acronym for **AN**alysis **O**f **VA**riance, a statistical method for testing the significance of differences observed at one or more levels of comparison, by segregating the variation according to explained and unexplained factors.
biofilter	A blended ratio of organic materials constructed over a series of perforated pipes through which process air is pumped and distributed. Biofilters retain air in this media for a specified time to ensure the biological degradation (or "scrubbing") of odorous compounds.
biosolids	Treated sewage sludge that has been dewatered to increase solidity, making for easier handling and transport.
bulking agent	Coarse material (such as wood chips) added to compost piles to provide porosity, and thereby air, which aids the aerobic decomposition process.
capture rate	The percent of material set out for recycling, out of the total quantity of recyclable material believed to be present in the waste stream.
City	New York City, also NYC
Class I compost Class II compost	Designation assigned by the DEC (prior to March 2003) to differentiate grades of compost, based on its ability to meet regulated, quality standards. Class I compost had less restricted end uses than Class II compost.
CN ratio	Carbon to Nitrogen ratio; a common indicator of compost maturity.

composting drum, digester, bioreactor	The large, rotary, kiln-shaped vessel in which the initial phase of MSW composting occurs.
Community District/ Sanitation District	One of the 59 administrative districts of NYC whose Boards advise Borough Presidents and City agencies on planning and services. Sanitation Districts, designated by the NYC Department of Sanitation for operational/administrative purposes are coterminous with community districts.
curing	The process whereby compost is aged and matured to form a stable end product.
DEC	New York State Department of Environmental Conservation
DEP	New York City Department of Environmental Protection
dewatered	The processes used by waste-water treatment plants to reduce the amount of water in sewage sludge. These include centrifuge, pressing, etc.
diversion rate	The percentage of the total waste stream collected for recycling as measured by dividing the weight of collected recyclables by the weight of collected waste, plus recyclables.
DSNY, the Department	New York City Department of Sanitation
FEL	Front-end loader
film plastic	Any type of plastic in sheet form, generally used for containers and packaging, such as shrink wrap and household garbage bags.
fines	Very small particles in a mixture of various sizes.
front-end residue	Items that are removed for disposal before entering the composting phase of a MSW-composting facility.
HDPE	High Density Polyethylene is plastic resin (#2) commonly used in bottles and containers.
ICI waste	Industrial, commercial, and institutional waste.
immature compost	Partially degraded organic material, which has not fully undergone the complex chemical and physical process of decomposition.
inerts	Very small pieces of non-degradable material, such as glass and plastic.

LDPE	Low Density Polyethylene is the plastic resin (#4) used primarily to make film for trash bags, food packaging, shrink films, and construction/agricultural films.
materials recovery	The process whereby recyclable materials are separated from non-recyclable items in the waste stream. Recyclable items are generally sorted into distinct categories to facilitate their input into subsequent manufacturing processes.
mpn	Most probable number in a laboratory sample; standard unit of measurement for pathogen analysis.
MRC	Materials-recovery and composting facility
MRF	Materials-recovery facility
MSW	Municipal solid waste
New York City waste	In this report, refers to the waste stream collected by the New York City Department of Sanitation. This stream is generated by residents and institutions (public universities, City offices, etc.), but does not include waste generated by businesses. The commercial waste stream in NYC is handled by private carters.
overs	Material greater in size than a given screen setting, thereby causing it to pass over the screen.
PET	Polyethylene terephthalate is a plastic resin (#1) commonly used in bottles and containers.
ppm	Parts per million
process air	In MSW composting refers to all air from the composting process that will require odor-control filtration before being released outside of the facility.
recovery rate	The percent of material actually recovered for beneficial, secondary use by the systems in place to accomplish this.
sort line	In a MRF, refers to the area(s) where materials are removed either manually or mechanically as they pass by on a conveyor.
source-separated	Term used to describe municipal, “curbside” recycling programs, where the responsibility to segregate designated items in the waste stream lies with the generator.

surge pile	Stock pile
TCLP	Toxicity Characteristic Leaching Procedure is a laboratory procedure that simulates conditions in a landfill, whereby weak acids are washed over a given material to determine if any heavy metals leach (or seep) out.
tip fee	The per-ton price charged by a solid-waste–management facility (MRF, transfer station, landfill, incinerator, etc.) to receive and process material.
tip floor	Receiving area of any solid-waste–management facility where incoming trucks tip their loads.
tpd	Tons per day
trommel screen	Rotary, kiln-shaped screen that can be equipped with different sized openings (or settings) to segregate material by size.
tub grinder	Heavy-duty piece of equipment used to shred bulk wood waste.
unders	Material smaller in size than a given screen setting, thereby causing it to pass under the screen.
VOA	Volatile Organic Acids when present in compost indicate partial anaerobic fermentation, and are largely responsible for odors, as well as toxicity to plants.
wet tons	Standard unit of measure for biosolids that represents what the material actually weighs inclusive of water, as opposed to dry tons, which is what the material would weigh exclusive of water.
windrows	A row heaped up by, or as if by the wind. Refers to the elongated piles of compost formed to facilitate turning and aeration.
WPCP	Water Pollution Control Plants treat municipal waste water before discharge into the environment.

(This page intentionally left blank)

INTRODUCTION
GOAL AND SCOPE OF THE PROJECT

This report describes a project initiated by the Bureau of Waste Prevention, Reuse and Recycling to determine whether or not municipal solid-waste (MSW) composting merits further, serious investigation by the New York City Department of Sanitation (DSNY, or the Department) in its search for increased recycling rates and decreased dependence on waste export. The simple answer to this question is, yes, further investigation is warranted.

To accomplish this goal, the project had the following objectives:

- Compost samples of municipal solid waste generated in New York City (the City).[1]
- Determine the quality of the compost produced from these samples, as well as the recycling recovery rate achieved by the process.
- Assess the general performance of other, operational MSW-composting facilities in terms of compost quality, odor control, process efficiency, and other factors that might affect potential application of this technology to the City.
- Develop an estimated cost-per-ton with which to compare MSW composting to current export and disposal options.

In order to meet these objectives, the project involved the following four tasks:

- Sending samples of New York City waste (50 tons per day for five days) to a commercial-scale, MSW-composting facility, located in Marlborough, Massachusetts (Marlborough) and conducting Composting Trials.
- Sorting and characterizing representative samples of the New York City waste used in the Composting Trials into fractional components in order to determine an overall process recovery rate.
- Surveying other commercial-scale, MSW-composting facilities operating in North America.
- Conducting extensive laboratory testing of the material throughout the entire MSW-composting process to determine the quality of the resulting compost. This included samples from both the New York City Composting Trials at Marlborough, as well as from the surveyed MSW-composting facilities.
- Developing a scenario for a theoretical pilot facility in New York City, in order to conduct a full-scale financial analysis, and calculate an estimated per-ton processing cost.

MSW Composting: The Basic Concept and a Brief History

The principal behind MSW composting is to direct the entire, mixed-solid-waste stream to a centralized, enclosed, odor-controlled facility, in order to recover (compost) the *degradable* fraction. The *non-degradable* fraction of the waste stream is directed for recycling, or disposal as garbage, after being separated out via manual sort lines and/or mechanized screens and other sorting processes. (It should be noted that MSW composting can, and often does, exist alongside

Photo 1: Aerial view of the Edmonton Facility
The newest and largest MSW-composting facility in North America, located in Alberta, Canada, began operating in 2000.

traditional curbside recycling programs, which require residents to separate out designated recyclable materials from the waste stream before setting materials at the curb for collection.)

The MSW-composting technologies commonly used in the United States were developed in Europe more than 30 years ago. In the past decade, several European countries have shifted their focus from mixed MSW to source-separated organics, or "biowaste" composting, in order to meet stringent quality requirements in agricultural markets. More recently, there has been another upsurge in mixed-waste composting in Europe due to pressure and regulations to address "greenhouse" gas emissions resulting from the landfilling of unprocessed organic waste.

There are currently 13 MSW-composting plants operating in North America (two in Canada and 11 in the U.S.). An additional seven plants are under development in the U.S. The facilities range in capacity from eight tons per day to 825 tons per day of MSW. The oldest running MSW-composting plant in North America is the Dennington County facility in Minnesota, in operation since 1987. The newest (and largest) is the Edmonton facility in Alberta, Canada, which began in 2000.

Despite the appeal of MSW composting (described below), the technology has experienced a rocky start-up over the past 20 years in this country, including some notable failures. A number of U.S. operations have closed primarily due to issues related to product quality and odor control. While other facilities, like the Bedminster plant in Marrietta, GA, have made significant strides (and investments) to improve in these areas. Built in 1995, the Marrietta plant underwent major renovations in 1998, and has operated successfully at capacity for the past five years (300 tpd of mixed waste).

Several plants built in the past three to four years, such as the Bedminster facility on Nantucket Island, MA, have performed as anticipated. While there are no doubt improvements yet to come, the industry appears to have arrived at a point where it can produce a known and consistent compost product, while effectively managing odors through proper air-handling and biofiltration.

The assessment made by *BioCycle Magazine* in its 2000 national survey of mixed-waste composting in the U.S. still applies:

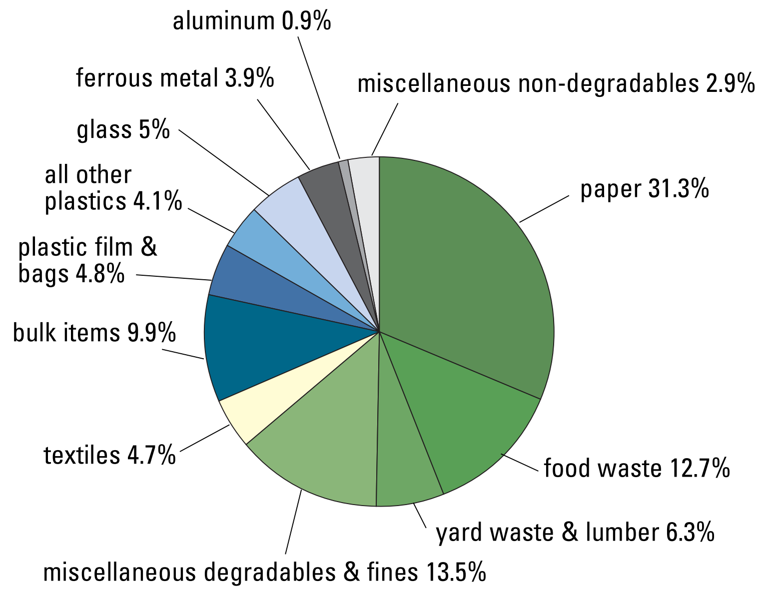
"…those (facilities) with the waste flow, cash flow, good process and odor management, viable end users, a well-defined mission and purpose and political support are doing well."[2]

MSW Composting in the Context of New York City

With the closure of the Fresh Kills Landfill in 2001, New York City has become entirely reliant on facilities outside of its borders to dispose of its solid waste. The Department has entered into short-term contracts for export and disposal that currently cost an average of $70 per ton. Long-term projections indicate that the City's export and disposal costs will average $95 per ton. As never before, the City has incentives to develop alternatives to disposal.

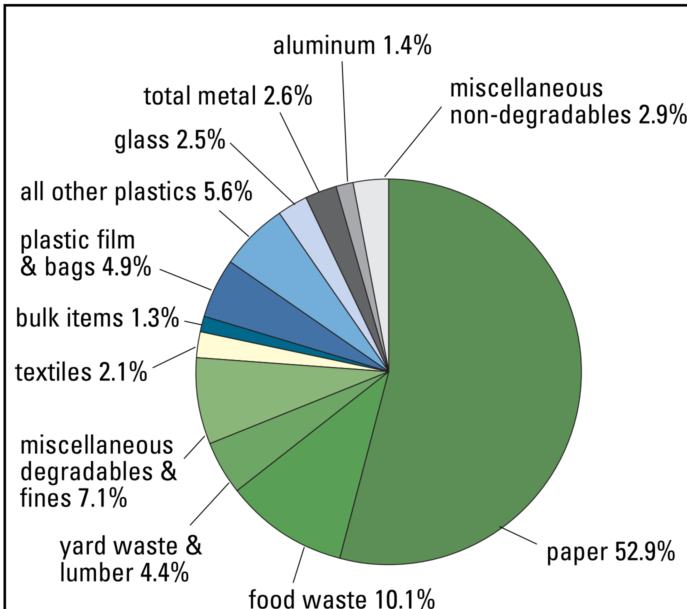
The first logical question to ask when looking for alternatives to disposal is, "What's in the garbage?" In 1990 (before the inception of the citywide, curbside recycling program), the Department conducted a comprehensive, multi-season, waste-composition study to answer that question. Figure 1 presents the average, annual, citywide, residential-waste components as a pie chart, while Figure 2 summarizes the composition of the institutional waste that the Department collects (from public schools, City offices, etc.). From a pragmatic, operational perspective, the division between institutional and residential waste is illusionary, as DSNY collects these two streams together.

Figure 1
Annual, Average, Citywide, Residential-Waste Composition (1990)



Source: 1992 Solid Waste Management Plan, Appendix 1.2, Waste Stream Data

Figure 2
Annual, Average, Citywide, Institutional-Waste Composition (1990)



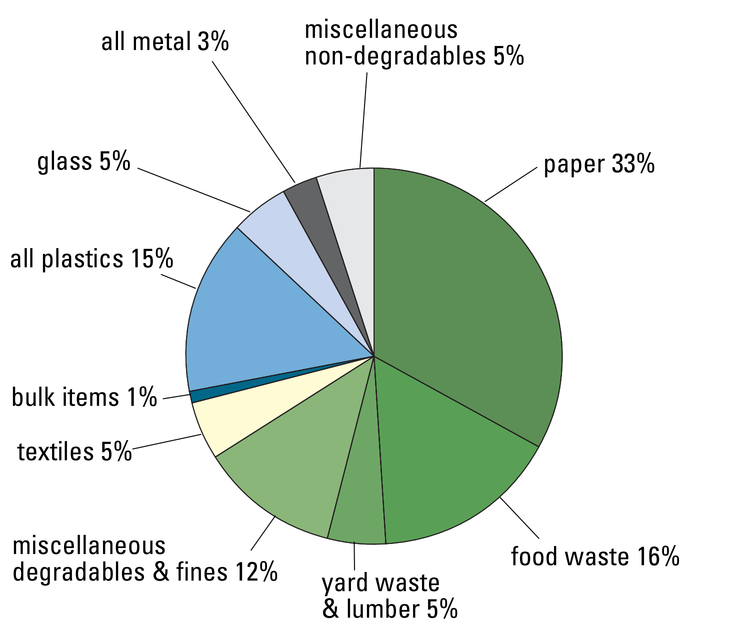
Source: 1992 Solid Waste Management Plan, Appendix 1.2, Waste Stream Data

A useful way of thinking about these materials is to group them as either biodegradable ("degradable") or non-degradable. Everything organic (derived from once-living organisms) eventually degrades over time. What is meant here, rather, is *readily* degradable (or compostable) material that breaks down over a short period of time. For example, plastics and certain textiles, while organic, are not classified as degradable. Therefore, the residential waste stream is 63.8% degradable (shown in shades of green) and 36.2% non-degradable. The institutional waste stream is 74.5% degradable and 35.5% non-degradable.

While paper is readily degradable, recycling paper into new paper products represents a higher end use for this material, and is therefore preferable to composting it. However, even with a curbside, mixed-paper-recycling program, paper products still comprise roughly a third of the post-recycling waste stream. Figure 3 presents the results of a waste characterization that the Department performed in association with this Research Project on samples of "black-bag" waste (or regular garbage). It should be noted that the waste samples for this study were not representative of the City as a whole, nor did they take into account seasonal differences. For more information on the limitations of this data, see Chapter 1.

As readily degradable materials comprise over half of the post-recycling, municipal solid-waste stream, it is understandable that the Department would seek ways to divert these items from disposal, and redirect them for composting. This has been a goal since the inception of the recycling program in 1989. The initial focus was to test the feasibility of asking waste generators serviced by the Department (NYC residents and institutions) to source-separate degradable material for collection.

Figure 3
Post-Recycling Waste Composition (2001)



Note: Results from representative residential- and institutional-waste samples from Staten Island District 2. (See Chapter 1 for more information.)

The Department ran two pilot projects testing the viability of diverting degradable waste through source-separated collection. In the first pilot, DSNY designated two areas of Brooklyn (Park Slope and Starrett City) as "Intensive Recycling Zones," where it asked residents to separate out three streams in addition to regular garbage: paper and textiles, recyclable containers, and food scraps and soiled paper (plus yard waste for Park Slope). The second pilot recruited institutions on Staten Island, such as hospitals and schools, and provided them with separate dumpsters for food waste. (For more detailed information on these two pilots, as well as efforts to promote on-site composting, see *"Composting in New York City: A Complete Program History,"* on the Department's website at the following URL: www.nyc.gov/html/dos/html/recywprpts.html#2.)

The findings from these two pilots can be summarized as follows:

- The capture rate for the degradable fraction of the waste stream was only 41 percent in the Park Slope pilot. This means that out of the total amount of these materials known to be in the waste stream through waste characterization studies, 41 percent—less than half—was placed out for recycling collection (or conversely, 59 percent was still in the garbage).
- The capture rate for degradable waste was so low in the Starrett City pilot as to essentially be zero. Residents, especially those living in high-rise buildings, are reluctant to separate and store wastes such as spoiled food and dirty diapers for any period of time.
- Trucks collecting only degradable waste were not efficient, averaging around four tons per truck, per route (compared to the 10- to 12-tons-per-truck generally averaged during regular garbage collection).
- Without continuous education, retraining, and supervision, source-separated food-waste streams become contaminated. (This finding is reinforced by DSNY's experience with its curbside recycling program.)
- Since the Department collects institutional waste for free, institutions have few incentives to invest the time and effort required to maintain food-waste–separation programs.
- Many New York City institutions simply do not have the space for separate, food-waste dumpsters.

The appeal of MSW composting is that the entire waste stream, after curbside recycling, can be efficiently collected and delivered to a central facility, where nearly 100 percent of the degradable material is recovered and turned into usable compost. Since the degradable material is not set out separately, and is instead collected with the regular garbage, the Department can capitalize on the collection efficiencies it already achieves for refuse, without the monetary and environmental burden of sending out more collection vehicles.

Photo 2: Typical New York City garbage awaiting collection
The appeal of MSW composting is that the entire waste stream, after curbside recycling, can be collected efficiently and delivered to a centralized facility, where nearly 100 percent of the degradable material is recovered and turned into compost.

To say that the appeal of MSW composting is clear, is not to say that MSW composting is *always* the best approach for handling all predominantly degradable waste streams in the City. There are several locations, for example, that generate significant quantities of degradable waste in a concentrated area—such as at the Hunts Point Terminal Produce Market in the Bronx, and the Rikers Island Correctional Facility—where source-separated composting makes sense. Since these locations offer the possibility of high capture rates, efficient collection routes, and manageable contamination levels, a source-separated, rather than mixed-waste approach, may be more appropriate.

Another example where MSW composting may be inappropriate is for fall leaves. City residents generate large volumes of fall leaves over a short time period, which allows for high collection efficiencies. In addition, homeowners normally bag leaves separately from the rest of their waste, making it relatively easy to obtain "clean" source-separated material. Finally, the innocuous nature of leaf composting also means that it can be done outdoors with simple equipment and at relatively low cost. For more information about the Department's source-separated-based composting programs, see *"Composting in New York City: A Complete Program History,"* on the Department's website at: www.nyc.gov/html/dos/html/recywprpts.html#2.

The opportunity to efficiently capture nearly 100 percent of the substantial, degradable fraction of the municipal solid-waste stream is a strong reason to consider MSW composting. But is the cost to process MSW into compost competitive with other waste-management options? And is the compost produced from such a process of a sufficient quality to have beneficial end uses? These, as well as other key questions, informed the Department's MSW-composting research project.

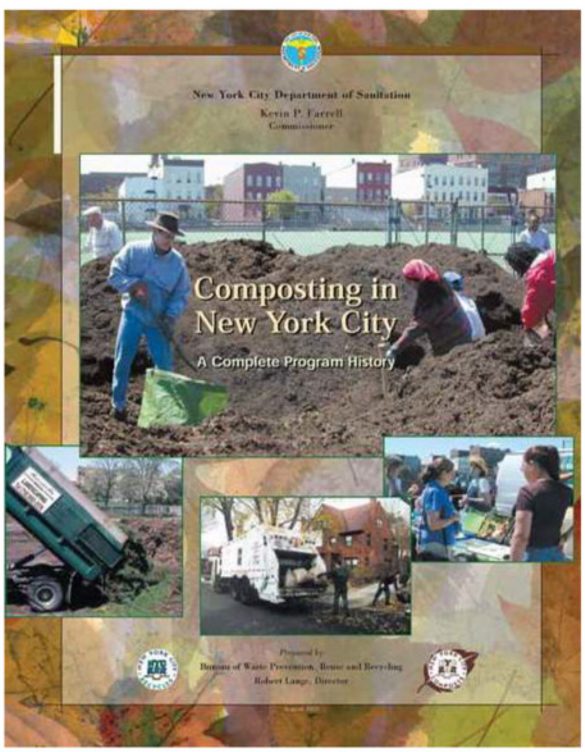


Photo 3: *Composting in New York City* report cover
Information about the Department's experience with source-separated and on-site composting can be found in this report, on the Department's website.

Report Structure

This report is divided into two main parts. The first part of the report presents the results from the New York City Composting Trials (held at Marlborough) and the survey of other, operating MSW-composting facilities. This includes the summary data from the extensive, compost-quality testing protocol for both the compost produced during the New York City Composting Trials, as well as compost sampled from the other surveyed facilities. The actual data are contained within Appendix F (New York City Composting Trials) and Appendix H (surveyed facilities) of this report, attached in portable document format (PDF) on the enclosed compact disk.

The second part of the report builds upon the learning of the first to describe a theoretical, pilot MSW-composting facility in New York City. The pilot facility design is in no way meant to be read as a blueprint, but is presented rather to help the reader envision what such a facility might look like and how it might operate. More importantly, in order to calculate an estimated cost-per-ton to process New York City waste through MSW composting, it was necessary to assume specific throughput volumes, residue rates (and conversely disposal costs), as well as equipment, buildings, personnel, and power requirements.

Summary of Key Findings

Part One: Research Project

The first three chapters of the report begin with research questions. The key findings are summarized here as answers to those questions.

What quality of compost might DSNY expect to produce by composting samples of New York City residential and institutional waste?

> The compost produced from samples of New York City waste met New York State Department of Environmental Conservation (DEC) Class I compost standards in effect during the time of the survey, as well as the current pollutant-limit and product-use criteria (in effect as of March 10, 2003).

What is the quality of compost produced by existing MSW-composting facilities?

> Each of the surveyed facilities producing a finished compost made a product that met DEC Class I compost standards. The compost from each facility except one would meet the DEC's current pollutant-limit and product-use criteria. (The facility in question would need to lower the percentage of small pieces of non-degradable material in its finished compost from 3.9 to 2.0 percent.)

What is the potential recovery rate of New York City waste through MSW composting?

> The Marlborough facility recovered 50 percent of the sample New York City waste during the New York City Composting Trials. This recovery rate is in line with recovery rates achieved by the other MSW-composting facilities surveyed for this report, and makes sense given that the characterization of the New York City sample waste found 55.6 percent to be degradable. (Inevitably, some percentage of degradable material becomes entwined with non-degradable material and is discarded as residue.)

How well do other MSW-composting facilities perform, and what are the factors that affect the potential application of this technology in New York City?

> The four, MSW-composting facilities surveyed charge tipping fees between $45 and $85 per ton. These prices are competitive with other disposal options in the respective facility locations.
>
> The surveyed facilities recover between 49 and 70 percent of the solid waste that they process, with the balance disposed of as residue.

The facilities have been designed and are operated in such a way that they have successfully avoided odor problems with their residential and business neighbors.

Compared to MSW-composting facilities that employ a less mechanized approach, those facilities that actively manage (turn and water) their compost using mechanized processes for extended periods of time (50-plus days) produce a better finished compost, with regards to all horticultural and agronomic properties.

MSW-composting facilities could improve their performance by placing more emphasis on removing non-degradable items in the waste stream *before* they go through the initial MSW-composting process. This additional step would accomplish three important objectives:

- Increase recovery of recyclable items
- Decrease residue disposal costs
- Produce a cleaner final compost with wider application value

Part Two: Pilot Facility

The second part of the report builds upon both the results of the Composting Trials and the facility surveys to envision a theoretical, 300-ton–per-day, pilot MSW-composting facility for New York City. Through the Composting Trials and surveys the Department learned what makes a successful MSW-composting facility from a process perspective. In very general terms, this can be summarized as follows:

Successful facilities maximize recovery rates by increasing "desirable" outputs, which are quality compost, marketable recyclables, and loss of water vapor (shed during the composting process), while decreasing "undesirable" outputs, which are residual items requiring disposal.

Theoretical Pilot Facility Design
The theoretical pilot facility design incorporates two principal features (intensive, front-end materials recovery and extended, active composting), which distinguish it from current MSW-composting facilities, and would enable it to achieve success by the standard defined above.

- **Front-End Materials Recovery.** To maximize the recovery of the non-degradable, marketable recyclables that inevitably remain in the municipal solid-waste stream (even with curbside recycling programs), a pilot facility should employ front-end, materials-recovery equipment and manual sort lines. Such equipment would remove recyclables before waste went through the MSW-composting process. De-bagging and sorting all incoming MSW would not only increase the recovery of non-degradable recyclables, but would also decrease residue disposal costs and create a cleaner compost product.
- **Extended Composting.** A pilot facility should provide for 51 days of active, on-site composting of degradable materials. For perspective, this is more than twice the amount of time that material is actively composted at the Marlborough facility, where the New York City Composting Trials occurred. This extended composting time would allow for greater loss of mass in the decomposing material, as well as produce a better final compost product from a horticultural and agronomic perspective.

Projected Recovery Rates
A pilot facility's pre-composting, materials-recovery process should have three primary goals:

- Send as much paper and paper products (remaining in the MSW after curbside recycling program) to the composting process as possible.
- Prevent as much non-degradable material, especially glass and film plastic, from going to the composting process as possible.
- Recover as many non-degradable, recyclable items as possible.

Based on these goals and a detailed analysis of how each material fraction of the waste stream will move through a hypothetical pilot facility, the report concludes that the process could achieve a 70-percent recovery rate.

Projected Facility Cost
As noted, one of the goals of this project was to develop an estimated cost-per-ton with which to compare MSW composting to current and future export and disposal options. The Department accomplished this by supplying as many assumptions as possible about a hypothetical pilot facility to a financial analyst with experience in the economics of commercial-scale, MSW-composting and other MSW-handling facilities. The analyst took these assumptions and then calculated the per-ton costs for the projected life-cycle of the facility. Appendix J of this report presents the full, 30-year, life-cycle financial analysis for the pilot facility. The costs include:

- Capital development (including permitting and design work)
- Facility financing (debt service, etc.)
- Annual operation and maintenance (such as residue disposal and electricity)

The financial analysis concludes that the cost to DSNY to process MSW in a hypothetical pilot facility in the first year of operation would be approximately $75 per ton.

Conclusions

In 1992, the City's first comprehensive Solid Waste Management Plan (SWMP) recommended that the Department assess MSW composting more fully as a "major component of the waste management system," and encourage the City to build a facility so as to "extensively analyz[e] and carefully evaluat[e]" its potential.[3]

This report constitutes the full assessment that the SWMP recommends, and like the SWMP, also proposes that the City seriously consider building a pilot MSW-composting facility to learn more about this promising technology. Again, the pilot facility described in this report is a theoretical proposal. Should the City proceed with developing a facility, it would likely employ other types of equipment and be configured entirely differently than the facility presented herein. However, no matter what type of facility is built, it should have a number of discrete learning objectives (which are summarized in Table 5-1 of this report), and should have a set time period in which to answer some important questions.

If the pilot facility is able to operate successfully in a cost-effective, nuisance-free manner, and consistently produce a quality compost product with viable end markets, then the City might consider scaling up to a permanent facility. If the pilot facility is unable to accomplish these goals, then the facility should be dismantled, with the component equipment sold for reuse to other solid-waste–handling enterprises.

In conclusion, this report describes a waste-management option that would allow the Department to:

- Capture nearly 100 percent of the degradable fraction of the waste stream (as well as most recyclable items remaining in the garbage after curbside collection).
- Build upon existing waste-collection efficiencies.
- Require no additional public education since residents would not have to handle their waste any differently than they do currently.
- Potentially recover 70 percent of the waste stream for recycling (in addition to what is recovered through the existing curbside recycling program).
- Pay an equivalent cost-per-ton compared to current disposal options.

Given these important incentives, it seems well worth while to invest the time and funds necessary to build a pilot facility in order to extensively analyze and carefully evaluate these claims.

CHAPTER 1
THE NEW YORK CITY COMPOSTING TRIALS

Summary

This chapter describes the 2001 New York City Composting Trials DSNY conducted at the Bedminster Marlborough MSW-composting facility in Marlborough, Massachusetts. The chapter begins by outlining the waste characterization that the Department performed on representative samples of the New York City waste sent to Marlborough for the Composting Trials. Tables summarize the weights of all inputs to, and outputs from the process, which in turn determine the recovery rate achieved during the Composting Trials. A discussion of Marlborough facility operations serves both to introduce the MSW-composting technology, as well as to explain the sampling procedure used to determine the quality of the compost produced in the Composting Trials.

Research Questions

As part of its research to determine if MSW composting merits further, serious study as a waste-management strategy for New York City, the Department set out to answer the following questions:

- What quality of compost might DSNY expect to produce by composting samples of New York City residential and institutional waste (referred to as New York City waste or City waste throughout the report)?
- What is the potential recovery rate of New York City waste through MSW composting?

In answer to the first question, the compost produced from samples of New York City waste would meet New York State Department of Environmental Conservation (DEC) pollutant-limit and product-use criteria. (Chapter 2 presents the actual compost-quality results.)

Regarding the second question, the NYC Composting Trials achieved a 50 percent solid-waste–recovery rate, which is in line with recovery rates achieved by the other MSW-composting facilities surveyed for this report. (Chapter 3 contains the results of this survey.)

In addition to this research, the Department worked with a local, environmental consulting group who received a grant from the Empire State Development Environmental Services Unit to perform an economic and technical viability study for composting New York City's commercial waste through a similar MSW-composting process. Appendix D contains the final report to the State summarizing the commercial-waste portion of the Composting Trials conducted at the Marlborough facility.

New York City Composting Trials

To answer the research questions posed above, DSNY sent 50 tons a day, for five consecutive days, of residential and institutional waste that it collected on Staten Island to the Bedminster Marlborough (Marlborough) MSW-composting facility.[1]

New York City Municipal Solid Waste

DSNY selected the Marlborough facility for its MSW Composting Trials for several reasons. As Marlborough is only four hours away from New York City, the proximity of the plant facilitated both shipping waste and providing direct project oversight, including continuous monitoring of the entire process. Additionally, Marlborough facility management was willing to dedicate one of its two composting drums (also referred to as digesters or digester drums in this report) for City waste exclusively, as well as space on the aeration floor for the resulting compost. This dedicated capacity was essential in order to keep New York City material separate from local material throughout the Composting Trials.

Photo 1-1: New York City waste used for the MSW Composting Trials

Photo 1-2: Removing samples for waste characterization
Under supervision of the sampling coordinator, a front-end loader removed one to two samples from each pile.

Photo 1-3: Sorting and characterizing samples of New York City waste
Workers sorted samples of waste into 13 categories.

Obtaining representative samples of the entire New York City waste stream was not operationally feasible for the limited scale of the Composting Trials. Therefore, the Department chose to take representative samples of waste from one Sanitation District—Staten Island District 2 (SI 2)—that it felt were in some way typical of City waste. Comprising the middle section of Staten Island, SI 2 (coterminous with SI Community Board 2) had a recycling diversion rate of 23 percent, close to the citywide average of 20.1 percent at the time of the Trials. Similar to other City Sanitation Districts, SI 2 also contains a mix of multi- and single-family residences, as well as the types of educational and religious institutions from which the Department routinely collects waste. In addition, SI 2 was also a convenient District to work with, as it is geographically proximate to the Fresh Kills landfill, the location for waste characterization and transfer to long-haul vehicles during the Composting Trials.

The capacity dedicated to New York City waste at the Marlborough MSW-composting facility was approximately 50 tons per day for five days.[2] This represents seven to eight DSNY collection vehicles per day, for a total of 37 truck loads. In order to obtain representative samples of the City waste from SI 2, DSNY worked with a consultant specializing in waste-characterization work, to select the seven or eight trucks that would be used for each day of the Trial. The following factors influenced the selection process:

- The relative quantities of residential and institutional waste generated in the four subsections of SI 2 during the previous year (2000)
- The distribution of DSNY's 105 collection truck routes in these four subsections
- Analysis of census-block-group data for the district

The consultant's final report to the Department, attached as Appendix A, describes the truck sampling methodology in greater detail.

Once trucks from the targeted routes were full and back at their garage, the Department instructed a relay driver to divert the load for the Composting Trials, rather than tip at their assigned transfer station. This way the collection drivers did not know that there was anything special about the waste, and did not bias its collection.

For the five days of the Trials, the drivers tipped their loads directly onto an asphalt pad (Photo 1-1) at the Fresh Kills landfill (Fresh Kills). The drivers unloaded material to form discrete piles, which were then recorded as to their origin (i.e., the section of SI 2 and the collection route). Under direct supervision of the consultant's sampling coordinator, a front-end loader removed one to two samples from each pile (the average sample size was 313 pounds) and placed them on a tarp (Photo 1-2). Workers pulled the tarp into an equipment maintenance building at Fresh Kills, where they sorted materials into 13 primary categories (Photo 1-3). Over the course of the five days, workers sorted a total of 70 samples, totaling 21,934 pounds. Table 1-1 summarizes the waste-characterization results. The consultant's final report

Table 1-1

Composition of the New York City Waste Used in the MSW Composting Trials

Waste Category	Average Percentage Composition by Weight
Paper	32.1%
Food Waste	15.9%
Yard Waste[1]	1.6%
Other Compostables[2]	6.0%
All Compostables	**55.6%**
Bulk Wood	3.4%
Plastic[3]	15.4%
Textiles	5.3%
Glass & Ceramics[3]	3.3%
Metal	3.1%
Large Composite Items	1.0%
Non-Compostable Fines	3.5%
Other Non-Compostables	5.1%
All Non-Compostables	**40.1%**
Unclassified Fines	4.3%
Total	**100%**

1. This characterization took place at the end of February, so it is logical that there is little yard waste. The annual citywide average for yard waste is estimated to be 4.1%.
2. "Compostable" is interchangeable with the term "degradable" in this report. This category includes readily degradable materials that do not fit in the paper, food-waste, or yard-waste categories, such as disposable diapers, sanitary napkins, animal feces, cut flowers, etc.
3. As this characterization took place before the suspension of glass and plastic recycling in July 2002, these numbers would now be proportionally higher.

(Appendix A) presents the sorting procedures and the waste-characterization process in further detail.

After representative samples of the waste had been removed and characterized, the remaining waste was loaded into long-haul, 100-cubic-yard, tractor trailers and transported directly to the MSW-composting facility in Marlborough, Massachusetts. The tractor trailers could haul approximately 20 tons each, so the Department loaded and sent three trailers to Marlborough for each day of the Trials to ensure that at least 50 tons would be available for composting.

The Bedminster Marlborough, LLC Facility

Bedminster Technology

The MSW-composting facility in Marlborough, Massachusetts (population approximately 37,000) was built in 1998/99, under contract with the City of Marlborough. At that time, Marlborough was in need of a new processing facility for its sewage sludge (biosolids), as the previous, unenclosed, biosolids-composting facility had been shut down under court order due to persistent odor complaints. Marlborough sought an alternative to paying for transportation and disposal of its biosolids. After evaluating MSW-composting plants employing the Bedminster Bioconversion Corporation (Bedminster)[3] technology in Tennessee and Georgia, Marlborough officials proceeded to negotiate a contract to develop a Bedminster facility to process all of Marlborough's biosolids in combination with its MSW.[4] At the time of the NYC Composting Trials, the facility was also processing municipal biosolids from several other towns, as well as solid waste from several commercial-waste haulers servicing college cafeterias, supermarkets, and grocery stores.

Table 1-2

North American MSW-Composting Facilities Utilizing Bedminster Technology

Location	Opened	Design Capacity
Big Sandy, Texas	1971	30 tpd (20 tpd MSW + 10 tpd biosolids)
Pinetop-Lakeside, Arizona	1991	15 tpd (10 tpd MSW + 5 tpd biosolids)
Sevierville, Tennessee	1992	340 tpd (240 tpd MSW + 100 tpd biosolids)
Cobb County, Georgia	1997	450 tpd (300 tpd MSW + 150 tpd biosolids)
Sumter County, Florida	1997	250 tpd (175 tpd MSW + 75 tpd biosolids)
Marlborough, Massachusetts	1999	150 tpd (100 tpd MSW + 50 tpd biosolids)
Nantucket, Massachusetts	1999	120 tpd (80 tpd MSW + 40 tpd biosolids)
Edmonton, Alberta, Canada	2000	1,043 tpd (715 tpd MSW + 328 tpd biosolids)

All biosolids data in this report are given in wet tons, which is standard nomenclature when discussing the weight of biosolids in relation to composting. The wet weight represents what the material actually weighs inclusive of water. The wastewater treatment industry will generally refer to the weight of biosolids using dry tons, which is what the material would weigh exclusive of water.

In addition to the Marlborough plant, Bedminster technology is employed in seven operating plants in North America, with two additional facilities under development. Table 1-2 lists all of the North American facilities utilizing Bedminster drums, and provides information on their respective design capacities.

Annual Capacity and Site Size

The Marlborough facility began receiving waste in August 1999. Table 1-3 shows Marlborough's annual processing capacity and rate. Designed originally to process a total of 54,000 tons per year (tpy), at the time of the NYC Composting Trials the facility was handling approximately 51,000 tpy, comprised of 35,000 tpy of solid waste and 16,000 tpy of biosolids. Of the solid-waste component, residential material accounted for 13,000 tpy; commercial sources generated the other 22,000 tpy.

The facility is situated on a six-acre site, adjacent to the City of Marlborough's Easterly Wastewater Treatment Plant and a capped sludge landfill. Located in the vicinity of other commercial operations such as a golf driving range, a restaurant, and a small shopping mall, the facility is only a half-mile from a residential area, containing some of the most expensive homes in Marlborough.

The actual facility footprint is approximately 2.3 acres, which includes the following components:

- Receiving building (including tip floor)
- Biosolids storage building
- Two composting drums
- Primary screening area and aeration floor
- Final screening area
- Biofilter building
- Other (scale, parking, office, vehicle maneuvering)

See Illustration 1-1 for a schematic drawing of the Marlborough facility. For more details on the respective area of each of these components, see Chapter 3.

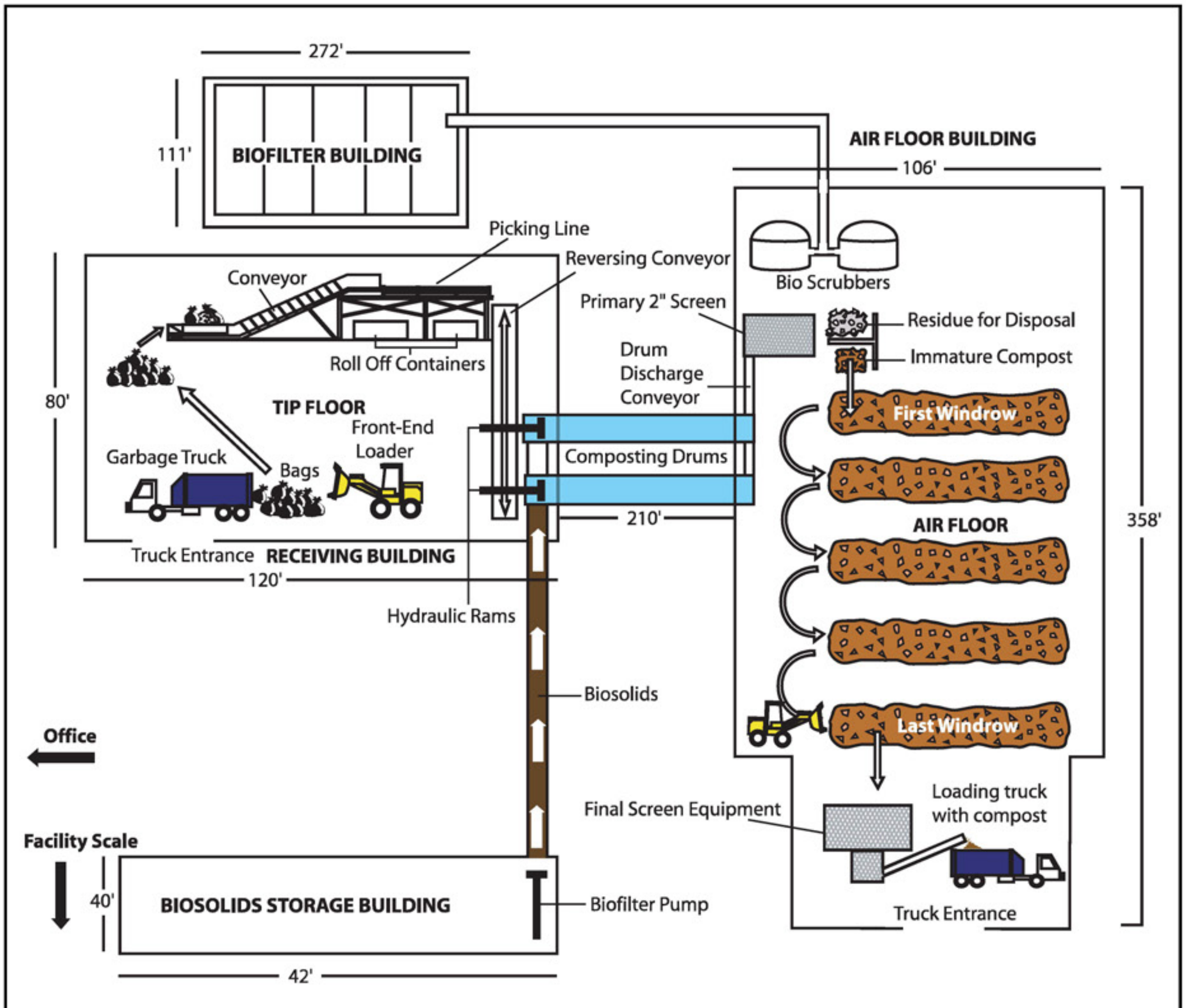
Table 1-3

Marlborough Facility Annual Processing Capacity and Rate

Maximum Annual Processing Capacity	Current Annual Processing Rate
36,000 tons solid waste 18,000 wet tons biosolids	13,000 tons residential solid waste 22,000 tons commercial solid waste 16,000 wet tons biosolids
= 54,000 tons total	= 51,000 tons total

Illustration 1-1

Marlborough Facility Layout



Total facility footprint is 99,812 square feet (not drawn to scale)

Photo 1-4: Long-haul trucks delivering NYC waste to the Marlborough facility
After weighing in, trucks hauling solid waste enter a fully enclosed receiving building and dump their contents onto the tip floor.

Marlborough Facility Operations and the New York City Composting Trials

Receiving Solid Waste

At Marlborough, trucks delivering solid waste and biosolids cross the weigh scale, both upon entering and exiting the facility. After weighing in, trucks hauling solid waste enter a fully enclosed receiving building and unload their contents directly onto the tip floor (Photo 1-4). At this stage, a front-end loader (FEL) and three laborers remove bulky materials for disposal, such as carpet, wood, furniture, and other durable goods (Photo 1-5). After helping to remove the large, bulky contaminants, the FEL pushes the waste into a live floor hopper, (Photo 1-6) from which waste is conveyed to a manual sort line. The three laborers move from the tip floor to the sort line, in order to remove additional wood, metal, textiles, and other non-degradable items for disposal. Once the waste passes by this sort line, it continues on the conveyor to a hopper, where a hydraulic ram pushes it directly into one of the two composting drums.

Photo 1-5: Close-up of bulky items in the NYC waste stream
Workers at the Marlborough facility remove bulky items for disposal, such as the mattress, bulk wood, and furniture shown here.

Photo 1-6: Tip floor at the Marlborough facility
From the tip floor, a front-end loader moves waste to a conveyor, which feeds to a manual sort line.

All MSW-composting facilities incorporate varying levels of materials recovery prior to loading waste into the composting drum. Marlborough's FEL operator and manual sort line represent typical pre-drum, materials-recovery efforts at MSW-composting plants currently operating in North America. While some plants employ more sophisticated technology, such as magnets and air classifiers, others do nothing beyond removing bulk items. For more information on materials-recovery efforts at existing MSW-composting facilities, see Chapter 3. For the more intensive materials-recovery system proposed for a New York City Research and Development Pilot Facility, see Chapter 5.

New York City waste was loaded into long-haul vehicles at the Fresh Kills landfill during the day for each of the five Trial days, and delivered to the Marlborough facility (Photo 1-4). New York City loads arrived at night (after the Marlborough material had been loaded into one of the two composting drums) to avoid cross-contamination on the tipping floor. Table 1-4 presents the weights of the incoming New York City waste to the Marlborough facility. (Appendix B contains

Table 1-4
Weight of Incoming NYC MSW at Marlborough MSW-Composting Facility

Date	Weight of NYC MSW (tons)
February 26, 2001	49.23
February 27, 2001	54.64
February 28, 2001	53.99
March 1, 2001	51.96
March 2, 2001	49.23
Total	**259.05**

Photo 1-7: Sort line at Marlborough facility
Following standard operations, workers at the Marlborough facility removed non-degradable items on the sort line before the NYC waste entered the composting drum.

copies of the scale receipts from the trucks hauling the New York City waste to the Marlborough facility, as well as those of local trucks removing all process residue from the facility.)

As per standard operations, workers removed bulk items from the incoming loads on the tipping floor and additional, non-degradable items on the sort line before the waste entered the composting drum (Photo 1-7). Together, these two streams are referred to as "front-end residue." Table 1-5 shows the percentage of New York City's waste that was removed for disposal as front-end residue during the Composting Trials.

The Composting Trials did not allow for measurement of the percent of front-end residue that could be recycled. However, Chapter 6 shows estimates of what could potentially be recovered by the proposed Research and Development Pilot Facility. Those estimates come from the waste characterization performed for the Composting Trials described above, combined with an analysis of existing materials-recovery technologies and systems.

Receiving Biosolids and Liquid Waste
Biosolids refers to treated sewage sludge that has been dewatered to increase solidity, thereby making it easier to handle and transport. Before dewatering (using presses or centrifuges), the sewage sludge generally goes through a process of microbial digestion at the wastewater treatment plant. Biosolids make an excellent feedstock for composting due to their homogeneity and stability. In fact, approximately 13 percent of the biosolids produced in New York City are currently composted by a private contractor based in Pennsylvania. See the *Biosolids* section of Chapter 2 for a brief

Table 1-5
Percentage of NYC MSW Disposed of as Front-End Residue

Date	Weight of Front-End Residue (tons)	Percent of Total Incoming NYC MSW
February 26, 2001	7.21	14.6%
February 27, 2001	7.16	13.1%
February 28, 2001	6.86	12.7%
March 1, 2001	6.97	13.4%
March 2, 2001	5.98	12.1%
Average	**6.84**	**13.2%**
Total	**34.18**	**13.2%**

description of this operation, as well as laboratory results from the compost made with New York City biosolids.

The high paper content of MSW typically makes it too dry and low in nitrogen for optimal composting conditions. Most MSW-composting facilities therefore incorporate municipal biosolids at the start of the composting process, to provide the moisture and nitrogen necessary for optimal decomposition conditions. In the case of at least one facility surveyed for this report (see Chapter 3), moisture and nitrogen are provided by other organic, industrial liquid wastes, such as out-of-date juices, dairy waste, and wastewater from slaughterhouses and an organic glue factory.

The amount of biosolids or other liquid waste that facilities use ranges from 10 to 50 percent of the total input material. Liquid wastes are handled separately from solid waste, and are pumped directly into the digester drums. Facility operators can also pump water, if necessary, into the drums to achieve the optimal moisture range, which is generally between 50-55 percent.

As noted, the Marlborough MSW-composting facility is located next to the town's wastewater treatment facility. From the biosolids storage building at the wastewater-treatment facility, a large hydraulic ram pumps this material directly into the composting drums. In general, for every 60 tons of solid waste, Marlborough facility operators add approximately 30 tons of biosolids, which have been previously dewatered by the wastewater-treatment facility to contain about 16 percent solids (84 percent moisture).

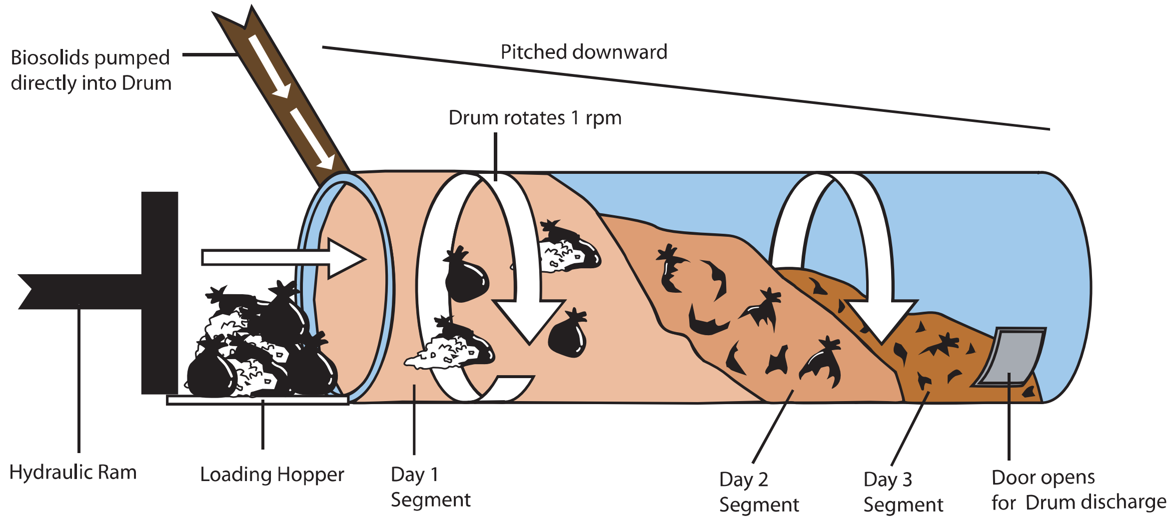
The New York City Department of Environment Protection (DEP) currently creates 1,200-plus tons of biosolids per day, dewatered on average to 26 percent solids. Private haulers remove this material at a cost of $112 per wet ton. The City's biosolids are either pelletized into a fertilizer (42 percent), directly land applied to crops (37 percent), composted (13 percent), or alkaline stabilized into an agricultural liming agent (8 percent). Due to logistical constraints, the New York City Composting Trials did not use biosolids from New York City. Instead, the Trials utilized Marlborough biosolids, samples of which were sent to a laboratory for analysis. Chapter 2 presents the results of Marlborough biosolids analysis and, for comparative purposes, also includes the results of routine testing that the DEP performs on New York City biosolids.

Digester Drums

The rotary digester drum represents the central element of the MSW-composting process. Fabricated from steel, the digesters (resembling elongated cement kilns) are divided into chambers, separated by interior baffles, which aid in retaining material for the desired amount of time. Facility operators feed and discharge material from the drum on a daily basis, with actual retention times varying between facilities anywhere from 24 hours to four days. Digester size is variable, depending on the technology, the amount of solid and liquid wastes processed per day, and the desired retention time. Illustration 1-2 shows the basic conceptual workings of a digester drum.

The Marlborough facility employs two proprietary, Bedminster digesters, each measuring 12.5 feet in diameter and 185 feet long, which retain material for two to three days. In addition to providing the ideal environment for the microbial populations that consume degradable waste,

Illustration 1-2
Basic Workings of a Digester Drum



the tumbling action of the rotary drum serves to homogenize liquid and solid waste, and break open garbage bags, exposing the degradable fraction within. At Marlborough, the digester exterior is insulated, and only the ends are enclosed in a building; the loading end is located in the receiving building, and the discharge end in the air floor building (Photos 1-8 and 1-9). At other facilities, the drums might be entirely housed indoors. The Bedminster drums are generally pitched slightly downward from loading end to discharge end, and gravity, combined with a slow rotation (at 1 rpm), serves to move the waste along. Air feeds into the digester either by blowers, or via a chimney effect when the discharge door opens. This air flow, along with the tumbling action, creates the conditions necessary for aerobic decomposition. Thermometers record the temperature of material in the drum, which routinely peak around 55°C (130°F).

Table 1-6
Amounts of New York City MSW and Marlborough Biosolids Loaded into the Marlborough Digester Drum

Date	New York City MSW (tons)	Marlborough Biosolids (tons)	Total Input to Digester Drum (tons)
February 26, 2001	42.02	18.01	60.03
February 27, 2001	47.48	23.12	70.60
February 28, 2001	47.13	23.61	70.74
March 1, 2001	44.99	21.91	66.90
March 2, 2001	43.25	19.80	63.05
Average	**44.97**	**21.29**	**66.26**
Total	**224.87**	**106.45**	**331.32**

During the Composting Trials, an empty, dedicated composting drum at the Marlborough facility received daily inputs of the New York City municipal solid waste along with the Marlborough biosolids. Table 1-6 shows the tonnage of each loaded into the drum during the five days of the Composting Trials. The material entering the drum was discharged three days later. This means that the majority of the material loaded into the drum on Monday, February 26 was discharged on Thursday, March 1; the material loaded on Tuesday, February 27 was discharged on Friday, March 2, and so on for the remaining three days of the Trials. Facility operators took daily thermometer readings in different sections of the drum to ensure that the material reached temperatures necessary to achieve pathogen kill. Appendix C contains these temperature record sheets.

Photo 1-8: Digester Drum at the Marlborough Facility
MSW loaded into the digester drum from the receiving building is discharged two to three days later in the air floor building.

Drum Discharge

Most MSW-composting facilities perform a primary screening of the material after discharging it from the digester drum. Before describing the results of the primary screening of the New York City material, it is helpful to understand how material actually discharges from the drum and moves to this first screen.

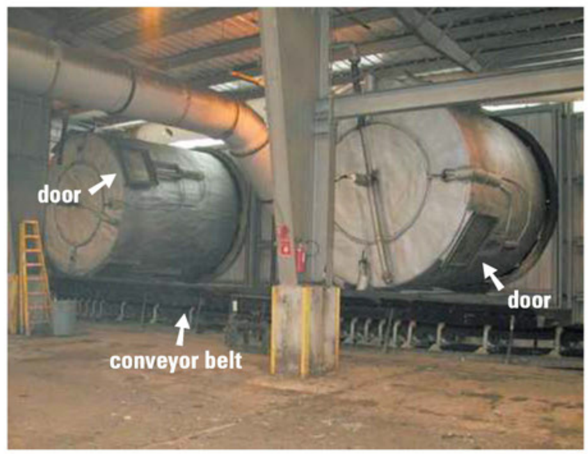


Photo 1-9: Discharge end of the composting drums at the Marlborough facility
After the two- to three-day retention time, operators discharge material from the drums onto a conveyor belt.

Each day, hydraulic rams push new material into the drums. Each day's worth of material forms a discrete segment inside the drum (although in actuality some mixing between days inevitably occurs). The action of the rams loading new material displaces the previous day's segment and forces it forward through the drum (see Illustration 1-2). This daily displacement, combined with gravity's pull (resulting from the slight downward pitch of the drum), means that each segment takes about two to three days to reach the discharge end of the drum. The more material operators load into the drum, the fewer days each segment takes to reach the end of the drum.

Facility operators do nothing to actively discharge material from the composting drums. To discharge material, facility operators simply open the door located on the discharge end of the drum. Material that has collected there falls through the door and onto a conveyor belt below, as the drum continues to rotate (Photo 1-9).

Photo 1-10: Conveyor belt leading to the two-inch, primary trommel screen
After discharge from the drum, material moves via convey belt to a two-inch trommel screen mounted above (not in view).

Photo 1-11: Two-inch trommel screen "overs"
The two-inch overs, comprised of broken plastic bags and other large, non-degradable items, fall into a concrete bay, and are moved by front-end loaders into containers for disposal as residue.

Photo 1-12: Two-inch trommel screen "unders"
The two-inch unders, consisting primarily of immature compost, as well as smaller, non-degradable items, get transported to the air floor for further composting.

After two to three days of tumbling through the hot, moist, and tightly packed conditions inside the composting drum, the degradable portion of the waste stream no longer appears recognizable as the paper towels, phone books, leftovers, etc. that were loaded into the drum. Due to the intensive physical and chemical decomposition occurring inside the drum, the degradable fraction of the waste stream discharges from the drum as very immature compost, resembling a rich topsoil.

However, despite appearances, these degradable materials have actually only partially undergone the complex decomposition process. This immature compost requires an extended period of active, aerated composting and curing (stabilization) in order to become a mature, usable, final product. Before the immature compost moves to this next stage, it must first pass through the **primary screen** to separate out the larger, non-degradable items.

Primary Two-Inch Screen

The conveyor belt running under the drum discharge door moves the newly discharged material to the primary trommel screen (Photo 1-10). The screen at Marlborough separates out two fractions: material over two inches in size ("overs") and material under two inches in size ("unders"). While most MSW-composting facilities employ this primary screening step, actual screen sizes vary between facilities.

At Marlborough, the **two-inch overs**, comprised of broken plastic bags and other large, non-degradable items, fall into a concrete bay, and are moved by a front-end loader into containers for disposal as residue (Photo 1-11). The **two-inch unders** consist primarily of immature compost, as well as smaller, non-degradable items from the waste stream, such as bottle caps, shreds of plastic bags, and broken glass (Photo 1-12). Front-end loaders move this material to the aeration floor for further composting. The smaller, non-degradable items will be removed with subsequent, finer screens later in the process.

Table 1-7
NYC Material After Passing Through Marlborough's Primary Two-Inch Screen

Date of Discharge	Two-Inch Screen Unders (tons)	Two-Inch Screen Overs (tons)	Total Discharge: Unders and Overs (tons)	Overs as Percentage of Total Discharge
March 1, 2001	45.36	14.14	59.50	24%
March 2, 2001	58.50	14.83	73.30	20%
March 3, 2001	36.56	15.63	52.19	30%
March 5, 2001	45.00	18.19	63.19	29%
March 7, 2001	52.80	15.17	67.97	22%
Average	**47.24**	**15.59**	**63.23**	**25%**
Total	**236.22**	**77.96**	**316.18**	**25%**

Table 1-7 summarizes the results of the primary two-inch screening of the New York City material after Marlborough facility operators discharged it from the drum. Again, the two-inch overs are generally residue and the two-inch unders are immature compost. Appendix B contains the daily facility scale tickets with the weight of the overs leaving the facility, as well as the derivation of the weight of the unders as front-end loaders formed this material into windrows (elongated piles) on the Marlborough air floor.

Three points should be noted about the data in Table 1-7. First, as the far right column indicates, a quarter of the inputs to the drum are screened away at this point for disposal as residue. The primary, post-drum screen, therefore, represents the point in the current MSW-composting operations where the largest separation of degradable from non-degradable items occurs. Chapter 4 of this report, which critiques MSW composting as a whole, will elaborate on the significance of this point.

Second, it is interesting to note that on some days it appears that more material was discharged from the drum than was initially loaded. For example, the total inputs to the drum on February 27 weighed 70.60 tons (Table 1-6). Three days later (March 2), when the bulk of this day's material should have moved through the drum, 73.30 tons discharged from the drum. This illustrates that although material does generally move through the drum in the discrete segments described earlier, some mixing does occur. Furthermore, heavier items tend to tumble through the drum faster and therefore might discharge in less than three days.

Finally, while 331.32 tons of material went into the drum (Table 1-6), only 316.18 came out. Some of this 4.5 percent loss occurred during material handling and weighing, but the majority is due to moisture and carbon dioxide lost during the initial decomposition process, which has already taken place inside the drum.

Sampling
After the primary two-inch screen, the Department selected the first samples of New York City material for laboratory analysis. Department personnel (and/or a consultant to the Department) sampled the material directly to ensure accuracy and veracity of reporting. The laboratory

provided the sampling methodology, which consisted of taking shovels of material at various locations and combining them to fill two, five-gallon containers, labeled A and B (Photo 1-13). For each sample testing point, the lab performed analyses on both the A and B sample to form paired data for each point.

The laboratory specified two-inch unders and overs sampling as follows:

- Collect two, composite, five-gallon samples (**A** and **B**) for the **first**, **second**, and **third** day of two-inch **unders**, as generated by the primary screen.
- Repeat the procedure for the two-inch **overs**.
- On the fourth day, combine and mix all of the **A** sample **unders** (15 gallons) and send five gallons of this mix to the laboratory. Repeat the procedure for the **B** sample **unders**.
- Repeat the process for the **A** sample **overs** and the **B** sample **overs**.
- Repeat the entire process for the **third**, **fourth**, and **fifth** day of discharge. The third day was sampled twice to account for the mixing in the drum.

Photo 1-13: Samples taken from the NYC two-inch unders (right) and overs (left) piles
For each of the five days of drum discharge, DSNY took samples from the two-inch unders and overs piles.

Photo 1-14: Windrow pile at the Marlborough facility
Forming windrows on aerated floors represents one of the ways that MSW-composting facilities maximize decomposition rates and minimize odors.

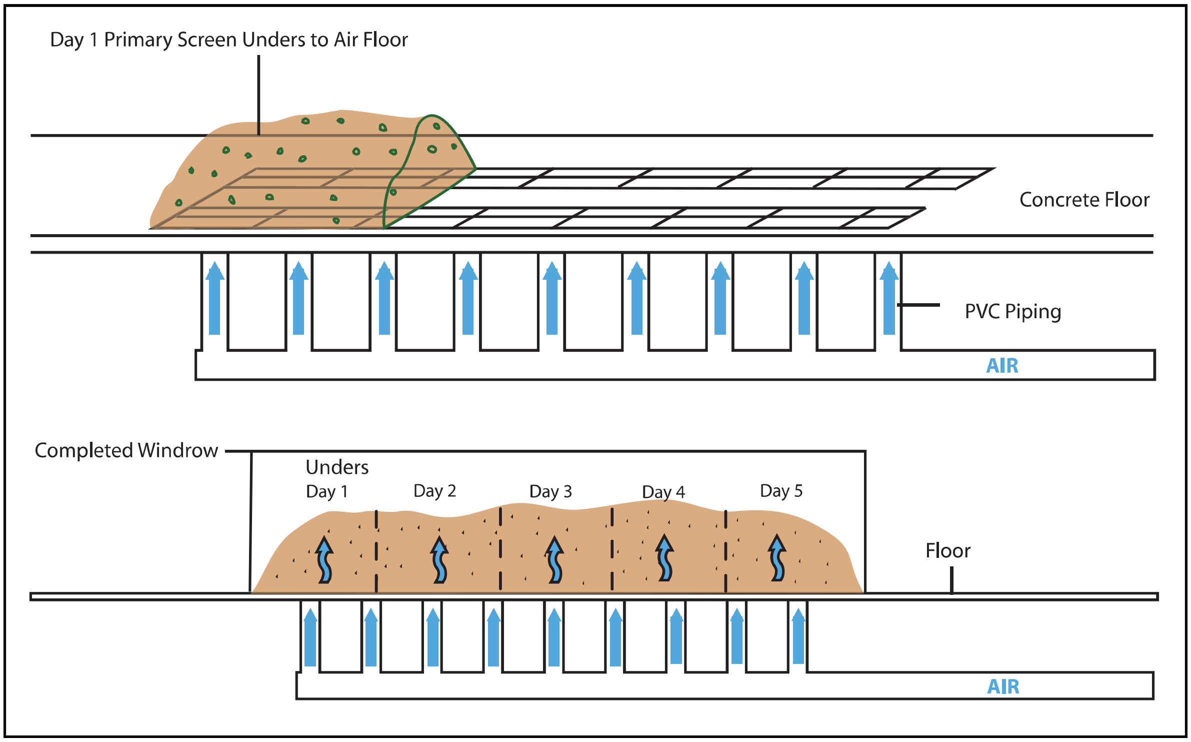
Therefore, the laboratory received a total of eight, composite, five-gallon samples at this point in the process. On the laboratory data sheets attached in the *Facility Data* section of Appendix F, the samples are labeled as follows: *Day 1-3 Unders, Sample A; Day 1-3 Unders, Sample B; Day 3-5 Unders, Sample A; Day 3-5 Unders, Sample B* (and likewise for overs).

Aeration Floor/Active Composting
Air flow is essential to the aerobic decomposition process. As any gardener knows, if a compost pile does not receive enough air, the pile turns anaerobic and starts to produce unpleasant, sulphurous odors. To maximize decomposition rates, as well as to minimize odors, all MSW-composting facilities must ensure that material discharged from the composting drum gets enough air. This stage of managed decomposition, when the material is still hot and needs oxygen, is referred to as "active composting." The material is still actively breaking down. After this active stage of composting, the material will require additional time to "cure" or stabilize.

Aeration strategies generally fall into two categories: **windrows** with forced aeration and

Illustration 1-3

Detail of Windrow and Aeration Trenches on Marlborough Air Floor



periodic turning (the strategy employed at Marlborough), or **aerated agitated bays**. In either case, active composting occurs inside a building with a system in place to capture and treat process air through a biofilter in order to minimize odors.

The **windrow** approach entails building large, elongated piles of the immature compost on an aeration floor (Photo 1-14) with embedded PVC piping, which functions to circulate air through the pile. Every few days facilities will use a front-end loader or windrow turner to move and mix the piles. Illustration 1-3 shows how the system of windrows and aeration trenches works on the Marlborough air floor.

The **agitated bay** approach[5] relies on the same basic principles for aerating the material, except rather than building piles, the facility operators place the material into aerated concrete channels, or bays. An automated agitator then moves down the length of the bay (either on a bridge crane, or rails set into the tops of the bays), and turns the composting material. This serves to introduce oxygen, chop up any remaining large pieces, and move the material towards the opposite end of the bay, where it is unloaded. Some facilities are also designed to allow the addition of moisture during active composting, if needed.

Meeting pathogen-kill requirements represents another function of the aeration floor. Most States mandate that compost made from MSW and/or biosolids exceed temperatures of 55°C (130°F) for a minimum number of days to kill harmful pathogens, such as *Salmonella* and fecal coliform. Therefore, MSW-composting facilities must monitor temperatures during this active-composting phase to document compliance with local pathogen-kill regulations. Appendix C contains the temperature monitoring sheets documenting the temperatures achieved by the New York City material both as it moved through the Marlborough facility digester and then onto the air floor. Chapter 2 presents pathogen-level (*Salmonella* and fecal coliform) data.

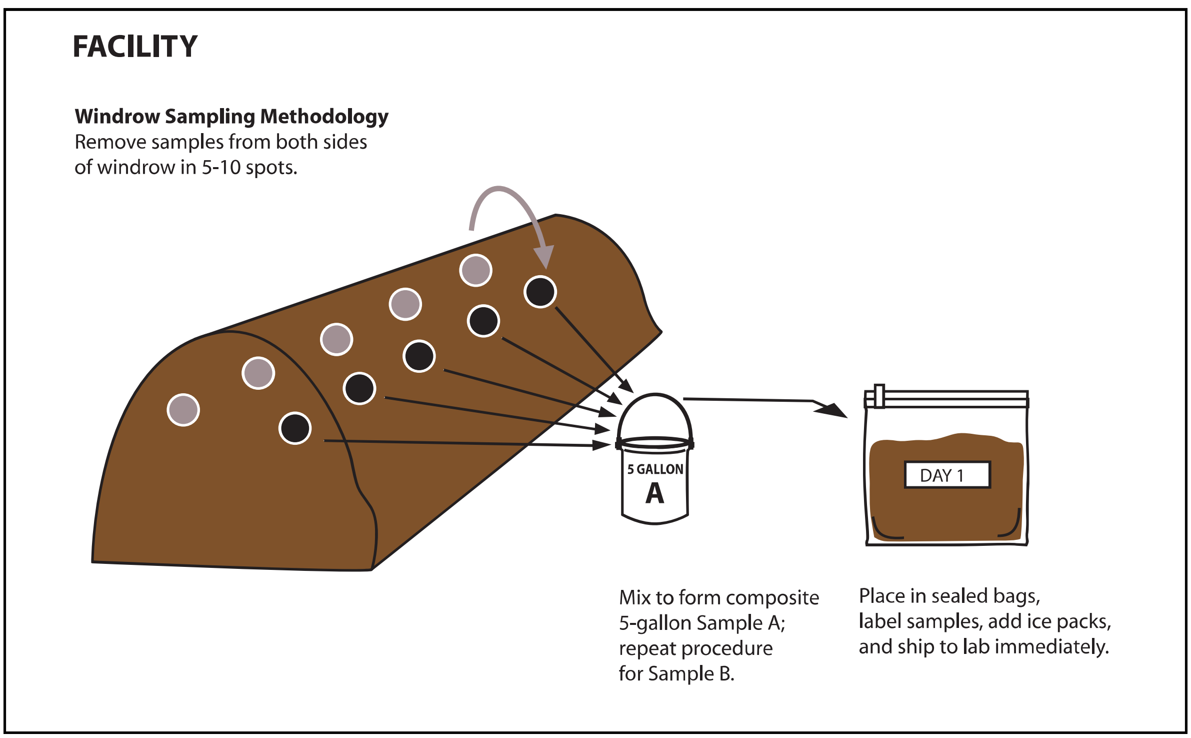
At Marlborough, front-end loaders (FELs) form the immature compost into windrows 90 feet long, 15 feet wide, and four- to eight-feet high. Each windrow sits on top of two lines of aeration trenches built into the concrete floor. The Marlborough facility employs 80 separate aeration trenches. Using computers, facility operators vary the air flow through each pair of trenches based upon the state of decomposition and windrow temperature.

Operators use FELs to turn the windrows every five to seven days. As operators turn the windrows, they transfer them from one aeration trench to the next, effectively moving the material from one end of the aeration floor to the other over the course of about twenty-one days. When a windrow is ready for final screening, it is moved off of the aeration floor (Illustration 1-1).

Per the terms of the Composting Trials, the management at Marlborough agreed to clear a portion of the air floor exclusively for the New York City material. Space was reserved in front of and behind the New York City material (both in the drum and on the air floor), so that there would be no chance of accidental mixing with local material. Each day of the Trials, facility operators discharged New York City material, ran it through the primary screen, and then transferred the unders to the first set of aeration trenches on the air floor.

Illustration 1-4

Windrow Sampling Methodology



After all five days' worth of New York City's material was discharged from the drum, the unders covered one whole set of trenches and the windrow was complete (Illustration 1-3). At this point the Department took the next set of samples, which are labeled "Day 1" (see Illustration 1-4) on the laboratory data sheets attached as Appendix F.[6]

Photo 1-15: Removing samples from the windrows for laboratory analysis
The Department took laboratory samples at different points during the 21 days that the NYC material spent on the Marlborough aeration floor.

The Marlborough facility retains material on the air floor for approximately 21 days. The first windrow is turned after one week, so depending on how long it takes to form this windrow, some material could be on the air floor slightly more or less than 21 days. On Day 1, 7, 14, and 21, the Department took two, composite, five-gallon samples for laboratory testing from the windrow of the New York City material as it moved along the Marlborough air floor (Photo 1-15). For the analysis of these lab test results, as well as a discussion of air floor performance in general, see the *Analysis of Variance (ANOVA)* section in Chapter 3.

Half-Inch Screen

After anywhere from 21 to 60 days in active composting, MSW-composting facilities will move the material to a final processing stage that includes some combination of the following:

- Finer screening at either a half-inch, three-eighths-inch, or an even smaller setting
- De-stoning to remove heavy inert materials, such as pieces of glass or stones
- Air-classification to remove any remaining small plastic shreds

See Chapter 3 for details on actual final-screening operations. Most facilities dispose of the residue from the final processing stage and typically move the remaining compost off-site for additional curing or end-use. Additional curing requirements depend upon end-use options, local regulations, and the length of the active composting stage. Immature compost (generally less than 50 to 60 days old) may be placed in outdoor windrows and turned periodically by an FEL, or it may be blended with sand, clay, or other ingredients to create different topsoil products.

Table 1-8
NYC Material After Passing Through Marlborough's Half-Inch Screen

Half-Inch Screen Unders (tons)	Half-Inch Screen Overs (tons)	Total Half-Inch Screen Unders and Overs	Overs as Percentage of Total
121.36	16.59	137.95	12%

Composting material remains on the Marlborough aeration floor for approximately 21 days, after which an FEL moves it to a **half-inch trommel screen**. Table 1-8 shows the results of the half-inch screening of the NYC material. From this final, on-site screen, the facility disposes of the **overs** (material greater than a half-inch)

Photo 1-16: Cubic-yard sample shipped to lab for additional curing and testing
The sample cured at the lab for an additional 21 weeks. At different points during this period, lab staff removed samples for analysis.

as residue, and moves the **unders** (material smaller than a half-inch) into trailers for transport to an outdoor curing facility (located in another town) for additional curing, screening through a three-eighths-inch screen, and blending for topsoil manufacturing.

Comparing Tables 7 and 8 shows that 98 tons of material was “lost” during the three weeks of active composting. (Operators originally transferred 236 tons of the two-inch unders to the curing floor, but only ran 138 tons through the half-inch screen three weeks later.) While some of this “loss” can be attributed to the invariable displacement that occurs during material handling, the bulk of the reduction results from moisture and carbon dioxide loss occurring during the active stage of composting. The percentage “lost” during the New York City Trials matches the typical loss experienced during regular Marlborough facility operations.

The Department sent a set of paired (A and B), five-gallon samples of both the half-inch unders and overs for laboratory analysis. The Department also sent to the laboratory one cubic yard of the half-inch unders for additional curing and testing. Lab staff removed the sample from the aerated packing crate (Photo 1-16) and formed a pile outdoors at their facility in Maine. They protected the pile with a specialized fabric designed for covering compost, which they removed periodically in order to manually turn the pile and incorporate water as needed. They continued to compost the NYC material in this fashion, and sampled the pile for all further compost-quality testing on Day 59, 70, 80, 91, 105, 125, and 147.

Final Three-Eighths-Inch Screen

The Department’s initial Trials protocol did not call for a half-inch screening of the material as described above. Instead, material was supposed to move directly off the air floor to a final

Photo 1-17: Marlborough final-screening equipment
While this equipment successfully removes small pieces of glass and plastic particles, Marlborough facility operators no longer use it because too much usable compost was also passing over the screens and being discarded as residue.

facility screen, involving a combination vibration screen, de-stoner, and three-eighths-inch screen (Photo 1-17). The Department had to alter its protocol in response to operational changes at the Marlborough facility. Namely, the decision by facility management to no longer use the facility final screen, and to run their material instead through a half-inch screen and then move it off-site for additional curing, blending, and screening (as described earlier).

Table 1-9
NYC Material After Passing Through Marlborough's Three-Eighths-Inch Screen

Compost: ⅜" Unders (tons)	Residue: ⅜" Overs (tons)	Total (tons)	Overs as Percentage of Total
95.25	26.11	121.36	22%

This new arrangement was unacceptable to DSNY as it was not possible to provide direct oversight of the New York City material at this satellite location. There was a risk that New York City material might accidentally get mixed with local material. Since the Department still needed a final three-eighths-inch screen in order to produce a finished compost that could meet DEC standards, the Department requested that the facility operators screen the New York City material through Marlborough's on-site, final-screening equipment. See Table 1-9 for the results of this final screening.

The facility's final three-eighths-inch screening equipment was still functional, but Marlborough facility management had chosen to no longer use it for several reasons. First, due to space constraints at the Marlborough facility, there was nowhere to stockpile material before sending it through the final screen. The screen would therefore have to operate continuously at a fast pace in order to facilitate increased facility throughput. The equipment was not up to this pressure and frequently caused back-ups and delays. Second, while the equipment did an excellent job of removing the small pieces of glass and shreds of plastic ("inerts"), it also removed a lot of compost. This was due to the fact that the compost was immature after only 21 days (and therefore still very wet) and would adhere to the inerts. In essence, facility operators were throwing compost away with the inerts in the final screen residue (bottom Photo 1-18). While similar screening equipment works smoothly in other MSW-composting facilities, the combination of the equipment configuration and space constraints caused facility management to forego using it at Marlborough.

Photo 1-18: Samples of the NYC material passing under (top) and over (bottom) the three-eighths-inch screen
Laboratory analysis confirmed Marlborough facility operators' criticism of the final screening equipment: 64.5% of the material passing over the final screen was compost.

Table 1-10
Characterization of NYC Material Passing Over and Under the Final Three-Eighths-Inch Screen

Amount of Material Passing Through 3/8" Screen:	Material Characterization	Sample of 3/8" Screen Unders	Sample of 3/8" Screen Overs
	Glass	ND	16.60%
	Film Plastic	.20%	1.90%
	Hard Plastic	.10%	ND
Unders: 95.25 tons	Metals	ND	.45%
Overs: 26.11 tons	Textiles	.20%	16.55%
	Total Inerts[1]	**.50%**	**35.50%**
	tonnage estimate	*.48 tons*	*9.27 tons*
	Compost[2]	**99.50%**	**64.50%**
	tonnage estimate	*94.77 tons*	*16.84 tons*
	total tonnage	*95.25*	*26.11*

ND means not detected.
1. Inerts are very small pieces of non-degradable material, such as glass and plastic.
2. Compost includes very small fragments of remaining degradable items, such as paper, wood, stones, bone, and shell, which the DEC does not count towards inerts levels.

The Department sent two, five-gallon samples of both the three-eighths-inch unders and overs for analysis. The laboratory performed a characterization of this material (Photo 1-18), which verified Marlborough's complaint of the final-screening equipment. Table 1-10 shows the results of this characterization. (Table 1-10 incorporates the tonnage numbers from Table 1-9.) The final screen left only .50 percent of inert material in the finished compost, which is an excellent result. However, a large percentage of the material that passed over the screen as residue (64.5 percent) consisted of compost (including small pieces of organic material, such as wood and stone, which are allowable in a finished compost product). For a more detailed discussion of inerts levels, see Chapter 2. The *Inerts Data* section of Appendix F contains the laboratory inerts-characterization data.

Table 1-11 presents a summary of the overall composting process at the Marlborough facility and at what stage lab samples were taken for compost-quality analysis.

Air Handling
Preventing offensive odors from migrating off-site represents one of the most important factors in the success of any composting facility. In order to do this, facilities must achieve the following:

- Maintain aerobic conditions in the decomposing material, since decomposition under anaerobic conditions produces the most offensive odors
- Capture and treat all process air prior to its release outside

Table 1-11
NYC Composting Trials Summary: Description of Composting Stages, Duration, and Lab Samples

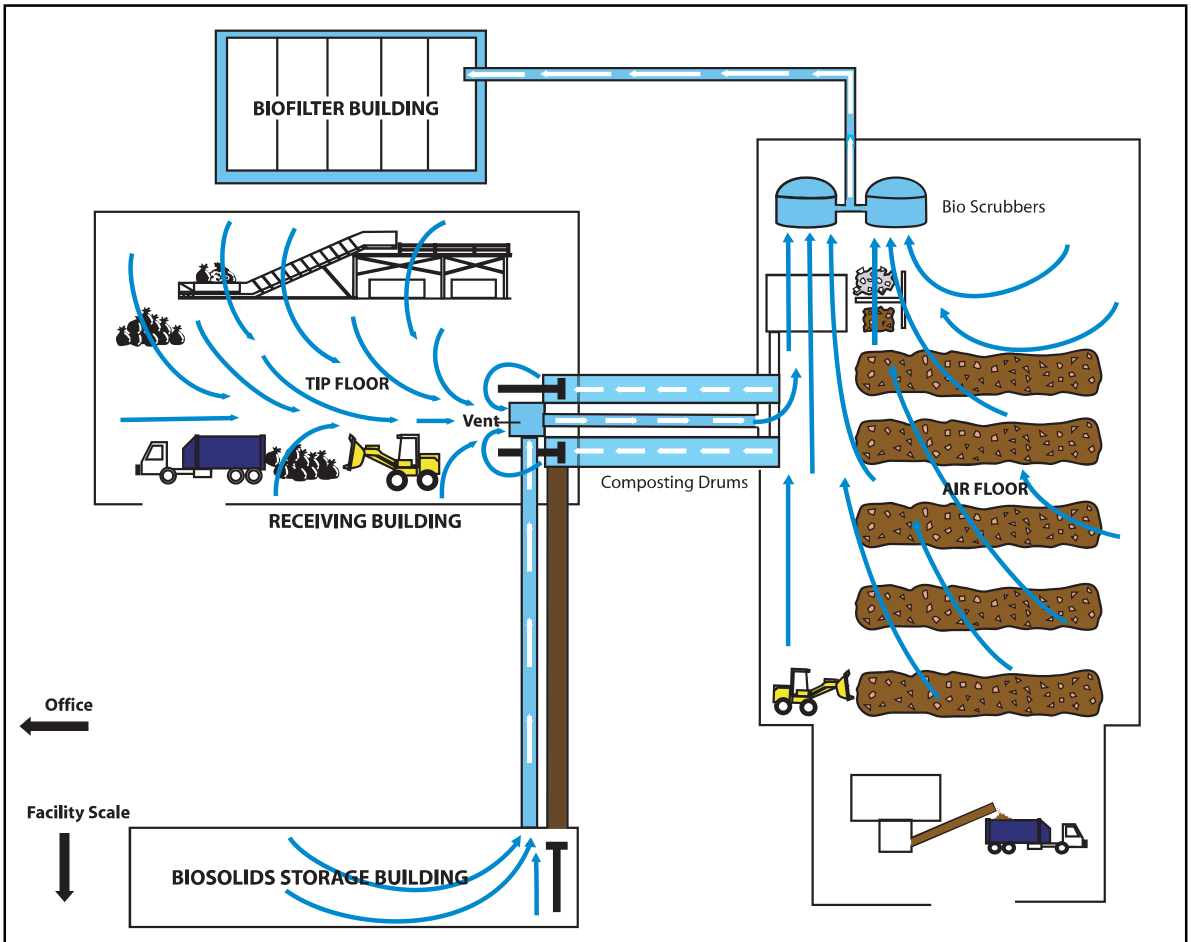
Description	Time/Period Duration	Day Sample Taken	Lab Sample Name[1]
NYC MSW loaded into composting drum	Material loaded each day for 5 days/ Remains in drum for 3 days	None	None
Biosolids loaded into composting drum	Material loaded each day for 5 days/ Remains in drum for 3 days	Every day and then combined into Day 1-3 (A) and Day 3-5 (B)	*NYC Trials Biosolids*
Material passes through primary 2" screen	Directly upon discharge from composting drum	Every day for unders and overs/Combined into Day 1-3 (A&B) and Day 3-5 (A&B)	*NMS[2] Primary Screen Unders* and *NMS Primary Screen Overs*
Active composting of 2" unders	21 days	Day 1, 7, 14, 21	*NMS Day 1 (7, 14, 21) Facility*
Material passes through ½" screen	After 21 days of active composting	Immediately after screening	*NMS Half-Inch Unders* and *NMS Half-Inch Overs*
One cubic-yard sample of ½" unders sent to lab for curing	Approximately 126 days	Day 59, 70, 80, 91, 105, 125, 147	*NMS Day 59 (70, 80,… etc.) WERL[3] Cure*
Material passes through Marlborough facility final ⅜" screen	In the week following the ½" screening and sampling	Immediately after screening	*NMS Facility Final ⅜" Screen Unders* and *NMS Facility Final ⅜" Screen Overs*

1. Lab data is attached as Appendix F.
2. NMS is the code the laboratory assigned to the NYC MSW during the NYC Composting Trials.
3. WERL is an abbreviation for Woods End Research Laboratory, the site of the NMS compost curing.

Maintaining aerobic conditions in the material is a function of supplying adequate oxygen through mixing and turning, as well as moving air through the composting piles. Facilities accomplish the second goal through the design and operation of an air-handling system. Generally, such systems work by keeping buildings under negative air pressure to prevent fugitive emissions, and directing all captured air to a **biofilter**—a living system that "scrubs" odorous compounds from the air passing through it. Some facilities may also employ a scrubber prior to the biofilter to improve the biofilter's performance or extend its life. Typically composed of a blended ratio of compost and wood chips, biofilters may also include soil, limestone, or other ingredients. The biofilter is constructed either above or below ground, over a series of perforated pipes through which process air is pumped and distributed. Biofilters retain air in the media for a specified time to ensure the degradation of odorous compounds.

Marlborough facility operators pay as much attention to *not* creating odors as they do to creating compost. All buildings at Marlborough are kept under negative air pressure. This means that any time workers open a door, fresh outside air is drawn in, rather than odorous facility air escaping out. Additionally, vents draw air from the receiving building, biosolids storage building, composting drums, and air floor building through **scrubbers**, and subsequently through an above-ground biofilter. Illustration 1-5 represents a schematic of Marlborough's air-handling system.
The scrubbers are two dome-like structures housed inside of the air floor building. The domes are filled with small, hollow, plastic spheres (resembling wiffle balls), over which a small stream of water continuously trickles down. The scrubbers serve to humidify and cool the airflow in order to prevent the biofilter from drying out or becoming too hot in the summer. Air stream

Illustration 1-5
Marlborough's Air-Handling System



Arrows represent airflow through the facility.

temperatures above 103°F could potentially damage the mesophyllic bacteria and other organisms at work in the biofilter. Vents draw air off of the top of the domes and pump it through a large pipe to a separate 30,000-square-foot building, which houses the biofilter.

The pipe from the bioscrubbers enters the biofilter building and connects to a network of smaller perforated pipes that lie on an asphalt pad. The biofilter itself sits on top of these pipes and is designed to retain the air for a specified period of time before releasing it. Again, the microbes in the biofilter media serve to "eat" the odor-causing compounds as they rise through it. Marlborough's biofilter consists of five cells, which typically operate together, but are designed to allow air to be directed to a set of three cells, while maintenance occurs on the other two.

Recovery Rate

Definition
The **recovery rate** represents the percent of material actually recovered for beneficial secondary use by the systems in place to accomplish this. For example, the three materials-recovery facilities (MRFs) with which the City contracted to process municipally collected metal, glass, and plastic recovered between 50-70 percent of the incoming material. This means that of the material DSNY brought to the MRFs as part of its source-separated, curbside (blue bag) recycling program, over half was recovered for use as input to manufacturing processes.

The recovery rate should not be confused with the **diversion rate***,* which in source-separated recycling programs represents the percentage of the total waste stream collected for recycling. It is measured by dividing the weight of collected recyclables by the weight of collected garbage plus recyclables.

The recovery rate is also distinct from the **capture rate**—the percent of material set out for recycling, out of the total quantity of recyclable material estimated to be present in the waste stream. The estimated amount of recyclables in the waste stream is based upon waste-composition sampling. Understanding these distinctions allows for better analysis of any waste-management strategy based on recycling.[7]

Recovery Rate Achieved During the New York City Composting Trials
Table 1-12 summarizes all of the inputs and outputs from the NYC Composting Trials, which can be used to determine an overall facility and solid-waste recovery rate. Similar tables can be found for each of the surveyed MSW-composting facilities in Chapter 3, as well as for the proposed New York City Pilot Research and Development Facility in Chapter 6. The loss-of-mass calculation presented here, as well as in the other recovery rate tables, is derived by subtracting the compost and residue outputs from the total inputs. In other words, the difference between the material brought to the facility for composting (MSW and biosolids) and the material leaving the facility (compost and residue) is attributed to loss of mass. Again, loss of mass is due to the loss of moisture and carbon dioxide that occurs during decomposition. This is a rough calculation, but is a standard way of deriving these types of "mass balance" numbers for MSW-composting facilities. As Table 1-12 shows, the overall facility recovery rate is 65 percent. This means that of all the New York City MSW and Marlborough biosolids processed at the Marlborough facility during the Composting Trials, the facility recovered 65 percent, either as compost or through loss of

Table 1-12
Recovery Rate Achieved During the New York City Composting Trials

Material	Tons	Percent of Input Material
INPUTS:		
MSW Input	259[1]	71
Biosolids Input	106[2]	29
Total Inputs	**365**	**100**
OUTPUTS:		
Compost Output	121[3]	33
Loss of Mass[4]	115	32
Residue Output	129[5]	35
RECOVERY		
Total Facility Recovery[6]	**236**	**65**
Recovery of Solid-Waste Fraction	**130[7]**	**50[8]**

Calculations based on compost and residue rates achieved after the ½" screen instead of the ⅜" due to the technical problems previously described regarding the ⅜" screen.

1. From Table 1-4.
2. From Table 1-6.
3. From Table 1-8.
4. Calculated by subtracting compost and residue output from total inputs. Loss of mass is attributed to loss of moisture and CO_2.
5. Sum of residue listed in Tables 2-5, 2-7, and 2-8.
6. Includes compost output and loss of mass.
7. Calculated by subtracting liquid input (biosolids) from "Total Facility Recovery."
8. Based upon solid-waste input.

moisture and carbon dioxide. The recovery rate for MSW alone, exclusive of biosolids, is 50 percent. These numbers are in line with recovery rates achieved at the four surveyed facilities. The actual rates are summarized in Chapter 3, Table 3-1, *Summary of the Four-Facility Survey.*

As discussed, residue refers to all non-degradable material that a facility must remove for disposal, either before it enters the digester drums (through sorting), or after it has gone through the composting process (through screening). It is interesting to note that the 35 percent residue rate from the NYC Composting Trials comes close to the consultant's determination of what is "non-compostable" in the samples of New York City MSW sent to Marlborough (Table 1-1). The waste characterization performed at the Fresh Kills landfill (before long-haul trucks transported the NYC MSW to the Marlborough facility) found that 40.1 percent of the material was "non-compostable." Conversely, the 50 percent recovery rate for the solid-waste fraction makes sense given that the waste characterization indicated that 55.6 percent of the NYC waste sampled was degradable.

To get detailed recovery rate information, it is necessary to have accurate waste-characterization data, which is why the Department performed a waste characterization on representative samples of the material it sent to the Marlborough facility. Such data enables DSNY to accurately determine the recovery rate achieved by the facility during the NYC Composting Trials for the *degradable fraction* of the MSW. As summarized in Table 1-13, the recovery rate for the degradable fraction of the MSW was 90 percent.

Focusing on the recovery of the degradable portion of the solid-waste stream represents another way to assess the performance of MSW-composting facilities. Most municipalities, however, do

Table 1-13
Recovery Rate for Degradable Waste Achieved during the New York City Composting Trials

NYC MSW Sent to Marlborough[1]	Amount of Degradable Material		Recovery Rate: Solid-Waste Fraction[3]		Recovery Rate: Degradable Portion of Solid-Waste Fraction[4]
Tons	Tons	%	Tons	%	%
259.05	144	55.6[2]	130	50	90

1. From Table 1-4.
2. From Table 1-1.
3. From Table 1-12.
4. Calculated by dividing the tons of solid waste recovered (130) by the estimated tons of degradable material in the waste stream (144).

not conduct regular, statistically valid, waste-composition studies owing to the relative time and expense involved. Therefore, the summary of the four-facility survey presented in Chapter 3 compares MSW-composting facilities using "total facility recovery" and "recovery of the solid waste fraction."

Chapter 4 presents the conclusions to the NYC Composting Trials, and discusses the results in the context of the findings from the four-facility survey.

CHAPTER 2
COMPOST QUALITY

Summary

This section summarizes the data from the extensive, laboratory analyses the Department undertook to determine the quality of compost produced during the New York City Composting Trials. At minimum, the Department wanted to ensure that the compost made from New York City waste at the MSW-composting facility in Marlborough, Massachusetts (described in Chapter 1) met New York State Department of Environmental Conservation (DEC) standards—which it did. The Department also tested the compost produced by the four surveyed facilities to see how this compost fared against DEC regulations. Tables in this section present all of the relevant standards, as well as the compost test results.

Research Questions

As part of its research to determine if MSW composting is worthy of further consideration as a waste-management strategy for New York City, the Department set out to answer the following questions:

- What quality of compost might DSNY expect to produce by composting samples of New York City residential and institutional waste?
- What is the quality of compost produced by existing MSW-composting facilities?

To answer the first question, the Department sent samples of compost made from New York City waste at the Marlborough facility to a research laboratory for complete analysis. *The compost produced met DEC Class I compost standards (in effect during the time of the Trials), as well as current DEC standards (effective March 2003).*

To answer the second question, the Department took similar compost samples from four other MSW-composting facilities currently operating in North America. *Each of the surveyed facilities producing a finished compost, made a product that met DEC Class I compost standards (in effect during the time of the survey).* For more information about these facilities, see *Quality of Compost from Surveyed Facilities* below, and Chapter 3.

New York State Regulatory Issues

As the DEC regulates all solid-waste facilities and activities, both source-separated and non-source-separated composting operations fall under DEC jurisdiction. Subpart 360.5 of DEC's Conservation Rules and Regulations (6NYCRR) describes the terms under which a municipality or private company may compost solid waste and biosolids. The rules include a requirement that any compost produced by a facility be tested by a certified laboratory and meet specific quality criteria. Table 2-1 presents the DEC pollutant-limit and product-use criteria for compost made with MSW and/or biosolids. The full text of Subpart 360.5 can be found at the DEC website (www.dec.state.ny.us/website/regs/360l.htm).

Table 2-1

DEC Pollutant-Limit and Product-Use Criteria for MSW Compost

Excerpt from Section 360-5.5 Organic waste processing facilities for biosolids, mixed solid waste, septage, and other sludges:

(c) **Pollutant limits and product use.**

(1) A product that does not meet the criteria in this section must be disposed in accordance with this Part.

(2) For facilities that accept biosolids, septage, or other sludges, each waste source must not exceed the pollutant concentrations found in Table 4 of Section 360-5.10, unless the waste source is a minor (less than 10% of the total dry weight of sludges accepted) component of the input to the facility and a program is developed to identify and reduce the pollutant(s) that exceed the limits found in Table 4 of Section 360-5.10 for that waste source. *[See note 1 below.]*

(i) If a waste input, other than a minor source, contains metals at concentrations greater than those set forth in Table 4, the waste can not be accepted at the facility until the generator has implemented a pollutant identification and abatement program and compliance with the requirements of this paragraph has been demonstrated for a period of at least six continuous months. At least six analyses for total solids and the parameter of concern must be provided to demonstrate compliance.

(ii) Wastewater and partially treated biosolids or septage that are generated at one wastewater treatment facility and are further treated at another wastewater treatment facility prior to beneficial use are not considered waste sources subject to the criteria in this paragraph. The resultant biosolids or sludge generated for beneficial use are subject to this paragraph. For the purposes of this paragraph, dewatering is not considered treatment.

(3) The product must not contain pollutant levels greater than the values found in Table 7 of Section 360-5.10. *[See note 2 below.]*

(i) The addition of sawdust, soil, or other materials to the process or product for dilution purposes is not allowed.

(4) Any material added to the process must not contain pollutants in concentrations that exceed the levels found in Table 4 of Section 5.10. If kiln dust is used, the kiln dust must not emanate from a kiln that accepts hazardous waste.

(5) The product must not contain more than two percent total gross contaminants by weight (dry weight basis).

(6) The particle size of the product must not exceed 10 millimeters (0.39 inch) particle size, except for wood particles derived from the use of wood chips as a bulking agent or amendment in composting.

(7) A compost product must be produced from a composting process with a minimum detention time (including active composting and curing) of 50 days, unless an alternate means for achieving sufficient maturity is approved by the department.

(8) The product must be mature. The department may require process operating conditions including, but not limited to, longer aeration time and/or product use restrictions.

(9) An information label must be affixed to the product bag or, for bulk distribution, an information sheet or brochure must be provided to the user. The label or information sheet must contain, at a minimum, the following information:

(i) the name and address of the generator of the product;

(ii) the type of waste the product was derived from;

(iii) the average metal content of the product and the allowable metal levels (or a mailing address, e-mail address, or phone number where this information can be obtained); and

(iv) recommended safe uses, restrictions on use, application rates and storage practices intended to minimize the potential for nuisance conditions and negative surface and groundwater impacts emanating from the storage or use of the product.

(10) The product may be distributed for use on all crops except food crops. This restriction no longer applies 38 months or later after the pathogen reduction criteria have been met. If the product is stored for 38 months or longer, it can be distributed for use on food crops. If the product has been applied to the soil, food crops could be grown on the soil 38 months or more after product application.

(11) If the product will be marketed as a fertilizer or agricultural liming material in New York State, a license must be obtained from the New York State Department of Agriculture and Markets, if required.

1. The pollutant levels from Table 4 of Section 360-5.10 are presented in Table 2-10 of this report.
2. The pollutant levels from Table 7 of Section 360-5.10 are presented in Table 2-2 of this report.

DEC Regulations in Effect During the New York City Composting Trials

The DEC updates its regulations periodically to reflect both changes in federal guidelines and State policy. The current Part 360 regulations went into effect on March 10, 2003. However, as the NYC Composting Trials took place during 2001, this report presents both the former as well as the current standards (see Table 2-2 for a comparison).

Perhaps the most significant change with regard to MSW-compost quality is that the current Part 360 regulations eradicate the previous distinction between a Class I and Class II compost

Table 2-2
Summary of Prior and Current DEC Part 360 Pollutant, Pathogen, and Physical Standards for MSW Compost

	Prior Standards (in effect during 2001)		Current Standards[1] (effective March 2003)	
	Class I	Class II	Monthly Average Concentration	Maximum Average Concentration
Pollutant Parameter (ppm)				
Arsenic	NS	NS	41	75
Cadmium	10	25	10	85
Chromium	100	1000	1000	1000
Copper	1000	1000	1500	4300
Lead	250	1000	300	840
Mercury	10	10	10	57
Molybdenum	NS	NS	54	75
Nickel	200	200	200	420
Selenium	NS	NS	28	100
Zinc	2500	2500	2500	7500
Total PCBs[2]	1	10	NS	NS
Pathogen Parameter (MPN)				
Fecal Coliform	NS	NS	<1000[3]	<1000[3]
Salmonella (per 44 dry grams)	NS	NS	<3[3]	<3[3]
Physical Parameter				
Particle Size (mm)	<10	<25	<10[4]	<10[4]
Percent Inerts	.50	NS	2.0[5]	2.0[5]

ppm = parts per million
MPN = most probable number per dry gram
NS = No Standard
< means not detected at the level noted.

1. Except where indicated, these parameters are from DEC regulations (6NYCRR) Section 360-5.10, Table 7.
2. There is no specific PCB limit in the new regulations since it is not found in Part 503 *(Standards for the Use and Disposal of Sewage Sludge)* of the Code of Federal Regulations. Should PCBs be a concern, a representative for the DEC indicated that the prior Class I standard would hold.
3. These parameters are from DEC regulations (6NYCRR) Section 360-5.5(b)(1).
4. These parameters are from DEC regulations (6NYCRR) Section 360-5.5(c)(4).
5. These parameters are from DEC regulations (6NYCRR) Section 360-5.5(c)(5).

product, and establish one set of criteria that *all* compost derived from solid waste and biosolids must meet. In addition, the new regulations introduce monthly average concentration levels, as well as maximum acceptable concentration levels. Other important revisions include additional testing (for arsenic, selenium, molybdenum, fecal coliform and *Salmonella*), changes to certain pollutant limits, and restricting levels of total gross contaminants to no more than two percent. (Contaminants in this case means the small pieces of glass, plastic, and other non-degradable items, which are referred to as “inerts” in this report.)

Quality of New York City MSW Compost

Section 360-5.5(c)(7) of the DEC regulations (see Table 2-1) states that an MSW-compost product must be “produced from a composting process with a minimum detention time (including active composting and curing) of 50 days, unless an alternate means for achieving sufficient maturity is approved by the department.”

As the last chapter described, the Marlborough facility (located in Massachusetts where there is currently no minimum detention time requirement) composts its material on the air floor for 21 days, passes it through a half-inch screen, and then sends the material off-site for additional curing. Since it was not possible at an off-site location to safeguard the New York City compost against contamination or mixing with local material, the Department sent a cubic yard sample of the half-inch unders (immature compost that passed under the half-inch screen) for supervised curing at the research laboratory that performed the compost-quality analysis.

Again, the New York City material spent 21 days on the air floor at Marlborough. Therefore, in order to test what would be considered a finished (mature) product by DEC standards (i.e., a product composted and/or cured for at least 50 days), the laboratory continued to cure the compost another 38 days before taking samples. The results listed in Table 2-3 are from these Day 59 samples (21 days on the Marlborough air floor plus 38 days under supervised curing at the laboratory), except where noted. Appendix F contains the actual laboratory data sheets.

As discussed in Chapter 1, in order to produce a compost with the required particle size, the Department ran its material through the final screening equipment at Marlborough, even though this equipment was no longer in use. Therefore, the physical standard test results, listed in Table 2-3, are from samples of the New York City compost passing under the Marlborough facility final, three-eighths-inch screen.

As Table 2-3 demonstrates, *the compost produced during the NYC Composting Trials met DEC Class I compost standards (in effect during the time of the Trials), as well as current DEC standards (effective March 2003)*.

Quality of Compost from the Surveyed Facilities

The Department sampled material throughout the composting process at the four surveyed, MSW-composting facilities in order to make meaningful comparisons. In addition, samples of the primary screen unders (post-drum discharge) were removed from each facility and sent to the laboratory where they underwent further composting under controlled conditions. (See the

ANOVA section of Chapter 3 for more detail on this procedure.) Appendix H contains the laboratory data sheets for the four surveyed facilities.

The samples for pollutant testing were taken from the material that the lab composted under controlled, optimized conditions. Relative pollutant-concentration levels tend to increase with more complete degradation of organic materials. Therefore, sampling the lab-composted material enabled the Department to take the most conservative look at pollutant-concentration levels, and put all the facilities on an equal footing with regard to pollutant levels (i.e., facilities that more completely composted their material were not put at a disadvantage and vice versa). The laboratory took samples for these tests between 50 and 52 days after drum discharge, in order to simulate the DEC's 50-day, material-detention-time requirement.

Table 2-3
Comparing NYC Composting Trials Results with DEC Regulations

	Trials Results NYC Composting	Concentration Limits Prior DEC Class I	Current DEC Limits: Monthly Average Concentration	Current DEC Limits: Maximum Average Concentration
Pollutant Parameter (ppm)[1]				
Arsenic	4.9	NS	41	75
Cadmium	4.0	10	10	85
Chromium	40.8	100	1000	1000
Copper	150.8	1000	1500	4300
Lead	239.6	250	300	840
Mercury	1.0	10	10	57
Molybdenum	5.5	NS	54	75
Nickel	57.6	200	200	420
Selenium	1.4	NS	28	100
Zinc	568.0	2500	2500	7500
Total PCBs	<1[2]	1	NS	NS
Pathogen Parameter (MPN)				
Fecal Coliform	50[3]	NS	NS	<1000
Salmonella (per 44 dry grams)	<2[3]	NS	NS	<3
Physical Parameter[4]				
Particle Size (mm)	<10	<25	<10	<10
Percent Inerts	.50	NS	2.0	2.0

See Table 2-2 for abbreviations and DEC regulations citations.
1. Except where noted, the results are from Day 59 samples (21 days on the Marlborough air floor plus 38 days under supervised curing at the laboratory).
2. Results reported as an average from two samples taken from Day 147 material (the next available sample point for these parameters).
3. Results reported from sample taken on Day 80 material (the next available sample point for these parameters).
4. Results are from the laboratory characterization performed on the NYC material passing under the Marlborough facility final screen during the Composting Trials.

The samples for pathogen testing, as well as all tests that assessed agronomic and horticultural properties, were taken from what each facility considered its final compost product. The Department's consultant sent samples of this material directly from the respective facility to the laboratory for testing. These tests essentially measure how well a facility makes compost. If the Department had sampled the laboratory-composted material for these properties, it would in essence be looking at the optimized version of each facility's respective process. Again, the Department wanted to take the most conservative look at the MSW-composting process.

Table 2-4 presents the results of the tests for pollutants, pathogens, and physical parameters on finished compost from the surveyed facilities, and provides a comparison with the results from the New York City Composting Trials. The actual facility names are coded to provide anonymity. As Facility NRC does not currently produce a finished compost, tests were conducted on NRC Day 1 drum discharge. Because this is essentially a very raw, immature compost, fecal coliform levels are still high. The NRC data is not intended to represent a final compost product and is included here for comparison only.

The table also shows the previous DEC standards for a Class I compost, as well as the current standards. In general, New York City's Trials compost compares favorably with compost made at other MSW-composting facilities, with some pollutants at higher levels and others at lower ones. More importantly, *each of the surveyed facilities producing a finished compost, made a product that met DEC Class I compost standards (in effect during the time of the four-facility survey).* With the exception of one facility, the compost produced by these facilities would also meet current DEC standards. (Facility NAL would have to reduce the percentage of inert material in its finished compost from 3.9 to 2.0.)

Other Test Parameters

Horticultural Properties

While the DEC does not provide specific standards for the horticultural quality of finished compost, it does require that facilities producing more than 50 cubic yards of compost per day analyze the following parameters and provide data on a monthly basis:

- total Kjeldahl nitrogen (TKN)
- ammonia (NH_3)
- nitrate (NO_3)
- total phosphorous (P)
- total potassium (K)
- pH
- total solids
- total volatile solids

The Department analyzed the compost produced in the New York City Composting Trials, as well as in the four surveyed facilities, for these parameters and several others considered

Table 2-4

Comparing Compost from the NYC Trials and the Surveyed Facilities with DEC Regulations

Pollutant Parameter (ppm)[1]	NYC Trials	Facility NQB	Facility NRC	Facility NAL	Facility NML	Prior DEC Class I Limits (ppm)	Current DEC Maximum Limits (ppm)
Arsenic	4.9	9.5	<4.0	6.41	3.05	NS	75
Cadmium	4.0	4.0	4.6	4.0	4.4	10	85
Chromium	40.8	42.0	26.2	73.2	45.3	100	1000
Copper	150.8	88.8	72.2	87.8	127.7	1000	4300
Lead	239.6	104.8	120.0	94.6	116.5	250	840
Mercury	1.0	0.5	1.7	1.8	0.6	10	57
Molybdenum	5.5	12.0	<9.1	5.17	4.75	NS	75
Nickel	57.6	35.4	40.4	36.3	57.7	200	420
Selenium	1.4	<5.5	<8.3	2.76	1.70	NS	100
Zinc	568.0	456.0	350.0	378.6	351.2	2500	7500
Total PCBs	<1	<1	<1	<1	<1	1	NS
Pathogen Parameter (MPN)[2]							
Fecal Coliform	50	209	8,529,000[3]	<2.7	<4.4	NS	<1000
Salmonella (per 44 dry grams)	<2	<1.1	<1.5	<1.3	<1.8	NS	<3
Physical Parameter[2]							
Particle size (mm)	<10	<5	NA[3]	<8	<10	<10	<10
Percent inerts	.50	.25	NA[3]	3.9	.50[4]	NS	2.0

See Table 2-2 for abbreviations and DEC regulations citations.

< signifies less than the minimum detection level for the particular parameter tested.

1. Testing performed on samples of lab-composted material, between 50 and 52 days after drum discharge from each facility. See notes to Table 2-3 for NYC sample-day information.
2. Testing performed on samples of finished compost shipped directly from each respective facility to the laboratory.
3. As Facility NRC does not currently produce a finished compost, tests were conducted on NRC Day 1 drum discharge. Since the material at this stage represents raw, immature compost, fecal coliform levels were still high. The NRC data is not intended to represent a final compost product and is included here for comparison only.
4. NML currently blends their final compost product with sand, a practice that would not be acceptable to the New York State DEC for inerts-measurement purposes.

relevant to product quality from a marketing or end-user perspective (such as moisture, density, and carbon-to-nitrogen ratio).

As noted, the agronomic/horticultural data (presented in Table 2-5) come from samples of what each facility considered its final compost. This varied significantly from facility to facility (see notes to Table 2-5). Chapter 3 provides a detailed discussion of operations at each of the surveyed facilities, however, it is important to note two points here.

First, as explained previously, Facility NRC did not produce a finished compost at the time of the survey, as the air-floor component of the facility was not yet built. Therefore, the testing for this facility was performed on drum discharge, which is essentially very raw (immature) compost.

Table 2-5

Evaluating Compost Quality from the NYC Trials and the Surveyed Facilities Based on Agronomic/Horticultural Properties

Parameter	NYC Trials	NQB	NRC[1]	NAL	NML[2]	Mulch Standard[3]
Total Kjeldahl Nitrogen[4] (% of total solids)	1.3	1.1	.83	2.2	.85	.15 - 1.0
Ammonia Nitrogen[5] (ppm)	2,243.0	198	248.5	1,407.5	2,233.5	<50
Nitrate[6] (ppm)	<2	<2	<2	<2	<2	10 - 100
Total Phosphorous (% of total solids)	.42	.20	.12	.23	.42	0.02 - 0.2
Total Potassium (% of total solids)	.30	.40	.26	.42	.21	0.1 - 0.5
pH	7.5	8.0	7.1	8.4	6.1	5.0 - 7.0
Total Solids (%)	76.5	78.3	52.1	73.5	44.4	NS
Total Volatile Solids[7] (% of total solids)	72	70.1	75.3	57.2	77.5	30 - 85
Nitrite (ppm)	<2	<2	<2	<2	<2	NS
Salinity[8] (mmhos/cm)	7.8	6.1	3.0	10.0	10.0	0.2 - 1.0
Density (lbs. per cubic yard)	775	716	783.5	884.5	1162.5	400 - 1200
Moisture (% of saturation)	23.5	21.8	47.9	53.2	55.6	35 - 85
Carbon-to-Nitrogen Ratio	25.9	33.45	48	13.4	38.9	35 - 150
Free Carbonates CO_3 (rating)	1	1.5	1	2	1	1 - 2
Solvita CO_2[9] (rating)	2	3	1.5	5	7	2 - 8
Solvita NH_3[9] (rating)	4	5	5	4	5	4 - 5
Calcium (% of total solids)	2.6	3.5	2.0	3.9	2.0	0.2 - 2.0
Magnesium (% of total solids)	0.38	0.22	0.16	0.35	0.18	0.04 - 0.4
Sodium (%)	0.56	0.30	0.39	0.63	0.38	<Potassium
Copper (ppm)	150.8	87.4	38.4	242	99.0	<1500
Manganese (ppm)	428	284	86.8	426	430	<1,000
Iron (ppm)	12,120	8,160	6,880	7,160	9,220	<12,000
Zinc (ppm)	568	482	218	660	400	<2,800

The unit of measurement follows most parameters in parentheses. Parameters in italics indicate those for which regular reporting is currently required. The lab data for the NYC Trials is found in Appendix F. Appendix H contains the lab data for the four-facility survey.

Final Product Sample Days: NYC (Day 59); NQB (Day 45); NRC (Day 1); NAL (Day 90); NML (Day 21).

< means not detected at the level noted.

1. Facility NRC did not produce a finished compost at the time of the survey, as the air-floor component of the facility was not yet built. Therefore, the testing for this facility was performed on drum discharge, which is essentially very raw (immature) compost.
2. NML facility finishes composting its material off site, where it blends material with sand before performing the final screen. Since the DEC would not allow such a dilution before testing, the lab performed the tests for the agronomic and horticultural parameters on samples of NML compost taken before it left the facility (Day 21). This product is therefore immature and these results do not represent the quality of NML's final product.
3. The Mulch Standard is not proscribed by any regulation, but is a part of the Rodale Quality Seal-of-Approval program for evaluating compost products, offered by the laboratory.
4. The Total Kjeldahl Nitrogen parameter is called "Organic-Nitrogen" in the lab data.
5. The lab reports Ammonia as Ammonia Nitrogen, labeled "Ammonium-N" in the data.
6. The Nitrate parameter is called "Nitrate-N" in the lab data.
7. The Total Volatile Solids parameter is called "Organic Matter" in the lab data.
8. The Salinity parameter is called "Conductivity" in the lab data.
9. Solvita is a registered trademark of the Woods End Research Laboratory, Inc.

Second, the NML facility finishes composting its material off site, where it blends material with sand before performing the final screen. Since the DEC does not allow such a dilution before testing, the Department chose to perform the tests for the agronomic and horticultural parameters of the NML compost as it left the facility (the last sample point before the material moved off site). This product is therefore immature and these results do not represent the quality of NML's final product, but are provided for comparison purposes.

Interpreting Agronomic/Horticultural Properties Data

Interpreting the agronomic and horticultural properties data is not as simple as interpreting the pollutants and pathogen data. In the case of pollutants and pathogens, there is an allowable limit, and a compost either meets the standard or it does not. With agronomic and horticultural properties, there is no absolute standard, but compost is evaluated depending on the intended end use. For example, what would be considered a good pH for mulch, might not necessarily be a good pH for potting soil. For a general guide to interpreting these results, see *Interpretation of Waste and Compost Tests,* attached as Appendix G.

The standard for "Mulch" provided in the far right column in Table 2-5 comes from the research laboratory that performed all of the tests associated with the New York City Composting Trials. Mulch represents one of the six recognized types of compost under the Rodale Quality Seal-of-Approval program—an independent quality-assurance program offered by the laboratory for evaluating and approving compost and soil amendment products.[1]

The intended uses of a mulch product are described as being for "surface application only, under shrubs or for non-growth purposes; 1"– 8" thick surface application for weed control, gradual nutrient release, and surface organic matter improvement." For a description of the other five recognized types of compost under the Rodale Quality Seal-of-Approval program, see page 5 of the lab's *Interpretation of Waste and Compost Tests* (Appendix G). The Department chose to analyze the compost produced in the New York City Trials and the four surveyed facilities against this standard, as this is the end use that best describes the types of projects that might utilize MSW compost.

Another important point to keep in mind when analyzing the agronomic and horticultural properties of a compost is that if an individual result falls out of the stated range for the standard, this is not necessarily a bad thing. For example, the fact that the nitrate levels for all of the composts fall below the range accepted for a mulch would not be considered a problem. However, if they deviated from the standard on the high end of the spectrum (i.e., >100 ppm), then this would be problematic. Likewise, for the composts listed in Table 2-5 that have higher amounts of phosphorous and calcium, this means that they contain more of these minerals than what is typical for a material being used as mulch. These levels are normally seen in compost used for topsoil blends, or other growth-oriented applications, where a user would want more minerals. Finally, the high iron level found in the NYC Trials' compost would not have negative implications and might actually be appreciated by a turf grower.

The standards are best read then as a guide. If most of the agronomic and horticultural parameters fall within the accepted range for a mulch, then a facility might want to adjust its operations to bring the few parameters that do not into conformance so that it could better promote its product for a specified end use. If the product can consistently meet the standards, then it can receive a seal of approval from the laboratory as a recognized "type" of compost. This makes marketing easier for the producer, and purchasing easier for the consumer, since the latter will know what they are getting without having to analyze the compost for themselves. For example, based on the data in Table 2-5, if operators at the four surveyed facilities wanted to receive a seal of approval for their respective products as a mulch-type compost, they would have to address the following three parameters: ammonia nitrogen, pH, and salinity.

Very high ammonia nitrogen levels in the NYC Trials compost, as well as those produced at facilities NAL and NML respectively, indicate that the nitrogen present in the material is not being stabilized by the available carbon. In fact, the carbon-to-nitrogen ratios for two of these three composts are on the low side, especially NAL. It is interesting to note that these three composts were made with biosolids (a direct source of nitrogen), while those at NQB and NRC were not. These results mean that either the facilities are using too much biosolids in relation to MSW, or that the material is not yet mature and requires further composting. These are both "corrections" that facilities can make.

The pH of compost should generally be neutral to slightly acidic (6.0-7.5), and efforts should be made to control it if it exceeds 8.5. However, if a facility was interested in making a mulch, operators would want to lower the pH to fall in line with the standard stated in Table 2-5 (pH 5.0-7.0). This can be accomplished by adding ammonium sulfate ($(NH_4)_2SO_4$—a chemical compound used for fertilizer that also occurs in nature as the mineral mascagnite). Research at Washington State University has shown that adding ammonium sulfate effectively lowers the pH of compost (as well as levels of ammonia nitrogen).[2]

Salinity represents the final parameter that facility operators would want to address in order to create a product that could earn a seal of approval for mulch. Soluble salt concentration is the concentration of soluble ions in solution and is usually expressed as the electrical conductivity (dS/m or millimhos per centimeter) of a saturated extract of compost. Soluble salt levels in compost can vary considerably, depending on the nature of the feedstocks and processing. Compost may therefore contribute to or dilute the accumulative soluble salt content in the amended soil. In general, knowledge of soil salinity, compost salinity, and plant tolerance to salinity is necessary for the successful establishment of plant material. For example, the final salinity of the amended soil for most turf and landscape plantings should be less than 4.0 dS/m, and for mulch it should be lower still (0.2-1.0). Most feedstocks generally produce compost with salinity levels greater than 4.0 dS/m, and most compost made with municipal feedstocks have a soluble salt concentration of 10 dS/m or below. The results for the NYC Trials compost and the four surveyed facilities are therefore typical given the nature of the feedstocks.

However, if they were to be used as a mulch, facility operators would want to lower the salinity level. This can be achieved by mixing the compost with other low-salinity materials (including other types of composts, such as tree bark) or by leaching with water. Compost with high-salts levels might also be applied well ahead of planting (fall or midwinter) to allow for natural leaching with rainwater.

When it comes to compost quality, facility operators need to work with end users in order to produce a compost that fits the intended application. Compost labeling and other programs that attempt to create recognizable standards (such as the Rodale Quality Seal-of-Approval) are relatively new in this country. While extra effort is involved to meet such standards, the appeal for a facility operator is that once they meet the standards, their product gains status as a recognized type of compost, which allows them to better target their product to end users. It also assures the end user of the quality of the product, which is particularly important for MSW composts.

Toxicity Characteristic Leaching Procedure

Since the non-degradable items removed by each of the various screening processes (after material has been discharged from the digester drum) would presumably have to be landfilled as residue, the Department wanted to determine if anything about the MSW-composting process (including mixing solid waste with biosolids) would in any way make this material hazardous for disposal (thereby necessitating different disposal practices than those used for regular garbage). Therefore, the laboratory performed a Toxicity Characteristic Leaching Procedure (TCLP) on samples of post-drum residue (material passing *over* the various screens), as well as on samples of immature compost discharged from the drum (labeled “2" Unders” in Table 2-6).

The TCLP simulates conditions in a landfill, whereby weak acids (replicating the effect of rainwater percolating through organic waste in the absence of oxygen) are washed over the material to determine if any heavy metals leach out. While this test is not commonly required in MSW-composting regulations, the Department wanted to take the most critical look possible at the results of the MSW-composting process.

The results of the TCLP test (Table 2-6) show that neither the residue nor the compost would pose a threat in a landfill. Five of the eight metals controlled by the U.S. Environmental Protection Agency did not register at all, while the remaining three were detected at levels far below the control limit.

Table 2-6
TCLP Results for the Post-Drum Residue of the New York City Composting Trials

Parameter (ppm)	2" Overs Day 1-3	2" Overs Day 3-5	2" Unders Day 1-3	2" Unders Day 3-5	½" Overs	⅜" Overs Facility	⅜" Overs Lab	EPA Control Limit[1]
Arsenic	—	—	—	—	—	—	—	5.0
Barium	0.36	0.26	0.43	0.45	.60	0.58	.48	100
Cadmium	—	—	—	—	—	—	—	1.0
Chromium	.05	—	0.1	0.06	—	.06	—	5.0
Lead	—	—	—	—	—	—	—	0.2
Mercury	.13	—	0.09	—	.07	—	—	5.0
Selenium	—	—	—	—	—	—	—	0.05
Silver	—	—	—	—	—	—	—	5.0

A dash signifies that there was no detection of the parameter in question at a minimum detection limit of 0.05 ppm.
1. Toxicity Characteristic Leaching Procedure is an EPA SW-846 analytical method (Method 1311). Control limits are set forth in 40CFR (Code of Federal Regulations) 261.4.

Inerts Levels and Characterization

DSNY carefully investigated the relative content of inert material ("inerts") in the compost made from New York City MSW, as well as that made at the four surveyed facilities. For the purposes of this report, inert material refers to small pieces (between 4-10mm or .152 - .39 inches) of plastic (such as shreds of plastic bags) or minute pieces of metal, glass, and textiles that fall under final screens and end up in the finished compost. To give an idea of the relative size of these inerts, four millimeters (4mm) is slightly larger than an eighth of an inch (⅛"), or the height of two, stacked nickels.

The laboratory conducting the analysis for the Composting Trials encountered two obstacles in measuring inerts levels:

1. There is no method describing how a lab is to determine inerts levels in any State or federal guidelines.
2. Each facility surveyed uses a different type and level of final screening, so the lab was faced with "comparing apples and oranges."

To address the first obstacle, the lab turned to *internationally* accepted standards to develop a measurement methodology. The methodology the lab used required that the compost first pass through a 10mm (⅜") hand screen before it was manually sorted down to a resolution of 4mm into the following five categories: glass, hard plastic, film plastic, metals, and textiles. While the DEC regulations do not list textiles as an inert material, DSNY chose to include it in order to be conservative in its evaluation of MSW composting. The lab chose the five categories of inert materials based upon prior compost-analysis experience.[3]

The differences in screen sizes between facilities was more difficult to overcome. Therefore, Table 2-7 lists next to the facility code the final screen size through which the material passed before it went to the lab. The results of the inerts characterization and percent composition come from an average of two composite samples. As stated earlier (Table 2-2), the updated DEC regulations limit the percent of inerts in finished compost to two percent. As Table 2-7 shows, all the finished composts, with the exception of facility NAL, fall below this limit.

It is not possible to speculate why the samples of NAL compost contained higher levels of inert material than samples of compost from the other surveyed facilities. However, factors that generally contribute to inerts levels include:

- The degree to which source-separated, curbside recycling programs remove non-degradable items before they reach the facility
- Whether or not collection trucks compact and break materials during transportation
- The efficacy of pre-drum sorting and post-drum screening of the resulting compost

For a point of comparison, the Department had the lab analyze compost produced at one of DSNY's leaf-and-yard-waste–composting sites. For anyone who has seen this compost, it is remarkably free of any visual contamination, and will serve to contextualize the inerts levels reported above. The results shown in Table 2-8 are an average of an A/B sample pair. Given that

Table 2-7
Inerts Characterization and Percent Composition of the <10mm Finished Compost

Inert Material (%)	NYC Trials (10mm)	NQB (5mm)	NRC[1]	NAL (8mm)	NML[2] (8mm)	Current DEC Total Inerts Limit (%)
Glass	—	0.1	NA	1.8	.4	
Hard Plastic	0.2	0.1	NA	1.2	.1	
Film Plastic	0.1	.05	NA	.4	—	
Metals	—	—	NA	.1	—	
Textiles	0.2	—	NA	.4	—	
Total	**0.50**	**0.25**	**NA**	**3.9**	**.50**	**2.0**

Results are an average of composite samples (A/B), except for facility NML data. For inerts-characterization data for the NYC Trials, see Appendix F. For the inerts data for the surveyed facilities, see Appendix H.
A dash signifies that there was no detection of the material in question.
1. NRC does not currently produce a finished compost product, so this analysis was not applicable.
2. NML blends its compost with sand before screening. This practice would not be allowed by the DEC. The results are provided for comparative purposes.

the input to the Department's leaf and yard-waste compost is source-separated leaves, brush, and grass from residents and landscapers, and the input to the NYC MSW-Composting Trials was mixed, residential garbage, the inerts levels achieved in the NYC Trials are fairly impressive.

Since the DEC has adopted the rigorous two-percent inerts level for MSW compost, it is imperative that the presence of this material be minimized, if not eliminated, in a final compost product. Beyond regulatory compliance, the outlets for finished compost are greatly enhanced when the product is visually free of contamination.

Biosolids

As explained in the *Receiving Biosolids and Liquid Waste* section of Chapter 1, the New York City Department of Environment Protection (DEP) currently produces 1,200-plus tons of biosolids per day, dewatered to 25-26 percent solids. Private contractors take these biosolids and pelletize

Table 2-8
Percent Composition of Inert Material: NYC MSW-Composting Trials vs. NYC Leaf-and-Yard-Waste Compost

Inert Material (%)	NYC MSW-Composting Trials Compost	NYC Leaf and Yard-Waste Compost	Current DEC Total Inerts Limit (%)
Glass	—	0.2	
Hard Plastic	0.2	0.1	
Film Plastic	0.1	—	
Metals	—	—	
Textiles	0.2	—	
Total	**0.5**	**0.3**	**2.0**

them into a fertilizer (42 percent), directly land apply them to crops (37 percent), compost them (13 percent), or alkaline stabilize them into an agricultural liming agent (8 percent).

The DEP produces dewatered biosolids at its eight Water Pollution Control Plants (WPCP) that possess dewatering capabilities. The other six WPCPs without dewatering capabilities either barge or pump sewage sludge via pipeline to the closest one that does. Figure 2-1 shows the locations of all 14 WPCPs.

The State DEC regulates the production and use of biosolids, and requires routine testing of incoming biosolids when used as a feedstock to MSW-composting facilities operating in New York State. Table 2-9 presents the parameters for which incoming biosolids must be analyzed.

Figure 2-1
Map of Water Pollution Control Plants in New York City

Table 2-9
Parameters for Analysis Required by the DEC for Biosolids as an Input to MSW Compost[1]

Group A	Group B	Group C
Total Kjeldahl Nitrogen	Arsenic	Extended Parameters
Ammonia	Cadmium	(see Appendix E)
Nitrate	Chromium (total)	
Total Phosphorous	Copper	
Total Potassium	Lead	
pH	Mercury	
Total Solids	Molybdenum	
Total Volatile Solids	Nickel	
	Selenium	
	Zinc	

1. These parameters are from DEC (6NYCRR) Section 360-5.10, Table 1.

For facilities accepting more than 1,000 dry tons of biosolids per year, the DEC requires monthly testing of the parameters listed under Group A and Group B, and *annual* testing for the extended list of 116 parameters listed under Group C. Appendix E of this report contains this extended list of parameters, including volatile organic compounds, acid-base-neutral compounds, pesticides, and PCBs.[4] While the DEC has not currently established limits for these 116 parameters, test results must be provided to the DEC for their discretionary review.

Table 2-10 presents the Group B parameters for which specific pollutant limits apply, along with the average results reported by the DEP for New York City's biosolids in 2001, and the data on the Marlborough biosolids used in the New York City Composting Trials. (As discussed in Chapter 1, due to logistical constraints, the New York City Composting Trials did not use New York City biosolids, but instead, made use of Marlborough biosolids.) For the laboratory results for the Marlborough biosolids used in the New York City Composting Trials, see Appendix F. For the actual DEP biosolids data, see Appendix E.

As Table 2-10 shows, some parameters in the DEP biosolids were at lower levels than those used in the New York City Composting Trials, while others were higher. Overall, the results for both biosolids fall well within DEC concentration limits. However, it would be prudent to monitor chromium, copper, lead, and zinc levels in the New York City biosolids since these were present at significantly higher levels than in the Marlborough biosolids used for the NYC Composting Trials.

Before generalizing about the quality of NYC biosolids, it is important to understand how the DEP results were derived. As noted, the DEP produces biosolids at eight of its fourteen WPCPs. Each of these plants produces different amounts of biosolids per day, and each plant's biosolids generally contain different levels of the parameters listed in Table 2-10. The DEP does not report these results on a citywide basis, both because of the relative complexity involved with weighting the results based on the actual amounts of biosolids each facility produces, and the fact that it does not make operational sense for the DEP to analyze biosolids generically. In order to generate the DEP data presented in Table 2-10, DSNY averaged the monthly biosolids data from each WPCP with dewatering capabilities for one year and then took a *non-weighted* annual average of all facilities together. This was the simplest way to derive one number for the purposes of comparison. For more information on how much biosolids each DEP facility actually produces, and the test data for each facilities' biosolids respectively, it is important to see Appendix E.

Table 2-11 presents the average results for the Group A parameters (listed in Table 2-9) reported by the DEP for New York City's biosolids in 2001, and the data on the Marlborough biosolids used in the New York City Composting Trials. These parameters are not pollutants, but pertain generally to the horticultural quality of the incoming biosolids and as such, the DEC does not set specific limits.

As Table 2-11 shows, the NYC biosolids and the Marlborough biosolids used in the NYC Composting Trials possess similar agronomic/horticultural qualities. However, a few differences are worth noting.

Table 2-10
Comparing NYC and Marlborough Biosolids Data Against DEC Regulations: Pollutant Parameters

Parameter (ppm)	DEP: NYC Biosolids Data[1]	NYC Trials: Marlborough Biosolids[2] Sample A	NYC Trials: Marlborough Biosolids[2] Sample B	Prior DEC Limits	Current DEC Limits[3] Monthly Average	Current DEC Limits[3] Maximum Average
Arsenic	4.1	15.0	<12	NS	41	75
Cadmium	5.1	0.2	2.0	25	21	85
Chromium	55.6	3.5	27.2	100	1000	1000
Copper	721	28.2	276.0	1000	1500	4300
Lead	191.9	24.8	32.0	250	300	840
Mercury	2.5	0.57	4.9	10	10	57
Molybdenum	12.3	<5	<31	NS	40	75
Nickel	34.6	59.6	47.6	200	200	420
Selenium	5.2	<5	<26	NS	100	100
Zinc	1002.6	328.0	372.0	2500	2500	7500
PCBs[4]	<1	<1	<1	10	NS	NS

NS = No Standard
< means not detected at the level noted.
1. The New York City biosolids data were derived by summing the annual averages of DEP data from January 2001-February 2002 for the City's eight dewatering facilities (Appendix E), and then averaging the sum of those eight. It is important to note that these averages were not weighted to account for the considerably different-sized output of each facility.
2. Appendix F contains the lab data for the Marlborough biosolids used for the NYC Trials.
3. These pollutant limits are from DEC (6NYCRR) Section 360-5.10, Table 4.
4. See note in Table 2-2 regarding PCB limits.

First, the NYC biosolids (containing 25.1 percent solids and 74.9 percent liquid) are significantly drier than the Marlborough biosolids (containing 15.6 percent solids and 84.4 percent liquid). This is most likely due to the fact that Marlborough treats its biosolids on-site (by pumping them directly to the MSW-composting facility), whereas NYC has to pay to export its biosolids. To reduce transportation costs, it is in the DEP's interest to remove as much water (and therefore weight) as possible from its biosolids. How the moisture level of New York City's biosolids would affect an MSW-compost "recipe" would be one of the learning objectives of any proposed pilot MSW-composting facility (see Chapter 5 for more information).

Second, the parameter *Total Volatile Solids* describes how much organic matter is present. In general, biosolids have an organic matter content of 70-80 percent. The organic matter content for New York City's biosolids (62.0 percent) is lower than Marlborough's (78.8 percent), and is on the low side in general. This may be due to the types of material coming into the New York City sewer system, the treatment process, or the way that the DEP handles fines or grit. Typically, if a fraction of the non-organic grit (such as sand, small pieces of gravel, etc.) finds its way into the biosolids, then proportionately the percent organic-matter content will be lower. While the actual reason that New York City's biosolids have a lower organic-matter content than Marlborough's is not known, it would be important to monitor the impact of this on compost quality, again, should the City go forward with a pilot MSW-composting facility.

Finally, the nitrate levels in the two biosolids appear to be different. However, due to the scale of measurement in this instance, the magnitude of difference is not important as both biosolids essentially have zero nitrates. For example, the 21.15 parts per million of nitrate in the NYC biosolids have to be read in relation to the total Kjeldahl nitrogen (TKN) level of 6.3 percent. This means that of the 6.3 percent of the biosolids that are nitrogen, .0003 percent (21.15 divided by 63,000) is present as nitrate.

Table 2-11
Comparing NYC and Marlborough Biosolids Against DEC Regulations: Agronomic/Horticultural Parameters

Parameter	DEP: NYC Biosolids Data	NYC Trials: Marlborough Biosolids
Total Kjeldahl Nitrogen (TKN) (% of total solids)	6.3	.76
Ammonia (NH_3)[1] (% of total solids)	1.5	.84
Nitrate (NO_3) (ppm)	21.15	3.0
Phosphorous (P) (% of total solids)	2.52	2.0
Potassium (K) (% of total solids)	.29	.20
pH	7.9	5.93[2]
Total Solids (%)	25.05	15.6[2]
Total Volatile Solids (% of total solids)	62.0	78.8[2]

For sources of lab data, see notes to Table 2-10. For nomenclature used in the lab data, see notes to Table 2-5.

1. Since the DEP reports ammonia levels as a percent (instead of ppm), the NYC Trials' value for ammonia was converted here for comparative purposes. The DEP data labels ammonia as NH_3, whereas the NYC Trials' data labels ammonia as Ammonium-N(NH_4-N). They are equivalent parameters.
2. These results are the average of two samples (A/B).

Compost Made from New York City Biosolids

As noted earlier, about 13 percent of the 1,200-plus tons of biosolids that New York City produces each day are collected and composted by a private contractor based in Pennsylvania. As the Department was unable to utilize New York City biosolids in its MSW-Composting Trials, it is important to know about the compost quality that these biosolids make.

The contractor collects biosolids from a number of WPCPs around New York City, including Oakwood Beach on Staten Island, the 26th Ward in Brooklyn, and occasionally, Tallman Island in Queens. The contractor owns two outdoor-composting facilities, approximately five acres each, in West Virginia. The one located in Wetzel County, West Virginia employs the aerated static-pile method to compost New York City biosolids exclusively. Facility operators lay down perforated PVC pipes and layer over them a blend of wood chips and biosolids. This material is then covered with finished compost to act as an in-place biofilter.

When the compost is finished and screened, the operator tests it against West Virginia, Pennsylvania, Ohio, Maryland, New York (all of the States where the compost is sold), and federal EPA standards to verify that the product is a Class A compost. The finished compost is called "Landscapers' Advantage Class A Compost," and is marketed as a soil conditioner for landscaping, tree farms, nurseries, sod farms, topsoil blending, land reclamation projects, parks, athletic fields, lawns, cemeteries, golf courses, and other horticultural applications. (See Appendix E for a copy of the promotional brochure.)

Tables 2-12 and 2-13 show the laboratory analyses for samples taken from the Wetzel County compost facility. Appendix E contains the lab results themselves. Table 2-12 presents the pollutants testing results (Group B parameters, for which specific limits apply), while Table 2-13 presents the data for the agronomic/horticultural properties (Group A, for which the DEC requires routine testing, but does not provide limits). The "Mulch Standard" in the right-hand column of Table 2-13 is not proscribed by law, but is provided for comparative purposes. See *Interpreting Agronomic/Horticultural Properties Data* earlier in this chapter for more information on this standard.

It is difficult to draw direct comparisons between the Wetzel County data (presented in Tables 2-12 and 2-13) and the data for either the compost made with Marlborough biosolids in the NYC Composting Trials, or for the uncomposted New York City biosolids themselves (Table 2-10). While the Wetzel County compost was made with New York City biosolids, the biosolids came from select WPCPs. The data for New York City biosolids in Table 2-10 presents an unweighted average of biosolids from *all* eight WPCPs. It is difficult to compare the Wetzel County data with the compost made in the New York City Composting Trials because the Wetzel County facility mixes New York City biosolids with wood waste, not municipal solid waste (MSW).

That being said, several things are interesting to note. Compost experts generally agree that the heavy metals in compost made with biosolids and MSW originate with the biosolids, not the MSW. While the Wetzel County compost was not made with MSW, it effectively demonstrates how heavy metals from biosolids "carry through" to the compost (assuming that the wood waste with which it was made has relatively low levels of metals).

Table 2-12
Quality of Compost Made with NYC Biosolids: Pollutant Parameters

Parameter (ppm)	Compost Made with NYC Biosolids[1]	Prior DEC Class I Limits	Current DEC Limits Monthly Average	Current DEC Limits Maximum Average
Arsenic	5.4	NS	41	75
Cadmium	2.9	10	21	85
Chromium	40.0	100	1000	1000
Copper	569	1000	1500	4300
Lead	140	250	300	840
Mercury	1.0	10	10	57
Molybdenum	10	NS	40	75
Nickel	33.8	200	200	420
Selenium	0.5	NS	100	100
Zinc	637	2500	2500	7500
Total PCBs	<1	1	NS	NS

See Table 2-10 for abbreviations and sources for DEC regulations.

1. Based on test results provided by Wetzel County, West Virginia compost facility, which uses NYC biosolids exclusively in its operations.

Focusing on the four heavy metals that were potentially of concern—chromium, copper, lead, and zinc—the data shows similar levels in the Wetzel County compost as in the unweighted average of all New York City biosolids (Tables 2-12 and 2-13). The Wetzel County compost shows levels of 40 ppm for chromium, 569 ppm for copper, 140 ppm for lead, and 637 ppm for zinc. The respective levels of these heavy metals in the unweighted average of New York City biosolids are 55.6 ppm, 721 ppm, 191.9 ppm, and 1002.6 ppm.

That these four metals appear in higher concentrations relative to other metals, both in the Wetzel County compost and in New York City biosolids as a whole, demonstrates the principle of heavy metals carrying through from the biosolids to the compost. While *relative* levels of these metals are elevated, the *actual* levels will naturally be slightly lower due to dilution through mixing the biosolids with wood waste. To keep this discussion in perspective, it should also be noted that levels of chromium, copper, lead, and zinc were well within the more stringent DEC concentration limits in effect during the time of the NYC Composting Trials. Furthermore, in the recent changes to these regulations, the DEC raised the concentration limits for these four metals in particular.

With regard to the agronomic and horticultural properties of the compost made with New York City biosolids (Table 2-13), the results do not generally fall in line with the “Mulch” standard. Total phosphorous and pH are both higher than the standard. This would generally not be a problem for phosphorous, but depending on the specific intended end use, the pH might be a bit high. More importantly, the ammonia nitrogen level is very high and the total Kjeldahl nitrogen is also high. Elevated ammonia nitrogen levels could potentially be a concern if this compost was

Table 2-13
Quality of Compost Made with NYC Biosolids: Agronomic/Horticultural Properties

Property[1]	Compost Made with NYC Biosolids	Mulch Standard[2]
Total Kjeldahl Nitrogen (% of total solids)	3.02	.15-1.0
Ammonia[3] (ppm)	35,000	<50
Nitrate (ppm)	ND	10-100
Total Phosphorous (% of total solids)	2.17	.02-0.2
Total Potassium (% of total solids)	0.18	0.1-0.5
pH	7.8	5.0-7.0
Total Solids (%)	54.8	NS
Total Volatile Solids (% of total solids)	57.6	30-85

ND = None Detected
NS = No Standard
< means not detected at the level noted.
1. The DEC requires regular reporting of these parameters, but does not provide specific limits or standards that a compost product must meet.
2. This standard is not proscribed by law, but is a part of the Rodale Quality Seal-of-Approval program for evaluating compost products. “Mulch” represents one of the six recognized types of compost under this program.
3. The data for the Wetzel County compost, attached in Appendix E, reports ammonia (listed as “ammonia nitrogen”) on a percent dry-weight basis. This table converts the result to parts per million in order to compare it to the Mulch Standard.

used straight as a mulch, rather than blended, for example, with topsoil. This is due to the fact that mulch is generally applied in fairly deep layers (six-plus inches) to kill weeds, and so much ammonia nitrogen could burn the plants that the mulch is intended to protect.

The company that makes and markets the Wetzel County compost recommends that users apply it when establishing new lawns and flower beds, when maintaining existing lawns, on nursery and house plants, and when mulching trees and shrubs. The promotional sheet that describes the Wetzel County compost product accompanies the biosolids data in Appendix E.

CHAPTER 3
FOUR-FACILITY SURVEY

Summary

This section summarizes DSNY's survey of four, operating, MSW-composting facilities. The Department chose the four facilities because each employs a different variation on the drum-based composting approach, and operates successfully at throughput volumes relevant to New York City. The survey (carried out by a consultant to the Department in 2001) included three components: site visits, compost sampling and laboratory analyses, and written questionnaires.

Chapter 2 contains the results from the laboratory analyses. The *Facility Surveys* section below presents the following findings from the site visits and questionnaires for each facility:

- Facility Size and Throughput Capacity
- Facility Operations
- Facility Recovery Rate
- Compost Quality and End Use
- Facility Economics

The *Facility Surveys* section also presents the results of an Analysis of Variance (ANOVA) conducted by the research laboratory to detect statistically significant differences among facility processes and resulting compost quality. Chapter 4 draws conclusions from the data and extrapolates lessons for New York City.

Research Questions

As part of its research to determine whether MSW composting merits further study as a waste-management strategy for New York City, the Department set out to answer the following questions:

- How well do other MSW-composting facilities perform, and what are the factors that affect the potential application of this technology in New York City?

To answer these questions, the Department conducted a survey of the following MSW-composting facilities operating in North America:

- Groupe Conporec Inc. Sorel-Tracy facility in Quebec, Canada (Conporec)
- TransAlta Corporation Edmonton facility in Alberta, Canada (Edmonton)
- Bedminster Marlborough, LLC facility in Marlborough, Massachusetts (Marlborough)
- Rapid City Regional Recovery and Landfill Facility in Rapid City, South Dakota (Rapid City)

Table 3-1 summarizes the survey results, including the estimated capital development costs for

Table 3-1
Summary of the Four-Facility Survey

Parameter	Conporec[1]	Edmonton[1]	Marlborough	Rapid City[2]
Population Served	50,000	920,000	37,000	85,000
Design Capacity (tons per day)	120 solid waste 12 liquid waste	825 solid waste 380 biosolids	100 solid waste 50 biosolids	213 solid waste 100 biosolids
Actual Throughput (tons per day)[3]	96 solid waste 11 liquid waste	750 solid waste 200 biosolids	100 solid waste 50 biosolids	213 solid waste 37,875 gallons of water[4]
Site Size	9 acres	60 acres	6 acres	NA
Facility Size	2 acres	10 acres	2.3 acres	5+ acres
Facility Recovery Rate[5]	75%	61%	64%	64%
Recovery Rate of Solid-Waste Fraction[5]	72%	50%	48%	60%
Percent Loss of Mass[5]	28%	32%	16%	29%
Percent Residue[5]	25%	39%	36%	36%
Facility Capital Costs	$14.1 million	$100 million	$15 million[6]	$22.6 million[7]
Per-Ton Processing Cost/Tip Fee	$80 est. MSW $45 commercial $40 liquid waste	$69 MSW & biosolids	$92 MSW $70-$85 commercial $72 biosolids	$27 MSW & biosolids[8] $45 commercial

1. Dollar figures are Canadian; the average current exchange rate is $1.00 American to $.65 Canadian.
2. All aspects of the Rapid City facility are not yet complete; figures are projected estimates. The Department chose to include this plant in its survey because it employs a different type of digester drum and material-recovery process.
3. Based on the number of operating days per year at the respective facilities.
4. At the time of the survey, the facility was not accepting biosolids because the plant was not yet complete; to achieve the desired moisture level in the drums, the facility pumped in water.
5. Based upon 2001 annual inputs and outputs. See notes in Tables 3-3, 3-5, 3-7, and 3-9 for how figures were calculated.
6. Facility incorporated already existing structures from biosolids-composting operation.
7. Includes construction of Materials Recovery Facility (MRF).
8. The per-ton figure is derived from the operation of the MSW-composting facility and adjacent MRF, which share overall costs. The figure also includes the offset of sold recyclables from the MRF.

each facility, as well as the per-ton processing cost (when the facility is publicly owned) or tip fee (when it is privately owned). The capital costs are not adjusted to reflect current year dollars, but are the costs associated with developing the respective facility in the year each was built.

When reviewing Table 3-1, it is important to keep in mind the difficulty of comparing waste-management costs across municipalities, let alone countries. The cost of local labor, insurance, real estate, taxes, utilities, and disposal alternatives represent just a few of the factors that make an “apple” in one place, an “orange” somewhere else. Given these difficulties, the information presented in Table 3-1 should be used for making rough comparisons only. Similarly, it is not possible to use the facility development and per-ton processing costs in Table 3-1 to accurately estimate the cost to develop and operate an MSW-composting facility in New York City. This was not the intended objective for conducting the survey. Rather, the goal of the survey was to present the range of costs and to show that MSW composting falls in line with other recycling and disposal options. See Chapter 7 for a projection of the costs associated with a hypothetical pilot facility in New York City.

Facility Surveys

Groupe Conporec Inc. Sorel-Tracy Facility, Quebec, Canada

Introduction

Groupe Conporec Inc., a Canadian-owned company, operates an MSW-composting facility in the City of Sorel-Tracy (40 miles northeast of Montreal), in the Province of Quebec.[1] Built in 1992 under contract with Bas-Richellieu County, the facility serves a population of approximately 50,000 in 11 municipalities. The impetus for constructing the facility resulted from the closure of the County's last landfill and pending new Canadian regulations that would substantially increase the cost for landfill construction and operation. After evaluating a number of alternative technologies, including waste-to-energy facilities and composting plants, the County entered into an agreement with Conporec. The County's contract with Conporec is a 20-year agreement, under which participating municipalities commit to utilizing Conporec's services for the residential waste they generate, while Conporec guarantees to recover a minimum of 70 percent of the incoming waste stream. The Conporec facility began operation in 1993, and has not had to turn away any collection vehicles since then.

Facility Size and Throughput Capacity

The Conporec facility (Photo 3-1) is designed to process 38,500 tons per year of solid waste, and currently handles approximately 29,000 tons per year, not including curbside recyclables or drop-off materials. Located in the Tracy Industrial Park on a nine-acre site, the actual facility footprint is approximately two acres and includes the following components: receiving building, waste pit, digester drum, primary refining, maturation, secondary refining, biofilter, and scale (Photo 3-2). Table 3-2 lists the area of principal facility components.

Photo 3-1: Front of the Conporec Tracy MSW-composting facility
The facility is located in the City of Sorel-Tracy, 40 miles northeast of Montreal, in the Province of Quebec.

Nearby industries include an oil-storage and distribution facility, and shops devoted to fabrication, machining, and reconditioning. A golf course is located directly across the street; the nearest residential area is approximately a quarter of a mile away.

Facility Operations

The facility operates seven days a week, 12 hours (two shifts) per day. Upon entering

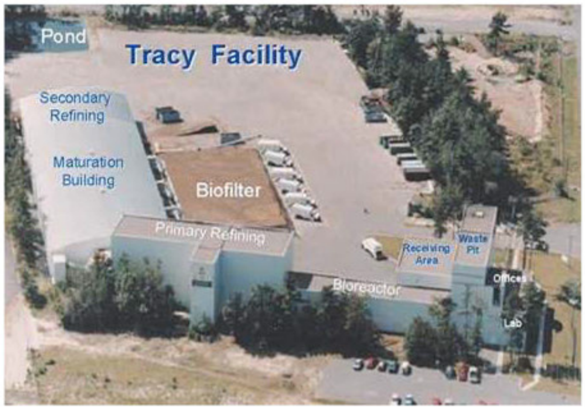


Photo 3-2: Aerial view of Conporec Tracy MSW-composting facility
Located on a nine-acre site in the Tracy Industrial Park, the actual facility footprint is approximately two acres.

and leaving, trucks cross a weigh scale where, utilizing a magnetic swipe card, a computer records all weights. Trucks carrying solid waste then proceed to a fully enclosed tipping building, where they empty their loads directly into a large waste pit (Photo 3-3) with a 650-ton capacity (one week's worth of waste). Although the pit can handle four trucks at once, facility operators only open one door to the receiving building at a time. This ensures the maintenance of negative air pressure in the building and minimizes odors. (For more information on odor reduction, see the *Air Handling and Odor Control* section in Chapter 5.)

An operator, sitting within an enclosed, central control room overlooking the waste pit, uses a single grapple crane to move the solid waste from the pit to the in-feed chute of the digester drum (Photo 3-4). (From the control room, the operator can also open and close the doors to the receiving building.) In addition, the grapple picks out large, bulky contaminants, such as mattresses and water heaters, and sets them to one side of the receiving building for removal. As the County offers a monthly, dedicated, bulk-waste-collection service, the presence of these items at the facility is minimized.

The receiving building is also equipped with a 20,000-gallon tank which can receive liquid wastes, such as biosolids, out-of-date juices, dairy waste, wastewater from slaughterhouses and an organic glue factory, or any other organic-based liquid waste. Ideal moisture levels for the digester-output material range between 52 percent and 54 percent; incoming solid waste typically has a moisture content of 40 percent to 43 percent. Therefore, to optimize conditions for decomposition in the digester drum, facility operators must add liquid to the solid-waste feedstock. For every 100 tons of solid waste that operators load into the digester drum, they pump in approximately 10 to 12 tons of liquid. Where possible, Conporec seeks to meet these moisture requirements with wastewater rather than potable water. The 20,000-gallon tank holds approximately a week's supply of the liquid required by the bioreactor (digester) drum.

Table 3-2
Conporec Facility Footprint (in feet)

Component	Dimensions	Square Feet
Receiving Building	65 x 75	4,875
Waste Pit	25 x 75	1,875
Bioreactor Building	160 x 25	4,000
Primary Refining Area	100 x 40	4,000
Maturation & Secondary Refining	105 x 350	36,750
Biofilter	200 x 80	16,000
Estimated Other (scale, parking, etc.)		15,000
Total		**82,500**

The Conporec digester, housed within the bioreactor building, consists of a 14-foot diameter drum, 157 feet long, which rotates at one rpm (Photo 3-5). The rotation helps to level the waste and move it toward the discharge end of the drum when new waste is loaded into the in-feed end. To maintain aerobic conditions, air circulates through the digester by either a chimney effect (when the in-feed or discharge doors are open), or by activated blowers (when drum doors are closed).

Photo 3-3: Inside the Conporec tipping building
After crossing the weigh scale, trucks empty solid waste into a large waste pit.

Channels running the length of the drum's interior become packed with decomposing organic matter, which serves to "kick-start" the decomposition of incoming waste. Material remains in the drum for three days and reaches temperatures of 55°C (130°F), thereby killing any weed seeds and pathogens. As with most MSW-composting facilities, operators achieve pathogen-kill mandates during the post-digester, active-composting stage, where decomposing materials typically reach temperatures of 71°C to 82°C (160°F to 180°F).

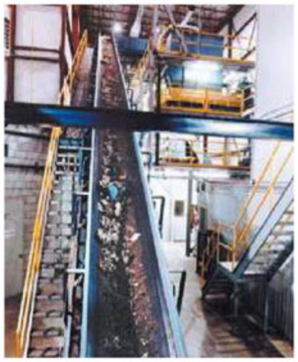
Photo 3-4: Conporec grapple crane operator
From the control room, an operator uses a grapple to move waste from the pit to the bioreactor (composting) drum.

Material discharged from the drum travels via conveyor belt to a trommel screen, which separates out two fractions—"overs" and "unders"(Photo 3-6). A conveyor transports the "overs"(particles greater than one inch in size) to a recycling area where two laborers pick off non-ferrous metals, wood waste, and stones (Photo 3-7), while a magnet recovers ferrous metals. Overs that are not recovered for recycling at this stage are compacted and removed for landfilling.

Photo 3-5: Bioreactor drum at the Conporec MSW-composting facility
The drum is 14 feet in diameter, 157 feet long, and is housed entirely indoors.

"Unders" (particles less than one inch in size) from the primary trommel screen travel up a fast incline conveyor (which serves to remove dense, inert materials, such as glass, ceramics, and hard plastic) and past an air classifier (which removes film plastic particles). The inerts and film plastics are added to the one-inch overs fraction, which travels by conveyor to the recycling area described above for recovery or disposal. A separate conveyor moves the unders material—which at this point primarily consists of immature compost (with most plastics and other inert contaminants removed)—to the maturation building.

The maturation building contains five concrete bays for maturing compost. An overhead conveyor deposits the one-inch unders (immature compost) into one of the bays, forming windrows 213 feet



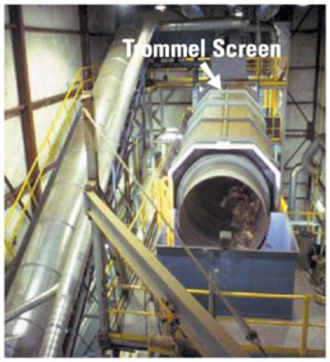


Photo 3-6: Conveyor belt (left) moving material to the Conporec primary trommel screen (right)
Material discharged from the composting drum moves via conveyor to a primary trommel screen, which separates particles greater than one inch ("overs") from those under one inch in size ("unders").

Photo 3-7: Removing recyclables from one-inch overs
A conveyor transports one-inch overs to a recycling area where recyclable material is recovered and the rest is compacted and removed for landfilling.

long, 18 feet wide, and four- to eight-feet high (Photo 3-8). Piping embedded in the floor forces air through each windrow. With three aeration zones in every bay, facility operators can control air supply depending on the state of decomposition and the corresponding oxygen requirement (oxygen levels in the windrows are maintained at levels between 5 and 15 percent).

The composting material remains in the bays for a minimum of 42 days. Every three to five days an automated windrow turner turns the material and slowly moves it from the front to the end of the bay (Photo 3-9). This equipment is also fitted to provide moisture in the initial weeks of composting to help speed the decomposition process. Then, to optimize screening of the finished product, facility operators allow the moisture content of material in the bays to decline so that it exits the maturation bays with a moisture content of 37 percent.

Photo 3-8: Inside Conporec maturation building
The maturation building contains five concrete bays for maturing compost (primary screen unders).

Photo 3-9: Automated windrow turner at the Conporec facility
Composting material remains in the bays for a minimum of 42 days. Every three to five days an automated windrow turner (shown above) turns the material and slowly moves it toward the end of the bay.

After maturation, a front-end loader (FEL) moves the compost to a secondary refining area, where operators feed it into a trommel with a 5mm (0.2 inch) screen (Photo 3-10). Approximately 70 percent of the material falls under the 5mm screen, and moves for further processing to a pulverizer that reduces particle size to 1.5mm. The approximately 30 percent of the material that passes over the 5mm screen collects in a roll-off container until operators redirect it to the waste-receiving pit for reintroduction into the digester drum.

To reduce odors, all process air from the receiving building, digester drum, and maturation building is filtered through a 200-by-80 foot biofilter (Photo 3-11). The number of air changes (how often air is removed and replaced with clean air) ranges from five per hour in the receiving building, to eight changes per hour in the maturation building. Designed to allow for 55 seconds of retention time in the filtration media, the biofilter is 48 inches thick, and sits

Photo 3-10: Secondary screen at Conporec facility
After maturation, the compost moves to a final, five-millimeter screen.

Photo 3-11: Conporec biofilter
All process air from the receiving building, digester drum, and maturation building is filtered through a 200-by-80 foot biofilter.

on top of rounded stones and air-distribution piping. The biofilter consists of three, separate cells that typically operate together, but are designed to allow facility operators to direct air to one or two cells while maintenance occurs on the other(s).

Facility Recovery Rate

Before presenting the recovery rate for Conporec's MSW-composting facility, it is helpful to understand how MSW composting fits in with other solid-waste–recovery operations. Here is a brief description of the tonnages and materials collected through Bas-Richellieu County's various materials-recovery programs.

• **MSW Composting:** The 11 participating municipalities generate 23,100 tons of solid waste per year and divert 91 percent or 21,000 tons per year to the Conporec MSW-composting facility, which also accepts an additional 8,000 tons per year of solid waste from commercial sources. Composting and the post-drum, sorting procedures described above recover 72 percent of the incoming solid waste (Table 3-3). Non-degradable recyclables recovered at this stage include ferrous and non-ferrous metals, wood, and stones. Metals are sold to local scrap dealers. Wood wastes are stockpiled (along with wood from bulk-waste–sorting operations) and periodically a grinder is rented. Ground wood is mixed with unders from the digester at the beginning of the maturation process. Stones, rocks, concrete, and bricks are stockpiled and sold as clean fill.

• **Curbside Recycling Collection:** In addition to running the County's MSW-composting plant, the Conporec company also provides weekly MSW collection, and biweekly collection for the following source-separated recyclables: newspaper, magazines, corrugated cardboard, as well as plastic, metal, and glass containers. Conporec collects these items commingled and transports them to a regional processing center. Source-separated, curbside collection diverts 2,000 tons per year, or approximately nine percent of the residential waste stream (actual recovery rates at the processing center are unknown).

• **Bulk-Waste Collection:** Conporec provides a monthly collection of bulk waste, which is sorted at the Conporec facility. Scrap steel is recycled. Wood waste is ground with other wood residue from the digester and composted. Other bulk materials are landfilled.

Table 3-3
Conporec Facility Annual Inputs and Outputs (for 2001)

Material	Tons	Percent of Input Material
INPUTS:		
MSW Input	21,000	65
Commercial-Waste Input	8,000	25
Liquid-Waste Input	3,500	11
Total Inputs	**32,500**	**100**
OUTPUTS:		
Compost Output	14,500	45
Recyclables[1]	1,000	3
Loss of Mass[2]	9,000	28
Residue Output	8,000	25
RECOVERY:		
Total Facility Recovery[3]	**24,500**	**75**
Recovery of Solid-Waste Fraction	**21,000[4]**	**72[5]**

1. Includes metal, wood waste, and stones recovered after processing through the digester drum.
2. Calculated by subtracting compost output, recyclables, and residue from total inputs. Loss of mass is attributed to loss of moisture and CO_2.
3. Includes compost output, recyclables, and loss of mass.
4. Calculated by subtracting liquid input from "Total Facility Recovery."
5. Based upon solid-waste input.

• **Residential Drop-off:** Conporec allows for direct, residential drop-off at its facility. Drop-off materials include bulk waste, brush, construction debris, tires, car batteries, and paint cans. Drop-off materials are either recycled, directed into the facility's composting system, or landfilled. The percent diversion from Bulk-Waste Collection and Residential Drop-off combined is 1,000 tons per year, or four percent of the total residential waste stream.

• **Fall Leaf Collection:** Conporec provides separate collection in the fall for leaves. Collected leaves are stockpiled at the Conporec facility, and gradually fed into the digester with solid waste.

Compost Quality and End Use
The Conporec facility produces approximately 15,000 tons of compost a year. Material that leaves the facility is considered finished, although it is not fully mature. Conporec sells this material directly from its facility to landscapers (approximately 70 percent of total sales) and farmers (approximately 30 percent of total sales) for an average price of $8 (Canadian) per ton. These end-users undertake an additional curing of the material of at least 45 days. Some of them also provide storage capacity for Conporec's product in the winter months.

Facility Economics
Groupe Conporec financed the Tracy facility. The original capital cost for the facility, including land, was $12.6 million (Canadian) in 1992. In 1994, Conporec expended an additional $1.5 million in capital improvements, primarily to the air-handling and filtration systems.

The Conporec facility employs a total of 15 people, including two shifts of four operating staff, plus seven additional staff members serving in administrative or advisory capacities. In addition to labor, the principal operating cost is electricity, which amounts to approximately $200,000 (Canadian) per year. Municipalities within Bas-Richellieu County are committed to use Conporec for solid-waste services for a period of 20 years (for a fixed fee with built-in escalators), but are not required to produce a given tonnage (this is not a put-or-pay contract). Each municipality pays Conporec approximately $155 (Canadian) per household per year, which covers all aspects of collection, recycling, composting, and disposal. The $155 fee breaks down approximately as follows: $40-45 for collection, $80 for processing at the Conporec facility, and $35 for transport and landfill disposal of residue.

Liquid wastes are accepted at the facility for $40 (Canadian) per ton. As noted above, such wastes include biosolids, out-of-date juices, wash water from slaughterhouses, and the waste water from an organic glue factory. Conporec receives and processes approximately 3,500 tons of liquid wastes per year.

Conporec also receives and processes industrial, commercial, and institutional (ICI) solid waste. This material is accepted for a $45 (Canadian) per ton tipping fee. Conporec processes approximately 8,000 tons per year of ICI waste, including 5,000 to 6,000 tons of waste from a supermarket chain, and waste from schools and restaurants. The facility charges these generators less money to process their waste because the higher concentration of organic (degradable) materials means there is less residue to transport for disposal.

Edmonton Facility, Alberta, Canada

Introduction

The TransAlta Corporation built the Edmonton MSW-composting facility in 1999, under contract with the City of Edmonton, Alberta. Serving a population of approximately 920,000, the facility accepts only municipal solid waste and municipal biosolids.

Prior to contracting with TransAlta, Edmonton spent several years unsuccessfully searching for an appropriate site for a new landfill. The City also wanted to meet the 50 percent landfill diversion goal set by the Canadian government in 1989, and needed a long-term outlet for its MSW that did not require construction of a new landfill, or long-distance hauling. TransAlta—a large, private, electric utility and coal mining concern—wanted to diversify its business and produce a product suitable for mine reclamation. The company approached the City of Edmonton with a proposal to privately finance and construct an MSW-composting facility if the City in return would guarantee the waste stream. The Edmonton facility began receiving waste in March 2000. During the course of the facility survey in 2001, the City of Edmonton purchased the composting facility from TransAlta for $96 million (Canadian).

Facility Size and Throughput Capacity

The Edmonton facility currently handles approximately 198,000 tons per year of MSW and 52,800 tons per year of biosolids (dewatered to 25 percent solids). Located on a 60-acre site, the facility is part of the Clover Bar Waste Management Centre (operated by the City of Edmonton), which includes the Clover Bar Landfill, a fully automated, materials-recovery facility (MRF), as well as landfill-gas recovery and leachate-treatment plants. The actual facility footprint, not including outdoor curing and storage, is approximately 10 acres (Photo 3-12). This includes: receiving building, tip floor, five drums, primary screening area, aeration hall, refining area, biofilters, an office building, and parking. Within the Waste Management Centre, there is an additional 40 acres for curing and storage for up to 110,000 tons of compost. Table 3-4 lists the area of principal facility components.

Photo 3-12: Aerial view of Edmonton facility
The actual facility footprint is approximately 10 acres, which includes: receiving building, tip floor, five drums, primary screening area, aeration hall, refining area, biofilters, an office building, and parking.

The site is located in the vicinity of a power generation plant, an oil refinery, several chemical plants, and other heavy industrial uses. The nearest residential area is approximately one mile away.

Facility Operations
Though staff is present 24 hours a day, seven days a week, the facility only receives waste 10 hours a day, five days a week. The facility employs a staff of 42, including equipment operators, engineers, laborers, and management. A laboratory staff of three analyze compost material and provide input on process control and feedstock ratios. Trucks delivering solid waste weigh in at a scale that the City of Edmonton operates in conjunction with its landfill. After weighing in, trucks back up to the receiving building (which is designed to accommodate eight trucks tipping at once) and unload directly onto the tipping floor. The floor is about 10 feet below the level of the driveway, so that trucks do not actually enter the building.

On the opposite side of the building from the tipping area, five openings are cut into the floor for each digester drum. Front-end loaders spread waste materials in front of these openings and a picking crew goes through the material and pulls out inappropriate and oversized items, such as carpets, lumber, branches, large auto parts, and other durable goods. Facility operators bring these discards to the Clover Bar Landfill or to the MRF. FELs push the remaining material into one of the openings, where it falls into a 15-cubic-yard hopper. A hydraulic ram then loads the material into one of the digester drums.

Table 3-4
Edmonton Facility Footprint (in feet)

Component	Dimensions	Square Feet
Receiving Building (includes tip floor and biosolids processing and storage)	360 x 120	43,200
Five Drums (includes spacing between drums)	242 x 150	36,300
Primary Screening, Aeration Building, and Refining Area	707 x 350	247,450
Three Biofilters	79 x 280 each (plus spacing)	75,348
Curing and Storage Area		1,640,000
Office and Parking		12,000
Total		**2,054,298**

To optimize conditions for decomposition, operators pump biosolids into the drums. For every 750 tons of solid waste loaded into the digester drums, operators add approximately 200 wet tons of biosolids. Since the Edmonton facility has dewatering equipment on-site, they can take sewage sludge directly from a city-owned, wastewater treatment plant and dewater it to approximately 25 to 30 percent solids. In addition, the system can pump liquid "centrate" (the liquid separated from the biosolids in the dewatering process) directly into the drums to achieve the desired moisture content, which is 48 percent.

Photo 3-13: Digester drums at Edmonton facility
Edmonton employs five digester drums, each measuring 16 feet in diameter and 242 feet in length.

Edmonton employs five digester drums, each measuring 16 feet in diameter and 242 feet in length. Fabricated in sections and connected at the site, the drums are situated such that only the loading and discharge ends are inside a building (Photo 3-13). The drums are pitched slightly downward from the loading end (in the receiving building) to the discharge end (in the aeration building). Rotation (at one rpm) of the drums, combined with gravity, helps to move the waste from the loading end to the discharge end.

Waste materials remain in the drums for approximately 24 hours (as opposed to two to three days in other facilities). This short time period means that the digesters function more to mix and homogenize wastes, and break open plastic bags, rather than to initiate any significant composting. Even for this short cycle time, it is still important that conditions in the drum remain aerobic. Therefore, operators pump air at high pressure into the drums from the discharge end. Due to the short retention time, temperatures in the drums typically do not exceed 23.5°C (74°F). The facility achieves pathogen kill, as well as more complete decomposition, in the aeration bays, where compost typically maintains temperatures of 40°C to 70°C (104°F to 158°F) during the 21-day detention period.

Material discharged from the drum travels via conveyor to one of two, three-inch trommel screens, where it is separated into two fractions, "overs" and "unders." The "overs"(particles greater than three inches) move directly into trailers that haul the material to the Clover Bar Landfill for disposal as residue.

The "unders" (particles less than three inches) move by conveyor under a magnet that removes ferrous metals, and then on to the aeration bays (Photo 3-14). Table 3-5, which summarizes the Edmonton facility annual inputs and outputs for 2001, shows that the ferrous recovery at this stage of the process is minimal. According to facility management, the low recyclable recovery can be attributed to the design of the post-digester magnet conveyor belt. The material discharged from the trommel screens piles up to a significant depth in the center of this belt. The cross-belt magnet lacks sufficient strength to pull the ferrous material out of the pile, and thus only recovers about half of the passing ferrous. Facility management plans to rectify the situation by installing a second magnet at this stage to increase ferrous recovery.

Photo 3-14: Conveyor to primary trommel screens (left) in the Edmonton facility and recovery of ferrous metals (right)
Material discharged from the drum travels via conveyor to one of two three-inch trommel screens, which separates two fractions—"overs" and "unders." Before the three-inch unders move to the aeration bays, a magnet removes ferrous metals for recycling.

The aeration hall contains three, concrete aeration bays. Each bay is 587 feet long and 65 feet wide and holds piles of composting material approximately 7.5 feet high. Compared to other facilities, Edmonton employs a more mechanized approach to the aeration process. Conveyors and sidecars automatically load the bays with immature compost, rather than an operator with a front-end loader. Three separate bridge cranes, mounted on rails, straddle each bay and move up and down its length (Photo 3-15). The cranes support a series of augers. The augers, mounted at an angle, mix the material and simultaneously draw it forward towards the unloading side of the bay (Photo 3-16). A series of pipes embedded in the bay floor serves to draw additional air down through the composting material.

After each pass of the crane down the bay, augers automatically move (approximately four feet) toward the unloading side; this process ensures that the material is in the bays for 21 days. As the augers draw material away from the loading side of the bay, they create space for new material. The bay wall at the unloading side has a broad shelf onto which material is deposited as the augers make their closest pass along this side. A paddle device pushes discharged material

Photo 3-15: Edmonton aeration hall (before facility operation) and closeup of the conveyor and sidecar system
Edmonton employs a mechanized approach to the air-floor composting process. Conveyors and sidecars (above right) automatically load the bays with immature compost. Three separate bridge cranes (like the one shown above left) straddle each bay and move up and down its length.

off the shelf and onto a conveyor. The crane and auger assembly make approximately 16 passes in the 19 hours it takes to mix and move all of the material in the bay; material in the bays is mixed five days a week. At any time during the mixing process, facility operators can add moisture to the material at the point where the augers are turning (Photo 3-17).

Upon discharge from the bays, material travels via conveyor to a 25mm (0.985 inch) trommel screen in the refining area. The "overs" (particles greater than 25mm) move to trailers for ultimate disposal in the landfill as residue. The "unders" (particles less than 25mm) travel via another conveyor for further processing. An air classifier separates the material into heavy and light fractions. The heavier materials are processed through a de-stoner, which separates compost from contaminants such as glass and stones (Photo 3-18). The light fraction, containing primarily compost fines and plastic, moves to a finer, final, 8mm (0.315 inch) trommel screen. Overs from this screen (>8mm), along with residues from the de-stoning process, travel on a conveyor to the trailer holding overs from the 25mm screen, and likewise are disposed as residue. Unders from the 8mm screen are combined with de-stoned compost and move on a conveyor to a loading shed. Here, a sprayer nozzle automatically adds moisture as compost travels via conveyor into trailers.

Photo 3-16: Close-up view of an auger mounted on a bridge crane in the Edmonton facility
Each bridge crane supports a pair of augers, which mix the material and simultaneously move it toward the unloading side of the bay.

Trucks transport the compost to a 40-acre, outdoor curing site adjacent to the compost facility, with a capacity for approximately 110,000 tons of material. At the curing site, FEL operators form the compost into windrows. Facility operators were not actively managing these outdoor windrows at the time of the survey. However, they were considering plans for employing a windrow turner, as well as additional screening at the curing site, to improve ultimate product quality.

The facility pumps all process air from the receiving building, drums, and aeration hall to a cooling chamber for volume reduction, then to an acid scrubber to remove ammonia, and finally to a biofilter system. There are three biofilters, each 79 feet wide, 280 feet long, and 4 feet high. Constructed above ground, the biofilters are comprised of softwood bark and compost and are designed to allow 45 seconds of retention time (Photo 3-19). Two biofilters are required to process the exhaust from the facility.

Photo 3-17: A system to add moisture to the composting material on the Edmonton facility air floor
At any time during the air-floor–composting process, facility operators can add moisture to the material.

Photo 3-18: De-stoning equipment at the Edmonton facility
Upon discharge from the bays, material travels via conveyor to a 25mm (0.985 inch) trommel screen with unders moving to an air classifier. Heavier materials from the air classifier are processed through a de-stoner, which separates compost from contaminants, such as glass and stones (shown above).

Photo 3-19: Biofilter at Edmonton facility
Edmonton has three, above-ground, outdoor biofilters, which are composed of softwood bark and compost.

Facility Recovery Rate

Before presenting the recovery rate for Edmonton's MSW-composting facility, it is helpful to understand how MSW composting fits in with other solid-waste–recovery operations.

The City of Edmonton generates 231,000 tons of MSW (this figure does not include commercial waste or construction and demolition debris) and diverts nearly all of this material to the MSW-composting facility and to a city-run, materials-recovery facility (MRF). Here is a brief description of the tonnages and materials collected through Edmonton's various materials-recovery programs.

• **MSW Composting:** Edmonton diverts approximately 194,000 tons per year, or 84 percent of its MSW to the MSW-composting facility. Table 3-5 shows a breakdown of the inputs and outputs from the Edmonton facility. The facility achieves a 50-percent recovery rate, in terms of solid waste alone (exclusive of biosolids), producing 70,568 tons of compost annually (and releasing over 79,000 tons as moisture and carbon dioxide). It is not surprising that this recovery rate is relatively low, as other than a post-drum magnet recovering a negligible amount of ferrous metal, facility operators do nothing else to remove and recover non-degradable, recyclable material. Essentially all non-degradable materials, both recyclable and non-recyclable, are landfilled as residue.

• **Curbside Recycling:** The City of Edmonton contracts for a curbside, source-separated collection program for commingled metal, glass, plastic, newsprint, and mixed paper. The City operates a MRF for its source-separated, non-degradable recyclables, to which it diverts approximately 33,000 tons per year, or 14 percent of its total annual MSW stream. The MRF reports a 90 percent recovery rate, reclaiming 29,700 tons for recycling.

• **Household Hazardous Waste:** The City of Edmonton operates several "Eco-Centres," which are drop-off locations for recyclable and non-recyclable household hazardous wastes. Diversion and recovery rates for this operation are unknown, but presumably minor in terms of tonnage.

Compost Quality and End Use
At the time of the survey, compost produced at the Edmonton facility received a Category B rating from Alberta regulatory authorities.[2] An environmental services company uses Edmonton's Category B product to decontaminate hydrocarbon-contaminated soils, and TransAlta uses it for mine reclamation. TransAlta marketed its compost product as *"Nutri-Plus Compost,"* which is available to Edmonton residents at the Clover Bar Waste Management Centre. Before the City of Edmonton purchased the facility, TransAlta had planned to make the product available through retail outlets.

Table 3-5
Edmonton Facility Annual Inputs and Outputs (for 2001)

Material	Tons	Percent of Input Material
INPUTS:		
MSW Input	193,680	79
Biosolids Input (@ 25% solids)	52,910	21
Total Inputs	**246,590**	**100**
OUTPUTS:		
Compost Output	70,568	29
Recyclables[1]	974	0
Loss of Mass[2]	78,493	32
Residue Output	96,555	39
RECOVERY:		
Total Facility Recovery[3]	**150,035**	**61**
Recovery of Solid-Waste Fraction	**97,125[4]**	**50[5]**

1. Includes ferrous materials recovered by the post-digester magnet (based on estimate for 2002).
2. Calculated by subtracting compost output, recyclables, and residue from total inputs. Loss of mass is attributed to loss of moisture and CO_2.
3. Includes compost output, recyclables, and loss of mass.
4. Calculated by subtracting liquid input (biosolids) from "Total Facility Recovery."
5. Based upon solid-waste input.

Facility Economics
TransAlta privately financed the Edmonton composting facility. The original capital cost for the facility, excluding land, was approximately $100 million (Canadian dollars) in 1999. During the course of the facility survey in 2001, the City of Edmonton purchased the composting facility from TransAlta for $96 million. The City reports that operation, maintenance, and debts service costs total approximately $17 million per year (for the MSW-composting and biosolids-dewatering operations), which translates into about $69 per ton of waste processed.

Employees at the Edmonton facility include: one director of plant operations, one plant manager, two assistant managers, one engineer, two mechanics, eight waste pickers, four front-end loader operators, 20 general laborers, and two administrative assistants. In addition to labor, the principal operating costs consist of electricity (which amounts to approximately $3 million per year) and polymers used in the biosolids dewatering process (at a cost of approximately $600,000 per year). The high cost of electricity probably relates to the intensive use of blowers at the Edmonton facility. As the plant operators hired by the City are relatively new to MSW-composting operations, they err on the side of caution and blow large amounts of air into the digesters. More experienced operators, like those at Marlborough who are closely familiar with recipe formulation and digester mechanics, will rely more on the tumbling of the drum and the chimney effect for aeration inside the drum.

Table 3-6
Marlborough Facility Footprint (in feet)

Component	Dimensions	Square Feet
Receiving Building (including tip floor)	80 x 120	9,600
Biosolids Storage Building	42.5 x 40	1,700
Two Composting Drums	210 x 42	8,820
Primary Screening Area and Aeration Floor		39,072
Final Screening Area	48 x 120	5,760
Biofilter Building	110.8 x 272.2	30,160
Other (scale, parking, office, vehicle maneuvering)		4,700
Total		**99,812**

Table 3-7
Marlborough Facility Annual Inputs and Outputs (for 2001)

Material	Tons	Percent of Input Material
INPUTS:		
MSW Input	13,000	25
Commercial-Waste Input	22,000	43
Biosolids Input	16,000	31
Total Inputs	**51,000**	**100**
OUTPUTS:		
Compost Output	24,300	48
Loss of Mass[1]	8,400	16
Residue Output	18,300	36
RECOVERY:		
Total Facility Recovery[2]	**32,700**	**64**
Recovery of Solid-Waste Fraction	**16,700[3]**	**48[4]**

1. Calculated by subtracting compost and residue output from total inputs. Loss of mass is attributed to loss of moisture and CO_2.
2. Includes compost output and loss of mass.
3. Calculated by subtracting liquid input (biosolids) from “Total Facility Recovery.”
4. Based upon solid-waste input.

Bedminster Marlborough, LLC Marlborough Facility, Marlborough, Massachusetts

Introduction
As the Bedminster Marlborough, LLC (Marlborough) facility was the site for the New York City Composting Trials, see Chapter 1 for a description of the Marlborough facility and its operations. The section below discusses aspects not already reported in Chapter 1, and presents data for Marlborough’s operations in relation to its own local waste stream.

Facility Recovery Rate
Before presenting the recovery rate for Marlborough’s MSW-composting facility, it is helpful to understand how MSW composting fits in with other solid-waste–recovery operations.

The City of Marlborough’s 37,000 residents generate 15,000 tons of MSW per year (this figure does not include commercial waste or construction and demolition debris). Of this total, they divert 100 percent through their MSW-composting and recycling operations.

- **MSW Composting:** Marlborough diverts approximately 13,000 tons per year, or 87 percent of its MSW to the MSW-composting facility. The facility also receives 22,000 tons per year of commercial waste (Photo 3-

20). Table 3-7 shows a breakdown of the inputs and outputs from the Marlborough facility.

Photo 3-20: Tipping floor at the Marlborough MSW-composting facility
In addition to residential waste, the Marlborough facility also accepts commercial waste. Residential waste accounts for less than half of the total waste that the facility processes.

• **Curbside Recycling:** The national, waste-management company, Browning Ferris Industries (BFI), under contract with the City of Marlborough, provides residential, curbside-collection service for source-separated, non-degradable recyclables. These include separate collections for paper (newsprint, corrugated cardboard, and mixed paper) and commingled metal, glass, and plastic. Marlborough diverts approximately 2,000 tons, or 13 percent of its total annual MSW stream, to a BFI materials-recovery facility (MRF); the recovery rate achieved at the MRF is not known.

• **Drop-off**: Located adjacent to the composting facility is the city's drop-off center. City residents can drop off solid waste, bulk waste, large appliances, yard waste, brush, construction debris, tires, car batteries, paint cans, textiles, electronics, used motor oil, and recyclables (metal, glass, and plastic). Drop-off materials are recycled, directed to the composting facility, or landfilled. Additionally, the City offers two, household-hazardous-waste drop-off events each year.

• **Leaf & Yard-Waste Collection**: The City of Marlborough co-collects leaves and yard waste with solid waste on a year-round basis. This material is brought to the compost facility and fed into the digesters with solid waste.

Compost Quality and End Use
Compost produced at the Marlborough plant is utilized primarily in soil-blending operations (Photo 3-21). The facility produces approximately 24,300 tons of compost a year and disposes of waste residues in landfills.

The compost is tested against Massachusetts Department of Environmental Protection regulations and so far has maintained Type I designation, which allows for unrestricted distribution of the compost. All of the compost produced to date has gone to beneficial use, primarily as intermediate or final landfill cover, or in a gravel-pit–reclamation project.

Facility Economics
Bedminster Marlborough, LLC privately financed the Bedminster-Marlborough facility. The capital cost of the facility, excluding land, came to $15 million in 1999. It should be noted that the facility's design incorporated some of the infrastructure of the prior sludge-composting operation,

Photo 3-21: Final compost product load-out at the Marlborough facility
Compost produced at the Marlborough plant is utilized primarily in soil-blending operations, as well as mine-reclamation projects.

including the aeration floor and maturation building, as well as the biosolids storage building.

Employees at the Bedminster-Marlborough facility include: one plant manager, one assistant manager, two mechanics, three waste pickers, two front-end loader operators, four general laborers, and one administrative assistant. In addition to labor, electricity represents the principal operating cost, amounting to approximately $300,000 per year. The transport and disposal of residue costs about $67 per ton.

Under their agreement with the City of Marlborough, Bedminster Marlborough, LLC is paid $92 per ton of MSW (an amount in line with the high cost of waste disposal in Massachusetts), and $72 per wet ton of biosolids received. The City is contractually committed to utilize the Bedminster-Marlborough plant for solid-waste and biosolids processing for a period of 20 years (with built-in CPI escalators). In addition, the facility has capacity for 22,000 tons per year of commercial waste, which it provides to private carters for a tip fee of $70 to $85 per ton.

City of Rapid City, Regional Recovery and Landfill Facility, Rapid City, South Dakota

Introduction

In 1990, a Mayor's Committee and a City Council Committee adopted a Solid Waste Management Plan for Rapid City, South Dakota, consisting of three main components: a yard-waste collection and composting program; a materials-recovery facility (MRF) to process and ship traditional recyclables; and an MSW-composting facility (Photo 3-22). The yard-waste program was implemented in 1994, along with a ban on such waste from the landfill. In 1997, the MRF and the front end of the MSW-composting facility began operating, serving the entire Rapid City metropolitan area (population 85,000).

The post-digester portions of the Rapid City facility are not yet complete, so the plant produces a very raw, unscreened product that the City currently landfills. Plans call for the aeration building—which will facilitate compost maturation and final screening—to be completed by the end of 2003. When fully operational, the plant anticipates recovering 67 percent of the MSW it accepts, extending the life of the City's landfill by 30 years.

Photo 3-22: MSW-composting facility in Rapid City, South Dakota

The Department chose to include this plant in its survey—despite the fact that it is incomplete—because Rapid City currently employs two digester drums made by the European company, Dano. One objective of the survey was to look at facilities using different types of digester drums. More importantly, as the Rapid City facility employs some materials-recovery technologies in conjunction with MSW composting (such as bag breakers and sort-line pickers), it most closely approximates the type of facility that this report recommends for a New York City pilot plant. While it is useful to learn more about this equipment, it is unfortunate that the facility data (especially with regard to recovery rates) is necessarily incomplete.

Facility Size and Throughput Capacity

The Rapid City facility processes approximately 213 tons per day of solid waste, which matches its design capacity. The facility is part of a larger, waste-management complex that includes the City's 365-acre landfill and yard-waste–composting facility. The existing facility footprint is approximately three acres, which includes: receiving building, tip floor, MRF and compost-sorting lines, two Dano digester drums, discharge and primary screening area, biofilter, and an

Table 3-8
Rapid City Facility Footprint (in feet)

Component	Dimensions	Square Feet
Receiving Building (includes tip floor)	100 x 400	40,000
MRF & Compost-Sorting Lines	100 x 400	40,000
Two Digester Drums	14 dia. x 80 long	3,000
Discharge Building and Primary Screening Area	75 x 30	2,250
Biofilter	20 x 40	800
Offices		7,500
Parking and Truck Staging Areas		40,000
Total (existing facility footprint)		**133,550**
Planned Post-Drum Active Curing (bay system)		69,070
Planned Additional Biofilter		24,000
Planned Additional Final Screening		3,000
Total Planned Components		**96,070**
Total (with planned expansions)		**229,620**

office building. The planned back-end of the composting plant (including curing and final product screening, along with additional biofiltration capacity) is expected to occupy an additional two-plus acres. Table 3-8 lists the area of existing and planned facility components. The site is located on the outskirts of Rapid City in a rural area. A particleboard manufacturing plant is within a half-mile, and the nearest residential area is just over a half-mile away.

Facility Operations

The MRF and MSW-composting facility operate five days a week, nine hours per day. A staff of ten operates the composting portion of the facility, including: six pickers on a sorting line, a maintenance supervisor, a process engineer, and a plant manager. Maintenance, management, and engineering are shared between the MRF and the composting operation.

Trucks delivering solid waste enter a fully enclosed tipping building through one of four bays and tip waste directly onto the floor (Photo 3-23). The tipping floor can accommodate four trucks tipping simultaneously. In one corner of the receiving building there is a pit, into which an FEL feeds either commingled recyclables (to be processed through the MRF portion of the facility) or MSW (which is directed to the composting portion of the facility). Conveyors transport waste from the pit to one of two sort lines (for recycling or composting). FEL operators also push aside bulky items on the tip floor for disposal.

The recycling sort line handles materials collected through a residential, source-separated, curbside recycling program, run by Rapid City. The line has two, separate, enclosed sorting stations (Photo 3-24), each one with space for six or more pickers, an air classifier (for plastic), a magnet (for ferrous), and an eddy current separator (for aluminum). Materials sorted include: plastics (PET, LDPE, and HDPE), ferrous metal, aluminum, and corrugated cardboard. All sorted materials are collected in custom-designed bins, which are sized according to material to be the equivalent of one bale. Recyclables are baled on-site and marketed by Rapid City.

Photo 3-23: Tipping floor at the Rapid City MRF and MSW-composting facility
Trucks delivering solid waste enter a fully enclosed building and tip waste directly onto the floor. The tipping floor can accommodate four trucks tipping simultaneously.

Photo 3-24: Sorting system at the Rapid City MRF
The recycling-sorting system consists of two, enclosed sorting stations with space for six or more pickers, an air classifier (for plastic), a magnet (for ferrous), and an eddy current separator (for aluminum).

Photo 3-25: Compost sort line at the Rapid City MSW-composting facility
The compost-sorting station accommodates six pickers who pick out misplaced recyclables, as well as large, non-degradable items, such as five-gallon buckets, plumbing supplies, etc.

The compost sort line (Photo 3-25) includes a trommel de-bagger and a sorting station that accommodates six pickers. Material is sorted for both misplaced recyclables, as well as large, non-degradable items, such as five-gallon buckets, plumbing supplies, etc. The compost sort line recovers three to six tons per day of recyclables. After material passes through the sorting station, it travels via conveyor to a hopper, where a hydraulic ram pushes it into one of the two digester drums. Currently, facility operators pump water into the drums to achieve the desired 50 to 55 percent moisture level. In the future, the facility will use municipal biosolids, instead of water, to provide the needed moisture and additional nitrogen.

Rapid City employs two Dano digester drums, each 14 feet in diameter and 79 feet long, with loading and discharge ends enclosed in two separate buildings, and the middle sections exposed to the outside (Photo 3-26). The drums are level and can rotate at speeds between one and four rotations per minute (rpm). After the loading cycle is complete (typically at the end of the workday around 5:30 p.m.), the drums rotate for up to five hours and then stop. The following morning (typically at 7:30 a.m.), the drums rotate again for a few hours before facility operators discharge the material. Waste materials usually remain in the drums for less than 24 hours.

Material is discharged through a large hatch on the flat end of the drum, with the sides of the drum extending beyond the unloading hatch and forming a two-layer trommel screen. The top layer of the screen is six inches and the bottom layer, one and three-quarter inches (1¾"). Discharge material falls directly onto these screens and separates into two fractions, “unders” (material smaller than 1¾") and “overs” (a combination of “overs” from both screens).

During the time period of the survey, Rapid City landfilled both fractions. When the composting system is complete, unders from the two-layer trommel screen will be further processed through an agitated bay composting system to make a finished compost product. Materials in the drum reach temperatures approaching 37°C (99°F), which do not meet regulatory requirements for pathogen kill. (South Dakota has adopted U.S. EPA Part 503 compost regulations; there are no other local or State regulations governing composting facilities.) Plant managers anticipate that the needed temperatures for pathogen kill will be achieved in the post-drum processing stage, which, when complete, will include an estimated 60 days of composting and curing.

Air is drawn out from each end of the drums and directed to an in-ground biofilter, which is covered by an open-sided tent structure for moisture control. The biofilter is 40 feet by 20 feet and approximately three and a half feet deep. Air from the discharge building is processed through a separate biofilter that consists of a 30-cubic-yard, roll-off container. The media for both biofilters is a unique mix of locally available materials, such as river rocks (limestone), coal, and wood chips. All process air from the receiving building and MRF is filtered through a cyclone dust-collection system, which relies on centrifugal force to remove particulates from the air stream.

Facility Recovery Rate

The Rapid City metropolitan area generates approximately 99,000 tons of waste per year (this figure includes residential, commercial, and yard waste, but excludes construction and demolition debris). Of this total, they divert 69 percent for MSW composting, yard-waste composting, and recycling:

• **MSW Composting:** Rapid City diverts approximately 51,400 tons per year, or 52 percent of its solid-waste stream to the MSW-composting facility. While it is premature to speak of a recovery rate for the facility since it is not yet complete, Table 3-9 shows a projection of the facility's inputs and outputs for the year 2004.

• **Curbside Recycling:** Rapid City diverts 2,500 tons, or three percent of its total annual MSW stream to its MRF.

• **Drop-off Center:** Located adjacent to the MRF/compost facility is a city-run, drop-off center. Eligible drop-off materials include: residential waste, bulk waste, construction debris, tires, car batteries, household hazardous waste, and recyclables (metal, glass, plastic, and paper). Drop-off materials are recycled, directed into the facility's composting system, or landfilled.

Photo 3-26: Digester drum at the Rapid City MSW-composting facility
The facility uses two digester drums, each 14 feet in diameter and 79 feet long. The loading and discharge ends are enclosed inside two different buildings.

• **Yard-Waste Composting:** The State's Second Century Act bans the landfilling of leaves. Rapid City provides a separate fall collection for leaves and yard waste, which are taken to a yard-waste–composting facility the city developed within its landfill site. Horse manure (6,000 tons per year) is also accepted at this facility. Yard waste and manure are composted in open-air windrows. Rapid City diverts 14,000 tons, or 14 percent of its total annual waste stream, through this program.

Compost Quality and End Use

As noted, Rapid City does not currently produce finished compost from MSW because its facility is still under construction. The plant is expected to be fully operational sometime before the end of 2003, at which point biosolids will be added to the solid waste fed into the drums. Based on the quality of drum discharge to date, Rapid City anticipates producing a Class A compost, which will be sold for agriculture and mine-reclamation uses.

Table 3-9

Rapid City MSW-Composting Facility Annual Inputs and Outputs (projected for 2004)

Material	Tons	Percent of Input Material
INPUTS:		
MSW Input[1]	51,400	72
Biosolids Input (@ 8-10% solids)	20,000	28
Total Inputs	**71,400**	**100**
OUTPUTS:		
Compost Output	23,800	33
Loss of Mass[2]	20,700	29
Recyclables[3]	1,000	1
Residue Output	25,900	36
RECOVERY:		
Total Facility Recovery[4]	**45,500**	**64**
Recovery of Solid-Waste Fraction	**25,500[5]**	**60[6]**

1. Includes municipal solid waste (MSW) and commercial waste.
2. Calculated by subtracting compost output, recyclables, and residue output from total inputs. Loss of mass is attributed to loss of moisture and CO_2.
3. Recyclables remaining in the refuse, recovered at the facility.
4. Includes compost output, loss of mass, and recyclables.
5. Calculated by subtracting liquid input (biosolids) from "Total Facility Recovery."
6. Based upon solid-waste input.

Facility Economics and Ownership

The City of Rapid City financed the MRF and the composting facility. At the time of the survey, capital costs for the MRF, receiving building, composting drums, and site development totaled $13,763,903 (not including land). Costs for completing the composting facility, including curing, screening, and biofiltration, are expected to be $8.9 million.

When the composting plant is fully operational, it and the MRF together will have the following employees: one division manager, one MRF supervisor, one administrative secretary, two mechanics, one plant engineer, one load inspector, and five general laborers. (The division manager and secretary costs are split 50 percent with the landfill operation.) In addition to labor, the principal operating costs include natural gas and electricity, totaling approximately $130,000 per year.

Because it is a municipally owned facility, there is no tipping fee for residential waste. When the facility is fully operational, Rapid City officials estimate that the per-ton cost for operating the MRF and compost plant, after the sale of recyclables, to be approximately $27. The facility currently accepts commercial waste for a tip fee of $45 per ton. It is anticipated that under full operation, approximately 60 percent of the feedstock managed by the facility will come from commercial sources.

Analysis of Variance (ANOVA)

The Department sought to compare the performance of the four surveyed facilities, both to each other, and to the performance achieved in the New York City Composting Trials. One means of doing this was to conduct laboratory tests on the compost produced by each facility for parameters specified by the DEC. DSNY used these compost-quality analyses to determine if operational MSW-composting facilities produce compost that meets DEC standards. Chapter 2 summarizes the results of these tests.

Another way to compare facility performance is through statistical analysis. The sampling protocol that DSNY used in the New York City Composting Trials and the four-facility survey was designed to facilitate ANOVA—ANalysis Of VAriance. This procedure tests the significance of differences observed at one or more levels of comparison by segregating the variation according to explained and unexplained factors. If the variation is so large that the probability that it occurred by chance is very low (for example, $p \leq 0.05$), one can conclude that the source of that variation had a significant effect. For complex trials, this procedure prevents making unwarranted judgments about observed effects.

The research laboratory that conducted all the compost-quality analyses also designed the sampling protocol, and provided the assumptions necessary to perform the ANOVA. Through

Table 3-10
Description of ANOVA Samples

Sample Location	Sample Description	Lab Sample Name[1]
On-site at each of the four surveyed facilities[2]	Two composite 5-gallon samples (A/B) taken from each facility's air floor	*NAL Day 1 (7, 14, 21) Sample A/B* *NML Day 1 (7, 14, 21) Sample A/B* *NQB Day 1 (7, 14, 21) Sample A/B*
On-site at the Marlborough facility during the NYC Composting Trials	Two composite 5-gallon samples (A/B) taken from the facility's air floor	*NCI Day 1 (7, 14, 21) Facility A/B* *NMS Day 1 (7, 14, 21) Facility A/B*
Lab bench-scale reactors[3]	Two composite samples (A/B) taken from the lab's 4-liter, bench-scale reactors	*NAL Day 7 (14, 21) Bench-Scale A/B* *NCI Day 7 (14, 21) Bench-Scale A/B* *NML Day 7 (14, 21) Bench-Scale A/B* *NMS Day 7 (14, 21) Bench-Scale A/B* *NQB Day 7 (14, 21) Bench-Scale A/B* *NRC Day 7 (14, 21) Bench-Scale A/B*

1. Facility names have been coded for anonymity. NMS is the code the laboratory assigned to the New York City residential/institutional waste during the Composting Trials. NCI is the code the laboratory assigned to the New York City commercial waste during the Composting Trials. Actual lab data is attached in Appendix D (NCI), Appendix F (NMS), and Appendix H (NQB, NRC, NAL, NMS).
2. As NRC does not yet have an air floor, there were no on-site, air-floor samples from this facility. NRC digester discharge (Day 1) samples were sent to the lab and composted in the bench-scale reactors.
3. Closely monitored containers, which allow the lab to simulate ideal composting conditions (See Photo 3-27.)

the ANOVA, the lab sought to answer the following question: Are there (statistically) significant performance differences between different MSW-composting facilities? Or, to state the question negatively, are there differences between the facilities that are not attributable to chance?

To test facility performance, the lab established a uniform sampling methodology for the New York City Composting Trials and the four-facility survey. Material was sampled at each facility on Day 1 (the first day of discharge from the drum when the material is formed into windrows), Day 7, Day 14, and Day 21.[3] Two composite, five-gallon samples of composting material were taken on each of these days to create an A/B pair. These samples provided the basis for looking at performance differences among facilities over time.

In addition to analyzing samples sent directly from the facility on each sample day, the lab took a four-liter portion of the Day 1 windrow samples from each facility and continued to compost this material in laboratory bench-scale reactors (Illustration 3-1, Photo 3-27). The lab's bench-scale reactors simulate ideal compost conditions by controlling air supply, heat, and moisture. The bench-scale–reactor compost was also sampled on Day 7, 14, and 21 to provide a basis for looking at ideal facility performance over time. By using bench-scale reactors and Day 1 samples, the lab was able to identify differences between the compost produced by each facility, controlling for the different post-digester, air-floor technologies, described in Chapter 2.

The ANOVA results presented below include data from both the residential/institutional, as well as the commercial-waste portion of the New York City Composting Trials (held at the Bedminster Marlborough, LLC facility in Marlborough, Massachusetts). Table 3-10 provides a summary of the various sample points used in the ANOVA.

Chapter 1 of this report discusses the residential/institutional-waste portion of the NYC Composting Trials, while Appendix D contains information on the results from the commercial-waste portion of the Trials. The actual lab results for each facility and sample day can be found in the appendices to this report. See Appendix D (*Attachment D*) for the actual lab data from the commercial-waste portion of the NYC Trials. See Appendix F (*Facility Data and Bench-Scale Data* sections) for the residential/institutional lab data from the NYC Composting Trials. See Appendix H (*Facility Data* and *Bench-Scale Data* sections) for the lab data from the four surveyed facilities.

Using the compost samples described in Table 3-10, the lab assessed facility performance based upon data from the following parameters:

- CN ratio
- Organic matter loss
- Volatile organic acid content

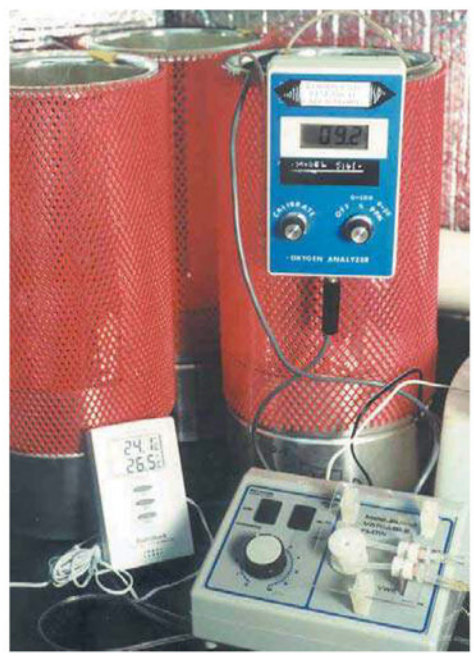
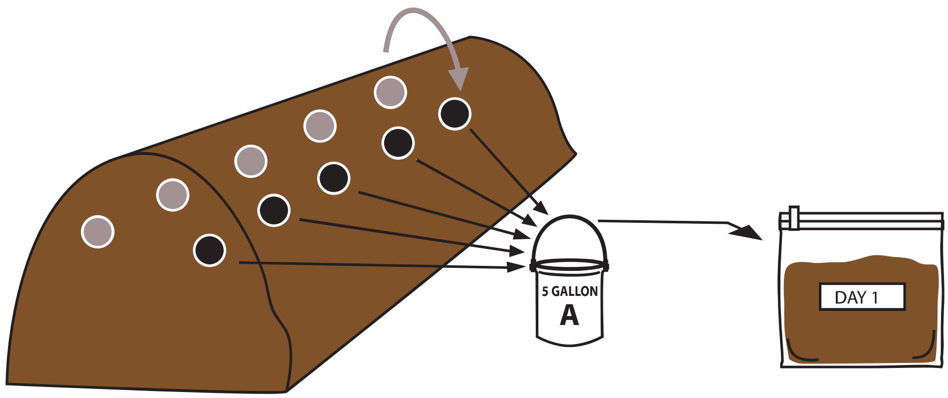


Photo 3-27: Bench-scale reactor
The laboratory's bench-scale reactors simulate ideal compost performance by controlling air supply, heat, and moisture. Each bench-scale sample contains approximately four liters of compost.

Illustration 3-1

Procedure for Composting Day 1 Facility Windrow Samples in Lab Bench-Scale Reactors

FACILITY

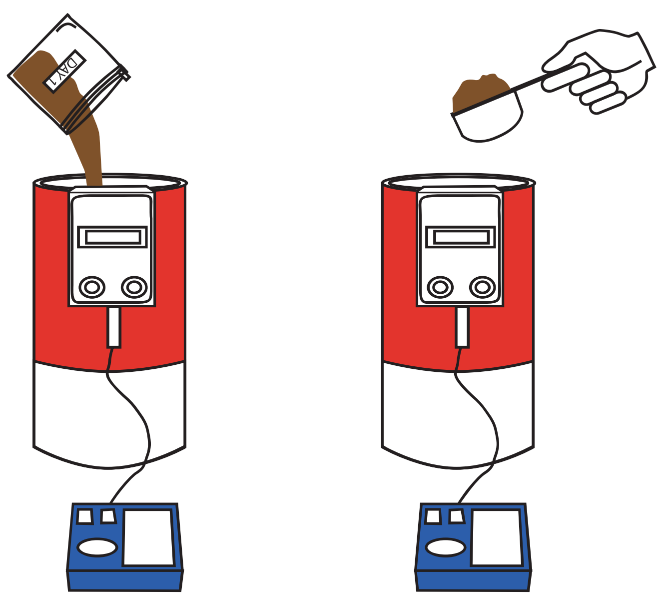


Remove samples from both sides of windrow in 5-10 spots.

Mix to form composite, 5-gallon Sample A; repeat procedure for Sample B.

Place in sealed bags, label samples, add ice packs, and ship to lab immediately.

LAB



Take Day 1 windrow samples from each facility and place them in separate bench-scale reactors, which compost the material under controlled, optimal conditions.

On Day 7, 14, and 21, remove samples for testing.

- Moisture level
- pH
- Ammonia nitrogen

To compare facility performance based on data from these parameters, the lab used ANOVA to analyze the following three levels of effects and their interactions to see if the differences observed were statistically significant:

- Facility (i.e., Edmonton vs. Bedminster Marlborough)
- Day of compost sample at the Facility (Day 7, 14, 21, etc.)
- Type of sample (on-site facility sample vs. lab bench-scale sample)

The remaining sections of this Chapter summarize the salient results of the ANOVA.

CN Ratios

The carbon-to-nitrogen ratio (CN) ratio is one of the most common indicators of compost maturity. Generally, a CN ratio of 17 (meaning 17 parts carbon to 1 part nitrogen) indicates that a compost is mature, or that the decomposition process has stabilized. The actual desired CN ratio will depend on the intended end use of the compost. For example, the desired CN ratio range for the Mulch Standard listed in Table 2-5 is acceptable anywhere from 35 to 150.

Figure 3-1 depicts the average carbon-to-nitrogen ratios from all the on-site facility samples against those of the lab bench-scale samples. Since a portion of the on-site, Day 1 samples were placed in the lab bench-scale reactors, the average CN ratios from the facility and the bench-scale samples start at the same place. The greater overall decline in the bench-scale CN ratios compared to the facility CN ratios indicates that on the whole, the facilities are not optimizing the post-drum decomposition process.

Figure 3-2 extracts data from the material used for the New York City Composting Trials. Again, "NMS" represents compost made from NYC residential/ institutional waste and "NCI" represents compost made from NYC commercial waste.

Both the New York City NMS and NCI composts show the expected decline in CN ratio in the optimized conditions

Figure 3-1
CN Changes During Composting: Facility vs. Bench-Scale Reactor Samples

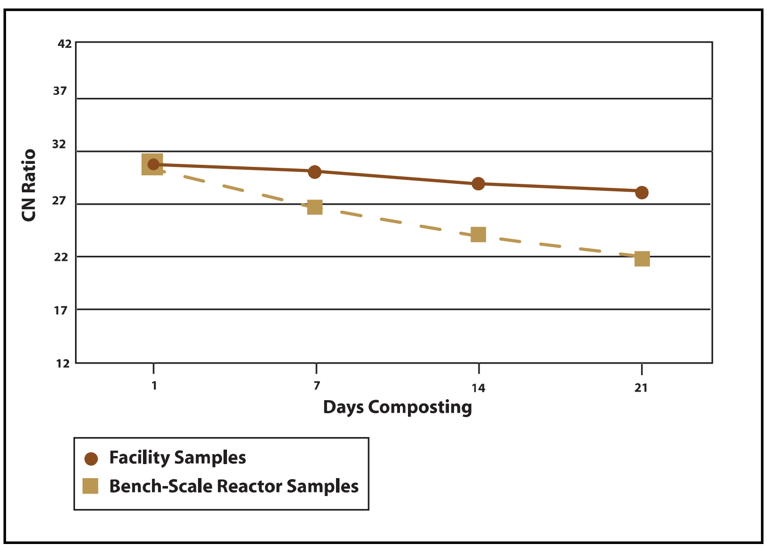


Figure 3-2
CN Changes During Composting of NYC Waste Streams: Facility vs. Bench-Scale Reactor Samples

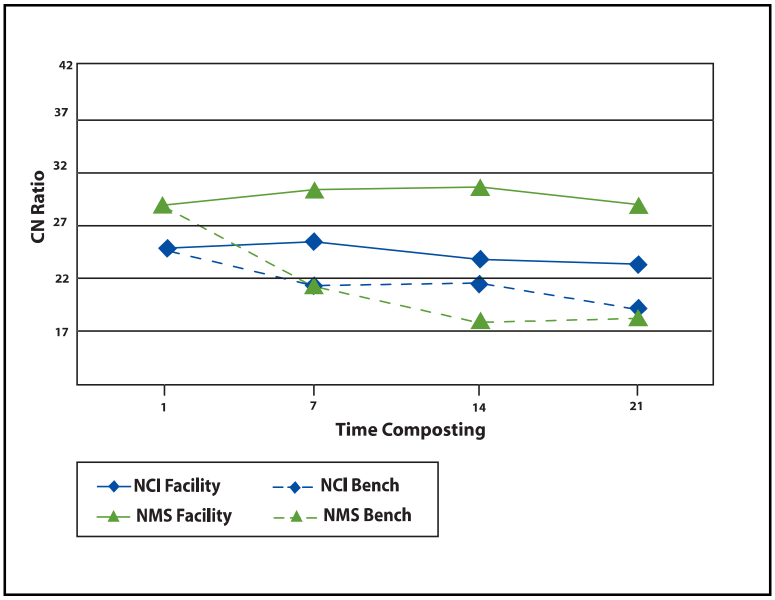
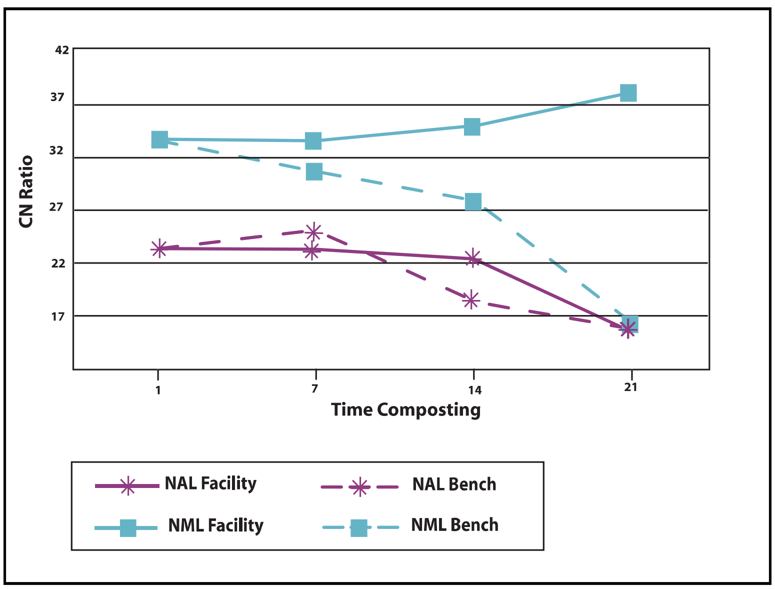


Figure 3-3
CN Changes with Different Post-Drum Composting Processes: NAL vs. NML



provided by the bench-scale reactors. This suggests that under proper conditions, it is possible to make mature, stable compost using these two New York City waste streams. The fact that the CN ratios remain constant for the on-site samples of the New York City material composted at the Marlborough facility implies that Marlborough's air-floor technology does not provide for the desired rate of decomposition.

Facility operators at Marlborough are aware of the shortcomings of their post-drum operations and would like to move to a more regulated, mechanized process on the air floor, such as a windrow turner or agitated bay system employed at other MSW-composting facilities. Figure 3-3 compares Marlborough's (NML) CN ratios to those of another surveyed facility (NAL) that uses such a mechanized, post-drum process.

Figure 3-3 demonstrates the advantages of using a regulated, mechanized process on the air floor, as opposed to just forming large windrows and occasionally turning the material with a front-end loader as Marlborough did at the time of the survey. The NAL CN ratios demonstrate optimal decline, indicating near complete decomposition. In fact, performance at the NAL facility almost exactly mirrors the ideal lab conditions of the bench-scale reactor. The CN ratio of Marlborough's on-site compost, on the other hand, not only fails to decline, but actually increases over time, meaning the air floor is actually not helping to decompose the material at all.

Further examination of Figure 3-3 indicates that this effect reflects a shortcoming of Marlborough's air floor, rather than of its digester performance or composting recipe. Day 1 samples of Marlborough's material start with a CN ratio of 33—an ideal ratio to ensure rapid decomposition according to all compost literature. The results from Marlborough's bench-scale samples indicate that given the proper air, moisture, and heat levels (the optimized conditions afforded by the bench-scale reactors), Marlborough's material can achieve "text book" decomposition, declining to a CN ratio of just under 17. In fact, its finishing CN ratio falls right in line with both NAL's facility and bench-scale results. This demonstrates that there is nothing inherently "uncompostable" about Marlborough's material, but rather that the facility's air floor does not optimize the decomposition process.

Why did Marlborough's own material demonstrate an increase in CN ratio (Figure 3-3), while that of New York City's material going through the same facility (Figure 3-2) remain constant? The fact that Marlborough facility management instructed FEL operators to turn the NYC Composting Trials material more frequently than they would typically turn their own might explain the discrepancy in CN ratios. Aware of the shortcomings of their air floor, the management at Marlborough was trying to demonstrate that with more regular turning they could optimize composting. Therefore, New York City's material did perform slightly better than Marlborough's own material, but it is simply not possible to replicate a mechanized, air-floor process with a front-end loader.

Organic Matter Loss

Similar to CN ratio, organic matter (OM) content normally declines during composting, as it is "lost" or converted by microorganisms into carbon dioxide and moisture. Therefore, the percent decline in OM in compost over time represents another indicator of the decomposition rate, or the efficacy of the respective composting process that produced it.

The lab's overall statistical analyses of the data indicate a very significant difference in OM content among all the facilities (at any date) and a significant relation to time, which is interpreted to mean that statistically significant changes occurred over time.

Figures 3-4 and 3-5 show the percent of organic matter loss over time for all the on-site facility samples and for the bench-scale samples, respectively. The percent of OM loss is derived from the difference between OM content at each date versus the total OM content on Day 1. Therefore, 1.00 relative organic matter on the Y-Axis represents 100 percent OM, meaning (Day 1) no decomposition. A measure of .40 equals 40 percent OM content or 60 percent decomposition (1.0 minus .40). In other words, a high percentage loss of organic matter signifies an effective decomposition process.

All facility operators calculate the loss of organic matter (also referred to as loss of mass) when they account for their annual facility inputs and outputs. The tables in the previous sections of this Chapter show the 2001 loss of mass figures for each facility surveyed, which ranged from 16 percent to 32 percent. This percent decline is also reflected in the laboratory test results presented in Figure 3-4, which show a 20 to 47 percent decomposition rate for the on-site facility samples.

The largest decline occurs in facility NAL, which, as noted in the previous section, employs the greatest degree of mechanization and sophistication in its post-drum, air-floor process. The samples from NMS and NML show the smallest decline, which further demonstrates how Marlborough's method of using front-end loaders to turn windrows on the air floor fails to achieve optimal decomposition. It follows then that NQB's results for OM fall somewhere in between, since NQB's air-floor technology is not as automated or mechanized as NAL's, but more so than Marlborough's.

Figure 3-4
Organic Matter Loss: Facility Samples

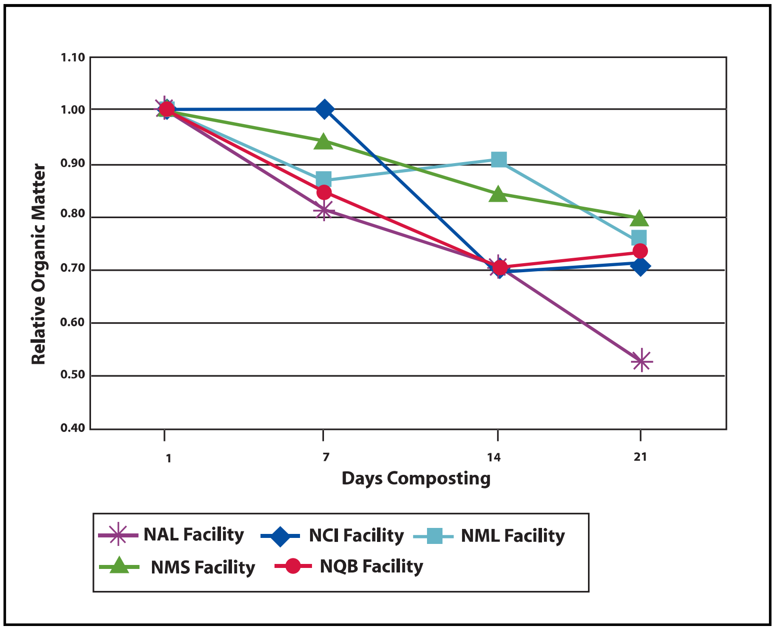


Figure 3-5
Organic Matter Loss: Bench-Scale Reactor Samples

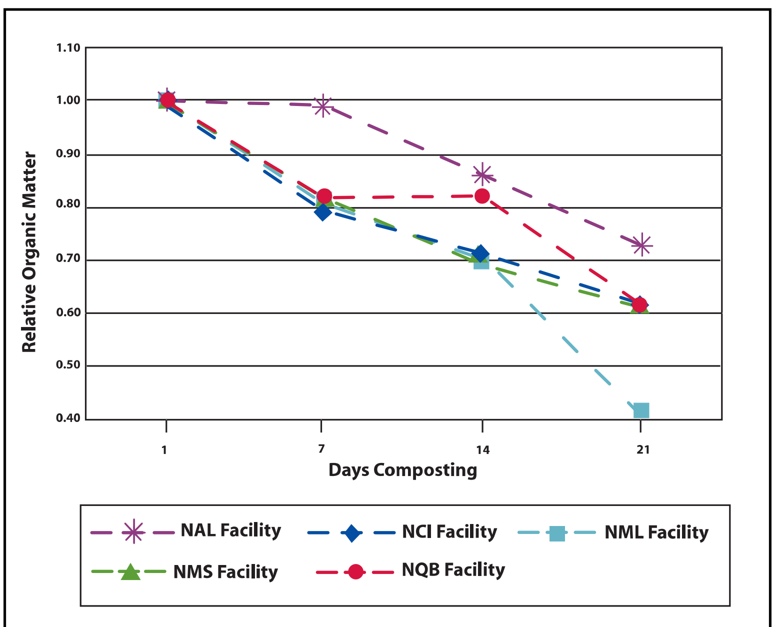


Figure 3-5 depicts the results from the bench-scale reactors. With regard to percent OM loss, the Day 1 material composted under ideal conditions in the bench-scale reactors shows almost the opposite results from the compost produced at the facilities themselves. In this case, NML performs the best with 40 percent OM content (or 60 percent decomposition) on Day 21. NAL presents the least impressive results with just over 70 percent OM content (or 30 percent decomposition) on Day 21.

Since the bench-scale reactors control for differences in facility post-drum procedures, the results presented in Figure 3-5 speak to the efficacy of the input "recipe" (the ratio of liquid to solid waste, CN ratios, etc.) and the use of the digester drum (including such factors as maintaining optimal temperature, throughput times, moisture, and oxygen levels).

The bench-scale results suggest that operators at NML have the best input recipe and command of the digester drum (Figure 3-5), but are hampered by their air floor (Figure 3-4), while operators at NAL have the worst input recipe and command of the digesters (Figure 3-5), but are helped tremendously by their air floor (Figure 3-4). As Marlborough facility operators had very little time to adjust the recipe during the New York City Composting Trials (five days for each waste stream), it makes sense that samples of this material (both NMS and NCI) would not perform as optimally as NML's in the bench-scale reactors.

Volatile Organic Acids

Measuring the presence of volatile organic acids (VOA) in compost represents another way to assess decomposition efficiency. Volatile organic acids are the episodic by-products of incomplete or anaerobic digestion. High VOA levels indicate that the decomposing material (immature compost) lacks oxygen. Mature, stable compost generally exhibits a VOA level of 1,500 parts per million (ppm) on a dry-weight basis.

When facility operators discharge immature compost from the drum, the material has a tremendous oxygen demand. That is why VOA levels are seen to rise in Figure 3-6 during the first week on the respective facility air floors. (The initial decrease in VOA levels at NML could be the result of a severe slowing down of decomposition during the first week on the air floor. In essence, the composting process "freezes" for a week before starting up again, albeit with large amounts of anaerobic activity, as indicated by increasing VOA levels.)

Figure 3-6 also reveals that only NAL and NQB compost reach the desired range of VOA content in 21 days. However, it is likely that even this compost will require further curing before it is completely mature. VOA levels for material from NML actually rise over the 21 days, exhibiting a similar performance as observed with CN ratios. Again, this most likely points to under-optimized, air-floor conditions at that facility.

The New York City Trials composts (NMS and NCI) follow similar paths at the Marlborough facility. Neither reaches stability from the point of view of VOA content during the 21 days on the facility air floor. This is not surprising, given the less-than-optimal conditions on the Marlborough air floor. That the New York City material exhibited eventual decreases in VOA level, while VOAs in Marlborough's own material continued to rise, could, like CN ratios, be explained by the "extra attention" the City's

Figure 3-6
Volatile Organic Acids Content: Facility Samples

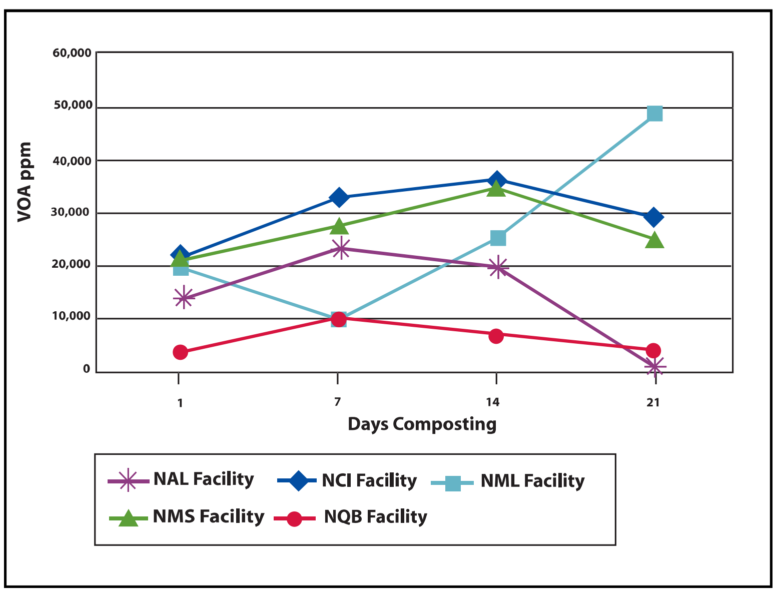
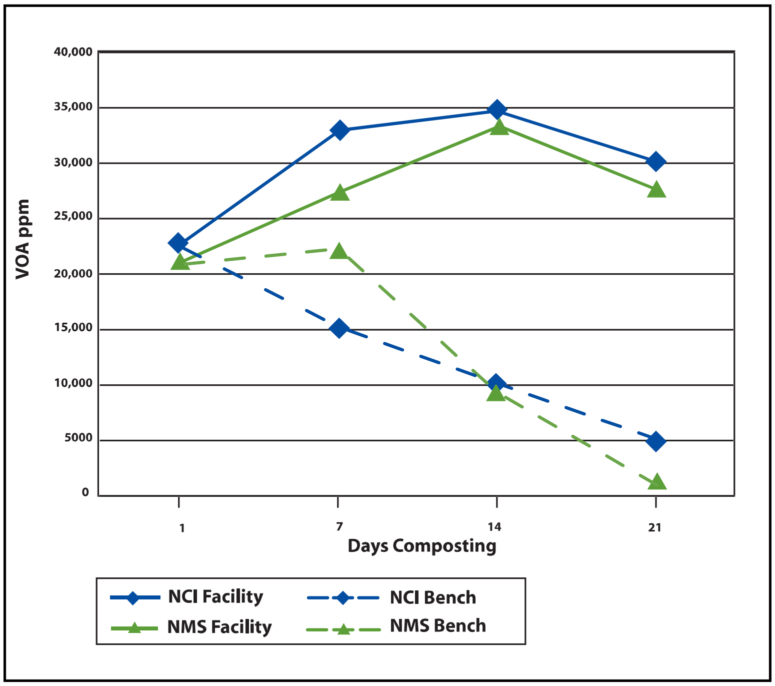


Figure 3-7
Volatile Organic Acids Content for NCI & NMS: Facility vs. Bench



material received on the air floor (see *CN Ratios,* earlier in this chapter).

Figure 3-7 compares VOA content of the NYC material composted on the Marlborough air floor versus the lab bench-scale reactors. The compost from the bench-scale reactors exhibits the typical decline in VOA levels that one would anticipate (and expect) from ideal conditions. As a representative from the research laboratory explained, these bench-scale results indicate the potential for the NYC-compost source materials to attain satisfactory quality, provided that basic, proper composting conditions exist.

Moisture Level

Moisture levels in MSW compost depend on three factors:

- input "recipe"
- air-floor efficiency
- water added to promote decomposition

The input "recipe," in terms of both the ratio of liquid to solid waste that a facility operator decides to use, as well as how "wet" the solid-waste feedstocks are to start, greatly influences the moisture level of the resulting compost. For example, the supermarket waste that MSW-composting facilities routinely accept has inherently greater moisture levels than typical, residential solid waste, due to the high organic content.

The efficiency of a facility's air floor also impacts moisture levels. As explained in the *Organic Matter Loss* section earlier in this chapter, during decomposition, microorganisms convert organic matter into carbon dioxide and moisture. The more effectively a facility's air floor can provide the ideal conditions for microorganisms to do this conversion work, the more moisture will be lost from the decomposing material. Ideally, no matter what the input recipe is, a facility will want to see a large decline in compost moisture levels (also referred to as loss of mass) from the beginning to the end of air-floor process.

Finally, most facility operators have the capability to add water at any point during the air-floor–

composting process. (See Photo 3-17 for an example.) Many facilities find this useful, especially during the first week that material is on the air floor, as additional moisture and frequent turning can help to "kick-start" the decomposition of degradable materials.

Moisture levels in an MSW compost therefore result from a somewhat complex interaction of controllable and less-controllable conditions, such as the economics of accepting different types of waste, the quality of facility equipment, and the skill of operators in managing the process.

Figure 3-8
Changes in Moisture During Composting: Facility Samples

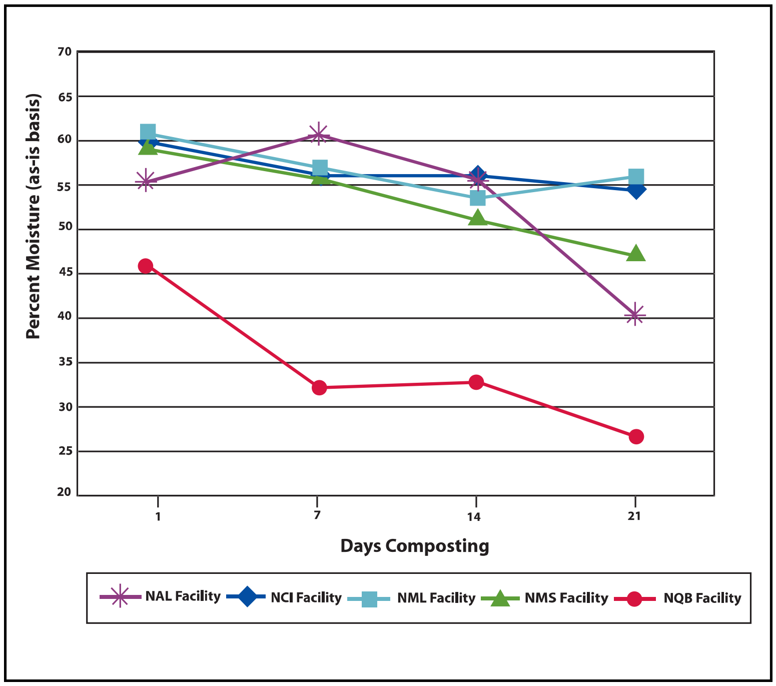


Figure 3-8 presents the moisture levels in samples of compost from the air floors at the surveyed facilities, starting at Day 1 (drum discharge) through Day 21. Assuming digester-drum performance is constant across facilities (and that differences in material-retention time in the drums are small enough to not significantly affect loss of mass), the Day 1 moisture levels indicate the "wetness" of the starting compost recipe.

The Marlborough facility (NML) composts a mix of residential and commercial waste, adding biosolids to this material in the digester drum at a ratio of two-parts liquid to one-part solid waste. The presence of commercial waste and a lot of biosolids makes the Marlborough compost the wettest. The fact that the NCI (NYC commercial waste composted at the Marlborough facility) material also exhibits high-moisture levels makes sense given that the incoming waste originated from collection routes servicing many restaurants and supermarkets. (See Appendix D for more information.) It is significant to note, however, that the Marlborough facility operators added no biosolids to the NCI material during initial composting in the digester drum.

NMS (NYC residential and institutional waste composted at the Marlborough facility) material is slightly drier than NCI, since residential waste contains more paper and less food waste than commercial waste from supermarkets and restaurants. It is still relatively wet though, due to the high ratio of liquid-to-solid waste employed at Marlborough.

NAL also composts biosolids with residential waste, but was mixing a drier recipe at the time of the survey, only adding one part biosolids to every 2.8 parts solid waste. As facility operators at NAL were less experienced at drum composting and air-flow management than those at

Marlborough, they tended to err on the side of underusing biosolids in order to avoid wet, odorous conditions. Marlborough, on the other hand, had financial incentives to use as much biosolids as possible, as they received more money to process this municipal stream. They also had the experience to handle this wet recipe confidently without generating facility odors.

NQB starts out with a much drier recipe on the air floor at Day 1 than the other facilities, and then over the course of 21 days, continues to drop moisture levels even further. It is significant that NQB does not use biosolids, but meets moisture needs with other liquids, only adding one part liquid to every ten parts solid waste.

Again, air-floor performance also affects compost moisture levels, since increased rates of decomposition mean more moisture lost. Due to the performance of the NAL air floor, this facility is able to almost “catch up” with NQB’s moisture levels in 21 days, despite a much “wetter” start recipe employing biosolids. NAL’s moisture levels can be seen to rise with the addition of water to the material during the first week on the air floor, and then sharply drop over the next three weeks, as the facility is able to “kick-start” the decomposition process.

The three streams of material moving through the Marlborough facility do not experience similar rates of moisture loss, due to the facility’s less-than-optimal air floor, as discussed earlier. NCI and NML composts are still very wet at the end of 21 days. NMS is slightly drier due to the drier feedstock, but also to the increased turning of the material, again, as discussed earlier.

The high moisture levels of the composts moving through the Marlborough facility underscores the difficulty that the facility had with running material through a fine screen after 21 days on the air floor. Their compost is still so wet at this point in the process that it jams small screens and “gums up” de-stoning equipment, rendering it ineffective. Marlborough facility management’s decision, therefore, to switch to a more coarse, half-inch screen at this point, and transport the material off-site for further composting (with the attendant moisture loss) before attempting a finer screen, makes sense.

The next chapter synthesizes the findings of the lab’s ANOVA work and translates this technical information into practical terms, when describing the components of a successful MSW-composting facility.

CHAPTER 4
CONCLUSIONS

Over the course of 2000-2001, the Department conducted a Research Project to determine if MSW composting merits further serious study as a waste-management strategy for New York City.

The Research Project consisted of sending samples of New York City waste, for five days, to a municipal-solid-waste (MSW) composting facility and closely analyzing the process, as well as the resulting compost. Before sending the samples to the MSW-composting facility, the Department conducted a waste-characterization study, which enabled the Department to calculate both the overall facility recovery rate, as well as the specific recovery rate for the degradable fraction of the waste stream.

In addition, the Department commissioned a survey of four, successfully operating MSW-composting facilities in North America, which involved site visits and reports, management questionnaires, and compost sampling. The laboratory that conducted the compost-quality tests structured the sampling protocol so that the results could be analyzed to infer if the differences observed among facilities were statistically significant. This chapter synthesizes the findings of the Research Project and extrapolates lessons for New York City.

Summary of Key Findings

The most important findings of the Research Project relate to the following:

Compost Quality: The Research Project demonstrated that the Department, like other municipalities utilizing MSW composting, produced a compost that met New York State Department of Environmental Conservation (DEC) Class I compost standards (in effect during the time of the Trials), as well as current DEC standards (effective March 2003). For a summary of results, see Chapter 2.

Odor Control: The Department determined that it is possible to operate an MSW-composting facility without generating nuisance odors. Each of the facilities surveyed employs sophisticated and effective air-handling systems that safeguard against odor emissions. As the facilities are generally located well within a mile of their neighbors, they could not continue operations if this were not the case.

Management of Non-Degradable Items: While the above findings speak to the successes of MSW composting, the Department learned that improvements could be gained by placing more emphasis on removing non-degradable materials *before* they go through the composting digester drums. Beyond the bulk items that facilities routinely remove (such as hoses and cords that cause “hairballs” in the drums), facilities should focus especially on removing problematic materials, such as:

- *Film plastics* (primarily plastic bags), which accumulate moisture in the drums, bind screening equipment, and break up into tiny, hard-to-remove pieces

- *Glass,* which tends to break into small pieces during materials handling and tumbling through the drum, making it difficult to screen away
- *Textiles,* which soak up a lot of moisture in the drums, becoming heavy and more expensive to discard
- *Metal cans,* which can become packed with immature compost in the drums, leading to lost compost and more expensive residue

Air-Floor Quality: It is on the air floor, not in the digester drums, where the significant decomposition of degradable items in the waste stream occurs. A quality air floor—with regular and automated turning, good air flow, and the ability to add moisture—allows a facility to attain the following important goals:

- *High loss of mass,* which is the most cost-effective means of achieving a high, facility recovery rate
- *More complete degradation,* which leads to a better overall compost product
- *Moisture control,* which allows a facility to achieve the optimal moisture range for effective final screening
- *Odor reduction,* which is achieved through maintaining aerobic conditions and minimizing volatile organic acid production

Air-Floor Capacity: By all measures of compost quality, a product is not mature after only 21 days, even on a well-designed air floor. Compost needs at least 50 days of turning and some additional type of aeration in order to lose mass and moisture, as well as attain maturity.

Based on the above findings, the Research Project concludes that MSW composting warrants further serious consideration as a waste-management strategy for New York City. However, in order to determine what it would cost per ton to process City waste through MSW composting, it is necessary to outline a theoretical New York City facility. The remainder of this chapter describes the components of a successful MSW-composting facility, based upon the Department's findings from its MSW-Composting Research Project. These in turn inform the conceptual design of the pilot facility presented in Chapter 5.

Components of a Successful MSW-Composting Facility

In addition to the important compost-quality data, the Research Project provided the Department with a greater understanding of the MSW-composting process itself, and insight into where possible improvements could be achieved.

In very general terms, successful MSW-composting facilities maximize recovery rates by increasing "desirable" outputs (quality compost, marketable recyclables, loss of mass) and decreasing "undesirable" outputs (residue requiring disposal). Table 4-1 summarizes how the four facilities surveyed for the Department's MSW-Composting Research Project, as well the facility used for the NYC Composting Trials, fared according to these measures. (For a description of the NYC Composting Trials, see Chapter 1.)

Table 4-1
Summary of Annual Facility Data: Four Surveyed Facilities and NYC Composting Trials

Parameter (% of total facility input)	Conporec	Edmonton	Marlborough	Rapid City[1]	NYC Trials[2]
Recovery Total Facility[3]	75	61	64	64	65
Recovery Solid Waste[4]	72	50	48	60	50
Compost Output	45	29	48	33	37
Recyclables	3	0[6]	0[6]	1	0
Loss of Mass[5]	28	32	16	29	24
Residue	25	39	36	36	39

1. All aspects of the Rapid City facility are not yet complete; figures are projected estimates.
2. The NYC Composting Trials were conducted at the Marlborough facility. See Chapter 1 for more information.
3. Based on solid and liquid inputs. Recovery rate includes loss of mass during composting.
4. Based on solid-waste inputs only.
5. Calculated by subtracting compost output, recyclables, and residue output from total inputs. Loss of mass is attributed to loss of moisture and CO_2 during composting.
6. This facility does recover some scrap metal, but the quantities are negligible as a percentage of the total facility input.

The following sections review the outputs (compost, recyclables, loss of mass, and residue) from each facility surveyed and how these contribute to the overall success of facility operations.

Quality Compost Output

Compost is obviously one of the primary output streams of an MSW-composting facility. The most import aspect of compost output is that it meet certain quality standards. As explained in Chapter 2, the compost produced through the NYC Composting Trials, as well as at the four surveyed facilities, met New York State Department of Environmental Conservation compost standards in place during the time of the Research Project. These standards regulate compost quality with regard to:

- *Pollutant and pathogen levels,* such as heavy metals, PCBs, fecal coliform, and *Salmonella*
- *Physical properties,* such as particle size and inert levels (i.e., small pieces of glass and plastic in the final compost product)
- *Horticultural/agronomic properties,* such as ammonia, pH, and nitrate levels

In order for an MSW compost to be used within New York State, the product must meet pollutant, pathogen, and certain physical-property limits set by the DEC. For the horticultural/agronomic properties of an MSW compost, the DEC requires that a facility regularly report levels for designated parameters, but does not provide set limits for a product to meet.

A successful MSW-composting facility will aim to produce a consistent-quality compost with regard to pollutant, pathogen, and physical contamination limits, as well as agronomic properties. The pollutant levels of the compost from all of the surveyed facilities, as well the compost produced in the New York City Composting Trials, were well within the current DEC limits. (See Appendix H and F, respectively, for data.) However, removing non-degradable materials before they go through the composting process not only improves overall compost quality, but also lessens the chance that certain pollutants will find their way into the final compost product.

Pathogen-kill requirements are standard in many State and federal requirements pertaining to the composting of biosolids. For example, the DEC mandates that for the composting of MSW and biosolids, the material must exceed 55°C (131°F) for three consecutive days to make sure pathogens are eliminated. The New York City Composting Trials demonstrated that this is possible and that pathogen limits were met. (See Appendix C for temperature data sheets and Appendix F for pathogen data.)

Physical contamination levels refer to the non-degradable materials (generally small pieces of plastic and glass) in a final compost product. As explained in Chapter 2, the DEC has set a limit of two percent (by weight on a dry-weight basis) for these materials in a compost. Measuring these small, non-degradable items (referred to as "inerts" throughout this report) is a new lab procedure, for which there is no standard methodology. With regard to inert levels, the New York City Composting Trials demonstrated that it was possible to meet the two-percent limit, but the Marlborough facility final screen removed a lot of compost in the process as well.

However, one of the surveyed facilities (Conporec) was able to overcome the problem of losing too much compost through the final facility screen by adopting the following procedures:

- **Reducing moisture levels in the compost before sending it to the final screen.** Drier compost screens more easily, facilitating the separation of compost from inerts. A facility can achieve this both by adjusting the ratio of liquid to solid-waste inputs, as well as aggressively composting material on the air floor to make sure that as much moisture as possible is lost (as vapor).
- **Sending final screen overs back through the composting process**. In order to meet the DEC particle size requirements (less than 10mm), the final facility screen must be very small. At this setting, even with drier material, compost will inevitably pass over the screen, as well as under. Sending final screen overs back through the composting process, rather than disposing of them as residue, leads to less overall residue.
- **Pulverizing final screen unders**. Pulverizing final screen unders serves to crush any remaining tiny pieces of glass in the compost into sand, as well as reduce the size of small pieces of wood, stone, and other inert materials that do not count towards physical contamination levels.

For further discussion of compost-moisture levels and final screening in general, see the *Residue Reduction* section later in this chapter. (For the inerts characterization data for the New York City Composting Trials and the four surveyed facilities, see Appendix F and H, respectively.)

Finally, with regard to agronomic/horticultural properties, a successful facility will consistently produce a compost product with certain useful properties, which can be labeled appropriately and marketed to end users. Even if limits for these parameters are not set by the DEC as law, a facility must pay utmost attention to producing a consistent, quality product and working with a laboratory, or other certification agency, to arrive at a recognizable soil-amendment product designation. This reduces the “guess-work” for compost users, increasing user confidence in the product, and making it possible for the facility to target specific end-use markets. *An MSW-composting facility must be in the business of creating quality compost, not just handling a municipality’s waste.*

In addition to compost quality, there are other factors relating to compost that are important to take into account. Table 4-1 shows the amount of compost produced (as a percent of total facility input) at each of the surveyed facilities, and during the NYC Composting Trials. These numbers should be viewed cautiously, however, since in terms of compost, quality is as important as quantity.

High-compost output is desirable only when it accompanies high loss of mass and low residue. The Conporec facility, with its 45-percent compost output, 28-percent loss of mass and only 25-percent residue, represents the ideal in this case. Marlborough, on the other hand, has high-compost output (48 percent), but low loss of mass (16 percent), indicating that the compost might not be fully mature and still retains a lot of water weight from the biosolids. Edmonton’s low compost-output number (29 percent) is positive in the light of its high loss of mass (32 percent), but negative in terms of its high residue rate (39 percent). For more information on loss of mass during composting, see the *High Loss of Mass* section on the next page.

Recovery of Recyclables

Recyclable or reusable, non-degradable materials represent another potential output stream from an MSW-composting facility. In order to increase recovery rates and keep residue rates low, MSW-composting facilities should ideally recover non-degradable recyclable items, in addition to the degradable materials that they recover as compost. However, as Table 4-1 reveals, the four surveyed MSW-composting facilities recover very little (0 to 3 percent) non-degradable, recyclable material.

All four of the municipalities that send their refuse to the MSW-composting facilities surveyed for this report offer curbside collection of source-separated recyclables such as paper, metal, glass, and plastic. (See Chapter 3 for more information.) Designers of MSW-composting facilities assume that most non-degradable recyclables will be handled through this separate curbside collection, or that the cost associated with recovery outweighs the cost associated with disposal.[1]

MSW-composting-facility operators, however, often have a different perspective than facility designers. Operations managers from both the Marlborough and Edmonton facilities expressed the desire to have greater ability to remove recyclables before they enter the digester drums. They both reported that even with a separate curbside collection in place, there are still significant quantities of recyclables in the incoming MSW. These recyclables become soiled and entrained with compost in the digesters and lose much or all value as commodities. Facility operators, therefore, not only lose this potential revenue stream, but must pay to dispose of the recyclable items after they are discharged from the digesters.

Furthermore, some of these recyclable items, such as tin cans, become solidly packed with immature compost in the digesters to form what one facility manager called "hockey pucks." To his annoyance, he noted that by not removing these cans before they went to the digesters, he was losing the recycling value of the can, losing the compost, *and* having to pay more to dispose of the residue, as the can was much heavier now that it was filled with compost. A consultant analyzing Marlborough's primary screen overs determined that 16.7 percent of this material, destined for disposal, consisted of metal and plastic containers that were designated as recyclable, per Marlborough's recycling law.

The characterization work associated with the NYC Composting Trials, both for the NYC MSW sent to the Marlborough facility, as well as for the material passing under and over various post-digester screens, did not specifically identify what non-degradable material was recyclable. For instance, the waste-characterization consultant and the research laboratory both used the category "hard plastic." This included readily recyclable plastics, such as polyethylene terephthalate (PET), as well as those without well-established recycling markets, such as acrylonitrile butadiene styrene (ABS).

Without hard numbers, one way to calculate how much recyclable material is in the New York City municipal-solid-waste stream is to consider the capture rate achieved by the City's recycling program (before the suspension of plastic and glass recycling in July 2002). The Department estimated that of the total amount of designated recyclable material in the waste stream, New York City residents captured (set out for separate collection) about 40 percent. This means that 60 percent of the items that the City designated as recyclable were still in the waste stream. As it is unlikely that residents will ever set out 100 percent of the materials designated for recycling, it makes operational sense for MSW-composting facilities to be equipped to recover this material. This is the case whether curbside recycling programs are in operation or not.

High Loss of Mass

One of the most cost-effective ways of maximizing recovery rates is through loss of mass. By aggressively composting the degradable fraction of the waste stream the material loses mass, primarily in the form of water, discharged as vapor. The water in organic (degradable) materials is what makes municipal solid waste heavy, and therefore expensive to transport. Composting the degradable fraction of the waste stream not only recovers this material for recycling, but also significantly reduces the weight of the remaining items requiring disposal.

With respect to every measurement of composting efficiency, the statistical analysis performed by the laboratory in association with the Research Project demonstrated that those facilities with mechanized, highly regulated air floors outperformed those without. This was true regardless of the "compostability" of the input recipe. In essence, a good air floor can compensate for the shortcomings of facility operator negligence, or inexperience, when formulating a recipe to load into the composting drums. Conversely, failure to maintain optimum conditions after drum discharge not only results in the decomposition rate slowing down, but can actually prevent the process from happening at all.

The initial emphasis in MSW-composting facility design (at least in North America) focused on the digester drums. The drums were considered the heart of the process, where the "real" composting occurred, and the air floor was deemed secondary, as the place where the material cured and stabilized (some facilities referred to the post-digester space as a "cure floor"). This may have resulted from the fact that drum designers originally envisioned longer material-retention times than what was practicably possible, given the value of high facility throughput.[1]

The Research Project firmly concluded that while the digester-drum stage is important, it is the post-digester, composting process that is essential to producing a quality product. After three days, for example, in the digester drum, the material requires additional time to both compost and cure. While the exact number of days that a facility should actively manage decomposing material on the air floor is unknown, an extended, mechanized, post-drum process remains crucial. The DEC's requirement that MSW compost be produced from a process with a *minimum* detention time of 50 days (including composting and curing) seems very reasonable in light of the findings of the Research Project.

Looking at the loss-of-mass data in Table 4-1, it is interesting to compare the Edmonton and Marlborough facilities. Both facilities compost MSW and biosolids, employ a similar pre-drum, non-degradables removal strategy, as well as utilize similar digester drums. Both facilities also detain their material on the air floor for 21 days. However, during those 21 days, Edmonton employs a mechanized system that turns the material daily and adds water as needed. Marlborough, on the other hand, forms its compost into piles and turns them weekly, flipping the piles with a front- end loader. It is not surprising then that Edmonton's material loses twice as much mass as Marlborough's. As Chapter 3 noted, the reason that the NYC Trials material lost more mass on the Marlborough air floor than Marlborough's own material is possibly due to the fact that Marlborough facility operators turned the NYC Trials' material more frequently than they would typically turn their own.

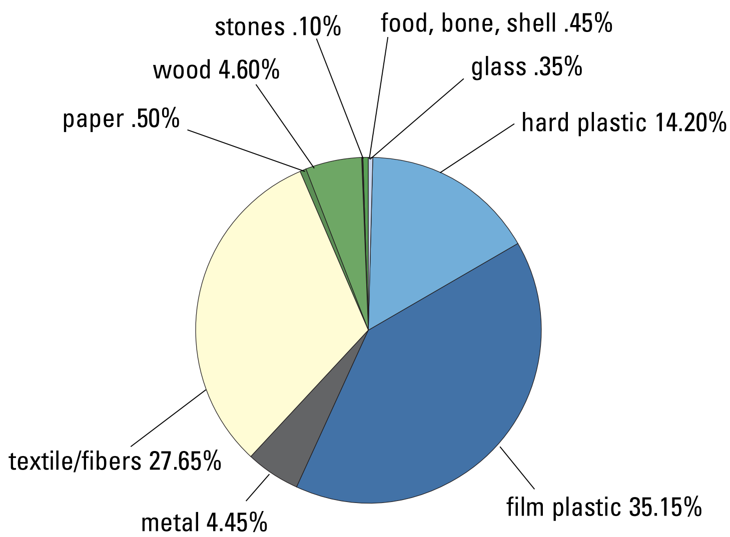
Residue Reduction

The initial thinking of MSW-composting facility planners and operators was that everything could go into the composting digester drums, with all non-degradable items (residue) removed by a series of subsequent screens, post drum-discharge. This is true for the most part. However, two problems arise from this approach:

- Non-degradable items saturate with moisture and immature compost in the digester, making the resulting residue much heavier and therefore more expensive to dispose.
- Small pieces of non-degradable items (such as tiny shreds of glass and plastic) are very difficult to screen away and remove completely without losing substantial compost to residue in the process.

Avoiding Heavy Residue
As part of the NYC Composting Trials (described in Chapter 1), the Department had the laboratory characterize samples of the New York City material that passed over the various Marlborough facility screens, and list the respective weights of each fraction. The composition of the material that passed over the first screen after discharge from the digester drum (meaning

Figure 4-1
Composition and Percent by Weight of Material Passing Over Primary Post-Drum Screen During NYC Composting Trials



Note: Results are an average of two samples (A/B). Data can be found in Appendix F, labeled *NMS Primary Screen Overs (>2")*.

material larger than two inches) is presented as a pie chart in Figure 4-1. Again, this represents residual material that will require disposal.

By far the two heaviest categories of material, as a percent of the total, are film plastic (primarily plastic garbage bags) and textiles (such as discarded clothing and bedding). These items soak up moisture and become entrained with immature compost in the digester drum, making them much heavier than they would be otherwise.

This same process occurs in the laundry—a pair of jeans is obviously much heavier after it comes out of the washing machine than before it went in. In fact, a consultant for one MSW-composting facility weighed a dry pair of pants and found them to be 1.52 pounds. Two similar pairs of pants after they had traveled through the composting digester drum weighed 3.74 and 5.10 pounds, respectively. A dry, plastic, kitchen garbage bag weighed .84 ounce before, and 3.5 ounces after going through the digester (although this bag had not captured any immature compost as many others do).

Since facilities process hundreds of tons of material and pay per ton to dispose of residue, these accretions of weight add up quickly. Therefore facilities can reduce residue disposal costs by removing such non-degradable items *before* loading material into the digester drums. How much can a facility save by doing this? Using the weight gains the consultant derived for textiles and film plastic, the Marlborough facility, for example, could have reduced disposal costs during the NYC Composting Trials by as much as 41% if they had been able to remove textiles and film plastic from the material entering the digester drums.[2]

Avoiding Screening Out Compost with Residue

The current approach to MSW composting, which removes non-degradable items through a succession of smaller post-drum screens, means that the final screen is designed to remove the smallest inerts. This step is particularly important, both for regulatory compliance (in certain States), as well as for visual appearance of the compost from a marketing perspective.

In New York State, even if a facility were to remove non-degradable items before they went through the composting process, as this report proposes, the final screen would still have to be set at three-eighths inch (⅜" or 10mm) in order to meet the DEC regulation that no compost contain *any particles* larger than this size. As noted above, the current DEC regulations also stipulate that inerts must make up no more than two percent of a final, MSW-compost product. In order to get these tiny inert materials out of the compost, the final screen setting at most MSW-composting facilities is very small (generally ten millimeters, or .4 inch, and under). However, with settings this small, the final screens also tend to remove a lot of compost along with inerts.

As presented in the *Quality Compost Output* section above, the Department learned through its Research Project that MSW-composting facilities can overcome this problem by:

- Sending final screen overs back through the composting process
- Reducing moisture levels in the compost before sending it to the final screen

In general, successful facilities will actively compost their material for at least 50 days and drop moisture levels in the compost to about 25-30 percent before sending it to the final screen.

As part of its MSW-composting facility survey, the Department looked at the amount of compost being lost to final screen overs. Table 4-2 presents the percent of compost and other degradable material in the final screen overs (on a dry-weight basis) for the two surveyed facilities that produced a (non-blended) final compost product. These results are more "meaningful" than the New York City Composting Trials results since these facilities run the same compost recipes year-round, as opposed to the limited duration of the Trials.

In the case of both Conporec and Edmonton, about a third of the material passing over the final screens is compost. Given that nearly 80 percent of Conporec's final screen overs is degradable, it makes sense that the facility runs this material back through the composting process rather than disposing of it. Edmonton, on the other hand, disposes of its final screen overs, despite the fact that nearly 40 percent of this material is degradable. This difference contributes to Edmonton's higher residue rate (39 percent), shown in Table 4-1.

Again, sending the overs back through the composting process (i.e., Conporec's approach) ensures that any wood or paper that has not yet degraded, is given a "second chance" to do so. This means that very little degradable material (including compost) is lost to residue.

As noted above, another means to prevent degradable material from ending up in the residue is to control compost moisture levels. Drier materials are generally easier for final-screening equipment to handle, allowing for a more effective separation of compost from small, inert materials.

Table 4-2
Percent of Compost and Other Degradable Material in Final Screen Overs (on a dry-weight basis)

Material	Conporec	Edmonton
Compost	33.13	32.79
Paper	38.16	2.09
Wood	6.33	2.40
Total	**77.62**	**37.28**

Table 4-3
Moisture Levels in Final Screen Unders: Surveyed Facilities and NYC Composting Trials

Facility	Age of Material (Days)	Percent Moisture (as-is basis)
Conporec[1]	42	21.75
Edmonton[1]	21	34.55
Marlborough	21	55.60
New York City Composting Trials	21	43.40

1. Results are the average of an A/B sample pair.

Table 4-3 shows the moisture levels of the compost passing under the final facility screens from each of the surveyed facilities producing a finished compost, as well as the New York City Composting Trials.

Even with moisture levels as low as 35 and even 22 percent (from Table 4-3), about a third of the material passing over the Edmonton and Conporec final screens is compost (from Table 4-2). However, Conporec remedies this situation by running these organic-rich overs back through the composting process.

What is significant to note here is that after 21 days of composting, the material from the Marlborough facility (both Marlborough's own compost and New York City Trials' compost) is extremely wet. The moisture level in Marlborough's compost (56 percent) is more appropriate for the beginning of the compost process, not the end. This means that Marlborough cannot run its material through a final screen at this stage of the process, let alone worry about losing compost to overs. The facility's decision to stop attempting to run its material through the final facility de-stoning equipment and fine screen (ten millimeters, or .4 inch), at this stage makes sense.

As explained in Chapter 1, the Department decided to run New York City Composting Trials' material through the Marlborough final-screen equipment, in spite of the fact that the facility was no longer using it. As Chapter 1 described, the Department verified the facility's complaint that the equipment was screening out too much compost along with the inert material that it was designed to remove. In addition, the final-screen equipment would jam up, break down, and generally struggle to operate at all. This makes sense given how wet the material from the New York City Trials was at this point.

While the exact moisture levels for ideal de-stoning and final screening are not known, facility operators generally agree that compost should contain less than 40-45 percent moisture in order to screen well. Based on the findings of the Department's Research Project, it is perhaps the case that MSW compost should be even drier when going to the final screen (around 25-30 percent moisture).

Given that Conporec detained its material for 42 days and the other facilities only 21, it is interesting to note how long it took for these other composts to exhibit the "ideal" moisture levels for final screening.

Both Edmonton and Marlborough send their material off-site after 21 days to outdoor areas for additional composting and curing. The Department took samples of the material that each facility considered finished. As explained in Chapter 1, the Department sent the lab a cubic-yard sample of the material from the New York City Composting Trials after it spent 21 days on the Marlborough air floor and was screened through the facility's half-inch screen. The lab sampled this New York City material at Day 59 and performed a full analysis, as this was the material that the Department considered the final product from the Trials. Sampling occurred at this point in order to meet the DEC's 50-day-minimum detention-time requirement, outlined in Chapter 2. Table 4-4 presents the moisture levels in the finished compost products from Edmonton, Marlborough, and the New York City Composting Trials.

Table 4-4
Moisture Levels in Finished Compost: Surveyed Facilities and NYC Composting Trials

Facility	Age of Material (Days)	Percent Moisture (as-is basis)
Edmonton[1]	90+	26.55
Marlborough	60+	20.8
New York City Composting Trials	59	23.5

1. Results are the average of an A/B sample pair.

At the time of the survey, the Edmonton facility was not actively managing the compost at their off-site curing location. They were not turning the material at all, but rather just leaving it in large piles. Marlborough facility operators provided for regular turning at their off-site curing location with a front-end loader. Staff at the laboratory also regularly turned the cubic-yard sample of the New York City Trials compost. It is interesting that with more active management, the Marlborough and the New York City Composting Trials materials lose more moisture in less time than Edmonton's. At 59 days, the New York City material has attained the "ideal" moisture range for final screening.

The next chapter discusses how a facility can systematically incorporate materials recovery with MSW composting, and presents the preliminary layout and proposed components of a theoretical pilot facility. The conceptual design of the pilot facility builds upon the findings from the Department's MSW-Composting Research Project, discussed earlier.

CHAPTER 5
LEARNING OBJECTIVES AND CONCEPTUAL DESIGN

Summary

This section presents the conceptual design for a theoretical, New York City Research and Development Pilot Materials-Recovery and Composting Facility ("MRC," pronounced *merc*). The chapter presents the basic design considerations and learning objectives of such a facility, and follows with a general description of the theoretical facility configuration and components.

The description of the pilot-facility layout and its components included herein should not be read as an actual design plan, but rather as a general guide to help conceptualize what a pilot MRC might look like and how such a facility might operate, should one be built in New York City.[1]

Materials Recovery and Composting

What is a MRC? A materials-recovery and composting facility is designed to recover as much recyclable and degradable material as possible from the waste stream. Simply stated, a MRC is an MSW-composting facility combined with a mixed-waste materials-recovery facility (MRF).

Recognizing that over half of the municipal solid-waste stream is degradable (even with a curbside, mixed-paper recycling program), a MRC's broad goals are to:

- De-bag and "clean" incoming MSW by removing as many non-degradable materials as possible before composting the larger, degradable fraction of the waste stream
- Focus especially on removing non-degradable items that are perennially problematic for MSW composting, such as plastic bags and glass
- Recover for recycling as many of the non-degradable items as is practically possible
- Produce a quality compost product

As described in Chapter 1, most MSW-composting facilities rely on the tumbling action of the rotating composting drum to break open garbage bags and thereby expose the degradable fraction of the waste stream to the agents of decomposition. The advantage of this approach is that 100 percent of the degradable material entering the facility goes to the composting drum. The disadvantage is that 100 percent of everything (with the exception of certain bulk items) in the waste stream goes to the composting drum as well.

For MSW composting to work, non-degradable material has to be separated from degradable material at some point in the process. As explained in Chapter 4, the current approach to MSW composting—where facilities attempt to screen out non-degradable material *after* it has gone through the composting process—leads to increased residue disposal costs, decreased recovery of non-degradable recyclable items, and increased contamination levels (small pieces of glass and plastic remaining) in the final compost product.

The pilot facility, described in this chapter, would attempt to avoid these problems by segregating and (where possible) recovering non-degradable materials *before* they go through the composting process. Again, this pilot facility can be thought of as a traditional MSW-composting facility with a mixed-waste materials-recovery facility (MRF) on the front end. Mixed-waste MRFs (sometimes referred to as "dirty MRFs") accept mixed waste, rather than source-separated recyclable items. These MRFs debag the incoming mixed waste and accomplish separation and recovery through various screens and sort lines. Much of the design for the pre-composting, materials-recovery process for a pilot Materials-Recovery and Composting Facility comes from these types of MRFs.

Design Considerations

Based upon the results of the MSW-Composting Research Project, this report recommends that, were a pilot Materials-Recovery Composting Facility to be built in New York City, it should include the following design features:

- **Removal of non-degradable items before MSW enters the composting digester drums.** Rather than rely upon a successive series of screens after drum discharge to remove non-degradable items, such materials should be removed *before* they go through the composting process. This would increase facility recovery rates, decrease residue disposal costs, and create a cleaner, final compost product.

- **Recovery of recyclable materials from the waste stream before MSW enters the composting digester drums.** Materials-Recovery Facilities (MRFs) employ technology and systems designed to remove targeted items from the waste stream. MRFs generally separate and bale these items for transport to manufacturers, who will use them as feedstock for production. An NYC Pilot Materials-Recovery and Composting Facility should test the configuration of these recovery technologies in order to remove and recover as many recyclables as possible from the waste stream, before material gets sent to the composting digester drums.

- **Flexible and largely modular design so that different components can be moved, reconfigured, or removed in order to meet learning objectives.** All sort lines should be skid-mounted, and all equipment should rest on a concrete floor, so that facility components could literally be rearranged. Most of the push walls could be recyclable steel, rather than concrete, and could fit into slots in the floor, rather than being permanently cast. The design elements should be reusable and recyclable to the extent possible.

- **Operational redundancy and flexibility.** Each piece of equipment should be paired, so that if one breaks down and requires repairs, the other could take up the slack. Additionally, the different component processes (materials recovery, composting drum loading and discharge, and compost curing) should be operated separately so, for example, material could be received and sorted on one shift and then loaded into the digester drum on another shift.

- **Adequately sized air floor.** One of the primary lessons of DSNY's MSW-composting research project was the need for extended, actively managed, post-digester composting to produce a quality compost product.

• **Sensitivity to neighbors.** Given New York City's dense, urban environment, neighbors will never be far from a potential facility, even in industrial zones. Therefore, the facility should be designed from the very beginning with the goal of being a good neighbor. Such design considerations include: preventing and minimizing odors, minimizing truck queuing, facilitating easy and routine cleaning, and keeping materials moving (not stockpiling them for long periods).

• **Adequate throughput to ensure economies of scale.** The facility should be designed not only to demonstrate the technical viability of the processes involved, but to handle sufficient volumes of waste, such that it is economically sensible to operate.

Learning Objectives

An NYC Research and Development Pilot Materials-Recovery and Composting Facility (from here on referred to as "pilot MRC facility" or "pilot facility") should have a discreet number of learning objectives (summarized in Table 5-1), and a set time period in which to answer some important questions. Another key function of the pilot facility would be to introduce legislators, interested parties, concerned communities, and local regulatory agencies to the process, such that all potential environmental concerns (including odor-control performance) are addressed. If a pilot facility is able to operate successfully in a cost-effective, nuisance-free manner, and produces a quality compost product with viable end markets, then New York City might consider scaling up to a permanent facility. If a pilot facility is unable to accomplish these goals, then the facility should be dismantled, with the component equipment sold for reuse to other solid-waste–handling enterprises.

Facility Layout and Description of Components

In preparing an initial plan and cost estimates for a pilot MRC facility in New York City, the Department worked with a consultant who has long-standing experience both with MSW-composting systems and facility design. This consultant in turn sought assistance from an engineer specializing in MRF design in order to identify successful and proven materials-recovery equipment. The goal was to identify equipment that would both maximize the recovery of non-degradable materials for conventional recycling markets, as well as target items (such as film plastic and small pieces of glass) that regularly cause problems for MSW-composting systems. For projected recovery rates for the various material fractions of the waste stream moving through a pilot facility, see Chapter 6.

Appendix I contains the engineer's recommended equipment list for the materials-recovery component of the theoretical pilot MRC facility, described herein. This list represents the engineer's recommendations only, and is provided primarily as a break-out of equipment costs. This list in no way constitutes equipment that New York City has chosen, or might chose to employ in the future, should it decide to pursue the development of a pilot facility. The engineer's drawings for the materials-recovery component of the pilot MRC facility have been reproduced from the original blueprints and resized for convenience of viewing. These drawings (Illustrations 5-2 through 5-8) accompany the narrative description which follows.

Illustration 5-1 shows a preliminary conceptual layout of a pilot MRC facility, designed to fit in the smallest footprint possible. Building numbers discussed in the text and in subsequent illustrations reference this drawing. The text that follows describes the hypothetical movement of materials from Building 1 (Facility Tipping Floor) through Building 14 (Final Screening and Compost Load-Out). Table 5-2 provides an overview of how a pilot MRC facility might function, and lists the various illustrations and photos associated with each section.

Receiving and Sorting Waste

After weighing in on facility scales, trucks pull up to the doors of the pilot facility and tip their loads onto a depressed, concrete **tip floor**, several feet below the entrance (Building #1 in

Table 5-1
Summary of Learning Objectives for an NYC Pilot Materials-Recovery and Composting Facility

Facility Size and Cost	• Test the pilot facility over the course of a year to determine its ability to handle the peaks and valleys in New York City's degradable waste stream (such as the influx of yard waste during the spring). • Test flow-through times in order to properly size a full-scale facility that would be able to handle the allocated fraction of the waste stream, as managed by the NYC Departments of Sanitation and Environmental Protection (in the case of biosolids). • Closely track recovery rates (including weights of all facility inputs and outputs) and operating and maintenance costs to develop an accurate basis with which to compare materials recovery and composting to other waste-management strategies.
Materials Recovery	• Test and configure different materials-recovery components (including conveying and baling equipment) to determine which are best suited for maximizing the recovery of non-degradable materials for conventional recycling markets, and diverting non-degradable materials that are especially problematic for composting (such as film plastic and glass). • Determine the optimum sorting-station length, number of sorting stations, and speed of the sorting belts for a given amount of material across the pre-processing sort lines, so as to maximize the removal of non-degradables. • Assess potential markets and their capacity to absorb both the compost and other products produced by the pilot facility (such as recovered textiles and standard, baled recyclable commodities).
Compost Quality	• Test input "recipe" formulations and material-retention times, both in the composting digester drum and post-digester composting systems, to optimize decomposition and final compost quality. • Determine the ability of the solid waste to absorb biosolids at different levels of dewatering. • Conduct intensive, independent laboratory analyses to make certain that the compost consistently meets or exceeds New York State and federal quality standards.
Facility Operations	• Assess ability of trucks to weigh in and tip quickly in order to minimize queuing. • Test different operating schedules to provide for adequate material throughput and regular facility cleaning. • Measure odor dilution at the perimeter of the facility to establish a consistent, objective record of odor-control performance through different weather conditions/wind patterns.

Table 5-2

Summary of the Basic Components of a Theoretical, NYC Pilot Materials-Recovery and Composting Facility

Facility Tipping Floor *Illustration 5-1*	• Contains tip floor, where incoming MSW is unloaded, and grapple crane, which removes bulk items (recyclable and non-recyclable).
Materials-Recovery Building *Illustrations 5-1 through 5-8; Photos 5-1 and 5-2*	• Contains primary and secondary sort lines and bag-opening equipment. These lines serve to remove large items not in bags (recyclable and non-recyclable), empty contents of opened bags, and remove film plastics. • Material then passes through a primary screen, a final sort line, and a final screen. • The screens and final sort line remove small, non-degradable items and recover recyclables from the waste stream.
Materials-Recovery Staging Area *Illustrations 5-1 and 5-9*	• Baling and storage area for the recyclables removed from the waste stream. • Staging area for any reusable, salvageable materials removed from the waste stream. • Staging area for the disposal of the non-degradable residue removed from the waste stream. • Potential location for the processing of the glass-and-organics–laden unders from the primary pre-drum screen.
Digester Drum Tipping Floor *Illustrations 5-1 and 5-10*	• Loading area for the sorted and screened MSW to be composted in the digester drums.
Biosolids Storage Bunker and Pumps *Illustration 5-1*	• Stores biosolids and pumps them directly into the digester drums where they will be mixed with sorted MSW.
Three Digester Drums *Illustrations 5-1, 5-10, and 5-11*	• Mix biosolids and sorted MSW to begin intensive decomposition process. • Two main drums handle the “overs” from the Materials-Recovery Building (largely comprised of paper and other degradable materials not picked out or screened away). • The third drum handles only the glass-and-organics–laden “unders” from the primary screen in the Materials-Recovery Building.
Primary Screening Building *Illustrations 5-1 and 5-11*	• Screens the immature compost discharged from the drums to remove large, non-degradable items missed by the materials-recovery process. • “Unders” from the first two drums go to the First-Phase Composting building. “Overs” are disposed as residue. • “Overs” from the third drum are also disposed, and the “unders” are sent to the De-Stoning Building.
First-Phase Composting *Illustration 5-1, Photo 5-3*	• Composts the “unders” from the two main digester drums for approximately 20 days.
Second-Phase Composting & Curing *Illustrations 5-1 and 5-12*	• Continues to compost materials from the First-Phase Composting building for an additional 30 days.
Final Screening & Compost Load-Out *Illustration 5-1, Photo 5-2*	• Screens the compost from the Second-Phase Composting & Curing building. • Staging area for loading final-screen “unders” (finished compost) into transport vehicles for additional curing or end use.
De-Stoning Building *Illustration 5-1*	• Separates the inerts from the immature compost discharged from the third digester drum. • Small, non-degradable material is disposed. • Remaining degradable material is sent back though one of the two main digester drums.
Biofilter and Emissions-Control Equipment *Illustrations 5-1, 5-13, and 5-14*	• Filters and treats process air from the facility to remove odors before release outdoors.

Illustration 5-1
Conceptual Layout of an NYC Pilot Materials-Recovery and Composting Facility

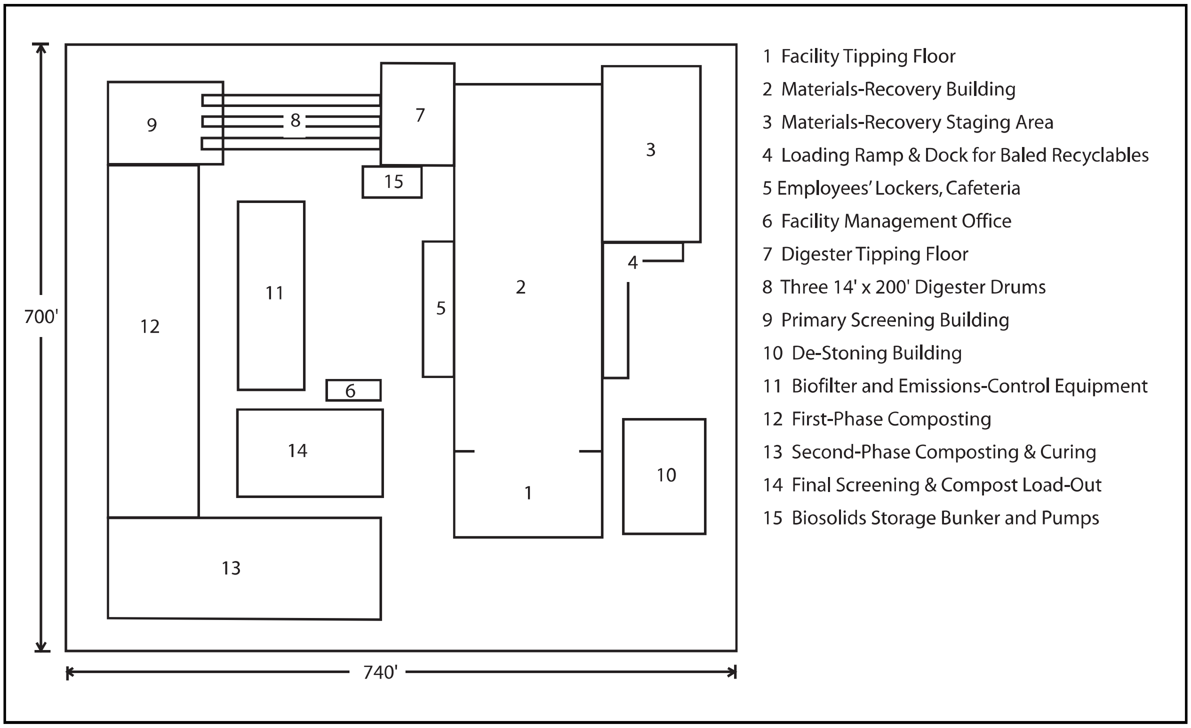


Illustration 5-1). With a depressed tip floor, trucks do not actually enter the facility, which reduces the amount of diesel fumes (and chances for accidents) inside the building. Since collection trucks often tip their loads in convoys, a pilot facility should be designed to accommodate many trucks tipping at once, in order to avoid queuing and delays. Installing high-speed doors would minimize the chance of odors escaping the building during unloading.

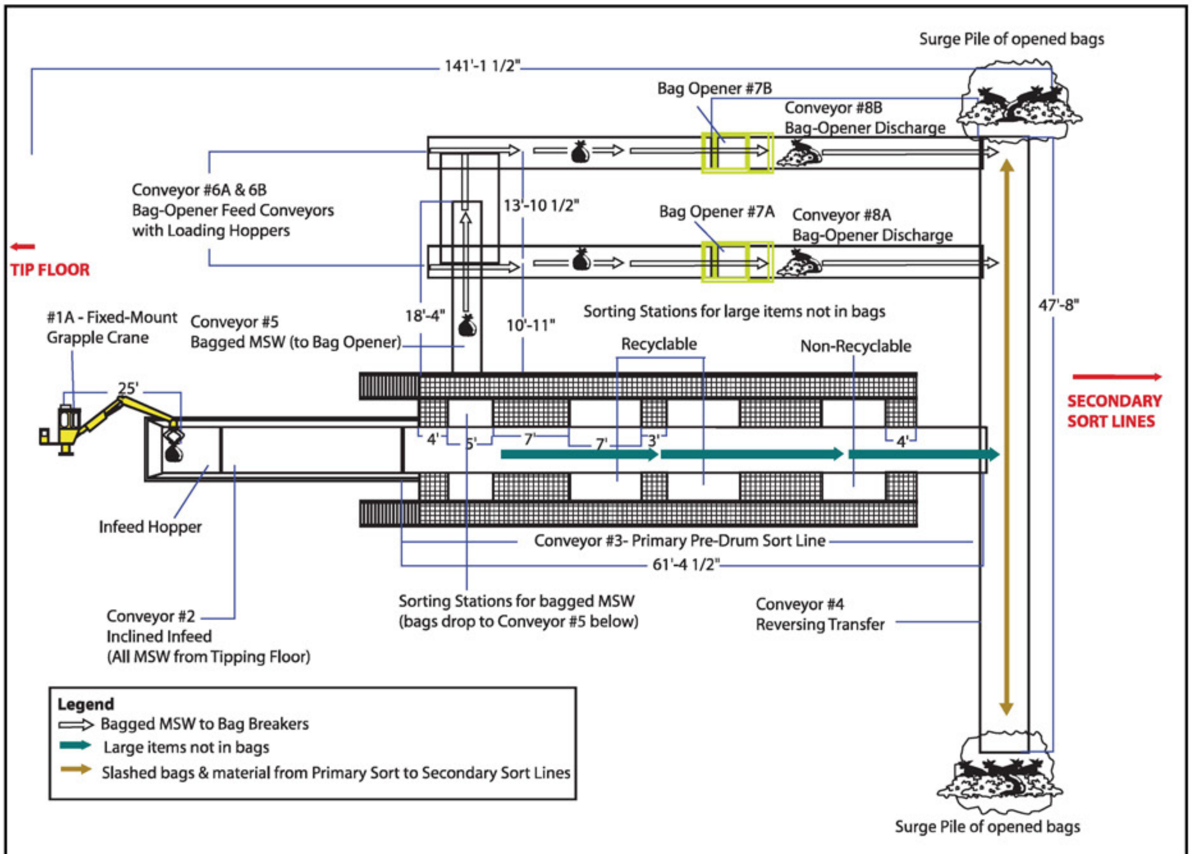
An operator in a electrically driven, **fixed-mount grapple crane** (#1A in Illustration 5-2) on the facility tipping floor removes bulky items (such as couches and plumbing fixtures) and places them into containers, and loads all other waste into the infeed hopper of a large conveyor belt (Conveyor #2). Electrically driven cranes are proposed for a pilot facility, instead of front-end loaders, again, to reduce diesel fumes inside the building. When the bulk-item containers are full, a truck transports them to the **Materials-Recovery Staging Area** (Building #3 in Illustration 5-1) for either recovery or disposal.

Conveyor #2 rises on a slight incline and moves past the elevated, **primary pre-drum sort line** (Conveyor #3 in Illustration 5-2) in the **Materials-Recovery Building** (Building #2 in Illustration 5-1), where workers in environmentally controlled housing perform the following tasks:

- Sort materials that arrive in plastic bags
- Sort bulky items that do not arrive in plastic bags

The first set of workers on the primary sort line picks all garbage bags, big or small, off the belt and drops them through a chute to a separate conveyor (Conveyor #5), running below the first

Illustration 5-2
Overhead View of Primary Pre-Drum Sort Line and Bag-Opening Process



See Illustration 5-3 for side view of bag-opening process, and Illustration 5-4 for side view of primary pre-drum sort line.

large conveyor (Conveyor #3). Conveyor #5 feeds into two conveyor lines (Conveyor #6A & 6B in Illustrations 5-2 and 5-3), which lead to **bag openers** (#7A & 7B) that slash open all of the garbage bags. Slashed bags then move by a discharge conveyor (Conveyor #8A & 8B) to a **reversing transfer conveyor** (Conveyor #4), and are deposited into two surge piles, which are ready to be loaded onto the **secondary pre-drum sort lines** (Illustration 5-5).

The second set of workers on the **primary pre-drum sort line** removes bulky, potentially reusable or recyclable items that do not arrive in garbage bags. This would include materials such as lumber, large sheets of corrugated cardboard, bulk metal, and electronics. Workers pick such materials off of the conveyor (Conveyor #3 in Illustration 5-2 and 5-4), and drop them into separate, designated

Photo 5-1: Example of an enclosed, climate-controlled sorting station
Photo taken at the materials-recovery facility, located adjacent to the MSW-composting facility in Rapid City, South Dakota—one of the facilities surveyed by DSNY for this report.

Illustration 5-3
Side View of Bag-Opening Process

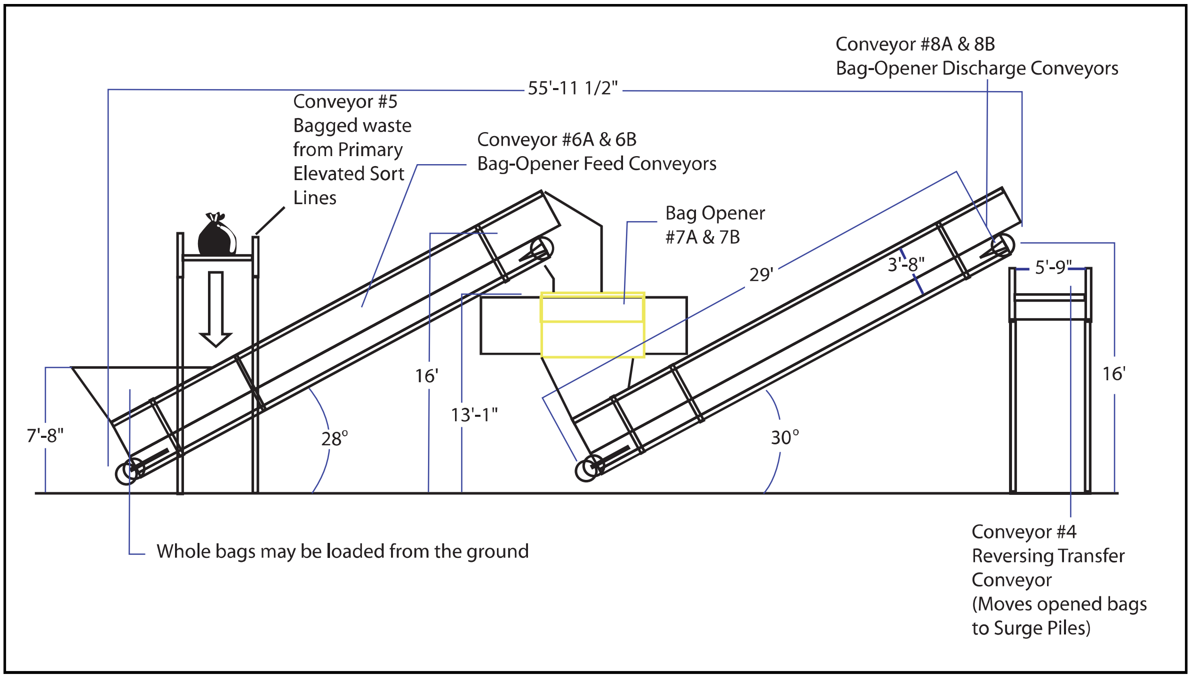


Illustration 5-4
Side View of Primary Pre-Drum Sort Line

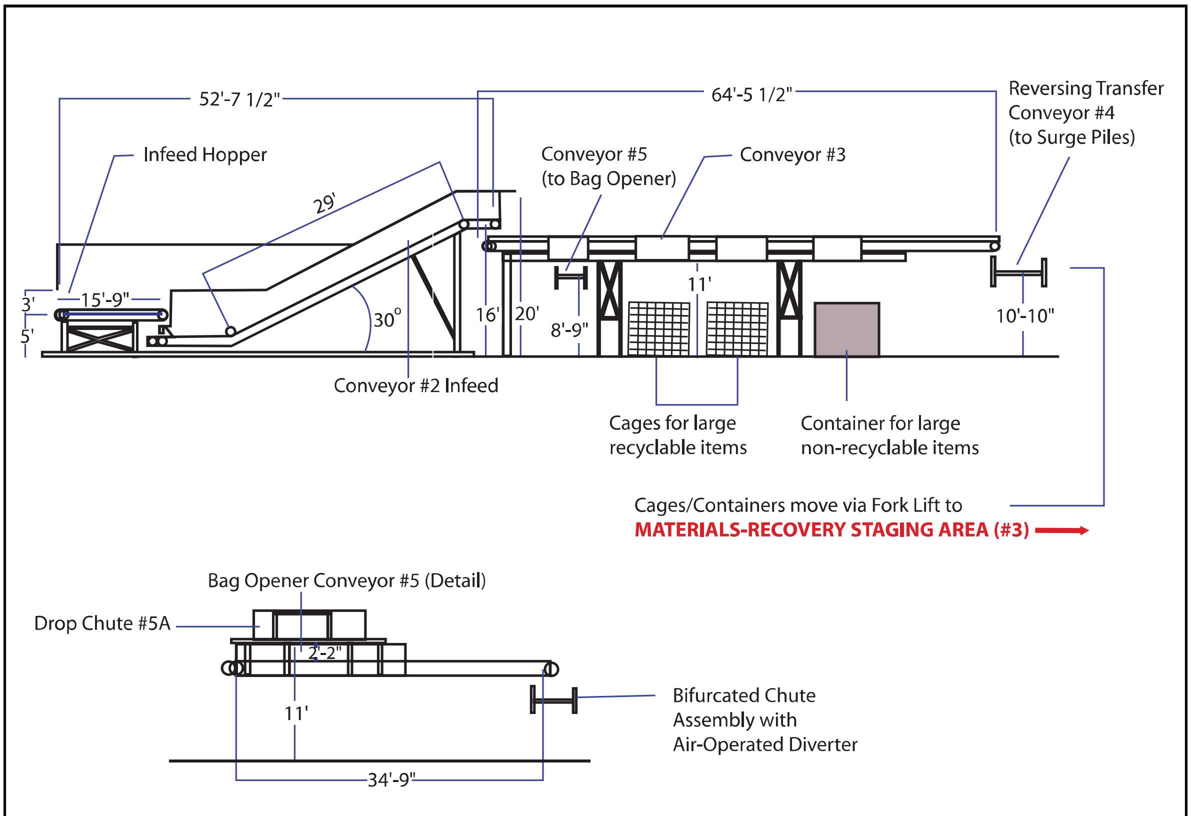
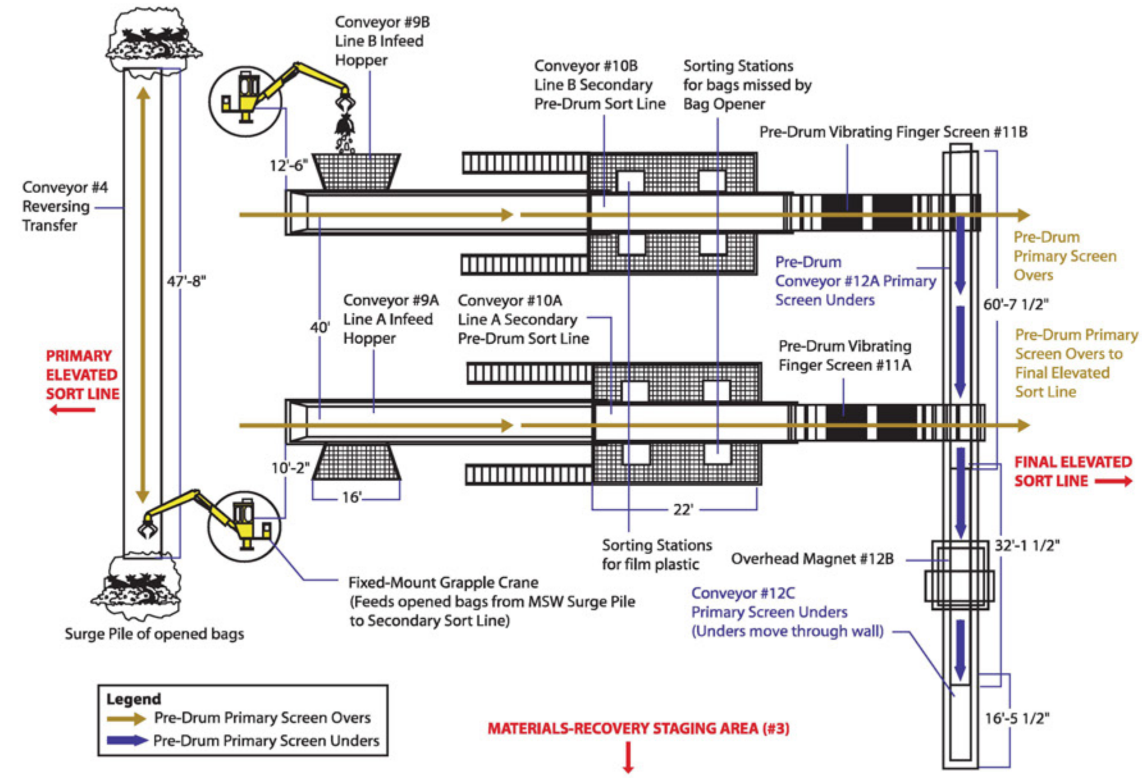


Illustration 5-5
Overhead View of Secondary Pre-Drum Sort Lines



See Illustration 5-6 for side view of Secondary Pre-Drum Sort Line, and Illustration 5-7 for movement of pre-drum, primary screen unders.

cages or containers below. The last workers on this line pick any large miscellaneous, non-recyclable items that did not arrive in bags and drop them into a container below for disposal. All other materials continue onto the **reversing transfer conveyor** (Conveyor #4), joining with the opened bags of MSW to be loaded onto the **secondary pre-drum sort lines** (Illustration 5-5).

Operators in a second set of electrically driven, fixed-mount grapple cranes pick up the slashed bags and other material from the surge piles formed by Conveyor #4 (Illustration 5-2) and load them into one of two hoppers.

The hoppers (Conveyor #9A & 9B in Illustration 5-5) feed into the elevated, **secondary pre-drum sort lines** (Conveyor #10A & 10B), where workers separate the materials into the following categories:

- Film plastic from the slashed garbage bags
- Unopened smaller bags, or unopened bags missed by the bag opener
- Clean, dry textiles

The first set of workers on the secondary sort lines picks up the slashed garbage bags, empties the contents onto the conveyor belt, and drops the film plastic into a cage below for baling (Illustration 5-5 and 5-6).

The second set of workers on the secondary sort lines picks unopened, smaller bags that were inside larger bags, and any bags missed by the bag opener (#7A & 7B in Illustration 5-2 and 5-3), and drops them into separate containers below (Illustration 5-5 and 5-6). When full, a forklift or front-end loader transports the containers with the unopened bags and deposits the bags onto the ground-level infeed conveyors, which lead to the bag openers previously described (Illustration 5-3). This step in the process is designed to address the way waste is generally set out for collection in multiple-unit apartment buildings (for instance, many smaller bags within larger bags).

A final set of workers, located in between these two stations, would assist in both tasks, but would also pick out all clean, dry textiles and drop them into separate containers below, before they became contaminated with other fractions of the waste stream.

Pre-Drum Screening

The material that remains on the secondary sort line continues over **pre-drum vibrating finger screens** (#11A & 11B in Illustration 5-5 and 5-6). These screens remove as much broken glass as possible from the material and can be equipped with different decks, which feature various sized openings. The pilot facility might start with a two-and-a-half-inch (2.5") screen setting, but could experiment with both a three-inch and four-inch setting. Testing different screen settings would help determine the optimal size to capture the maximum amount of broken glass, while minimizing the amount of degradable material also removed in the process.

Illustration 5-6
Side View of Secondary Pre-Drum Sort Line

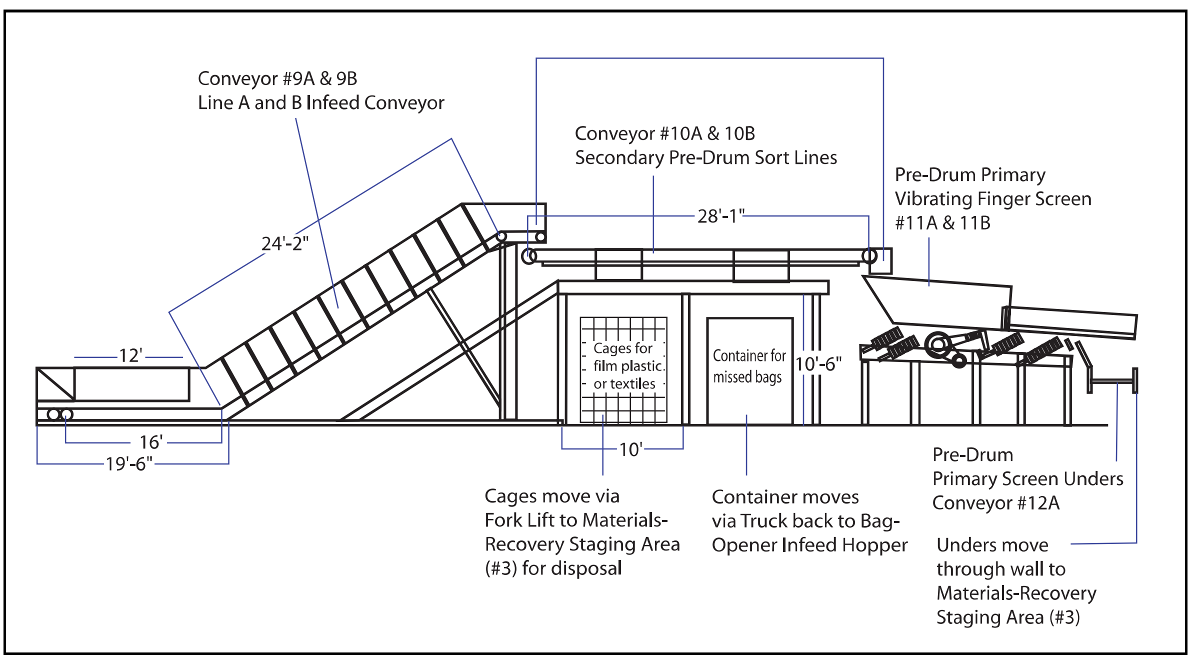
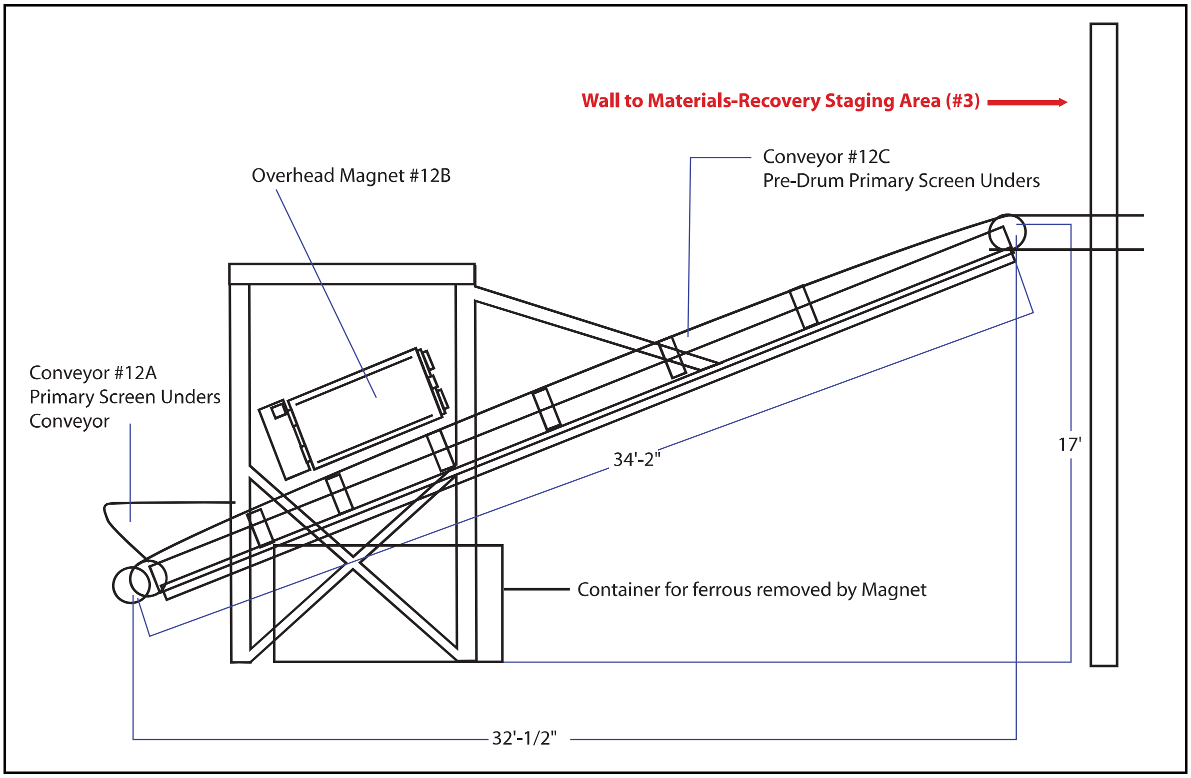


Illustration 5-7
Side View of Movement of Pre-Drum Primary Screen Unders



The material that passes **under** the vibrating finger screens—material smaller than 2.5 inches (or depending on the screen size, smaller than three or four inches)—drops onto a conveyor (Conveyor 12A) and moves under an **overhead magnet** (#12B in Illustrations 5-5 and 5-7), which removes small ferrous items for recovery.

The Edmonton Facility employs a similar technology to remove ferrous materials from their post-digester, primary screen unders. (See Chapter 3, Photo 3-14.) At a pilot MRC facility, the unders stream would be fairly light and spread out on the conveyor at this stage of the process. Therefore, a magnet should be more effective located here than post-digester discharge, as it is currently (and problematically) employed in Edmonton. (See the Edmonton section of Chapter 3 for details.)

After passing under the magnet, the **unders** from the finger screen continue on a conveyor (#12C) through the wall and are deposited in a surge pile (Illustration 5-9) on the floor of the **Materials-Recovery Staging Area** (Building #3 in Illustration 5-1).

To get an idea of the size and composition of the **unders** stream from the **vibrating finger screens**, DSNY's consultant visited a 1,900-ton-per-day, mixed-waste MRF in City of Industry, Los Angeles. This MRF processes non-source-separated, residential garbage from a substantial part of L.A., and runs the debagged material directly over a three-inch, vibrating finger screen. The facility reports that about ten percent by weight of the total incoming material passes under the three-inch screen and is largely comprised of broken glass, small pieces of yard and food waste, plastic, and other small, degradable and non-degradable fines.

Since one of the goals of a pilot facility is to keep as much glass as possible out of the composting drums, it would be better to segregate and dispose of this approximately ten percent as residue. However, as a large fraction of the unders stream would also be degradable, it is important to experiment with ways to separate the degradable from the non-degradable fraction. While existing de-stoning equipment could be used at this stage for such a purpose, it would be better to see what this stream actually look likes in New York City (including important seasonal variations) before designating any specific piece of equipment. Space in the Materials-Recovery Staging Area is allocated in the theoretical pilot facility for such pre-processing of these unders.

Another option that a pilot facility could test would be to compost these unders from the vibrating finger screens in a separate **designated digester drum**, and then screen and/or de-stone the resulting compost separately upon discharge. Depending on how glass-free the resulting screened, post-drum compost was, the material could either proceed to the **First Phase Composting** building, or be sent back through one of the **general digester drums**. (See *Composting Digester Drums and Post-Drum Composting*, which follows).

The material that passes **over** the vibrating finger screens—material larger than 2.5 inches—continues via conveyor (Conveyor #13A & 13B in Illustration 5-8) to the elevated, **final pre-drum sort lines** (Conveyor #14A & 14B). In addition to dropping out fines, the vibrating finger screens also serve to spread material out evenly on the conveyor belt, so that the sorters have a good visual presentation of the material.

On the **final pre-drum sort lines**, sets of workers would pick out small, potentially reusable or recyclable, non-degradable items such as:

- Certain hard plastics
- Certain plastic food and beverage containers
- Metal items
- Large pieces of glass
- Intact glass bottles and containers (sorted by color)
- Clean, intact toys
- Electronics

Workers drop these items into separate cages below the sort lines (Illustration 5-8). When the cages are full, a forklift transports them to the attached **Materials-Recovery Staging Area** (Illustrations 5-1 and 5-9). The last workers on the sort lines pick out any miscellaneous, non-reusable, non-recyclable items and drop them into containers below for disposal.

Material remaining on the sort lines then passes over **final pre-drum debris roll screens** (#15A & 15B, Illustration 5-8, and Photo 5-2), which are designed to drop out any small pieces of glass or plastic missed by the first screen. The overs from these screens move via conveyor (Conveyor #16A & 16B) to another conveyor (Conveyor #18), which deposits the material into a surge pile on the **digester tipping floor** (Illustrations 5-1 and 5-10).

Illustration 5-8

Overhead View of the Final Pre-Drum Sort Line for the Primary Screen Overs

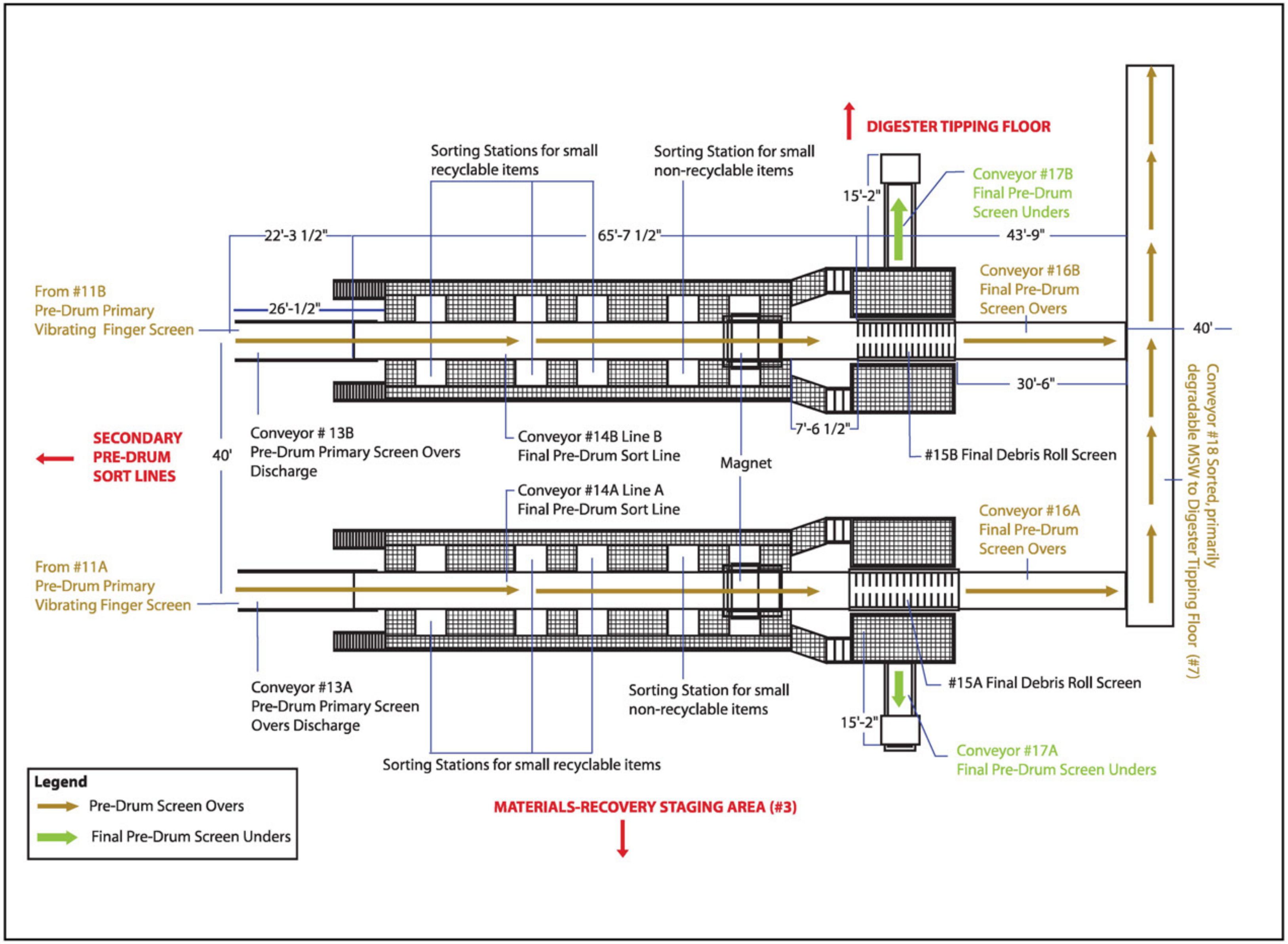
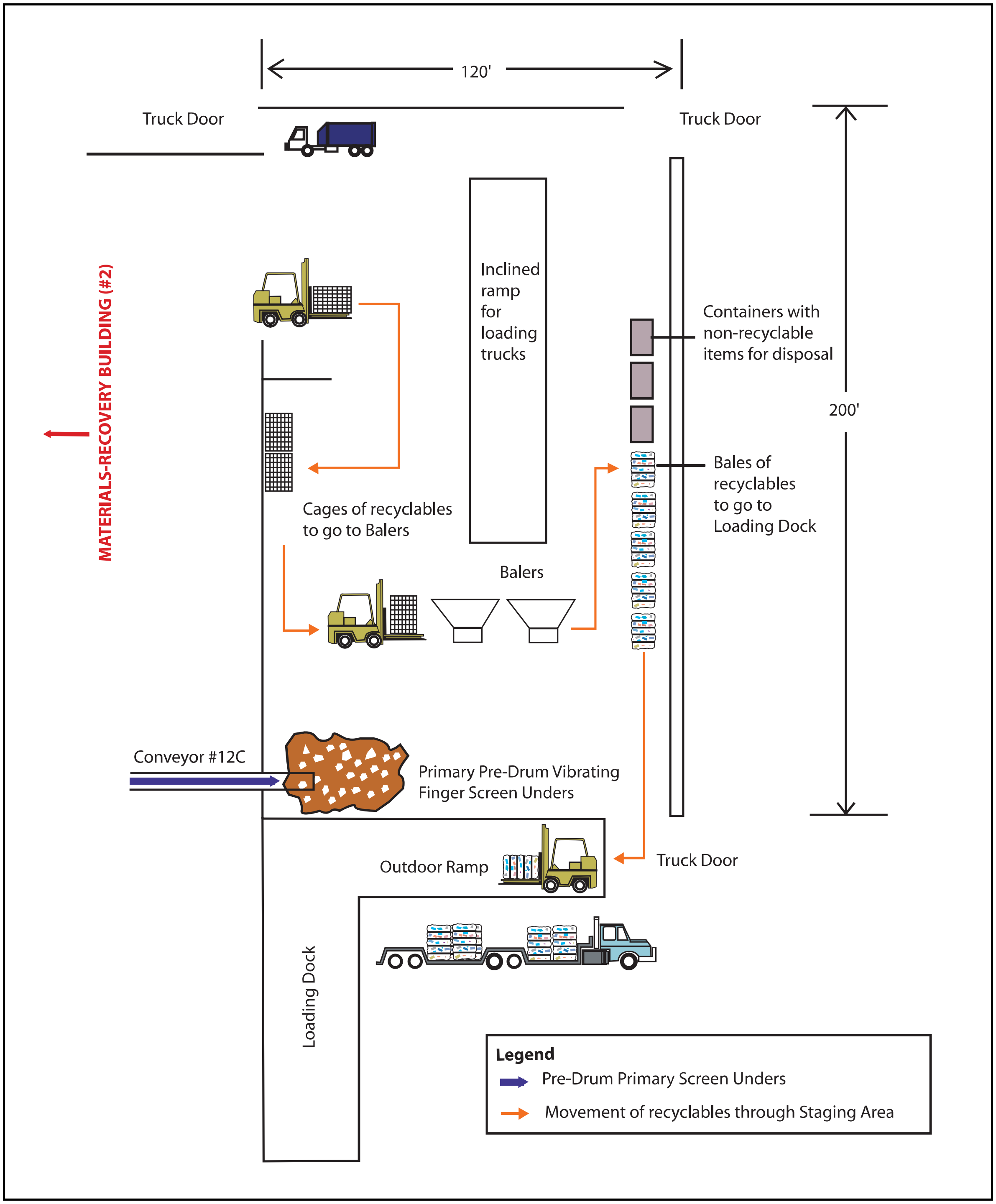


Illustration 5-9
Overhead View Inside Materials-Recovery Staging Building



Depending on the amount and composition, the final debris roll screen **unders** (Conveyor #17A & 17B, Illustration 5-8) would either be disposed as residue or sent to the Materials-Recovery Staging Area for processing with the unders from the first set of primary pre-drum vibrating finger screens (Illustration 5-9).

Pre-Drum Materials Recovery

A **Materials-Recovery Staging Area** (Building #3 in Illustration 5-1), accessible through a large, interior door from the Materials-Recovery Building (Building #2), would serve several purposes:

- Storing and baling **designated recyclables** removed from the waste stream
- Storing any **reusable, salvageable materials** removed from the waste stream
- Staging area for the disposal of the **non-degradable residue** removed from the waste stream
- Potential location for equipment to process **unders** from the primary **vibrating finger screens**

Cages full of **designated recyclable materials** picked off any of the materials-recovery sort lines—such as scrap metal, aluminum, and certain plastics—enter this building via a forklift and are stacked against a wall (Illustration 5-9). From here, workers bale the material (using the balers inside the building) and then stockpile the bales for shipment. When tractor trailer trucks arrive to take the baled material to processors, forklifts move the material to an outdoor loading ramp and deposit the bales into the awaiting vehicles.

A Materials-Recovery Staging Area also would serve as storage for any **reusable, salvageable items** (such as clean, intact furniture, toys, bicycles, and appliances) removed from the waste stream during the sorting procedures described earlier.

While known markets do exist for scrap metal, clean textiles, color-separated glass, dirty film plastic, and plastic bottles, it is less clear if outlets could be found for certain, recovered electronics, clean toys, and furniture. Part of the research associated with a pilot facility would be to investigate outlets for such materials, and to work with those entities to arrange for regular collection. In order to be conservative, however, the cost estimates for the pilot facility in Chapter 7 assume that all of recovered materials without established, secondary-use outlets would require disposal. Furthermore, the cost estimates conservatively assume that materials with established secondary-use markets would generate no revenue, but processors would pick up these baled items at no cost (freight-on-board at the facility).

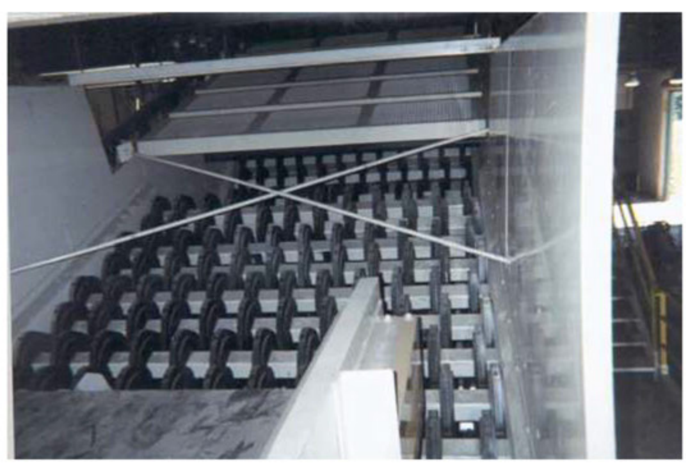


Photo 5-2: Debris Roll Screen at a Mixed-Waste MRF in Oakland, CA. Debris roll screens could be used in a pilot NYC facility to remove any small pieces of glass or plastic that were missed by the first screen.

A ramp within the Materials-Recovery Staging Area would be used for loading non-degradable, non-recyclable, non-reusable items (**residue** from the materials-recovery process) onto trucks for disposal.

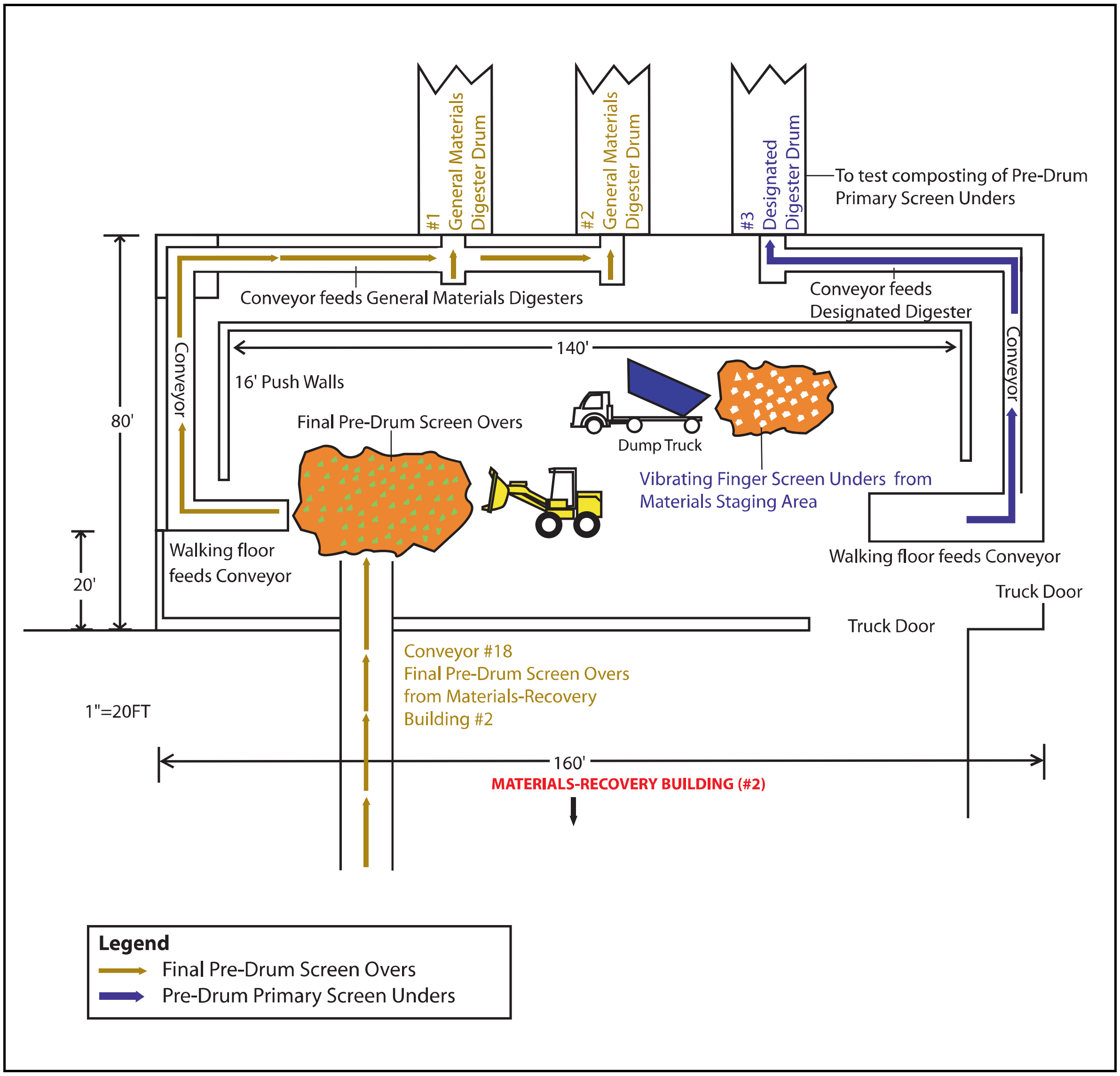
Composting Digester Drums

The material that passes over the **final pre-drum debris roll screens** (#15A & 15B, Illustration 5-8) in the **Materials-Recovery Building** moves via conveyor to form a surge pile on the **digester tipping floor** (Illustration 5-10). This material consists primarily of various types of paper and cardboard, diapers, and the larger pieces of yard and food waste that passed over the material-recovery screens.[2] There would also presumably be a very small amount of non-degradable material missed by the pre-drum sort lines and screens.

The **digester tipping floor** (Building #7 in Illustration 5-1) would be accessible by separate facility doors, so that clean, degradable material—such as landscaper waste—could bypass the materials-recovery process, and go directly to the digesters.

Illustration 5-10

Overhead View Inside Digester Tipping Floor Building



The theoretical pilot facility would employ three, 14-foot-wide by 200-foot-long **digester drums** (Building #8 in Illustration 5-1). Two of the drums (**general materials digester drums**) would be for loading overs from the materials-recovery process (such as degradable material that was not picked out or screened away). The third drum (**designated digester drum**) would be reserved for composting the glass-and-organics–laden unders from the primary vibrating finger screens in order to further segregate this problematic stream.

Digester Drum Sizing and Flowthrough Rates
The theoretical pilot facility would operate six days a week, processing 150 tons of MSW per eight-hour shift, for two shifts a day (300 tpd total). Facility operators would fill the two, general materials digesters on alternative shifts, so that one drum would be loaded on the day shift (8 am to 4 pm) and the other drum would be loaded on the night shift (4 pm to 12 midnight), Monday through Saturday.

The pilot facility would be closed to deliveries from some period between 12 midnight to 8 am, during which time a night crew would clean the entire plant. At this loading rate, material loaded on Monday, Tuesday, and Wednesday would have a three-day retention time in the digester drums, and material loaded on Thursday, Friday, and Saturday would have a four-day retention time.[3] For a description of how material moves through an MSW-composting drum, including retention times, and the continuous nature of the loading and discharge process, see the *Drum Discharge* section of Chapter 1.

In order to accommodate this facility flowthrough time, the digesters must be sized appropriately. Table 5-3 presents the estimate of the amount of material that would go to the two main digester drums per shift, after the incoming MSW had already passed through various materials-recovery processes.

Table 5-3
Estimate of the Amount of Material Going to the Two Main Digester Drums

Processing Stage	Tons per Shift (two 8-hour shifts)	Tons per day	Percent of Incoming Total
MSW Across the Facility Scale	**150**	**300**	**100**
Removed on Tipping Floor & Primary Pre-Drum Sort Line	15	30	10[1]
Material Available for Additional Pre-Drum Sorting and Screening	**135**	**270**	**90**
Material Removed by Vibrating Finger Screen on Secondary Pre-Drum Sort Line	16.2[2]	32.4	11
Material Available for Additional Pre-Drum Sorting and Screening	**118.8**	**237.6**	**79**
Material Removed by Final Pre-Drum Sorting and Screening	35.64[3]	71.28	24
Material Available for Two Main Digester Drums	**83.16**	**166.32**	**55**

1. Based on the percent of bulk material recovered during the NYC Composting Trials.
2. It is assumed that this screen will drop out 12 percent of the material, based on the California mixed-waste MRF experience, but adjusting for greater rainfall and wetter yard waste in New York City.
3. Assuming, based on the experience of other surveyed MRFs, that these sort lines and screens will recover 30 percent of the total material.

The approximately 83 tons of sorted MSW and 100 tons of dewatered biosolids would fill one of the 14-foot-wide by 200-foot-long digesters. Facility operators would pump dewatered biosolids directly to the drums from an adjacent **Biosolids Storage Bunker** (Building #15 in Illustration 5-1) at an initial ratio of 1.2 parts biosolids to one part sorted MSW. As noted, one of the learning objectives of a pilot facility would be to determine the optimal "recipe" for composting biosolids with sorted MSW (primarily paper and other degradable waste).[4]

Pilot facility operators would initially add no biosolids to the Designated Digester. This is because the unders stream from the primary materials-recovery screens should contain adequate moisture due to the presence of food and yard waste (especially when grass clippings are present). Also, facility operators would want to keep this stream on the drier side to facilitate separation of the degradable from the non-degradable as the material moves through the post-digester screening and de-stoning equipment.

Post-Drum Screening

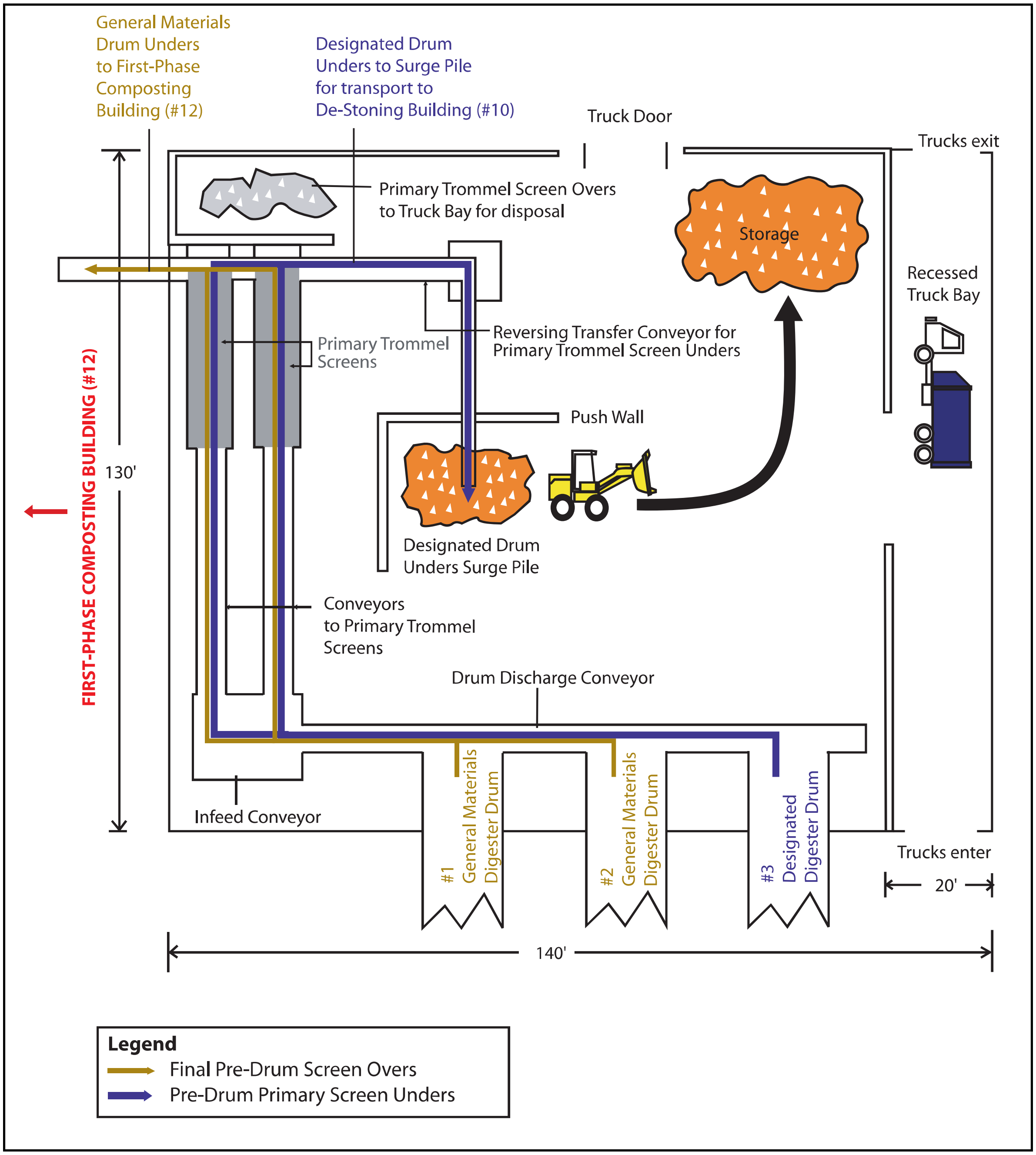
All three digester drums discharge into a separate, post-drum **Primary Screening Building** (Illustrations 5-1 and 5-11). Material discharged from the digester drums drops onto a conveyor, which feeds material onto one of two incline conveyors that lead to a post-drum **primary trommel screen** (Illustration 5-11).

To review, this material is comprised of the largely degradable items (such as soiled paper, food and yard waste, and diapers, etc.) that were present in the incoming MSW. It was composted in one of the two general materials digester drums with biosolids and has begun the initial decomposition process. This immature compost should be relatively free of non-degradable materials, including small pieces of glass and plastic, as these would have been removed in the materials-recovery stage. However, it will require extended composting on an air floor to complete the decomposition process and create a stable, useful end product.

Facility operators discharge material from the third, **designated digester drum** separately, once the discharge from the other two drums is complete. Again to review, this material is comprised of the organics-and-glass–laden fines that passed under the first screen (the vibrating finger screen) in the materials-recovery process. Based on the experience of other MRFs processing mixed waste, this stream consists of small pieces of yard and food waste, dirt, gravel, and unclassifiable fines, but also contains a lot of broken glass, small pieces of plastic, bottle caps, and other small, miscellaneous, non-degradable items.

The goal would be to segregate this inert material from the other "cleaner" stream of degradable material moving through the facility. However, a pilot MRC facility would want to experiment with different ways to recover the considerable organic fraction from this "dirty" stream. As described earlier, one of the ways a pilot MRC facility could attempt to separate the degradable from the non-degradable would be to compost this "dirty" stream separately in its own designated digester. Through the composting process organics would become more uniform and easier to remove through subsequent screening and/or de-stoning.

Illustration 5-11
Overhead View Inside Post-Drum Primary Screening Building



This immature (inert-laden) compost from the designated drum would pass through the post-drum, **primary trommel screens**, with the **unders** falling onto a conveyor that then drops the material into a separate surge pile on the floor (Illustration 5-11). This material would then be loaded onto trucks and taken to the **De-Stoning Building** (Building #14 in Illustration 5-1) to further segregate the degradable from the non-degradable. Depending on the composition of the immature compost from the designated digester, facility operators may decide to forego screening these unders and send this material directly to the De-Stoning Building.

De-stoning equipment is used in a number of industries for the continuous separation of stones and other dense objects from a stream of granular material. De-stoners stratify material according to its specific gravity by the oscillating motion of a screen and by air flowing through the material from the bottom to the top. The light particles (**"lights"**), in this case the immature compost, collect at the top, and the heavy ones (**"heavies"**), including pieces of glass, stones, metal, and other small inert materials collect at the bottom. The lower layer with the "heavies" flows upward and is fed to the final separation zone of the bottom de-stoning screen. Final separation is accomplished by a countercurrent flow of air.

The **"lights"** (immature compost) from the de-stoner would either be sent back through one of the general materials digester drums, or be placed directly onto the conveyor feeding the **First-Phase Composting** building. A front-end loader scoops up the **"heavies"** (inert materials) and places them onto a truck for disposal.

Facility operators at Marlborough (the location of the New York City Composting Trials, described in Chapter 1) found that the de-stoning equipment did an excellent job of removing heavy inerts from a stream of compost. However, they faced two problems that forced them to abandon de-stoning, which a pilot facility design should attempt to resolve. Marlborough facility operators reported that the de-stoner worked best when the compost was relatively dry and operators passed it through the equipment slowly. The compost coming off of the Marlborough air floor to the de-stoner (and final screen) after only 21 days was very wet and therefore jammed the equipment (see Table 4-3 for moisture-level data). In addition, as Marlborough operators were attempting to run all of their compost through the de-stoner (before it went to the final screen and was loaded out of the facility in trucks), it was important to move material quickly or potentially back up the whole facility.

The de-stoner at a pilot MRC facility should be used exclusively to process unders from the primary screening of the designated digester drum discharge. As this is a relatively small fraction of the total MSW processed by the facility, it would be possible to run material in small batches, slowly through the de-stoner. The processing of this separate stream should take place apart from the main movement of material through the facility and would therefore not cause delays to the larger facility operations. Additionally, pilot facility operators would be able to control the moisture level of the material that they send to the de-stoner by experimenting with input "recipes"and retention times in the designated digester drum.

The **overs** from the **post-drum primary screening** of all three digester drums (the two general materials drums and the designated drum) drop into a separate surge pile on the floor (Illustration 5-11). This material, consisting of non-degradable items missed by the materials-recovery process, is then loaded onto trucks and disposed as residue.

Post-Drum Composting

The importance of post-drum composting to produce efficiently a quality end product represents one of the key findings of the Department's research on mixed-waste composting. As discussed in Chapters 3 and 4, facilities with automated, highly regulated air floors produced a better, final compost in terms of important compost-quality and process parameters, such as carbon-to-nitrogen ratio, volatile-organic-acid production, and organic matter loss. In short, these air floors optimized the decomposition process.

Another important consideration when designing post-drum composting capacity is the DEC's requirement that compost in New York State be produced from a process with a minimum detention time of 50 days (including active composting and curing). This means that unlike the Marlborough facility, for example, which composts the material on-site for 21 days and then cures the material elsewhere, an NYC pilot facility design would require a post-drum composting system with the throughput capacity to actively manage the material on-site for 50 days. As Chapter 4 summarized, the Department's MSW Research Project determined that at least 50 days of active composting is necessary to achieve high loss of moisture and mass, as well as a reasonable degree of maturity in the material. Moisture loss is especially important as drier material screens more effectively.

One of the overarching objectives of any pilot facility should be to experiment with different types of equipment to determine the best system for sorting and composting New York City's waste stream. The hypothetical pilot MRC facility would therefore employ a **two-phase, post-drum composting and curing process**, in order to both meet the detention time requirements, as well as to compare the efficacy of different, automated air-floor approaches.

Both phases would be fully automated, with material moving through the first and second phases in approximately 27 and 31 days, respectively. Combined with the three-day retention time in the digesters, the total detention time would meet and exceed the DEC's 50-day detention requirement.

If 83 tons of sorted MSW plus 100 tons of dewatered biosolids were loaded into each of the two general materials digester drums (Table 5-3), then after composting and post-drum, primary screening, an estimated 272 tons of immature compost would go to the First-Phase Composting building per day (Table 5-4).

Table 5-4

Estimate of the Amount of Material Going to the First-Phase Composting Building

Processing Stage	Tons per drum	Total tons for both drums	Percent of Incoming Total
General Materials Digester Drums			
Sorted and Screened MSW[1]	83	166	45
Dewatered Biosolids[2]	100	200	55
Total	**183**	**366**	**100**
Immature Compost Discharged from General Materials Digester Drums[3]	146	292	80
Material Removed by Post-Drum, Primary Trommel Screen ("overs")	10	20	7
Material Available for First-Phase Composting ("unders")	**136**	**272**	**73**

1. From Table 5-3. One drum would be loaded during the first 8-hour shift and the other drum would be loaded during the next 8-hour shift.
2. Biosolids added at a ratio of 1.2 parts biosolids to one part sorted MSW.
3. The 37-ton-per-drum difference is due to the inevitable loss of mass that takes place during composting inside the drums.

Photo 5-3: Pictures of the proposed first-phase composting technology
The proposed first-phase composting technology would resemble that employed by Edmonton, with its automated bridge cranes and augurs that mix, add moisture, and move the immature compost over the course of 27 days.

First-Phase, Post-Drum Composting
First-phase composting in the proposed pilot facility would resemble the air floor at the Edmonton facility: a fully automated, agitated-bay curing module. (See Edmonton section in Chapter 3 for more information.) The conveyor carrying the post-drum, primary trommel screen unders from the post-drum, Primary Screening Building (Illustration 5-11) would feed a **tripper trolley** in the **First-Phase Composting** building (Building #12 in Illustration 5-1). The tripper trolley rides along tracks above each of the bays and spreads the immature compost along the length of the loading side of the bay. An **augur**, attached to overhead **bridge cranes**, then mixes the compost and moves it forward over the course of 27 days. Sprays attached to the bridge crane provide moisture to the composting material (Photo 5-3). As discussed in Chapter 4, additional water is especially effective in the beginning of the air-floor process to "kick-start" decomposition.

Air, a critical component of post-digester composting, is drawn down through the piles of composting material to the floor through perforated pipes. Different air-floor technologies handle this critical step in varying ways. The air floor at Edmonton uses this negative aeration technique (sucking air down), while others use positive aeration (blowing air up). The air floor is generally divided into zones, each with an automated, adjustable air-flow rate, so that facility operators can set a general temperature goal, and then the sections self-regulate based on the ambient temperature of the composting material.

The attractiveness of automated air floors is that once facility operators determine a good composting recipe (determining the ratio of solid to liquid waste, bulking-agent requirements, etc.) and the aeration needs of that recipe, then they can set the general parameters for the air floor and "walk away." Compost facility operators currently employing this type of equipment report that once things are up and running, the air floor "takes care of itself." This is important because it means that other than monitoring and making minor adjustments, operators do not need to spend all of their time on the actual composting process and are free to attend to other needs in the facility.

After 27 days, the augurs turn and push the composting material onto an unloading shelf, where it is automatically discharged onto a conveyor. The conveyor moves the material through the wall of the First-Phase Composting building and deposits it onto the floor of the **Second-Phase Composting and Curing** building (Building #13 in Illustration 5-1).

Second-Phase, Post-Drum Composting and Curing

The **Second-Phase Composting and Curing** technology is a similar concept to the first, but with a few key differences. Where the first phase employs active aeration (in this case using motorized fans to draw air down through the compost), the second phase will use **passive aeration**. Passive aeration relies on the principles of convection, or the transfer of heat by movement of a substance such as air or water. When compost gets hot, warm air rises naturally and the resulting convective currents cause a slow but steady movement of heated air upward through the composting material and out the top of the pile.

In the Second-Phase Composting and Curing building, the floor is traversed by a series of pipes with many air holes drilled around all sides. The in-feed conveyor (the discharge conveyor of the First-Phase Composting building) deposits material onto the floor of the Second-Phase Composting and Curing building and forms a stack of compost (approximately six feet deep) over the perforated pipes. The ends of the pipes, however, are not covered by compost. Convection again serves to draw the cooler ambient air in through the pipes up through the composting material.

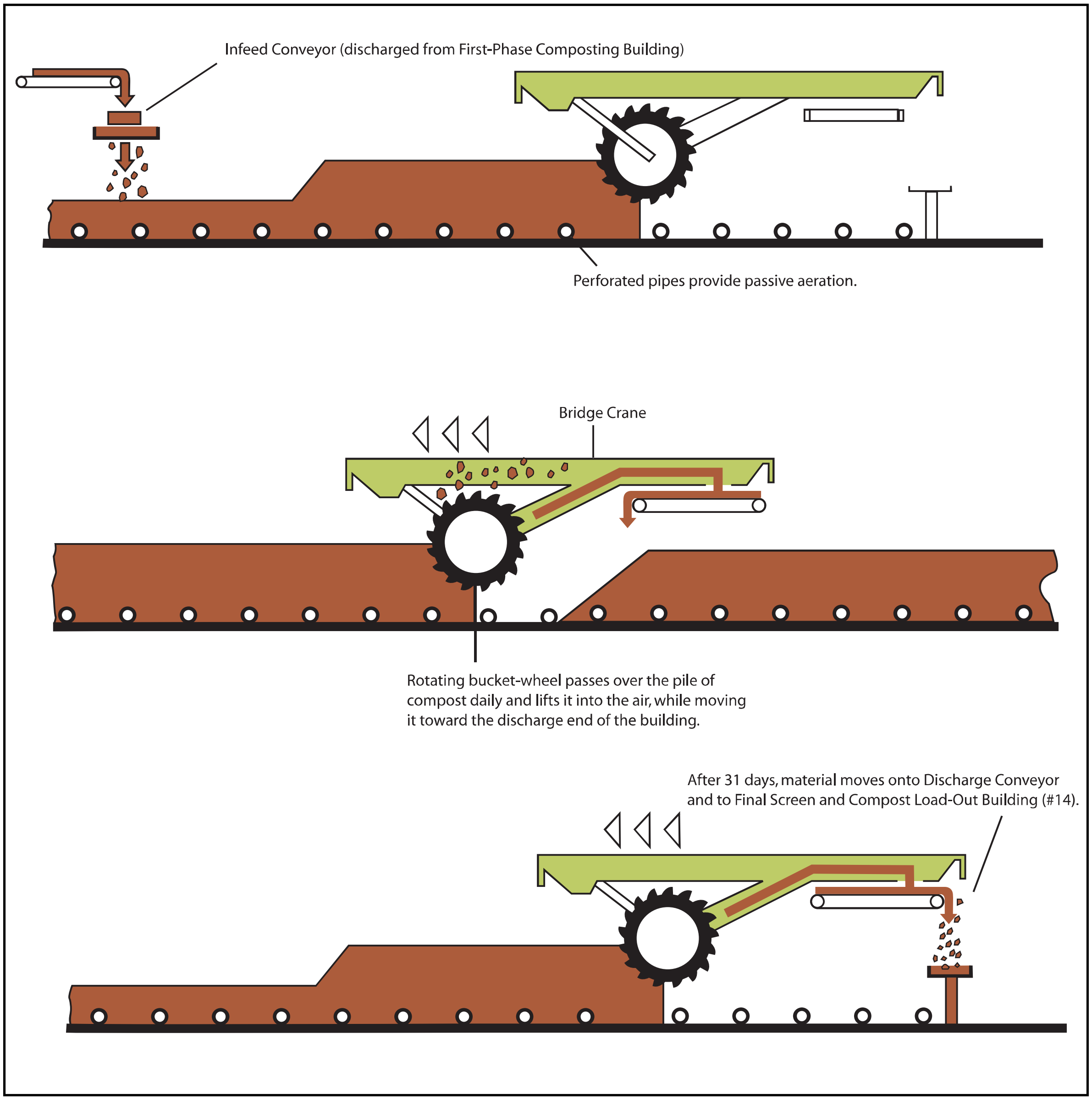
This composting process (with a 31-day detention time) would employ passive aeration, as well as an automated, bucket-wheel mixer to continue to provide air to the decomposing material.

This kind of passive aeration is less electricity-intensive, and therefore less expensive, than the active aeration proposed for the First-Phase Composting building. It is anticipated that this "lower tech" solution will provide adequate aeration and extend the number of days that the material is composted, without adding undue cost.

In addition to passive aeration, the second-phase composting process also provides the essential air and moisture to the decomposing material through a mixer that passes over on a bridge crane. The mixer in this case is not an auger, like in the first-phase process, but a rotating wheel, made of a series of small buckets. The bucket-wheel passes over the stack of compost (to a depth of approximately six inches above the pipes) and lifts it up into the air, while simultaneously moving it toward the discharge end of the building. This motion "fluffs" the material and breaks up any clumps, while introducing oxygen. As in the first-phase process, the bridge crane, to which the bucket-wheel is attached, is also fitted with nozzles to provide water to the piles of compost as needed.[5]

Illustration 5-12

Second-Phase Composting Process



However, it is during this stage of the process that facility operators would want to let moisture levels drop in the compost. As discussed in Chapter 4, the “ideal” compost moisture levels that facilitate effective final screening seem to be somewhere between 25 and 30 percent. Therefore, water would be used in the second-phase composting process, especially in the last 15 to 20 days, to suppress dust, rather than to aid decomposition.

Post-Drum Final Screening

After 31 days, a discharge conveyor moves the compost through the wall of the Second-Phase Composting and Curing building and deposits it in a large surge pile on the floor of the post-drum,


Photo 5-4: Finished compost after final facility screen

Final Screening and Load-Out building (Building #15 in Illustration 5-1). A front-end loader scoops up the compost from this pile and loads it into an infeed hopper connected to a conveyor. The conveyor moves the material up to the **final facility screen**, sized at ten millimeters (10mm or .4 inch) to meet DEC requirements that particles in a finished compost be no larger than this size.

The overs, particles larger than ten millimeters, are deposited in a bunker within the Final Screening and Load-Out building. If this material proves to contain a lot of compost and other degradable material (such as small piece of paper and wood), facility operators would load it into a truck and deposit it directly on the digester tipping floor for reintroduction into the digester drum. If the material is primarily comprised of small, non-degradable material, it will be loaded onto trucks destined for disposal. As described in Chapter 4, reintroducing final screen overs into the composting process is an effective way of lowering facility residue rates. However, in order to be conservative, the theoretical pilot facility cost estimates presented in Chapter 7 assume that all of this material would require disposal.

The **unders** from the final screen are the finished compost product (Photo 5-4). Based on the experience of other successfully operating MSW-composting facilities, after 50-plus days of active, aerated composting, the material does not have any odor associated with it, other than the pleasant, earthy smell of topsoil. At this point, therefore, the material can safely be loaded onto vehicles, and leave the facility without the risk of generating odors. Table 5-5 shows a breakdown of the estimated amount of compost the pilot facility would produce, based on loss-of-mass projections for both phases of post-drum composting, and estimates for final screening overs and unders.

Table 5-5
Estimate of the Amount of Finished Compost Produced by the Pilot Facility

Processing Stage	Tons per day (two 8-hour shifts)	Percent of Incoming Total
Material Sent to First-Phase Composting[1]	**272**	**100**
Loss of Mass During This Process[2]	108	40
Material Going to Second-Phase Composting	**164**	**60**
Loss of Mass During This Process[2]	25	9
Material Going to Post-Drum Final Screening	**139**	**51**
Material Removed by Post-Drum, Final Screen ("Overs")	12	4
Final Compost ("Unders" from Final Screen)	**127**	**47**

1. From Table 5-4.
2. Due to the release of moisture and carbon dioxide during composting on the air floor.

The New York City Composting Trials (held at the Bedminster, Marlborough MSW-composting facility in Marlborough, Massachusetts) demonstrated through extensive testing that it is possible to make a compost with waste generated in New York City that meets New York State Department of Environmental Conservation (DEC) standards. One of the primary goals of a pilot MRC facility in New York City would be to establish a record of that quality over an extended period of time. A testing protocol would be developed according to DEC guidelines. Once the DEC made a designation as to the quality of the compost produced by the pilot facility and acceptable end uses, the City might begin to use the material in such projects as final landfill cover, roadside erosion control, and construction projects. Once the pilot facility consistently produced a quality compost, outside markets could be sought for the material, such as large-scale, regional soil-blending and landscaping operations.

Although compost in the region usually commands between $10 to $15 per ton, to be conservative, the cost estimates in Chapter 7 for the hypothetical pilot facility assume zero revenue for the final compost product. Furthermore, additional funding is allocated for extensive laboratory testing, and the transportation costs that would initially be incurred when shipping compost off-site to various test locations.

Air Handling and Odor Control

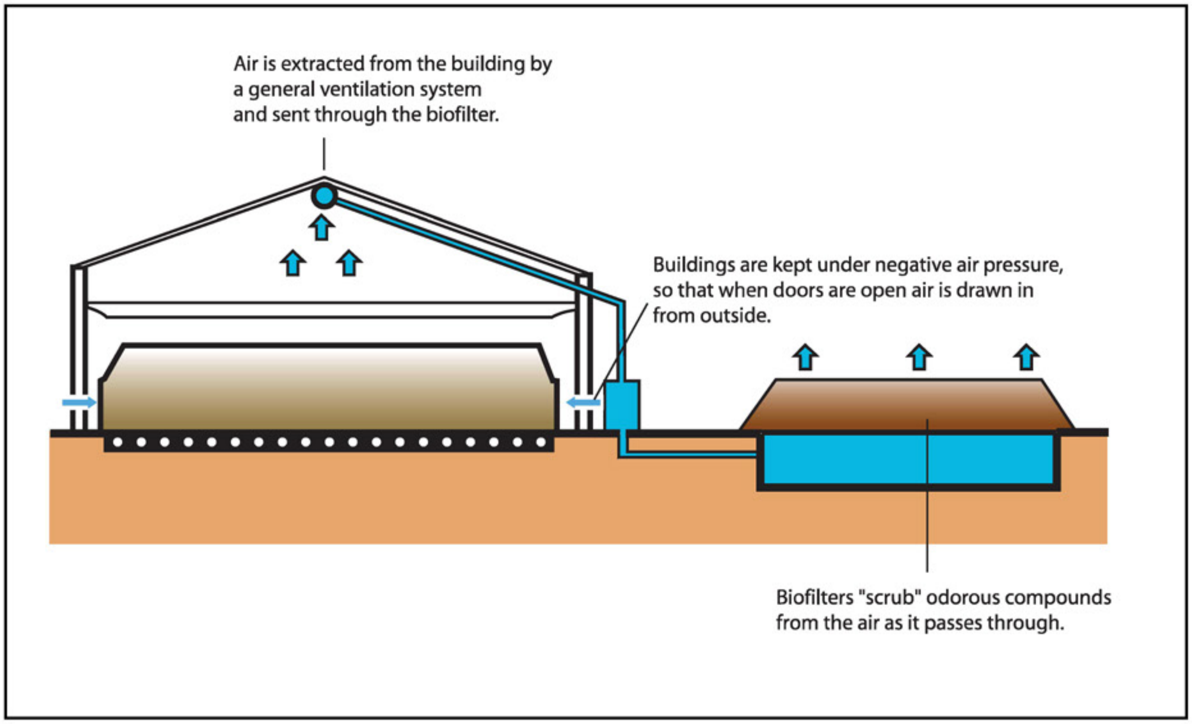
Without question, the most important task of any pilot facility should be air handling and odor control. Many of the early set-backs in the MSW-composting industry (as well as in the waste-water-treatment industry) were due to lack of attention to this critical facility component. The current generation of MSW-composting facilities have zero tolerance for odor emissions and thus, operate in a nuisance-free manner in close proximity to neighbors. If this were not the case, namely if the problem of odor control had not essentially been solved, then the Department would not even be evaluating this technology.

The air-handling system at the pilot MRC facility would be designed to treat process air from all the buildings where odors pose a potential concern. Air would enter these buildings through a centrifugal fan (as well as doors when they are opened) and then be dispersed through air distribution outlets running along the respective roofs. Air would then be extracted from the buildings by a general ventilation system. In the First- and Second-Phase Composting buildings, air would also be extracted through various aeration systems that draw air through the composting material (described earlier). In general, air-handling systems at these types of facilities are designed to provide a specific number of interior “air changes” in a given amount of time, both to ensure odor control and worker safety.

Air would enter and exit each building at slightly different pressures, which would serve to create a negative overall pressure condition in the building. This essentially means that when any doors are opened, air is drawn in from the outside, rather than escaping to the outside, as happens under normal pressure conditions. Maintaining buildings under negative air pressure is another, standard safeguard against odors emissions. (See Illustration 5-13.)

Actual air-handling processes are proprietary of the companies who design them, and a detailed description of their functioning would be out of place in this preliminary design discussion.

Illustration 5-13
General Air-Handling Schematic
A ventilation system removes process air from buildings and sends it to a biofilter for odor-suppression treatment.

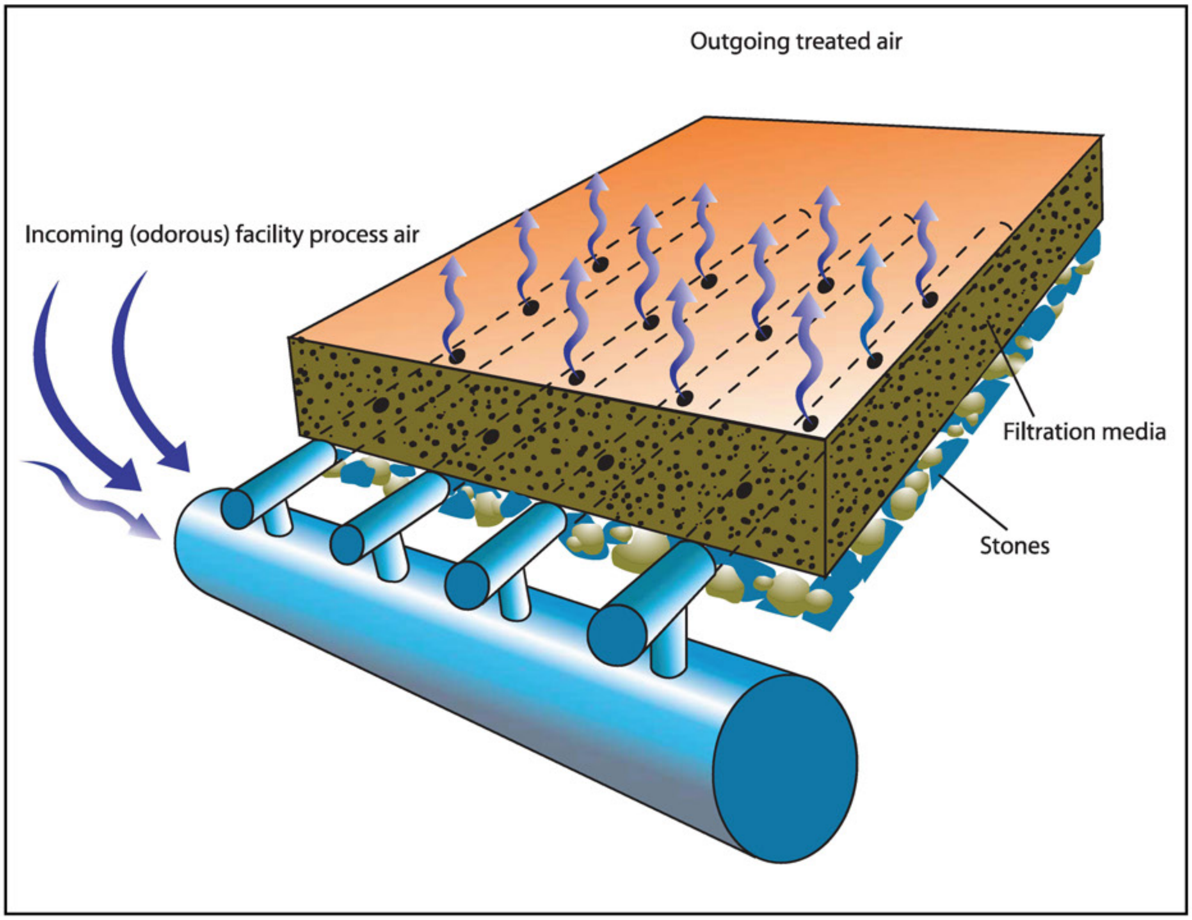


However, it is important to understand the basic concept behind **scrubbers** and **biofilters**. Scrubbers do not actually serve to reduce odors, which are known to be produced by a large number of organic and inorganic volatile compounds. The scrubbers instead use water to "wash" the air of ammonia and ammonia-derived volatile compounds and humidify the airstream before it reaches the biofilter, as high concentrations of these compounds and/or excessive dryness can reduce the biofilter's efficiency. In essence, the scrubbers are used to prolong the life and effectiveness of the biofilter, as well as safeguard against peaks in ammonia concentration.

Biofilters are standard equipment at all enclosed composting facilities. Recently, other solid-waste-management facilities, such as transfer stations, have also installed biofilters as they have proven to be an effective means to combat odors. A biofilter is a living system that microbially consumes odorous compounds from the air as it passes through. The biofilter is typically composed of compost and wood chips that have been blended in a prescribed ratio. It may also include soil, limestone, or other ingredients. The biofilter is constructed, above or below ground, over a series of perforated pipes through which process air is pumped and distributed. Biofilters are engineered to retain air in the media for a specified time in order to ensure odorous compounds in the air are degraded. (See Illustration 5-14.)

In addition to the formal systems and technologies designed to capture and treat all process air from the facility before releasing it outside, there are other means to prevent odors before they occur. The first is to keep aerobic conditions in the composting material at all times. The microbes that flourish during the anaerobic decomposition of organic material produce

Illustration 5-14
Cross-Section of a Biofilter



undesirable odors as by-products, including the rotten-egg smell of hydrogen sulfide gas. An adequate flow of air through the digesters, as well as during the first- and second-phase, post-drum composting processes, helps ensure that the recycling of the organic fraction of the waste stream will not generate undesirable odors within a pilot facility.

Other means of preventing odors can be built right into the facility design. High-speed, roll-up doors mean that when incoming trucks tip their loads, the doors to the facility are open for the shortest amount of time possible. Also, large doors can be fitted with blowers to create "air curtains" to prevent odors from escaping when the doors are open. Simple design considerations, like minimizing the use of interior columns, small corner spaces, and other areas where debris can accumulate can facilitate easy clean-up. A pilot facility should have heavy-duty concrete floors and be equipped with a system to hose down all equipment on a regular basis. Facilities should employ non-corroding fiberglass duct work, rather than metal, to better withstand the corrosive conditions produced by composting material. Corroded duct work provides a means for odors to escape. Sizing a facility correctly so waste never backs up in any place, and keeps moving through the facility, is another way to prevent odors from occurring.

The updates to New York State DEC regulations, which oversee composting facilities, include a new requirement for an odor-management plan. Such a plan formalizes and "institutionalizes" odor-prevention steps, making them an essential part of a facility's daily operation and maintenance procedures. The Department and the facility design team should take all necessary steps to make sure such a plan is crafted to the satisfaction of the DEC, as well as concerned members of the community. A facility's ability to prove itself as a good neighbor, especially in the field of odor prevention and control, will be critical to its success as a waste-management strategy for New York City.

The next chapter presents the estimated facility recovery rate, based on the projected recovery rate for each material fraction of the waste steam as it moves through the hypothetical pilot facility. Chapter 7 presents cost estimates for the theoretical, pilot MRC facility described in this report.

CHAPTER 6
PROJECTED RECOVERY RATES

Summary

This section begins by presenting materials-recovery projections for a theoretical, New York City Research and Development Pilot Materials-Recovery and Composting Facility ("pilot MRC facility" or "pilot facility"), as described in Chapter 5. A discussion follows providing the various assumptions that inform these projections, including NYC waste-composition data and interviews with managers of mixed-waste materials-recovery facilities (MRFs). The recovery-rate projections are then combined with the throughput data provided in Chapter 5 to arrive at an estimated, total annual recovery rate for such a pilot facility.

Annual recovery-rate projections for a theoretical, pilot MRC facility allow for a comparison with the recovery rates achieved by the four surveyed MSW-composting facilities (described in Chapter 3), as well as those achieved during the NYC Composting Trials (described in Chapter 1). Such information is useful in understanding how a pilot MRC facility would attempt to meet the dual goals of lower residue and higher recovery rates, presented in Chapter 4. What is not recovered by a pilot facility, conversely, would have to be discarded as residue. Recovery-rate estimates are important therefore in determining residue rates, which in turn are a key component of the estimated, pilot-facility operating costs, presented in Chapter 7.

Projected Materials-Recovery Rates

A pilot MRC facility, as conceptually outlined in Chapter 5, essentially consists of an MSW-composting facility with a mixed-waste MRF on the front end. To estimate how much material such a facility might recover for recycling, and how much material would still require disposal as residue, the Department relied on the following sources:

- NYC waste-characterization data
- Consultants with design experience in either MSW-composting and/or materials-recovery facilities (MRFs)
- Interviews with facility managers at mixed-waste MRFs
- The Department's own experience conducting the MSW-Composting Research Project

Waste Composition

Before estimating what a pilot facility might recover, the Department needed to know what might be in the waste stream arriving at such a facility. The Department turned to the waste characterization that was performed in conjunction with the NYC Composting Trials. It should be noted that there are some shortcomings associated with using this data, namely that it is not citywide, nor seasonal, nor does it take into account the suspension of glass and plastic recycling that went into effect in July 2002. Therefore, the percentage of yard waste might be low (since the characterization took place in February), as might be the respective percentages of glass and plastic.

That being said, the data itself is representative of the Sanitation District (Staten Island 2) from which it was collected, and is much more recent than the last citywide, multi-season, waste-characterization effort, undertaken in 1989/1990. (For more information about the waste characterization conducted as part of the NYC Composting Trials, see Chapter 1. Appendix A contains the consultant's final report and the actual waste-characterization data.)

The average composition by weight of the various components of the waste stream (the second column listed in Table 6-1 on the next page) comes from the summary of the NYC Composting Trials waste characterization presented in Table 1-1 of this report. However, while Table 1-1 groups materials as "Compostable" and "Non-Compostable," Table 6-1 adds the category, "Recyclable."

Recovery Goals

A pilot MRC facility's pre-composting, materials-recovery process should have three primary goals:

- Send as much paper and paper products to the composting drums as possible
- Prevent as much non-degradable material (especially glass and film plastic) from going to the composting drums as possible
- Recover as many non-degradable recyclable items as possible

Recovery Rates

The projected recovery rate column in Table 6-1 presents the estimated percentage of each material that a pilot MRC facility could potentially recover, and conversely, what percent would require disposal as residue.

To better understand the assumptions underlying these recovery-rate projections, the following sections review how different material fractions of the waste stream will move through a pilot MRC facility, and where and how they will be recovered for recycling. For each material, the section provides the projected recovery rate and the rationale that supports that projection.

Compostable Material

The broad goal for recovering compostable material is to send as much of the paper and other larger-sized, degradable items as possible to the composting drums, as this stream will produce a relatively clean, contaminant-free compost. The majority of the food and yard waste will be dropped out by the first set of screens in the pre-composting, materials-recovery process, along with the rest of the undersized fraction of the incoming waste stream (such as broken glass, bottle caps, etc). The aim is to isolate these small, non-degradable items and handle them separately, so that they do not contaminate the cleaner, mostly paper stream.

Paper

In some senses the entire, pre-drum, materials-recovery component of a pilot MRC facility (described in Chapter 5) can be seen as a positive sort for paper. This means that the various facility sort lines and screens are designed to pick out everything that is *not* paper. Therefore, all types of paper will be left on the conveyors to move to the digester tipping floor for composting.

Table 6-1

Projected Solid-Waste–Recovery Rate for a Theoretical, NYC Pilot Materials-Recovery and Composting Facility

Material Category	Average % Composition by Weight[1]	Projected Recovery Rate[2] %	Projected Solid-Waste Recovery[3] %	Projected Residue Rate %
Compostable Material				
Paper	32.1	100	32.1	0
Food Waste	15.9	90	14.3	1.6
Yard Waste	1.6	90	1.4	.2
Fines[4]	5.9	85	5.0	.9
Other Compostables	6.0	90	5.4	.6
Total Compostables			**58.2**	**3.3**
Recyclable Material				
Bulk Wood	3.4	95	3.2	.2
Plastic	15.4	25	3.9	11.5
Textiles	5.3	50	2.7	2.6
Glass & Ceramics[4]	5.2	0	0	5.2
Metal	3.1	95	2.9	.2
Total Recyclables			**12.1**	**19.5**
Other				
Large Composite Items	1.0	0	0	1.0
Other Non-Compostables	5.1	0	0	5.1
Total Other			**0**	**6.1**
TOTAL	**100.0**		**70.9**	**29.1**

1. Based on the waste-composition study performed in conjunction with the NYC Composting Trials; see Appendix A for the waste-composition data and final report.
2. Based on the findings of the Department's MSW-Composting Research Project and interviews with mixed-waste MRF managers.
3. Derived by multiplying "Average % Composition by Weight" with "Projected Recovery Rate %."
4. In the waste-characterization final report, fines were divided into non-degradable (3.5%) and unclassifiable (4.3%). According to the report, the non-degradable fines will become part of the compost (see Appendix A, *Waste Characterization for Composting Pilot Study*, p. 15) and therefore are listed under "Compostable material." However, as a portion of the unclassifiable fines was broken glass beverage containers, 45% (conservatively) of the unclassifiable fines have been assigned to the glass and ceramics category.

This includes incorrectly placed, designated paper items from NYC's curbside recycling program (newspapers, magazines, cardboard boxes, office paper, envelopes, etc.), as well as non-designated paper items (such as paper towels and napkins). Given that paper is the largest component of the waste stream, even post-recycling (32.1 percent by weight; see Table 6-1), this overall facility approach makes sense.

However, large sheets of corrugated cardboard would be removed on the first sort line, as these items tend to "blind" materials-recovery screens. "Blinding" in this instance refers to the phenomenon whereby small items ride on top of larger items, such as sheets of cardboard, and therefore fail to pass under the screens designed to remove them. Depending on what proved to be operationally and economically sensible, the facility would either bale this cardboard for recycling or send it through the composting drums.

The Department gained some understanding of the issues involved with composting the paper fraction of the waste stream from its survey of MSW-composting facilities (see Chapter 4 for more information). The Marlborough facility manager reported that without an automated compost-turning system, it was difficult to completely degrade the lignin in paper products (especially corrugated cardboard) in the 21 days that material resides on their air floor. Lignin (the large polymers that cement cellulose fibers together in wood) decomposes slowly because its complex structure makes it highly resistant to enzyme attack.

Even with an automated turning system on its air floor, and material-retention time of 42 days, 38.16 percent of the material passing over the Conporec facility's final screen consisted of paper. On the other hand, after 21 days on its automated air floor, only 2.09 percent of the material passing over the Edmonton final, facility screen was paper (see Table 4-2 for the percent of compost and other degradable material in Edmonton and Conporec final screen overs). It is difficult to know whether Edmonton successfully composts the paper fraction of the waste stream because of its effective air floor, its use of highly nitrogenous biosolids, or because there is less paper coming into the facility. Compared to Marlborough and Conporec, Edmonton may be receiving less paper because it does not process commercial solid waste from supermarkets, which often contains a lot of corrugated cardboard.

Building on this learning, the design for the hypothetical pilot facility allows for retaining composting material on an automated air floor for over 50 days, in order to fully degrade the paper fraction of the waste stream. If paper is still in the final screen overs, then these overs will be sent back through the composting process (as explained in Chapter 5). This, combined with the fact that the entire facility will be geared toward capturing paper, leads to the assumption presented in Table 6-1 that the facility will recover 100 percent, or all paper, available.

Food and Yard Waste

The projected recovery rate for these items is more difficult to predict than paper. This is because few mixed-waste facilities attempt to segregate food and yard waste up-front. MSW-composting facilities do not segregate this material, but leave it in garbage bags, mixed with other fractions of the solid-waste stream. Mixed-waste MRFs, on the other hand, do not generally attempt to recover food and yard waste for recycling. Rather, they leave these materials for disposal, as sort line workers can concentrate on recovering conventional recyclables, such as metal, plastic, and paper. The experience of both types of facilities informs the projected recovery rate for food and yard waste at the pilot MRC facility.

The pilot MRC facility is designed to separate out the majority of food and yard waste at the first set of screens in the materials-recovery building (see Illustrations 5-5 and 5-6 in Chapter 5). Material arrives at these screens after going through the bag openers and moving past sort line workers, who will tip the contents of these bags onto the conveyor belt (and remove the film-plastic bags).

The screens are vibrating finger screens, which are commonly used in mixed-waste MRFs to remove the small-sized fraction of the waste stream. Depending on the size setting, these MRFs will employ such screens to generate, for example, a "four-inch-under" (<4") stream or a "three-inch-under" (<3") stream. Based on the experience of other MRFs that accept mixed waste, the vibrating finger screens remove the majority of the food and yard waste, along with broken glass and other small, non-degradable items. Pilot facility operators would remove incoming brush and other large, woody waste off of the tip floor, or the elevated, primary, pre-drum sort line (see *Bulk Wood,* which follows). Some fraction of the food and yard-waste stream that is larger than the vibrating finger screen setting, such as bones, twigs, and smaller pieces of brush, would pass over this screen, but the majority would pass under.

As noted in Chapter 5, the City of Industry mixed-waste MRF in Los Angeles sends its incoming material to a bag breaker and then to a vibrating finger screen with a three-inch setting. They report that 10 percent of the incoming material passes under these screens, with the unders largely comprised of food and yard waste and broken glass. The City of Industry's facility disposes of these unders. However, a mixed-waste MRF in Medina County, Ohio (population 50,000), currently processing 550 tons of mixed waste a day, composts these unders. After sending incoming MSW through a bag-breaking trommel, this MRF takes the unders and composts them in outdoor windrows. While the actual screen-size setting is proprietary, the owner reports that similar to the L.A. MRF, unders comprise approximately 10 percent of the incoming material.

Again, the pilot MRC facility (as described in Chapter 5) is designed to drop out the majority of food and yard waste at the first set of materials-recovery (vibrating finger) screens, which would be located after the secondary sort line (film plastic picking station). This glass-laden organics stream would move under a magnet to remove any small ferrous items, and then continue to a designated digester drum, separate from the the clean paper stream. Upon discharge, facility operators would screen this material and/or de-stone it to separate the glass and other small non-degradable items (such as bottle caps, etc.) from the immature compost. The compost could be sent back through one of the two general materials digester drums, or moved directly to the First-Phase Composting building (see Illustration 5-1 for location).

What is known from MRFs handling mixed waste is that debagging incoming waste and sending it to a vibrating screen will drop out most of the food and yard waste (along with most broken glass, bottle caps, and other small, non-degradable items). What is also known is that due to the presence of food and yard waste, this unders stream is compostable. What is known from MSW-composting facilities is that it is possible to separate compost from small pieces of glass and other non-degradable items through de-stoning. This is especially true when the material is dry and run through the de-stoner slowly, in relatively small batches. However, as no facility to the Department's knowledge has documented experience with this procedure as a whole, this would be a research component of any pilot facility.

The assumption is that a pilot MRC facility would recover a significant fraction of food and yard waste (90 percent), but that a portion (10 percent) would still be lost to overs during the post-drum screening and de-stoning process. It should be noted that the facility could also process loose (unbagged) yard waste from commercial landscapers. Based on the Department's experience, this material is generally free of non-degradable contaminants and could therefore by-pass the materials-recovery and digester-drum components of the pilot facility, moving instead directly to the First-Phase Composting building. However, the facility recovery rate projections and cost estimates do not take this type of material, or potential revenue stream, into account.

Fines and Other Compostables

Fines are very small pieces of material, such as sand, dirt, ashes, cat litter, etc. Some fines are so small that they cannot be categorized. The consultant conducting the waste characterization divided fines into "non-degradable fines" (3.5 percent) and "unclassifiable fines" (4.3 percent). (See Table 1-1.) In the final report (attached as Appendix A), the consultant notes that (despite the "non-degradable" designation) most of the non-degradable fines will become part of the compost. Therefore, Table 6-1 combines these two types of fines into one and places them under the compostable material category. However, as explained in the *Glass* section later, broken glass was categorized with "unclassifiable fines." Assuming that just under half of the fines (45 percent) consisted of broken glass, 45 percent of the "unclassifiable fines" category in Table 1-1 was added back to the "glass and ceramics" category in Table 6-1. (In other words, glass and ceramics increase from 3.3 percent in Table 1-1 to 5.2 percent in Table 6-1.)

These fines would drop out with the food and yard waste (along with most broken glass, bottle caps, and other small, non-degradable items), passing under the first set of materials-recovery screens. These are the vibrating finger screens described in the *Food and Yard Waste* section above. The fines would travel with these unders to the designated digester drum and through the post-drum trommel screen and/or de-stoning equipment. The recovery-rate projection for fines is based on the assumption that the majority of what the waste characterization classified as non-degradable fines would become part of the compost, as would a portion of the unclassifiable fines (that are not broken glass). However, some fraction of the unclassifiable fines would be non-degradable. Given the New York State Department of Conservation (DEC) requirement that a final compost contain particles no larger than ten millimeters (three-eighths of an inch), these non-degradable items will pass over the final screen for disposal as residue. Therefore, the projected recovery rate is lower for fines (85 percent) than for food and yard waste (90 percent).

The waste-characterization final report describes the category "Other Degradables" (labeled "other compostables " in Table 6-1) as including all small, readily degradable items that did not fit the definition of paper, food waste, or yard waste. This included such things as disposable diapers and their contents, sanitary napkins, animal feces, cut flowers, and dryer lint. At six percent, these items do not comprise an insignificant amount of the total waste stream.

Given the small size of most of these items, they would generally pass under the first set of vibrating finger screens (along with food waste, yard waste, fines, and small, non-degradable items), and move to the designated digester for composting. The exception to this would be disposable diapers. The vibrating nature of the screens might shake out the contents of the diapers, while the diapers themselves passed over the screens to be removed on the next set of sort lines. Due to the "compostability" of this material, the recovery-rate assumption for the items within the "other compostables" category is the same as that for food and yard waste (85 percent).

Recyclable Material

A pilot facility's broad goals for recovering potentially recyclable items in the waste stream are to remove textiles early in the process, before they become wet and soiled, and to capture as much wood, metal, and designated plastics as possible. If it proved possible to separate clean, dry textiles, these would be diverted for disposal to avoid the heavy residue problem described in Chapter 4. Metal and certain plastics have known value as recyclables, while wood will be easy for a facility to grind and incorporate into the composting process. With regard to glass and other plastics (that a facility did not designate for recovery), the recovery goals are aimed first at diverting these problematic materials from the composting process, and then second, determining if it is worth recovering them for recycling. Film-plastic bags and broken glass are especially pernicious in the composting process and the materials-recovery component of the pilot facility will make every effort to divert these items before they go to the composting drums.

Bulk Wood

Bulk wood items (such as plywood, lumber, uprooted shrubs, and tree branches) are easy to identify and remove. As is currently the case at MSW-composting facilities and mixed-material MRFs, the grapple crane operators at the proposed pilot facility can pick this material out and move it into containers on the facility tipping floor. Workers on the elevated, primary, pre-drum sort line would intercept any bulk wood that the crane operators miss (see Illustration 5-2). A tub grinder at the facility would shred this material along with brush into chips, which facility operators could load directly into either the first- or second-phase composting process. Wood chips are an ideal bulking agent for compost, as their structure provides porosity and therefore air space in dense, decomposing material.

Wood chips that do not break down by the end of the second-phase composting process would pass over the final facility screen. Facility operators could run these woody overs back through the composting drums, or through either the first- or second-phase composting process. Therefore, it is assumed that the pilot MRC facility would recover 95 percent of woody materials.

Plastic

Plastic is a more complicated material category for which to project a recovery rate for two reasons. First, it is difficult to predict to what degree sorters will be able to pick out different types of plastics, and to what degree it will be worth the effort. Second, the waste characterization associated with the NYC Composting Trials grouped all plastics together and did not distinguish recyclable from non-recyclable items. For example, the 15.4 percent of the waste stream characterized as plastic in Table 6-1 includes both plastic garbage bags (non-recyclable) as well as PET and HDPE bottles (recyclable plastics). "Recyclable" in this instance means plastics with well-established, secondary-use markets.

The pilot MRC facility is designed to recover large plastic items that arrive at the facility loose (not in bags), on the primary, pre-drum sort line (see Illustration 5-2). Sort line workers will remove both large, recyclable, plastic items, such as five-gallon plastic buckets, as well as large, non-recyclable, plastic items, such as plastic furniture and laundry baskets.

After the material that arrives at the pilot facility in bags has gone through the bag openers and workers on the secondary sort line have emptied the bags (and separated the film plastic for disposal), the material passes over the first set of vibrating finger screens (see Illustrations 5-5 and 5-6). Very small pieces of plastic, such as bottle caps, broken toys, etc. would pass under these screens and move with the other undersized items (such as food waste, yard waste, and broken glass) to the designated digester for composting as described in the *Food and Yard Waste* section above. After composting, these small, hard plastic items would ultimately be separated from the immature compost through screening and de-stoning, and would be disposed of as residue.

Small, plastic items that are larger than the vibrating screen setting (greater than 2.5 inches), both recyclable (such as bottles and jugs) and non-recyclable (such as plastic deli containers) would pass over this screen and on to the final sort line (see Illustration 5-8). Workers would sort the recyclable from the non-recyclable, removing as much plastic as possible. A mixed-waste MRF manager in Oakland, California, interviewed by the Department's consultant, reports that the vibrating finger screens not only serve to drop out the undersized fraction of the waste stream, but also spread the remaining materials out on the conveyor belts so that sorters have a good visual presentation of what is moving past them.

Given the emphasis on removing both film plastic (primarily in the form of plastic garbage bags), as well as other types of plastic (both recyclable and non-recyclable), a pilot MRC facility would most likely divert the majority of plastic items before they reach the composting process. However, how much of this material would be recyclable is harder to predict.

The projected recovery rate for plastic assumes that film plastics, and other non-recyclable plastics that would require disposal as residue, would comprise 50 percent of the total incoming plastics stream. Of the remaining 50 percent, it is assumed that sort line workers would capture only half for recycling, with the other half also requiring disposal. Therefore, the projected recovery rate for the plastic materials category is 25 percent.

Textiles

Textiles comprised 5.3 percent of the waste stream that the Department sent to Marlborough for the New York City Composting Trials. This is the second-largest, non-degradable category of material after plastics. As a waste category, textiles includes such items as rugs, carpeting, towels, cloth napkins and place mats, curtains, pillows, bedding, and all types of clothing, including coats.

Visual inspection of the New York City MSW arriving at the Marlborough facility revealed that these textiles primarily took the form of carpets, as well as whole bags full of clean, discarded clothes, blankets, and curtains. That generators tend to separate these items from other parts of the waste stream makes sense, as people will set bags of old clothing or bedding aside when cleaning out their closets, basements, or attics. The Marlborough facility was not designed to sort for textiles before they went to the digester drums for composting. However, it seemed that if workers were sorting for these items, it might be possible to segregate these materials from others in the waste stream.

The pilot MRC facility design seeks to recover textiles as soon as material is de-bagged. To review, incoming, bagged MSW would pass over the bag breakers, which serve to slash bags (see Illustration 5-3 and 5-4). A conveyor leading from the bag breakers deposits the slashed bags into a surge pile, from where they are loaded by a grapple crane onto another conveyor, leading to the second elevated sort line (see Illustration 5-5). Workers on this sort line pick up the slashed bags, empty their contents onto the conveyor, and throw the film plastic bag into a cage below for baling and disposal. Another set of workers picks out garbage bags that the bag breaker missed, as well as any smaller, sealed bags that were inside the larger garbage bags, and drops these into containers below for re-processing through the bag breakers. A final set of workers positioned in between these two stations would assist in both tasks, but would also pick out all clean, dry textiles and drop them into separate containers below, before they became contaminated with other fractions of the waste stream.

Of all of the projected materials-recovery rates, the estimate for textiles is the most speculative. It is unclear to what extent the bags of clothing, curtains, bedding, and other items will remain relatively uncontaminated with other material fractions of the waste stream as they pass over the bag openers and move to the surge piles. None of the mixed-waste MRFs interviewed by the Department's consultant attempt to recover textiles through their respective processes, so there is no precedent to confirm the recovery-rate estimate, as there are for other projections presented here.

The post-consumer textile industry generally accepts any used clothing item and household textile article such as pants, dresses, hats, shirts, drapes, curtains, blankets, towels, sheets, handbags, belts, and paired shoes. However, they must be dry and in clean condition (meaning free from any contamination by water, chemicals, etc.). Textile recycling companies will then sort the material and sell it, depending on its quality, as usable clothing (for export or wholesale markets), or as wiping products, or to the fiber market. (Many products made from recycled fiber are used in the automotive industry, such as soundproofing for auto engines and carpet padding.)

Again, it is unclear if workers will be able to pull textiles off the passing conveyor belt before they become wet, soiled or otherwise unacceptable to the post-consumer textile industry. The facility recovery estimates assume that 50 percent of the incoming textiles will be unrecoverable. Conversely, the facility recovery-rate projection for textiles is 50 percent, which given textiles susceptibility to contamination may be optimistic.

Glass

Capturing glass would be as important an objective for a pilot MRC facility as capturing paper. However, whereas all paper would be directed to the composting drums, as much glass as possible would be diverted before it reached this stage.

Glass in the municipal waste stream is primarily found in various food and beverage containers. The waste characterization placed glass mirrors and ceramic items in the glass category, but did not include light bulbs, placing these in "Other Non-Compostables" instead. Two things are important to note about this data. First, as with plastic containers, the waste characterization was performed before the suspension of glass and plastic recycling in July 2002. Therefore, the amount of glass in the waste stream will be higher after this date (until such a time that source-separated glass recycling is restored). Second, because broken glass beverage containers were too dangerous for the waste-characterization workers to handle, the consultant notes that the broken glass tended to end up in the "unclassified fines" category. As explained in the *Fines and Other Compostables* section earlier, 45 percent of the "unclassified fines" total was therefore subtracted from this category and added back to "glass and ceramics." Glass then represents a total of 5.2 percent of the waste stream.

Glass would arrive at the pilot facility in two forms: intact (or largely intact) and broken. As described previously, the first screen in the materials-recovery process is a vibrating finger screen, which is designed to drop out the small fraction of the waste stream. By testing different screen sizes at this point, facility operators would attempt to drop out as much of the smaller broken pieces of glass as possible. Many mixed-waste (as well as single-stream) MRFs attempt to screen out all of the broken glass early in the process, as broken glass is extremely abrasive and can damage conveyor belts and other equipment.

As explained in the *Food and Yard Waste* section earlier, a significant portion of the food and yard waste would also drop out at this stage. Therefore, this glass-laden–organics stream would be sent to a separate, designated composting drum and composted separately from the clean paper stream. Post-drum, pilot-facility screens and de-stoning equipment would separate and remove pieces of glass from this resulting compost.

The Ohio mixed-waste MRF (described in the *Food and Yard Waste* section earlier), which currently composts their primary screen unders, reports that this compost is obviously full of glass. Therefore, they now use this material as landfill cover. They are experimenting, however, with drying these composted unders and sending the material through a de-stoner in order to remove the glass and produce a more useful compost. At the time of this writing, trials with de-stoning at the Ohio MRF had yielded positive results, but a full-scale operation had not yet begun.

The whole bottles and containers and larger pieces of glass would move over the vibrating finger screen and on to the secondary, pre-drum elevated sort lines where workers would manually pick them out. In order for recycled glass to be valuable as an input for container manufacturers, it generally needs to be separated by color. The materials-recovery facilities (MRFs) that processed the City's metal, glass, and plastic routinely complained that crushed, mixed-color glass had very little value and no market outlets (other than as fill material in road and construction projects, or alternative daily landfill cover). These MRFs were able to market the larger pieces of intact glass containers that workers would manually segregate by color, although this accounted for very little of the total glass stream that they received.

In order to be conservative, the assumption behind the facility cost estimates and the recovery rates is that the facility would *capture* all glass, however, none of it would be recovered for recycling, and would therefore require disposal as residue. Recycling outlets would actively be sought for this material, but realistically it would not be prudent to assign any value to this material in advance. Another option besides traditional recycling of glass would be to use pulverizing equipment to crush all of the glass into sand. The sand could be used in the composting process. The preliminary pilot facility design and budget does not specify this procedure, but it is an interesting option that could be explored.

Metal
The waste characterization associated with the NYC Composting Trials revealed that 3.1 percent of the post-recycling waste stream was metal. Since DSNY wanted to know what if any metal items in the waste stream might contribute to the heavy metals content in the ultimate compost, the consultant performed a sub-sort to further characterize metals as aluminum, brass, copper, lead, pot metal, and ferrous metal. Of the 3.1 percent of the waste stream that was metal, ferrous items were present at the highest levels (1.4 percent), followed by aluminum (.75 percent). From a compost-quality perspective, the compost made in the NYC Composting Trials met all the DEC limits for heavy metals. From the perspective of recycling, almost all metal, especially ferrous and aluminum, have established, secondary-use markets.

A grapple crane would remove bulk metal items from the tip floor of the pilot MRC facility and place them into containers, which would move via truck to the Materials-Recovery Staging Area and ultimately to scrap metal processors. Workers on the first sort line would remove large metal items not in bags and missed by the grapple crane and drop them into containers below for recycling. An overhead magnet would pull out very small ferrous items that fall under the primary set of vibrating finger screens (see Illustration 5-7). After the incoming, bagged MSW moves through the bag openers and the secondary sort lines, it moves to a final set of sort lines, where workers would remove any small, metal items that passed over the vibrating finger screens, such as metal cans. Finally, as the material moves to the last set of (debris roll) screens before the composting process, a set of magnets would remove any ferrous metal items, missed by the sort line workers.

Given the many opportunities to remove metal, including two sets of overhead magnets, the theoretical pilot facility recovery-rate projection assumes that 95 percent of the incoming metal items in the waste stream would be recovered for recycling.

Other Material

Large, Composite Items
Large, composite items include such things as mattresses, furniture, large cushions, home renovation debris, and other items consisting of material from more than one waste category. The pilot facility is designed to remove these items on the tip floor via grapple crane, as well as on the first elevated sort line. While some of these items might be reusable by the goodwill industry, the projected recovery rate assumes that none of these items will be recovered for recycling or reuse, and that all of them would require disposal.

Other Non-Compostables
Non-compostable items (referred to as "non-degradables" in the waste-characterization final report) include all items that are not readily biodegradable and do not fit in any other waste category. These include, among other things, wood that does not fit the definition of bulk wood, concrete, asphalt, stones, medium-sized composite items, all footwear, lightbulbs, electronics, wiring, and cables. In the conceptual pilot facility design, the final sets of workers on both the first and final elevated sort lines remove these medium-sized, miscellaneous, non-compostable, non-recyclable items and drop them into containers below for disposal. Inevitably, workers will

Table 6-2

Projected Annual Inputs and Outputs for a Theoretical, NYC Pilot Materials-Recovery and Composting Facility

Material	Tons	Percent of Input Material
INPUTS:		
MSW Input[1]	90,600	60
Biosolids Input[2]	60,400	40
Total Inputs	**151,000**	**100**
OUTPUTS:		
Compost Output[3]	38,354	25
Loss of Mass[4]	73,506	49
Recyclables[5]	12,775	8
Residue Output[6]	26,365	17
RECOVERY		
Total Facility Recovery[7]	**124,635**	**83**
Recovery of Solid-Waste Fraction	**64,235[8]**	**71[9]**

Note: Assumes 302 operating days per year.

1. From Table 5-3 in Chapter 5.
2. From Table 5-4 in Chapter 5.
3. From Table 5-5 in Chapter 5.
4. Calculated by subtracting compost output, recyclables, and residue from total inputs. Loss of mass is attributed to loss of moisture and CO_2.
5. Using recyclable-material–recovery projections from Table 6-1 (14.1% of total MSW input).
6. Using residue-rate projections from Table 6-1 (29.1% of total MSW input).
7. Includes compost output, loss of mass, and recyclables.
8. Calculated by subtracting liquid input (biosolids) from "Total Facility Recovery."
9. Based upon solid-waste input.

miss some of these items and they will pass over the materials-recovery screens and be loaded into the composting drums with the clean paper stream. As is the case at other MSW-composting facilities, these items will be screened out in the post-drum trommel screens for disposal.

Projected Annual Facility Recovery Rate

Table 6-2 contains the projected annual inputs and outputs for the theoretical, New York City Research and Development Pilot Materials-Recovery and Composting Facility described in Chapter 5. The pilot MRC facility would recover 83 percent of the total incoming material (MSW and biosolids), or 71 percent of the incoming MSW (exclusive of biosolids). The information in this table integrates the projected facility throughput rates presented in Chapter 5 with the materials-recovery and residue-rate information summarized in Table 6-1, and discussed above.

The data in Table 6-3 allows for a direct comparison of the proposed pilot facility with both the four, surveyed MSW-composting facilities, as well as the performance of the New York City material during the Composting Trials at Marlborough. While the actual number of annual operating days will vary slightly between facilities (and, of course, the NYC Trials was a limited pilot project), Table 6-3 compares the annual summary data from the proposed NYC pilot facility and the MSW-Composting Research Project.

The proposed pilot MRC facility is designed with the goal of achieving low-residue and high-recovery rates. As explained in Chapter 4, these attributes are the hallmarks of a successful facility. The following section briefly reviews the "desirable" and the "undesirable" outputs presented in Chapter 4 and summarized in Table 6-3, and describes how the pilot facility will meet its goal.

Table 6-3
Summary Data: Theoretical, NYC Pilot Materials-Recovery and Composting Facility and MSW-Composting Research Project

Parameter (% of total facility input)	NYC Pilot MRC Facility	Conporec	Edmonton	Marlborough	Rapid City	NYC Trials
Recovery Total Facility	**83**	75	61	64	64	65
Recovery Solid Waste	**71**	72	50	48	60	50
Compost Output	**25**	45	29	48	33	37
Recyclables	**8**	3	0	0	1	0
Loss of Mass	**49**	28	32	16	29	24
Residue	**17**	25	39	36	36	39

For source information, see the following tables: Table 6-2 (Proposed NYC Pilot Facility), Table 3-3 (Conporec), Table 3-5 (Edmonton), Table 3-7 (Marlborough), Table 3-9 (Rapid City), and Table 1-12 (NYC Trials).

Quality Compost Output and High Loss of Mass

As explained in Chapter 4, a successful facility will focus on making a quality compost product both from a regulatory and end-use perspective. A successful facility does not strive to make as much compost as possible, but rather seeks to actively manage the decomposing material in order to shed as much moisture and mass as possible.

The pilot facility will actively manage the composting material for over 50 days using highly automated air-floor processes, with the goal of maximizing loss of mass and creating a mature compost product. The pilot facility will actively manage the compost for longer than any of the surveyed facilities currently creating a finished product. This extended material-detention time will also allow facility operators to drop moisture levels towards the end of the composting process, in order to facilitate better screening and inerts removal. Conporec currently employs such practices and achieves positive results.

Recyclables

In order to maximize recovery rates, facilities need to capture non-degradable, recyclable materials, as well as degradable materials for composting. Recyclable material, such as certain plastic and metal containers, lose value as commodities after they go through the composting process, as is currently the case at most MSW-composting facilities. A pilot MRC facility should be equipped to systematically remove non-degradable materials before they go to the composting drum. The facility should attempt to recover as many of these non-degradable items as is economically practical and technically possible.

Residue

Residue is an "undesirable" facility output. As facilities must pay to dispose of all residue, keeping residue rates low represents an important way to reduce operating costs. A pilot MRC facility should reduce residue by recovering designated, non-degradable items for recycling, as well as running final screen overs back through the composting process. A pilot facility should also minimize the compost lost to overs, as well as the weight of those overs, by removing non-degradable items before they go to the composting drum. As explained in Chapter 4, immature compost becomes entrained in the non-degradable material while tumbling through the drum at MSW-composting facilities. For example, compost packs empty containers, sticks to plastic bags, and fills pockets in clothing, and is then disposed of with these items as residue. The compost and moisture also adds weight to these non-degradable items, making them more expensive to dispose.

The next chapter presents cost estimates for building and operating a theoretical, New York City Research and Development Pilot Materials-Recovery and Composting Facility (MRC), using the equipment and labor requirements outlined in Chapter 5, and the recovery, residue, and throughput estimates summarized here.

CHAPTER 7
COST ESTIMATES

Summary

This section presents preliminary cost estimates for the theoretical, 300-ton-per-day, New York City Research and Development Pilot Materials-Recovery and Composting Facility ("pilot MRC facility" or "pilot facility"), described in Chapter 5. The costs presented below include capital development and facility financing costs, as well as annual operation and maintenance costs, which are summarized into projected per-ton processing costs. All of the costs assume that the facility would be publicly owned and developed, but privately constructed and run (i.e., run by a private contractor). Appendix J to this report presents the full 30-year, life cycle financial analysis for the pilot facility.

These costs estimates are included here to help inform the overall discussion as to what it would cost to build and operate such a facility in New York City. Actual costs for the construction and operation of a pilot facility would be determined through a competitive procurement process.

Cost per Ton

The goal of the financial analysis was to determine estimates of the approximate per-ton cost for processing waste at the type of pilot MRC facility described in Chapter 5. The Department accomplished this by supplying assumptions about the theoretical facility to a financial analyst with long-standing experience in the waste-management industry, especially in the field of facility financing. The analyst took these assumptions (such as equipment costs, building costs, electricity requirements, etc.), added others pertaining to facility financing, and then calculated the per-ton costs for the projected life cycle of the facility (30 years). Appendix J contains this full life-cycle analysis for the facility.

Table 7-1 provides the estimated costs per ton to process MSW and biosolids at the theoretical pilot facility for the first year of operations.

The biosolids processing cost is an important number to understand as it is intimately tied to the ultimate MSW-processing cost. For this initial presentation, the objective was to derive a fee structure that would provide a disposal alternative to the Department of Sanitation that was competitive with export cost projections, while still offering a savings for biosolids management to the Department of Environmental Protection. (The DEP currently pays $112 per wet ton to export

Table 7-1
Cost per Ton of Material Processed at Theoretical Pilot MRC Facility

Material	Tons per Year	Cost per Ton
Municipal Solid Waste	90,600	$75
Biosolids	60,400	$100

biosolids, whereas DSNY pays $70 per ton on average to export solid waste.) If both DSNY and DEP shared evenly the cost of developing, operating, and maintaining a pilot facility, then the cost per ton of material processed (regardless of whether it was solid waste or biosolids) would be approximately $85 per ton. However, under the scenario presented here, DSNY would be financially responsible for developing and operating the facility and would “charge” the DEP a competitive tip fee for biosolids. Another way of looking at these figures is that for every dollar “less” the DEP would pay for processing biosolids at the pilot MRC facility, DSNY would pay 67 cents “more” for processing solid waste.

Financial Analysis

Table 7-2 is a reproduction of the summary page from the life-cycle financial analysis (attached as Appendix J). The following sections break out and review the various assumptions contained in each of the subsections of the financial analysis:

- Capital costs
- Operating costs
- Fees per ton

Capital Costs

The capital costs associated with developing a pilot facility generally include the cost of design, engineering, permitting, materials-recovery and composting equipment, facility financing costs, as well as building costs. The following section explains the rationale and background for the capital-cost estimates, cited in Table 7-2.

Engineering and Permitting
The engineering and permitting costs associated with designing and developing a facility of this size (and relative complexity) are as a rule between eight and 12 percent of the total capital costs. However, the assumption behind the financial analysis shown in Table 7-2 is that while the majority of the permitting costs would be borne by the City, part of the total engineering costs would be borne by the private company/companies who would be providing the composting and other equipment. Therefore, the total engineering and permitting costs in this case come to a little more than five percent (three million) of the total capital costs (58 million).

Equipment
Table 7-3 shows a breakdown of the equipment costs, which includes all of the machinery to run the pilot MRC facility, described in Chapter 5. The cost estimates come from the respective manufacturers, including the composting digester drums and the technologies envisioned for the first- and second-phase composting processes. The category for materials-recovery equipment includes all of the cranes, conveyor belts, magnets, screens, cages, containers, and sort-line housing, described in Chapter 5. The engineering consultant who developed the preliminary design for the materials-recovery component of the pilot facility provided these cost estimates. Appendix I contains the consultant’s cost estimates, including a breakout of all the proposed equipment, and a description of the individual components.

Table 7-2
Summary Data: Life-Cycle Financial Analysis for a Theoretical NYC Pilot MRC

Capital Costs:	Project Development (000)	Development Equity: Upon Project Finish (000)	Depreciation Per (Years)
Design & Engineering Cost	$1,000		28
Permitting & Project Development	$2,000		28
Equipment (Including Digester Drums)		$20,000	10
Biofilter		$1,000	10
249,200 Square Feet of Buildings @ $115 per Square Foot		$28,658	28
15-Acre Site @ $250,000 per Acre		NA	
Performance Guarantee		NA	28
Interest During Construction		NA	28
Borrower's Counsel		NA	28
Contingency & Spare Parts @ 10%		$4,966	28
Debt Reserve Fund		NA	
Financing:[1]			
Underwriting Fee @ 1% Assumes General Obligation Debt		$586	28
Underwriter's Counsel		$50	28
Issuer's Fee @ 1%, if required		NA	28
Bond Counsel		$50	28
Feasibility Opinion		NA	28
Trustee		$25	28
Cusip, Printing & Other		$25	28
Financial Advisor		$25	28
Miscellaneous		$250	28
SUBTOTAL	$3,000	$55,635	
TOTAL		$58,635	
Operating Costs:	**Cost (000)**	**Annual Escalation Rate**	**Per Ton of MSW**
Salaries & Benefits	$3,799	2.00%	$41.93
OTPS	$825	2.00%	$9.11
Repair & Replace	$1,000	2.00%	$11.04
Electricity (8,000,000 kwh/yr @ $0.08)	$640	2.00%	$7.06
Residue Disposal (29.1% of MSW @ $75/ton)	$1,977	2.00%	$21.83
TOTAL	$8,241		$91[2]
Fees per Ton:			**CPI**
MSW Tip Fee (w/Residue Disposal)		$0[3]	2.00%
Biosolids Tip Fee (per Wet Ton)		$100	2.00%
Aluminum Revenue (.75% MSW)		$0	2.00%
Ferrous Metal Revenue (2.3% MSW)		$0	2.00%
Sold Compost Revenue (Freight On Board at Facility)		$0	2.00%
Unsold Compost Cost (Freight On Board at Facility)		$0	2.00%
FINANCIAL RESULTS:	**Cost per MSW Ton**		
YEAR 1	**$75.00**		

NA = Not Applicable to a publicly financed facility, but would be relevant if the facility were privately financed.

1. The assumptions that inform the analysis are that the total capital cost of the facility ($58,635,000) will be publicly financed through a 20-year General Obligation Bond at the current debt rate of 4.72%.
2. This figure is derived by dividing the annual operating costs by the annual tons of MSW processed. It differs from the Year 1 cost ($75) in that it does not take into account revenues (from biosolids) or debt service.
3. The proposed pilot facility would not charge DSNY a tip fee for processing MSW. The cost for processing MSW is derived by dividing the total annual facility costs (including debt service) by the annual tons of material processed.

Table 7-3
Estimated Equipment Costs

Equipment	Cost
Three digester drums (14' x 200')	$7,000,000
Materials-Recovery Equipment	$4,200,000
First-Phase Composting[1]	$4,500,000
Second-Phase Composting and Curing	$1,300,000
Biofilter	$1,000,000
Post-Drum Screens and De-stoner	$500,000
Biosolids storage and pumping	$500,000
Miscellaneous Equipment[2]	$2,000,000
SUBTOTAL	**$21,000,000**

1. Includes air-handling equipment.
2. All other equipment not specified in other categories, such as front-end loaders, balers, forklift and dump trucks, tub grinder, etc.

The Miscellaneous Equipment category represents the cost of all the required equipment not specified in another category, such as front-end loaders, forklift and dump trucks, baling equipment, and tub grinders for shredding wood.

Buildings
Building costs greatly influence the total capital cost of any facility and, through the debt service that a municipality must pay over time, bear directly on the per-ton processing cost. For example, for every five-dollar increase in per-square-foot building costs, the cost per ton to process MSW in Year 1 increases $1.19.

Building costs are difficult to estimate, especially as there are a number of local and site-related conditions that are impossible to predict in a generic model. These include:

- Site condition and the degree of site preparation required
- Need for pilings to provide structural support
- Amount of concrete needed for foundations

Therefore, the approach presented here uses estimated dimensions (square feet) for each of the various buildings envisioned for a pilot MRC facility and then, for clarity and consistency,

Table 7-4
Estimated Building Costs

Buildings	Square Feet
Materials Recovery (including tipping floor)	80,000
Materials-Recovery Staging Area (including loading ramps and docks)	20,000
Digester Tipping Floor	12,800
Post-Drum, Primary Screening	19,200
First-Phase Composting (includes air-handling–equipment housing)	48,000
Second-Phase Composting & Curing	38,400
De-Stoning	10,800
Management Office	4,000
Final Screening & Compost Load-Out	16,000
TOTAL SQUARE FEET	**249,200**
SUBTOTAL (@ $115 per square foot)	**$28,658,000**

applies a constant square foot price for construction (including electrical work, fire systems, etc.). Table 7-4 presents the building dimensions and the total cost by square footage.

Financing
The cost associated with financing any project is the cost of borrowing the money to develop and build it. Again, the assumption guiding the financial analysis is that the pilot facility would be publicly developed, with the City retaining a private contractor to operate it. Therefore, the analysis assumes public financing, through a 20-year, General Obligation bond. This is the typical mechanism through which the City finances large-scale capital projects. The costs to the City associated with this type of financing are listed in Table 7-2 in the Capital Costs category under Financing.

These costs (such as the services of a financial advisor, the bond underwriter's fee and counsel, etc.) are important to include as they are borne by the City as a whole, and excluding them from the analysis would not accurately reflect the true cost of such a project.

Operating Costs

Operation costs, generally referred to as operation and maintenance costs, represent what is involved with the daily running of a facility. These costs are summarized in Table 7-2 as follows:

- Salaries and benefits
- Other than personnel services (OTPS)
- Repair and replacement
- Electricity
- Residue disposal

Unlike the capital costs, these costs are recurring over time, so an annual escalation rate (two percent) is built into the financial analysis to reflect rising costs over time.[1]

Salaries and Benefits
The workers' locations and positions listed in Table 7-5 are described in more detail in Chapter 5. Again, the assumption is that while the facility would be publicly owned and developed, operations would be contracted with a private company. The theoretical pilot facility would operate six days a week, with Saturday overtime costs broken out as a separate item below.

Table 7-6 provides a breakdown of anticipated management expenses. The total *Salary & Benefits* figure cited in Table 7-2 equals the sum of the totals listed in Tables 7-5 and 7-6.

Other Than Personnel Services
The OTPS figure in the financial summary is comprised of the items listed in Table 7-7. Compost-testing costs are for the laboratory analysis required by the State, as well as for additional testing to ensure that the compost meets the consistent quality standards outlined

Table 7-5

Estimated Annual Labor Expenses, Including the Estimated Cost of Fringe Benefits

Location within Facility and Position	First Shift (8am - 4pm)	Second Shift (4pm - 12am)	Third Shift (12am - 8pm)
Tipping Floor			
1 Grapple Crane Operator	$50,000	$50,000	-
1 Loader Operator	$50,000	$50,000	-
Primary, Pre-Drum Sort Line			
1 Supervisor	$50,000	$50,000	-
2 Sort Line Workers (Bag Handlers) @ $40,000	$80,000	$80,000	-
4 Sort Line Workers @ $35,000	$140,000	$140,000	-
Secondary, Pre-Drum Sort Lines			
2 Sort Line Workers (Bag Handlers) @ $40,000	$80,000	$80,000	-
4 Sort Line Workers @ $35,000	$140,000	$140,000	-
De-bagged Surge Piles			
2 Grapple Crane Operators @ $50,000	$100,000	$100,000	-
Final, Pre-Drum Sort Lines			
1 Sort Line Supervisor	$50,000	$50,000	-
6 Sort Line Workers @ $35,000	$210,000	$210,000	-
General			
1 Equipment Operator	$50,000	$50,000	-
Materials-Recovery Staging Area			
1 Supervisor	$50,000	-	-
3 Workers @ $40,000	$120,000	-	-
1 Equipment Operator	$50,000	-	-
Digester Drum Tipping Floor			
1 Equipment Operator	$50,000	-	-
Post-Drum Primary Screening[1]			
2 Equipment Operators @ $50,000	$100,000	-	-
First-Phase Composting			
2 Equipment Operators @ $50,000	$100,000	-	-
Second-Phase Composting			
1 Equipment Operator	$50,000	-	-
Night Clean-Up Crew			
1 Supervisor	-	-	$50,000
4 Workers @ $40,000	-	-	$160,000
SUBTOTAL LABOR	**$1,520,000**	**$1,000,000**	**$210,000**
Saturday Overtime[2]	$456,000	$300,000	$63,000
TOTAL LABOR	**$1,976,000**	**$1,300,000**	**$273,000**

1. One of the operators from the post-drum primary screening process will swing to also de-stone the unders from the designated digester (see Chapter 5 for a description of this operation).
2. The Saturday rate is derived by dividing the subtotal labor cost by five to arrive at a daily rate and then multiplying that by one-and-a-half to arrive at overtime costs. It should be noted that fewer people might actually be required as waste collection is generally light on Saturdays.

Table 7-6
Estimated Annual Management Expenses, Including the Estimated Cost of Fringe Benefits

Position	First Shift (8am - 4pm)	Second Shift (4pm - 12am)
Plant Manager	$75,000	-
Assistant Plant Manager/Maintenance Supervisor	$65,000	$75,000
Clerk	$35,000	-
TOTAL MANAGEMENT	**$175,000**	**$75,000**

in Chapter 4. Once a facility establishes a record of quality, then free, off-site deliveries of material could be made annually to new, potential end-users so they can sample the material.

Repair and Replacement
An important part of the daily operations of any facility is keeping all of the machinery and equipment in good working order. This category in the financial analysis provides the estimated annual expense the facility will incur through maintaining, repairing, and replacing broken equipment ($1,000,000 per year). As with any endeavor, purchasing quality equipment from reputable vendors, combined with a system of routine maintenance, helps to keep replacement costs down. Almost all of the equipment recommended for the theoretical pilot facility also comes with an extended service warranty.

Electricity
The electricity (kilowatt) requirements of the pilot MRC facility are fairly straightforward and are based on the usage of the actual equipment specified. The $.08 per kilowatt is a discounted rate provided to the Department as a bulk consumer of electricity. The assumption that served as an input to the life-cycle financial analysis is that the Department (and ultimately the City) as the owner of the facility would receive this rate. The electricity requirements for each facility component are listed in Table 7-8. In each case, the estimate came from the manufacturer and was then rounded up, to be conservative.

Residue Disposal
Incoming material that the pilot MRC facility does not recover for

Table 7-7
Estimated Annual Operating Expenses: Other Than Personnel Services (OTPS)

Category	Cost ($)
Heating	$225,000
Diesel Fuel	$100,000
Compost Testing & Off-Site Deliveries	$500,000
TOTAL	**$825,000**

Table 7-8
Estimated Annual Operating Expenses: Electricity

Facility Component	Electricity Requirement (kwH)
Composting Digester Drums	3,500,000
First-Phase Composting[1]	2,300,000
Materials Recovery	1,200,000
Second-Phase Composting	300,000
Other (screens, lighting, fans, etc.)	700,000
TOTAL	**8,000,000**

1. Includes air-handling equipment.

Table 7-9
Estimated Annual Tonnage: Waste Received & Processed

Throughput	Tons per Day	Days per Year	Tons per Year
MSW	300	302	90,600
Biosolids	200	302	60,400
Total	500		151,000

recycling or composting will require disposal. As Chapter 6 described, the pilot MRC facility would recover an estimated 71 percent of the incoming solid waste, meaning that approximately 29 percent would require disposal (see Table 6-1). The assumption is that residue disposal will cost $75 per ton in the first year of facility operation. Again, the financial analysis applies a two-percent annual escalation factor to residue disposal costs.

Fees per Ton

In order to determine a per-ton processing cost for a pilot MRC facility, it was necessary to apply all of the above costs to the number of tons that the theoretical facility would process. Table 7-9 presents the number of operating days and the amount of MSW and biosolids that the facility would receive. As described in Chapter 5, the facility would receive and process material on two, eight-hour shifts, six days a week. Using the DSNY operational calendar, this translates into 302 operating days (including Saturdays).

The Fees per Ton section of the financial analysis summary page (Table 7-2) describes the revenue that the facility would derive from its operation. The financial analysis assumes that DSNY would bear the costs of developing, operating, and maintaining the pilot facility, and would then “charge” the DEP a competitive tip fee of $100 per wet ton for biosolids. (As stated earlier, the DEP currently pays $112 per wet ton to export this material.)

The per-ton cost for MSW ($75, shown for Year 1 in Table 7-2) is the total cost of the theoretical pilot MRC facility operation (including debt service) divided by the total number of tons that the facility would process.

The financial analyst provided lines in the model for revenue from aluminum and ferrous metal recovered from the waste stream, as these two commodities have established and known value. However, as Chapter 6 explained, DSNY has chosen to set this revenue to zero, in order to conservatively assess the costs of a pilot facility.

The analyst also provided the ability in the model to assume revenue from selling compost. As noted, the assumption is that the compost would generate no revenue. If the facility is able, like many currently operating MSW-composting facilities (see Chapter 3 for more information), to generate a consistent, quality product, then this assumption is extremely conservative.

To balance these conservative assumptions, the cost for unsold compost is also zero. This is unlikely to be true, but without knowing the location of the facility and the proximity to outlets and modes of transportation, it is very difficult to assign a cost to unsold compost.

For example, if a pilot facility were located near a closed landfill, then a major distribution outlet would be readily available.

As described in the Other Than Personnel Services section above, money is allocated in the annual operating expense of the facility to provide free distribution of the material to potential end users, once the New York State Department of Environmental Conservation has approved its use. Ensuring that the compost is an asset and not a liability for a pilot facility will be critical to its success. The market demand and viable end uses of the compost is one of the important learning objectives of any pilot facility, as outlined in Chapter 5.

The findings of this report demonstrate that it is possible to make a compost that meets DEC pollutant-limit and product-use standards from samples of New York City MSW. Given the possibility of potentially recycling 70 percent of the municipal solid-waste stream at a price that is competitive with waste export costs, it would seem well worth the effort to build a pilot MRC facility to see if these goals can be met.

New York City MSW Composting Report

Appendix A
Waste Characterization for Composting Pilot Study

Report by Camp, Dresser & McKee, Inc.

CDM Camp Dresser & McKee

Staten Island Botanical Garden

Waste Characterization for Composting Pilot Study

March 2001

Report

Section 1
Introduction

As part of a pilot study of municipal solid waste composting, the New York City Department of Sanitation (NYCDOS) sent approximately 300 tons of residential refuse to a composting facility operated by Bedminster Bioconversion, Inc. in Marlboro, Massachusetts. The Staten Island Botanical Garden, Inc. retained Camp Dresser & McKee Inc. (CDM) to characterize the residential refuse sent to the Marlboro facility. NYCDOS collected the waste in its Staten Island District 2 on Saturday, February 24, 2001, and Monday through Thursday, February 26 through March 1, 2001. A total of 37 truckloads of residential refuse from preselected collection routes were sent to Marlboro. Prior to being shipped to Marlboro, each truckload was dumped on a paved area at the leaf composting facility at the Fresh Kills landfill on Staten Island. CDM performed the characterization work at the leaf composting facility at Fresh Kills from Monday, February 26 through Friday, March 2.

Assisted by a front-end loader and operator from Organic Recycling, Inc. and temporary workers supplied by Labor Ready, Inc., CDM collected a total of 70 samples from the 37 truckloads of waste and sorted them into 13 primary categories and 14 secondary categories. The material in each category was weighed and the resulting data analyzed to estimate the composition of the waste and the statistical reliability of the results. The average weight of the 70 samples was 313 pounds and the total quantity of waste sorted was 11 tons.

Section 2 of this report describes the procedures used in characterizing the residential refuse. Section 3 presents the results.

Section 2
Study Procedures

This section describes selection of collection trucks for sampling, sampling procedures, and sorting and weighing procedures. In addition, this section provides definitions of the waste categories used in the study.

2.1 Selection of Collection Trucks to Include in the Study

The New York City Department of Sanitation (DOS) selected Staten Island District 2 (SI2) as the source of the residential refuse to be included in the composting pilot study. DOS selected SI2 because it is adjacent to the waste transfer point at the Fresh Kills landfill and because it had the same residential recycling rate in 2000 as New York City as a whole, 23.4 percent. SI2 has four largely separate collection areas called sections, designated 21, 22, 23 and 24.

DOS informed CDM that collection trucks from Staten Island District 2 (SI2) would be sent to the Marlboro, Massachusetts composting facility as follows:

- 8 trucks collecting on Saturday, February 24 (to be sent to Marlboro on Monday)
- 7 trucks collecting on Monday, February 26 (to be sent to Marlboro on Tuesday)
- 7 trucks collecting on Tuesday, February 27 (to be sent to Marlboro on Wednesday)
- 7 trucks collecting on Wednesday, February 28 (to be sent to Marlboro on Thursday)
- 8 trucks collecting on Thursday, March 1 (to be sent to Marlboro on Friday)

Thus, a total of 37 trucks would be sent to the Marlboro composting facility during the 5 days of the portion of the pilot study devoted to residential waste. CDM allocated these 37 trucks among the four sections of SI2 as shown in Table 2-1. Based on the relative quantities of residential waste generated in the four sections during 2000, the target number of trucks from each section was as follows:

- 10 trucks from Section 21
- 9 trucks from Section 22
- 8 trucks from Section 23
- 10 trucks from Section 24

DOS provided detailed descriptions of 105 collection routes used in SI2 during a week at the time of year when the study occurred. CDM determined that among these 105 routes were 61 distinct routes (see Table A-1 in Appendix A). A route was classified as distinct if more than half of the lines in its description did not appear in the description of any other route.

CDM allocated the 37 trucks among the 61 distinct collection routes so as to include the right number of trucks from each section and the right number of routes for each day of the study. None of the 61 distinct collection routes had more than one truck included in the study. (See Table A-1 in Appendix A.)

For each census block group in SI2, CDM collected data on population, level of education, median household income, and per-capita income. Eight block groups were identified that had significantly higher or lower income and/or educational level than the others. CDM made adjustments in the list of 37 selected collection routes to avoid over- or underrepresentation of these eight block groups.

The final list of collection routes selected for inclusion in the study is shown in Table 2-2.

Table 2-2 also includes two alternate collection routes for each of the 5 days of the study. The alternate routes were selected using the same basic procedure used to select the preferred routes. A degree of overlap in the alternate routes proved to be unavoidable, however, and the first alternate for Thursday is almost the same route as the second alternate for Monday.

CDM collected and sorted 70 samples from the 37 trucks directed to the transfer point. Therefore, two samples were collected from all but four of the 37 trucks. Little could have been gained from further analysis aimed at identifying which four routes should be sampled only once. Within the limits of the target number of samples from each section shown in Table 2-1, therefore, the four truckloads to be sampled only once were chosen at random. The number of samples collected from each of the 37 truckloads is shown in Table 2-2.

In addition to showing the target number of samples from each section of SI2, Table 2-1 shows the actual number of samples from each section. DOS sent all of the primary targeted truckloads of waste to the transfer point except one. On Friday of the week of field work, DOS substituted a designated alternate collection route in Section 21 for the target route in Section 22. As a result, the total number of samples from Section 21 was approximately 1.5 more than its theoretical share and the total number of samples from Section 22 was approximately 1.5 less than its theoretical share.

2.2 Sampling Procedures

The selected truckloads of residential waste were dumped on a paved area at the leaf composting facility during the night prior to each day of field work. The truckloads were kept separate from each other. Each morning of the 5 days of field work, the CDM sampling coordinator was given a diagram indicating the section of SI2 and the

Table 2-1
Distribution of Truckloads and Samples
Among the Sections of Staten Island District 2

Section	Annual tonnage in 2000	Percentage of total tonnage in 2000	Theoretical share of 37 truckloads	Target number of truckloads	Actual number of truckloads	Theoretical share of 70 samples	Target number of samples	Actual number of samples
21	13,968	26.4%	9.78	10	11	18.49	18	20
22	12,467	23.6%	8.72	9	8	16.51	17	15
23	12,113	22.9%	8.48	8	8	16.04	16	16
24	14,322	27.1%	10.02	10	10	18.96	19	19
Total	52,869	100.0%	37.0	37	37	70.0	70	70

Table 2-2
Collection Routes Selected for Inclusion in Study

CDM route desig-nation	Section in which route begins	Day of week	Date	NYCDOS route designation Days of week	Number of trucks	Route number	Actually included in study?	Number of samples collected
Selected Routes for Saturday								
26	21	Sat	2/24/01	Wed/Sat	4	2	Yes	2
28	21	Sat	2/24/01	Wed/Sat	4	4	Yes	1
50	22	Sat	2/24/01	Wed/Sat	4.5	1	Yes	1
53	22	Sat	2/24/01	Wed/Sat	4.5	4	Yes	2
75	23	Sat	2/24/01	Wed/Sat	3	1	Yes	2
77	23	Sat	2/24/01	Wed/Sat	3	3	Yes	2
102	24	Sat	2/24/01	Wed/Sat	3.5	1	Yes	2
104	24	Sat	2/24/01	Wed/Sat	3.5	3	Yes	2
Alternate Routes for Saturday (in this order)								
52	22	Sat	2/24/01	Wed/Sat	4.5	3	No	0
105	22	Sat	2/24/01	Wed/Sat	4.5	4.5	No	0
Selected Routes for Monday								
3	21	Mon	2/26/01	Mon/Thu	5.5	3	Yes	2
5	21	Mon	2/26/01	Mon/Thu	5.5	5	Yes	2
31	22	Mon	2/26/01	Mon/Thu	4.5	3	Yes	2
55	23	Mon	2/26/01	Mon/Thu	5	2	Yes	2
79	24	Mon	2/26/01	Mon/Thu	7	2	Yes	2
81	24	Mon	2/26/01	Mon/Thu	7	4	Yes	2
83	24	Mon	2/26/01	Mon/Thu	7	6	Yes	2
Alternate Routes for Monday (in this order)								
56	23	Mon	2/26/01	Mon/Thu	5	3	No	0
2	21	Mon	2/26/01	Mon/Thu	5.5	2	No	0
Selected Routes for Tuesday								
8	21	Tue	2/27/01	Tue/Fri	4.5	2	Yes	2
10	21	Tue	2/27/01	Tue/Fri	4.5	4	Yes	2
34	22	Tue	2/27/01	Tue/Fri	5	2	Yes	2
37	22	Tue	2/27/01	Tue/Fri	5	5	Yes	2
59	23	Tue	2/27/01	Tue/Fri	4	1	Yes	2
62	23	Tue	2/27/01	Tue/Fri	4	4	Yes	2
87	24	Tue	2/27/01	Tue/Fri	3.5	3	Yes	2
Alternate Routes for Tuesday (in this order)								
7	21	Tue	2/27/01	Tue/Fri	4.5	1	No	0
86	24	Tue	2/27/01	Tue/Fri	3.5	2	No	0
Selected Routes for Wednesday								
12	21	Wed	2/28/01	Wed/Sat	5	1	Yes	2
15	21	Wed	2/28/01	Wed/Sat	5	4	Yes	2
38	22	Wed	2/28/01	Wed/Sat	6	1	Yes	2
40	22	Wed	2/28/01	Wed/Sat	6	3	Yes	2
43	22	Wed	2/28/01	Wed/Sat	6	6	Yes	2
65	23	Wed	2/28/01	Wed/Sat	4	3	Yes	2
89	24	Wed	2/28/01	Wed/Sat	4	2	Yes	2
Alternate Routes for Wednesday (in this order)								
91	24	Wed	2/28/01	Wed/Sat	4	4	No	0
64	23	Wed	2/28/01	Wed/Sat	4	2	No	0
Selected Routes for Thursday								
17	21	Thu	3/1/01	Mon/Thu	4	1	Yes	2
20	21	Thu	3/1/01	Mon/Thu	4	4	Yes	2
45	22	Thu	3/1/01	Mon/Thu	3	2	No	0
67	23	Thu	3/1/01	Mon/Thu	4	1	Yes	2
69	23	Thu	3/1/01	Mon/Thu	4	3	Yes	2
92	24	Thu	3/1/01	Mon/Thu	6	1	Yes	2
94	24	Thu	3/1/01	Mon/Thu	6	3	Yes	1
96	24	Thu	3/1/01	Mon/Thu	6	5	Yes	2
Alternate Routes for Thursday (in this order)								
18	21	Thu	3/1/01	Mon/Thu	4	2	Yes	1
44	22	Thu	3/1/01	Mon/Thu	3	1	No	0

collection route from which each truckload had come. The diagram was in the form of a table with a column for each row of loads on the pavement.

Under the direct supervision of the sampling coordinator, an employee of Organic Recycling, Inc. collected the samples using a front-end loader. The bucket of the front-end loader was large enough to hold large items of waste such as mattresses and sofas.

As indicated above, two samples were collected from 33 of the 37 truckloads of waste (a total of 66 samples) and one sample was collected from each of the remaining four truckloads. When two samples were collected, they were collected from different places in the load. The target sample size was 250-to-300 pounds.

For each sample, the sampling coordinator recorded the following at the top of a data form like that shown in Figure 2-1:

- The sample number (1 for the first sample collected on Monday through 70 for the last sample collected on Friday)
- The date the sample was collected from the load of waste
- The number of the section of SI2 in which the load of waste was collected
- The number of the collection route

The date the load of waste was collected and the DOS truck identification number for each sampled load were added to the data forms later.

The front-end loader deposited each sample on a 9-by-12-foot tarp outside the maintenance building at the leaf composting facility. The sampling coordinator maintained a diagram of the sample storage area indicating the number and location of each sample. When sampling was complete, netting was placed over the samples to minimize the amount of waste removed by wind and seagulls.

2.3 Sorting Procedures

Sorting proceeded as follows for each sample:

- The sampling coordinator gave the CDM sorting supervisor a data form with information identifying the sample filled in at the top (see Section 2.2 and Figure 2-1).
- The tarp and sample were dragged into the maintenance building.
- Large items (e.g., mattresses, furniture, carpeting) were removed from the sample and set aside for weighing.

Figure 2-1
Data Form

Sample #:	Section:		Route:	Truck #:	
Collection date:		Sorting date:		Sorting team:	
Paper		Food waste	Yard waste	Other degradables	Bulk wood
	Total:	Total:	Total:	Total:	Total:
Plastic	Textiles	Glass & ceramics	Large composites	Nondegrad. fines	Unclassifiable fines
Total:	Total:	Total:	Total:	Total:	Total:
Metal	Subsort of metal (does not add to total for metal)				
	Aluminum	Brass	Copper	Lead	Other (specify)
Total:	Total:	Total:	Total:	Total:	Total:
Other nondegrad.	Subsort of other nondegradables (does not add to total for other nondegradables)				
	Electronics	Other electrical	Insulated wiring	Batteries (specify)	Other (specify)
	Total:	Total:	Total:		
	Light bulbs	Fluorescent tubes	Gypsum board		
Total:	Total:	Total:	Total:	Total:	Total:
Notes					Total weight of sample

- The remainder of the sample was moved by increments into one of the two sorting boxes. The sorting boxes are 4 feet wide, 6 feet long, and 10 inches deep, and sit on stands approximately 33 inches high.
- Containers for 12 of the 13 primary sorting categories (see Section 2.4 below) were arranged around the sorting box and the waste was sorted into the containers. The sorting supervisor and the CDM field supervisor checked the containers periodically for accuracy of sorting.
- When a relatively small quantity of small pieces of waste remained on the half-inch mesh screen mounted 1.5 inches off the bottom of the sorting box, sorting became unproductive and was called to a halt. The sorting box was dumped in such a way that the material that had fallen through the screen was kept separate from the material that had remained on top of the screen. The two piles of material were placed in separate containers. The material from above the screen was categorized as "unclassifiable fines," the 13th primary sorting category. The material from below the screen was categorized as food waste, "other degradables," "other nondegradables," a combination of these, or unclassifiable fines, based on the judgement of the sorting supervisor.
- The containers were brought to the scale, checked again for accuracy of sorting, and weighed.
- The scale was set at minus the tare weight of the containers, each container was placed on the scale, and the weight shown on the scale's digital display was recorded as the weight of the waste in the container.
- The containers were dumped in a rolloff container provided by DOS.

When the primary sorting was complete, the CDM field supervisor sorted the metal and "other nondegradables" categories into the 14 secondary categories (see Section 2.4.2 below).

2.4 Waste Category Definitions

This section defines the 13 primary waste categories and 14 secondary waste categories used in the study. The results of the study should not be interpreted without reference to the category definitions.

2.4.1 Primary Categories

Paper. All paper, including plastic-coated paper and paper in bulky items such as paperboard barrels and thick-walled paperboard tubes.

Food Waste. All items produced or gathered for use as food, including the inedible portions, except large bones and shells. Includes the contents of beverage containers, including water. Includes coffee grounds. In practice, some food waste becomes part of the fines category.

Yard Waste. Leaves, grass clippings, shrub and garden trimmings, weeds and wild grasses, pine needles and cones, twigs, vegetative ground litter, small uprooted plants, and dirt that cannot readily be separated from the plant material. Also includes fruits, nuts, flowers and seed casings fallen from trees. Does not include cut flowers. Does not include uprooted shrubs or tree parts more than one half inch in diameter.

Other Degradables. Includes all small, readily biodegradable items that do not fit the definition of paper, food waste or yard waste. Includes disposable diapers and their contents, sanitary napkins, animal feces, cut flowers and dryer lint.

Bulk Wood. All plywood, chipboard, and particle board. All wooden and wicker furniture. All dimensional lumber with two dimensions greater than one half inch. All uprooted shrubs and all tree branches greater than one half inch in diameter. On a weight basis, this category includes almost all wood in residential refuse.

Textiles. Includes all separate items consisting of woven fabrics. Includes rugs, carpeting, and woven carpet padding. Includes towels and washcloths, cloth napkins and cloth place mats. Includes woven curtains and drapes, awnings, tents, and tarpaulins. Includes bed pillows, comforters, and quilted jackets and coats.

Plastic. All items consisting primarily of plastic. Includes polyethylene of all densities, polyethylene terephthalate (PET or PETE), polystyrene (both solid and foam), polypropylene, polyvinyl chloride (PVC), acrylonitrile butadiene styrene (ABS), polyurethane (both solid and foam), and a variety of other polymers.

Metal. All items consisting primarily of metal.

Glass and Ceramics. Items consisting primarily of glass or ceramics. Includes glass mirrors. Does not include light bulbs or fluorescent tubes, which are included in "other nondegradables." In practice, does not include broken beverage containers, because the broken pieces are too dangerous to handle. Broken beverage containers tend to end up as "unclassifiable fines" (see below).

Large Composite Items. All large items consisting of material from more than one of the other waste categories. Includes mattresses, box springs, and stuffed furniture, including large cushions.

Nondegradable Fines. All inorganic materials that can be separated from the other categories of waste and that consist of or will break down to small particles that are generally not objectionable in compost. Includes dirt, sand, ashes, and cat litter. Does not include broken glass.

Other Nondegradables. All materials that are not readily biodegradable and that do not fit any of the waste categories defined above. Includes wood that does not fit the definition of "bulk wood" above. Includes leather items. Includes gypsum board, bricks, cinder blocks, concrete, asphalt, stones, and gravel. Generally includes small and medium-sized items consisting of materials from more than one other waste category. Includes all footwear not primarily composed of plastic. Includes lightbulbs, fluorescent tubes, batteries, electronic and electrical devices, and insulated electrical wiring and cables.

Unclassifiable Fines. Includes material that passes through the half-inch wire mesh screen mounted 1.5 inches above the bottom of the sorting box (bottom fines), if this material can not be classified as food waste, other degradables, classifiable fine inorganics, or other nondegradables. Also includes small pieces of material left on top of the screen at the point when sorting becomes too inefficient to justify continuing (top fines). Generally includes pieces of broken beverage containers.

2.4.2 Secondary Categories

2.4.2.1 Subcategories of Metal

Aluminum. All items consisting primarily of aluminum, including but not limited to aluminum beverage cans, aluminum foil and disposable pans, aluminum pet food containers, aluminum cookware, aluminum aerosol spray cans, and aluminum lawn furniture. Does not include bimetal (aluminum and steel) cans.

Brass. All items consisting primarily of brass, including but not limited to brass plumbing fixtures and parts, keys, antennas, and decorative items. Brass is an alloy that is typically about two-thirds copper and one-third zinc but often contains up to 2 percent lead and occasionally contains 5 or 10 percent lead.

Copper. All items consisting primarily of copper, including but not limited to copper tubing, uninsulated copper wire, and U.S. coins other than nickels. Does not include the copper in insulated copper wiring, electronic devices, electric motors, or other electrical devices.

Lead. All items consisting in substantial part of lead, including but not limited to wheel weights, ceiling fan balancing weights, lead-acid batteries, lead wine bottle caps (wrapped around the bottle mouth), and tin-lead solder. Includes tin-lead solder if separate in the sample, but does not include the lead in soldered devices such as circuit boards (see “electronics” below).

Pot Metal. All items consisting primarily of die-cast, nonmagnetic, silver-gray metal. Largest component is generally zinc. The term "pot metal" is also used to refer to alloys of copper and lead used for bearing surfaces, but that is not the type of pot metal typically found in residential refuse.

Ferrous Metal. All items consisting primarily of iron and steel. This category typically includes essentially all of the metal that does not fit any of the subcategories described above.

2.4.2.2 Subcategories of "Other Nondegradables"

Electronics. Devices that contain a circuit board of significant size relative to the size of the device, and insulated wiring attached to such devices. Includes computers, computer monitors and printers, touchtone telephones, boom boxes, radios, calculators, microwave ovens, video cameras, and stereo components other than speakers.

Other Electrical Devices. Electrical devices other than electronics, light bulbs, and fluorescent tubes. Includes insulated wiring attached to such devices, but does not include extension cords or other detached wiring (see "insulated wiring" below). Includes mechanical devices with electric motors such as vacuum cleaners and garbage disposals. Includes speakers, power tools, lamps, flashlights, and most toasters and toaster ovens. Includes electrical fixtures such as switches, receptacles (outlets), and lighting fixtures.

Insulated Wiring. All wire covered with plastic or other insulation, except such wiring attached to electronics or electrical devices. Includes electrical cable and extension cords, cable television wiring, and telephone wire. Includes printer cables and other detached wiring associated with computers.

Light Bulbs. All incandescent light bulbs except those inside electrical devices. Includes the bases of broken light bulbs.

Fluorescent Tubes. All lighting tubes and bulbs based on fluorescent technology.

Gypsum Board. Wallboard with a layer of gypsum sandwiched between two thin layers of paper.

Batteries. All batteries except lead-acid batteries, which are included in the metal category and the lead subcategory of the metal category.

- The standard deviation is the square route of the mean of the squares of the differences.

The standard deviation is a standard function in spreadsheet programs and many calculators.

Confidence interval. The range of values, centered on the mean, that has a specified statistical probability of including the true value of the parameter being sampled. The 90-percent confidence interval has a 90-percent statistical probability of including the true value.

Confidence level. The likelihood that the actual value falls within the corresponding confidence interval. A 90-percent confidence level corresponds to a 90-percent confidence interval. The confidence level is selected in advance based on a tradeoff. The tradeoff is between great confidence that the true value lies within a wide range and lower confidence that the true value lies within a narrow range.

Student t value. A standard statistical value corresponding to a specific number of samples and a specific confidence level. Most basic statistics books have tables of Student t values. These values were first calculated in the early 1900s by W. S. Gossett, who used the pseudonym "Student" at that time.

Uncertainty value. The absolute difference between the mean and either the upper or lower limit of the confidence interval. It is the product of the Student t value and the standard deviation, divided by the square root of the number of samples. Each waste category in each group of samples has its own distinct uncertainty value.

Precision level. The uncertainty value divided by the mean. Note that the "precision level" decreases as precision increases, so a lower precision level is better. Each waste category in each group of samples has its own distinct precision level.

Weighted-average precision level. An overall precision level for a group of samples and waste categories, calculated by weighting the precision levels of the individual waste categories in proportion to the relative abundance of the individual waste categories.

3.2 Results of Sampling and Sorting

This section, together with Appendix B, presents the results of the waste sampling and sorting. Table B-1 in Appendix B shows the weight data for the primary waste categories for each sample. In addition to the quantity of paper shown in Table B-1, the sorted refuse contained at least $45 in paper currency.

Table B-2 in Appendix B shows the composition of each waste sample based on the weight data for the primary waste categories shown in B-1. The mean (average) values across the bottom of Table B-2 are the average composition of the 70 samples, based on the primary waste categories. Just below the mean composition values are the standard deviations for the percentages in each column.

Table B-3 in Appendix B shows the weight data for the secondary waste categories for each sample (the raw results of subsorting the metal and "other nondegradables" categories). Table B-4 in Appendix B shows the percentage of each secondary waste category in each sample, based on the weight data in Table B-3. As in Table B-2, average percentages and standard deviations for each secondary category are shown at the bottom of Table B-4.

A waste composition study is essentially a statistical exercise, and statistical analysis requires that the samples have equal statistical weight. Because the samples have different numbers of pounds, the pound data (tables B-1 and B-3) are converted to percentage compositions (tables B-2 and B-4) to give the samples equal statistical weight.

Tables 3-1 and 3-2 show the average percentages and the standard deviations from across the bottom of tables B-2 and B-4. In addition, tables 3-1 and 3-2 show the derivation of uncertainty factors and precision levels for the sorting results, as well as the 90-percent confidence interval for each waste category. Note that in Table 3-1 the sum of the uncertainty values for the individual waste categories is the same as the overall (weighted average) precision level. This is always true for data sets of this type.

3.3.1 Results of Primary Sorting

During the 5 days of field work, 70 samples totaling 21,934 pounds were sorted into 13 primary categories. The average sample size of 313 pounds exceeded the guaranteed average by 63 pounds.

The weighted average precision level for the 13 primary waste categories was 9.4 percent at 90-percent confidence. This is an excellent level of precision in waste characterization work. It indicates that there is a 90-percent probability that the true composition of the loads of waste sent to the Marlboro composting facility was within 9.4 percent of the composition presented in Table 3-1.

Combining the 13 primary waste categories into only three categories—degradables, nondegradables, and unclassifiable fines—improves the weighted average precision level to 3.2 percent at 90-percent confidence.

As shown by Table 3-1, the degradable categories totaled 55.5 percent of the sorted waste, the nondegradable categories totaled 40.2 percent, and the unclassifiable fines accounted for the remaining 4.3 percent. In considering the feasibility of composting in light of these values, the following should be kept in mind:

- Most of the nondegradable fines (3.5 percent of the total and 8.7 percent of the nondegradables) will become part of the compost.

Table 3-1
Composition of the Sorted Samples with Statistical Analysis

Waste category	Average percentage in the 70 samples (x)	Standard deviation (s)	Student t value (t^*) for 70 samples (n) and 90% confidence	Uncertainty value for 90% confidence ($U_{90}=t^*s/n^{1/2}$)	Precision level at 90% confidence (U_{90}/x)	90% confidence interval ($x-U_{90}$ to $x+U_{90}$)
Paper	32.1%	5.2%	1.668	1.0%	3.2%	31.0% to 33.1%
Food waste	15.9%	4.5%	1.668	0.89%	5.6%	15.0% to 16.8%
Yard waste	1.6%	3.4%	1.668	0.67%	41.6%	0.94% to 2.3%
Other degradables	6.0%	3.5%	1.668	0.69%	11.6%	5.3% to 6.7%
Total degradables	55.5%	7.1%	1.668	1.4%	2.5%	54.1% to 56.9%
Bulk wood	3.4%	3.0%	1.668	0.60%	17.7%	2.8% to 4.0%
Plastic	15.4%	3.4%	1.668	0.68%	4.4%	14.8% to 16.1%
Textiles	5.3%	4.3%	1.668	0.86%	16.3%	4.4% to 6.2%
Glass and ceramics	3.3%	2.5%	1.668	0.50%	15.2%	2.8% to 3.8%
Metal	3.1%	1.4%	1.668	0.28%	9.0%	2.9% to 3.4%
Large composite items	1.0%	4.5%	1.668	0.90%	91.4%	0.084% to 1.9%
Nondegradable fines	3.5%	3.8%	1.668	0.76%	21.7%	2.7% to 4.2%
Other nondegradables	5.1%	6.0%	1.668	1.2%	23.4%	3.9% to 6.3%
Total nondegradables	40.2%	7.3%	1.668	1.5%	3.6%	38.7% to 41.6%
Unclassifiable fines	4.3%	1.7%	1.668	0.34%	7.9%	4.0% to 4.7%
Total of 13 individual categories	100.0%	---	---	9.4%	---	---
Weighted-average precision level based on the 13 individual categories	---	---	---	---	9.4%	---
Weighted-average precision level based on degradables, nondegradables, and unclassifiable fines	---	---	---	---	3.2%	---

Table 3-2
Composition of Subsorted Waste Categories with Statistical Analysis

Waste category	Average percentage in the 70 samples (x)	Standard deviation (s)	Student t value (t*) for 70 samples (n) and 90% confidence	Uncertainty value for 90% confidence ($U_{90}=t^*s/n^{1/2}$)	Precision level at 90% confidence (U_{90}/x)	90% confidence interval ($x-U_{90}$ to $x+U_{90}$)
Aluminum	0.75%	0.40%	1.668	0.080%	10.6%	0.67% to 0.83%
Brass[1]	0.039%	0.078%	1.668	0.015%	39.7%	0.024% to 0.055%
Copper	0.0047%	0.017%	1.668	0.0033%	69.7%	0.0014% to 0.0080%
Lead	0.0020%	0.012%	1.668	0.0025%	121.0%	0.000% to 0.0045%
Pot metal[2]	0.010%	0.039%	1.668	0.0077%	74.1%	0.0027% to 0.018%
Ferrous metal	2.3%	1.4%	1.668	0.28%	11.8%	2.1% to 2.6%
All metal (from Table 3-1)	3.1%	1.4%	1.668	0.28%	9.0%	2.9% to 3.4%
Electronics	0.52%	1.4%	1.668	0.28%	52.5%	0.25% to 0.80%
Other electrical devices	0.70%	1.8%	1.668	0.35%	50.4%	0.35% to 1.0%
Insulated wiring	0.10%	0.3%	1.668	0.055%	54.4%	0.046% to 0.16%
Light bulbs	0.046%	0.13%	1.668	0.025%	54.6%	0.021% to 0.071%
Fluorescent tubes	0.00%	0.00%	1.668	0.00%	---	0.00% to 0.00%
Gypsum board	1.3%	3.1%	1.668	0.62%	47.5%	0.68% to 1.9%
Batteries	0.11%	0.12%	1.668	0.024%	22.2%	0.085% to 0.13%
Other "other nondegradables"	2.4%	4.8%	1.668	0.95%	40.2%	1.4% to 3.3%
All "other nondegradables" (from Table 3-1)	5.1%	6.0%	1.668	1.2%	23.4%	3.9% to 6.3%

[1]Alloys of copper and zinc with some lead
[2]Primarily zinc

- A substantial portion of the unclassifiable fines (4.3 percent of the total) is small pieces of paper and food waste that will become part of the compost. The abundance of broken glass in the unclassifiable fines was relatively low.
- On the other hand, the degradable waste categories are not completely degradable. Some paper is resistant to composting, food waste contains bones, yard waste contains twigs that resist composting, and "other degradables" include the plastic covers of diapers.

3.3.2 Results of Secondary Sorting

Table 3-2 shows the results of subsorting the metal and "other nondegradables" categories.

3.3.2.1 Subcategories of Metal

Almost three fourths of the metal was ferrous metal, most of which can be removed from the composting process using magnets. Almost one fourth of the metal was aluminum. Brass, copper, lead and pot metal (primarily zinc) accounted for a total of less than 2 percent of the metal. A small percentage of the ferrous metal was plated with brass, but quantifying the brass plating was beyond the scope of this study.

With respect to composting, the most significant object in the subsorted metal was half a pound of fine tin-lead solder on a light plastic spool. If the solder broke into small pieces that all ended up in the compost, the solder could contribute 86 parts per million of lead (dry basis) to the compost derived from 5 tons of refuse. New York's lead standard for Class I compost is 250 parts per million. The estimate of 86 parts per million is based on the solder being 40-percent lead, the refuse being 30-percent moisture, and the 5 tons of refuse yielding one third as much compost (both refuse and compost on a dry basis). Because the size-reduction process at Bedminster Bioconversion composting facilities does not include violent shredding, it is unlikely that all of the solder would become part of the compost from a Bedminster facility.

The copper in the metal category included at least 35 pennies, 6 dimes and a quarter.

In Table 3-2, the 90-percent confidence interval for lead extends to zero. This does not mean it is possible that the residential refuse sent to Marlboro contained no lead. The fact that the confidence interval extends to zero is an indication that the standard statistical formulas do not work well for waste categories that appear in only a few samples. The means for these waste categories are low compared to their statistical variability, so the confidence intervals for these categories are large compared to their means. Because the means are low, the large confidence intervals may extend to zero, or even below zero.

No lead-acid batteries were found in the samples. Other types of batteries are addressed in Sections 3.3.3 and 3.3.4.

3.3.2.2 Subcategories of "Other Nondegradables"

The great majority of the insulated wiring was copper wiring. Almost all of the electronics, other electrical devices, and insulated wiring are large enough to be pulled out or screened out during either the material preparation or compost refinement process.

The majority of the light bulbs in the samples were broken, and the broken glass could not be recovered for weighing with the light bulbs. This reduced the result for this subcategory significantly.

A significant portion of the gypsum board category could break down into pieces small enough to be included in the compost. On the other hand, the facility operator might prefer to pull the gypsum board out prior to composting to remove the potential for the sulfur in the gypsum to cause odor problems. Gypsum is hydrous calcium sulfate, which is 18.6 percent sulfur by weight.

Batteries are addressed in sections 3.3.3 and 3.3.4.

The 90-percent confidence interval for fluorescent tubes in Table 3-2 begins and ends at zero. This does not mean the residential refuse sent to Marlboro contained no fluorescent tubes. It means only that the 11 tons of sorted refuse contained no fluorescent tubes. Because none of the 70 sorted samples contained a fluorescent tube, the variability among the samples in each season was zero and the statistical confidence interval is zero. This is another illustration of the fact that statistics are not reality. Rather, statistics are a mathematical tool used to estimate how close to reality the results of a study are likely to be. Although we know there are fluorescent tubes in residential refuse, the results of this study indicate that their number is small.

3.3.3 Results of Examination of Bottom Fines

The bottom fines are the small pieces of waste that fall through the half-inch mesh ("hardware cloth") mounted 1.5 inches above the bottom of each sorting box. The CDM field supervisor thoroughly stirred and sifted through the bottom fines from each sample using a pair of permanent disk-shaped magnets approximately 2 inches in diameter (one magnet in each hand). The purpose of this exercise was to find objects that could contaminate compost.

Eight button batteries were found in the bottom fines. Button batteries are the very small batteries used in watches, calculators and hearing aids. They are magnetic and were found on the magnets used to stir the fines. Seven of the button batteries appear to be of the silver oxide type and the seventh is a zinc-air battery. It is significant that no mercury (mercuric oxide) batteries were found. Battery manufacturers have discontinued many mercuric oxide batteries.

No other objects with particular significance for composting were found in the bottom fines.

3.3.4 Overall Results for Batteries

Table 3-3 presents an accounting of the loose batteries found in the 11 tons of refuse sorted during the 5 days of field work. Sixty-eight percent of the 304 batteries found were AA batteries of the alkaline and zinc-carbon types.

In New York State, the particle size of Class I compost must not exceed 10 millimeters (0.39 inches). The diameter of AA, C, D and 9-volt batteries, as well as the nickel-cadmium and "other" batteries shown in Table 3-3, is 0.5 inches or greater, and the batteries do not degrade during composting. Therefore, none of these batteries should be present in compost qualifying as Class I. Most of the AAA batteries should be screened out as well.

If not screened out, the nickel-cadmium batteries could contribute 7 parts per million of cadmium (dry basis) to the compost derived from 5 tons of refuse. New York's cadmium standard for Class I compost is 10 parts per million on a dry basis. The estimate of 7 parts per million is based on the batteries being 17.5-percent cadmium, the refuse being 30-percent moisture, and the 5 tons of refuse yielding one third as much compost (both refuse and compost on a dry basis). It is unlikely that the three nickel-cadmium batteries, which were combined in one plastic-wrapped battery pack, would not be screened out of the compost.

3.3.5 Summary of Results

Table 3-4 summarizes the results of the primary and secondary sorting. Each value in Table 3-4 is the same as the corresponding value in Table 3-1 or Table 3-2.

Table 3-3
Loose Batteries Found in the Sorted Refuse

Configuration	Total number	Number per ton of refuse	Percent of total number of batteries found	Average weight (lbs)	Total weight (lbs)	Weight per ton of refuse (lbs)	Percent of total weight of batteries
AAA	27	2.5	8.9%	0.026	0.71	0.065	3.0%
AA	207	18.9	67.9%	0.05	10.4	0.94	44.0%
C	24	2.2	7.9%	0.15	3.6	0.33	15.3%
D	23	2.1	7.5%	0.31	7.2	0.66	30.5%
9V	14	1.3	4.6%	0.096	1.3	0.12	5.7%
3x1.2V NiCd	1	0.091	0.33%	0.094	0.094	0.0085	0.40%
Button	8	0.7	2.6%	0.0026	0.021	0.0019	0.089%
Other	1	0.091	0.33%	0.24	0.24	0.022	1.0%
Total	305	27.8	100.0%	---	23.5	2.1	100.0%

Table 3-4
Summary of Results

Waste category	Average percentage in the 70 samples	90% confidence interval
Paper	32.1%	31.0% to 33.1%
Food waste	15.9%	15.0% to 16.8%
Yard waste	1.6%	0.94% to 2.3%
Other degradables	6.0%	5.3% to 6.7%
All degradables	55.5%	54.1% to 56.9%
Bulk wood	3.4%	2.8% to 4.0%
Plastic	15.4%	14.8% to 16.1%
Textiles	5.3%	4.4% to 6.2%
Glass and ceramics	3.3%	2.8% to 3.8%
Metal		
Aluminum	0.75%	0.67% to 0.83%
Brass[1]	0.039%	0.024% to 0.055%
Copper	0.0047%	0.0014% to 0.0080%
Lead	0.0020%	0.000% to 0.0045%
Pot metal[2]	0.010%	0.0027% to 0.018%
Ferrous	2.3%	2.1% to 2.6%
Total metal	3.1%	2.9% to 3.4%
Large composite items	1.0%	0.084% to 1.9%
Nondegradable fines	3.5%	2.7% to 4.2%
Other nondegradables		
Electronics	0.52%	0.25% to 0.80%
Other electrical devices	0.70%	0.35% to 1.0%
Insulated wiring	0.10%	0.046% to 0.16%
Light bulbs	0.046%	0.021% to 0.071%
Fluorescent tubes	0.00%	0.00% to 0.00%
Gypsum board	1.3%	0.68% to 1.9%
Batteries	0.11%	0.085% to 0.13%
Other	2.4%	1.4% to 3.3%
All "other nondegradables"	5.1%	3.9% to 6.3%
All nondegradables	40.2%	38.7% to 41.6%
Unclassifiable fines	4.3%	4.0% to 4.7%
Total	100.0%	---

[1]Alloys of copper and zinc with some lead
[2]Primarily zinc

Table A-1
List of Collection Routes and Selection of Routes to Include in Study

CDM route desig-nation	Section in which route ends	Section in which route begins, if different	Day of week	Date	Primary over-lapping route	Overlap with primary over-lapping route[1]	Other over-lapping route	Overlap with other over-lapping route[1]	CDM desig-nation of distinct routes[2]	Include in study? 1 = yes 0 = no	Use as alternate? 1 = yes 0 = no
1	21	---	Mon	2/26/2001	---	---	---	---	1	0	0
2	21	---	Mon	2/26/2001	---	---	---	---	2	0	1
3	21	---	Mon	2/26/2001	---	---	---	---	3	1	0
4	21	---	Mon	2/26/2001	---	---	---	---	4	0	0
5	21	---	Mon	2/26/2001	---	---	---	---	5	1	0
6	21	22	Mon	2/26/2001	---	---	---	---	6	0	0
7	21	---	Tue	2/27/2001	---	---	---	---	7	0	1
8	21	---	Tue	2/27/2001	---	---	---	---	8	1	0
9	21	---	Tue	2/27/2001	---	---	---	---	9	0	0
10	21	---	Tue	2/27/2001	---	---	---	---	10	1	0
11	21	24	Tue	2/27/2001	---	---	---	---	11	0	0
12	21	---	Wed	2/28/2001	---	---	---	---	12	1	0
13	21	---	Wed	2/28/2001	---	---	---	---	13	0	0
14	21	---	Wed	2/28/2001	---	---	---	---	14	0	0
15	21	---	Wed	2/28/2001	---	---	---	---	15	1	0
16	21	---	Wed	2/28/2001	---	---	---	---	16	0	0
17	21	---	Thu	3/1/2001	1	79%	---	---	1	1	0
18	21	---	Thu	3/1/2001	2	91%	---	---	2	0	1
19	21	---	Thu	3/1/2001	3	62%	---	---	3	0	0
20	21	---	Thu	3/1/2001	4	75%	---	---	4	1	0
21	21	---	Fri	3/2/2001	7	85%	---	---	7	0	0
22	21	---	Fri	3/2/2001	8	97%	---	---	8	0	0
23	21	---	Fri	3/2/2001	9	100%	---	---	9	0	0
24	21	---	Fri	3/2/2001	10	81%	---	---	10	0	0
25	21	---	Sat	2/24/2001	12	87%	---	---	12	0	0
26	21	---	Sat	2/24/2001	13	75%	---	---	13	1	0
27	21	---	Sat	2/24/2001	15	79%	---	---	15	0	0
28	21	---	Sat	2/24/2001	16	90%	---	---	16	1	0
Total	---	---	---	---	---	---	---	---	---	10	3

Table A-1, continued
List of Collection Routes and Selection of Routes to Include in Study

CDM route designation	Section in which route ends	Section in which route begins, if different	Day of week	Date	Primary overlapping route	Overlap with primary overlapping route[1]	Other overlapping route	Overlap with other overlapping route[1]	CDM designation of distinct routes[2]	Include in study? 1 = yes 0 = no	Use as alternate? 1 = yes 0 = no
29	22	---	Mon	2/26/2001	---	---	---	---	17	0	0
30	22	---	Mon	2/26/2001	---	---	---	---	18	0	0
31	22	---	Mon	2/26/2001	---	---	---	---	19	1	0
32	22	---	Mon	2/26/2001	---	---	---	---	20	0	0
33	22	---	Tue	2/27/2001	---	---	---	---	21	0	0
34	22	---	Tue	2/27/2001	---	---	---	---	22	1	0
35	22	---	Tue	2/27/2001	---	---	---	---	23	0	0
36	22	---	Tue	2/27/2001	---	---	---	---	24	0	0
37	22	---	Tue	2/27/2001	---	---	---	---	25	1	0
38	22	---	Wed	2/28/2001	---	---	---	---	26	1	0
39	22	---	Wed	2/28/2001	---	---	---	---	27	0	0
40	22	---	Wed	2/28/2001	---	---	---	---	28	1	0
41	22	---	Wed	2/28/2001	---	---	---	---	29	0	0
42	22	---	Wed	2/28/2001	---	---	---	---	30	0	0
43	22	---	Wed	2/28/2001	---	---	---	---	31	1	0
44	22	---	Thu	3/1/2001	6	41%	---	---	32	0	1
45	22	---	Thu	3/1/2001	30	76%	---	---	18	1	0
46	22	---	Thu	3/1/2001	31	88%	---	---	19	0	0
47	22	---	Fri	3/2/2001	33	79%	---	---	21	0	0
48	22	---	Fri	3/2/2001	35	41%	34	36%	22/23	0	0
49	22	---	Fri	3/2/2001	36	63%	35	37%	24	0	0
50	22	---	Sat	2/24/2001	39	75%	38	8%	27	1	0
51	22	---	Sat	2/24/2001	40	61%	---	---	28	0	0
52	22	---	Sat	2/24/2001	41	76%	---	---	29	0	1
53	22	---	Sat	2/24/2001	42	68%	---	---	30	1	0
Total	---	---	---	---	---	---	---	---	---	9	2

Table A-1, continued
List of Collection Routes and Selection of Routes to Include in Study

CDM route designation	Section in which route ends	Section in which route begins, if different	Day of week	Date	Primary over-lapping route	Overlap with primary over-lapping route[1]	Other over-lapping route	Overlap with other over-lapping route[1]	CDM desig-nation of distinct routes[2]	Include in study? 1 = yes 0 = no	Use as alternate? 1 = yes 0 = no
54	23	---	Mon	2/26/2001	---	---	---	---	33	0	0
55	23	---	Mon	2/26/2001	---	---	---	---	34	1	0
56	23	---	Mon	2/26/2001	---	---	---	---	35	0	1
57	23	---	Mon	2/26/2001	---	---	---	---	36	0	0
58	23	---	Mon	2/26/2001	---	---	---	---	37	0	0
59	23	---	Tue	2/27/2001	---	---	---	---	38	1	0
60	23	---	Tue	2/27/2001	---	---	---	---	39	0	0
61	23	---	Tue	2/27/2001	---	---	---	---	40	0	0
62	23	---	Tue	2/27/2001	---	---	---	---	41	1	0
63	23	---	Wed	2/28/2001	---	---	---	---	42	0	0
64	23	---	Wed	2/28/2001	---	---	---	---	43	0	1
65	23	---	Wed	2/28/2001	---	---	---	---	44	1	0
66	23	---	Wed	2/28/2001	---	---	---	---	45	0	0
67	23	---	Thu	3/1/2001	54	78%	---	---	33	1	0
68	23	---	Thu	3/1/2001	55	70%	---	---	34	0	0
69	23	---	Thu	3/1/2001	56	35%	---	---	46	1	0
70	23	---	Thu	3/1/2001	58	78%	57	22%	37	0	0
71	23	---	Fri	3/2/2001	59	100%	---	---	38	0	0
72	23	---	Fri	3/2/2001	60	100%	---	---	39	0	0
73	23	---	Fri	3/2/2001	61	100%	---	---	40	0	0
74	23	---	Fri	3/2/2001	62	100%	---	---	41	0	0
75	23	---	Sat	2/24/2001	63	79%	---	---	42	1	0
76	23	---	Sat	2/24/2001	64	81%	---	---	43	0	0
77	23	---	Sat	2/24/2001	66	79%	65	27%	45	1	0
Total	---	---	---	---	---	---	---	---	---	8	2

Table A-1, continued
List of Collection Routes and Selection of Routes to Include in Study

CDM route desig-nation	Section in which route ends	Section in which route begins, if different	Day of week	Date	Primary over-lapping route	Overlap with primary over-lapping route[1]	Other over-lapping route	Overlap with other over-lapping route[1]	CDM desig-nation of distinct routes[2]	Include in study? 1 = yes 0 = no	Use as alternate? 1 = yes 0 = no
78	24	---	Mon	2/26/2001	---	---	---	---	47	0	0
79	24	---	Mon	2/26/2001	---	---	---	---	48	1	0
80	24	---	Mon	2/26/2001	---	---	---	---	49	0	0
81	24	---	Mon	2/26/2001	---	---	---	---	50	1	0
82	24	---	Mon	2/26/2001	---	---	---	---	51	0	0
83	24	---	Mon	2/26/2001	---	---	---	---	52	1	0
84	24	---	Mon	2/26/2001	---	---	---	---	53	0	0
85	24	---	Tue	2/27/2001	---	---	---	---	54	0	0
86	24	---	Tue	2/27/2001	---	---	---	---	55	0	1
87	24	---	Tue	2/27/2001	---	---	---	---	56	1	0
88	24	---	Wed	2/28/2001	---	---	---	---	57	0	0
89	24	---	Wed	2/28/2001	---	---	---	---	58	1	0
90	24	---	Wed	2/28/2001	---	---	---	---	59	0	0
91	24	---	Wed	2/28/2001	---	---	---	---	60	0	1
92	24	---	Thu	3/1/2001	78	95%	---	---	47	1	0
93	24	---	Thu	3/1/2001	79	94%	---	---	48	0	0
94	24	---	Thu	3/1/2001	80	96%	---	---	49	1	0
95	24	---	Thu	3/1/2001	81	74%	---	---	50	0	0
96	24	---	Thu	3/1/2001	82	84%	---	---	51	1	0
97	24	---	Thu	3/1/2001	83	89%	---	---	52	0	0
98	24	---	Fri	3/2/2001	85	100%	---	---	54	0	0
99	24	---	Fri	3/2/2001	86	100%	---	---	55	0	0
100	24	---	Fri	3/2/2001	87	100%	---	---	56	0	0
101	24	22	Fri	3/2/2001	37	50%	---	---	37	0	0
102	24	---	Sat	2/24/2001	88	75%	---	---	57	1	0
103	24	---	Sat	2/24/2001	89	81%	---	---	58	0	0
104	24	---	Sat	2/24/2001	90	85%	---	---	59	1	0
105	24	22	Sat	2/24/2001	91	24%	43	8%	61	0	1
Total	---	---	---	---	---	---	---	---	---	10	3

Monday total	7	2
Tuesday total	7	2
Wednesday total	7	2
Thursday total	8	2
Friday total	0	0
Saturday total	8	2
Total for week	37	10

[1]This is the number of lines in the route description that match lines in the description of the overlapping route, divided by the total number of lines in the route description.

[2]A route is counted as distinct if more than half of the lines in its description are not found in the description of any other route.

Table B-1
Pounds of Each Primary Waste Category in Each Sample

Sample number	Waste collection date	Sampling & sorting date	Section	Route	Truck number	Paper	Food waste	Yard waste	Other degradables	Bulk wood	Plastic	Textiles	Glass & ceramics	Metal	Large composites	Nondegradable fines	Other nondegradables	Unclassifiable fines	Total
1	2/24/2001	2/26/2001	24	3	25BR245	81.8	44.0	0.0	9.9	17.6	30.8	12.5	3.3	10.8	0.0	11.4	1.9	4.7	228.7
2	2/24/2001	2/26/2001	24	3	25BR245	103.4	58.3	0.9	17.2	29.1	40.4	12.8	5.7	20.8	0.0	19.3	17.0	3.5	328.4
3	2/24/2001	2/26/2001	22	4	25CN362	70.1	46.5	2.1	27.1	19.8	44.9	0.0	9.3	6.5	0.0	18.4	9.3	10.3	264.3
4	2/24/2001	2/26/2001	22	4	25CN362	88.3	35.8	55.7	13.5	3.7	64.1	7.7	33.9	10.6	0.0	28.9	49.6	14.8	406.6
5	2/24/2001	2/26/2001	21	2	25CF179	92.4	69.8	0.3	27.0	32.2	46.1	32.6	9.5	5.8	0.0	8.7	17.0	6.8	348.2
6	2/24/2001	2/26/2001	21	2	25CF179	82.5	30.1	0.0	26.2	2.8	37.8	17.6	2.5	7.7	0.0	15.0	21.7	1.4	245.3
7	2/24/2001	2/26/2001	24	1	25CF167	117.1	60.6	0.0	14.8	7.1	45.5	15.0	12.1	11.2	0.0	4.7	34.5	12.7	335.3
8	2/24/2001	2/26/2001	24	1	25CF167	96.7	53.4	0.1	5.1	10.1	57.5	8.9	12.1	12.3	0.0	1.6	37.5	13.2	308.5
9	2/24/2001	2/26/2001	23	3	25CN040	100.7	56.4	0.0	20.4	8.0	49.7	20.3	12.3	6.6	0.0	11.6	5.5	12.1	305.6
10	2/24/2001	2/26/2001	23	3	25CN040	109.7	32.3	31.9	12.5	7.6	42.0	11.6	16.2	17.8	0.0	6.2	15.4	16.1	319.3
11	2/24/2001	2/26/2001	22	1	25BR170	126.4	81.0	0.0	55.2	34.3	57.4	38.6	20.9	11.0	0.0	14.1	1.4	17.1	457.4
12	2/24/2001	2/26/2001	23	1	25CN056	101.3	43.8	0.0	39.8	4.9	44.8	5.4	16.1	6.2	0.0	11.7	2.6	10.5	287.1
13	2/24/2001	2/26/2001	23	1	25CN056	95.5	47.9	16.2	23.3	11.9	32.3	3.0	13.4	8.4	0.0	6.8	8.8	11.8	279.3
14	2/24/2001	2/26/2001	21	4	25CF181	94.6	28.4	30.5	8.5	5.6	44.1	19.4	5.4	6.7	9.6	5.9	8.3	6.3	273.3
15	2/26/2001	2/27/2001	24	6	25BF781	205.4	96.8	0.7	15.8	10.0	104.4	31.1	9.6	14.4	0.0	29.0	8.6	28.9	554.7
16	2/26/2001	2/27/2001	24	6	25BF781	168.0	109.0	0.0	0.0	8.7	91.2	10.6	6.2	16.6	0.0	2.0	12.4	30.2	454.9
17	2/26/2001	2/27/2001	22	3	25BR170	144.9	68.1	0.0	72.1	46.3	60.9	7.2	3.6	31.9	0.0	14.3	3.6	27.7	480.6
18	2/26/2001	2/27/2001	22	3	25BR170	77.9	34.0	0.8	10.3	16.3	49.7	11.8	19.5	11.6	0.0	10.2	4.3	12.1	258.5
19	2/26/2001	2/27/2001	21	5	25BR288	174.1	57.9	0.0	21.0	6.1	72.6	44.7	5.2	15.4	0.0	5.7	14.7	29.9	447.3
20	2/26/2001	2/27/2001	21	5	25BR288	192.5	95.8	2.7	43.8	0.5	88.9	6.3	16.6	16.4	0.0	19.1	50.9	29.1	562.6
21	2/26/2001	2/27/2001	23	2	25CN056	173.4	77.5	1.0	53.2	4.8	111.0	12.0	22.8	14.0	0.0	8.3	9.2	30.6	517.8
22	2/26/2001	2/27/2001	23	2	25CN056	151.1	99.1	0.1	32.8	1.0	77.4	8.5	5.0	11.6	0.0	5.4	5.6	22.0	419.6
23	2/26/2001	2/27/2001	24	4	25BR302	144.0	68.7	0.0	24.8	3.2	74.5	11.2	10.2	14.7	5.6	6.3	14.4	16.9	394.5
24	2/26/2001	2/27/2001	24	4	25BR302	143.8	48.8	2.8	14.6	18.4	64.0	9.3	18.8	14.3	72.8	16.7	16.0	15.3	455.6
25	2/26/2001	2/27/2001	24	2	25CF101	70.1	35.0	0.0	9.8	17.0	21.7	6.7	3.4	4.7	0.0	3.0	3.1	12.1	186.6
26	2/26/2001	2/27/2001	24	2	25CF101	75.8	21.9	0.1	4.4	4.1	29.0	17.7	3.9	3.8	0.0	0.3	19.1	7.4	187.5
27	2/26/2001	2/27/2001	21	3	25BR286	60.5	11.4	0.0	6.8	4.9	23.4	16.2	1.7	3.4	0.0	21.8	4.5	7.3	161.9
28	2/26/2001	2/27/2001	21	3	25BR286	77.5	47.3	16.8	13.5	14.3	52.9	11.8	8.8	24.9	0.0	1.0	35.4	31.3	335.5
29	2/27/2001	2/28/2001	24	3	25CF101	65.5	47.1	0.0	27.6	6.3	48.2	46.0	5.3	10.0	0.0	1.0	4.6	10.9	272.5
30	2/27/2001	2/28/2001	24	3	25CF101	62.1	24.4	1.3	16.4	2.0	21.9	7.8	4.1	8.0	0.0	1.5	0.9	5.1	155.5
31	2/27/2001	2/28/2001	23	1	25CN018	36.0	10.6	13.0	2.2	4.8	20.4	6.1	1.8	1.7	0.0	0.8	3.6	2.2	103.2
32	2/27/2001	2/28/2001	23	1	25CN018	62.5	20.7	0.0	10.4	1.7	29.6	1.5	6.4	4.7	15.8	0.9	12.3	7.1	173.6
33	2/27/2001	2/28/2001	21	4	25CF179	73.1	23.2	0.0	5.8	13.6	46.6	11.5	22.6	11.4	0.0	0.1	6.7	7.2	221.8
34	2/27/2001	2/28/2001	21	4	25CF179	123.7	62.8	2.6	15.0	17.6	37.4	8.9	37.2	6.9	0.0	3.2	2.4	20.1	337.8
35	2/27/2001	2/28/2001	21	2	25CN362	109.5	41.2	8.0	19.7	7.8	36.2	30.9	6.7	11.0	0.0	5.0	2.1	16.9	295.0
36	2/27/2001	2/28/2001	21	2	25CN362	109.9	27.5	29.6	13.0	10.6	41.0	6.4	10.4	6.7	0.0	8.6	57.4	23.4	344.5
37	2/27/2001	2/28/2001	22	5	25BR170	81.2	38.3	2.0	4.5	0.3	39.5	13.1	5.8	24.2	0.0	55.5	0.6	13.6	278.6
38	2/27/2001	2/28/2001	22	5	25BR170	74.2	38.9	0.8	19.7	20.8	32.8	8.7	8.9	10.3	0.0	23.5	12.8	11.5	262.9
39	2/27/2001	2/28/2001	23	4	25CN039	178.5	82.3	0.0	29.8	5.0	85.5	22.8	10.8	14.0	30.8	14.3	32.3	20.5	526.6
40	2/27/2001	2/28/2001	23	4	25CN039	101.1	39.6	1.4	6.6	0.0	25.9	31.6	4.6	3.9	0.0	4.9	14.3	9.1	243.0
41	2/27/2001	2/28/2001	22	2	25CF180	61.1	23.3	22.3	0.0	3.1	41.8	11.0	4.3	8.6	0.0	6.0	0.3	13.9	195.7
42	2/27/2001	2/28/2001	22	2	25CF180	76.8	40.9	0.0	18.7	17.1	32.7	14.9	3.6	8.8	0.0	10.0	35.6	11.3	270.4
43	2/28/2001	3/1/2001	24	2	25BR781	105.5	43.9	0.1	15.6	3.1	56.6	11.6	9.4	13.0	0.0	0.6	7.4	4.4	271.2
44	2/28/2001	3/1/2001	24	2	25BR781	107.3	82.2	0.8	19.5	2.1	40.1	3.4	8.0	11.6	0.0	7.3	19.0	9.4	310.7
45	2/28/2001	3/1/2001	22	3	25BR170	107.7	46.9	0.4	31.9	13.7	59.6	31.1	7.8	8.8	0.0	17.3	6.4	16.7	348.3
46	2/28/2001	3/1/2001	22	3	25BR170	132.9	59.0	0.0	28.3	10.9	47.9	11.9	8.4	9.8	0.0	9.6	9.3	9.4	337.4
47	2/28/2001	3/1/2001	21	4	25BR166	106.4	55.8	2.8	27.5	4.9	50.4	4.3	15.2	8.4	0.0	8.8	5.4	12.0	301.9
48	2/28/2001	3/1/2001	21	4	25BR166	109.4	84.7	0.1	14.2	8.5	60.4	10.8	7.0	8.8	0.0	3.7	6.9	10.3	324.8
49	2/28/2001	3/1/2001	22	6	25CN056	68.2	33.0	0.1	24.2	2.6	39.0	7.1	33.0	5.4	0.0	0.6	5.7	12.3	231.2
50	2/28/2001	3/1/2001	22	6	25CN056	118.2	77.6	2.0	21.5	8.2	43.5	10.5	4.9	8.2	0.0	14.9	2.1	17.7	329.3
51	2/28/2001	3/1/2001	23	3	25CN018	74.6	48.0	0.3	15.8	1.3	33.2	13.7	4.6	5.3	0.0	1.0	63.6	4.3	265.7
52	2/28/2001	3/1/2001	23	3	25CN018	91.8	24.2	0.0	6.1	0.0	26.2	2.4	15.6	4.7	0.0	13.5	101.6	12.8	298.9
53	2/28/2001	3/1/2001	21	1	25BR289	85.2	65.5	1.5	21.6	14.8	62.6	41.1	10.9	9.7	0.0	12.4	3.3	13.2	341.8
54	2/28/2001	3/1/2001	21	1	25BR289	95.8	59.3	0.0	36.2	8.1	47.9	21.6	5.7	11.1	0.0	11.2	8.3	21.4	325.6
55	2/28/2001	3/1/2001	22	1	25CN226	109.4	43.6	0.2	12.3	11.6	60.2	43.7	3.3	9.7	158.3	6.1	7.6	16.1	482.1
56	2/28/2001	3/1/2001	22	1	25CN226	120.7	54.0	0.0	19.6	14.7	54.1	19.2	3.3	10.0	0.0	10.4	8.5	23.3	337.8
57	3/1/2001	3/2/2001	24	5	25CF004	37.4	23.4	0.2	10.7	6.2	23.0	21.7	5.2	2.9	0.0	18.5	2.0	4.6	155.8
58	3/1/2001	3/2/2001	24	1	25BR781	67.1	19.5	0.8	5.7	5.5	34.6	2.6	2.8	4.4	0.0	3.1	3.1	7.0	156.2
59	3/1/2001	3/2/2001	23	1	25BR245	86.8	40.1	0.0	4.8	40.5	60.5	23.5	18.3	3.5	0.0	4.9	26.4	12.3	321.6
60	3/1/2001	3/2/2001	21	1	25CN406	72.5	63.5	14.0	22.1	26.5	31.6	9.4	10.7	6.1	0.0	5.7	56.9	10.5	329.5
61	3/1/2001	3/2/2001	24	3	25BR302	80.4	46.3	0.2	5.3	5.5	76.0	8.2	5.8	11.7	0.0	59.2	5.3	7.3	311.2
62	3/1/2001	3/2/2001	23	3	25CN040	132.4	104.3	0.2	22.9	5.3	61.1	32.7	14.8	16.3	0.0	5.5	3.8	16.7	416.0
63	3/1/2001	3/2/2001	21	4	25CF181	74.4	28.8	0.0	20.1	35.0	27.2	6.4	3.8	10.3	0.0	24.6	29.2	14.7	274.5
64	3/1/2001	3/2/2001	21	2	25CF006	91.9	46.5	7.9	18.2	4.5	39.6	14.2	12.8	8.6	0.0	7.7	2.9	9.2	264.0
65	3/1/2001	3/2/2001	24	5	25CF004	91.7	92.2	7.7	17.2	6.5	37.7	101.3	8.2	6.4	0.0	2.4	9.6	10.4	391.3
66	3/1/2001	3/2/2001	24	1	25BR781	83.0	72.9	0.0	15.2	4.4	35.8	33.5	4.0	6.0	0.0	17.2	15.0	12.7	299.7
67	3/1/2001	3/2/2001	23	1	25BR245	96.3	57.8	0.1	9.5	6.2	52.7	23.3	8.4	7.2	0.0	4.9	21.3	10.5	298.2
68	3/1/2001	3/2/2001	21	1	25CN406	85.3	47.2	31.2	20.4	18.9	48.6	3.2	11.0	7.2	0.0	7.5	72.3	20.1	372.9
69	3/1/2001	3/2/2001	23	3	25CN040	59.6	33.6	3.2	40.3	2.0	46.1	3.1	1.7	3.7	0.0	7.0	6.5	12.8	219.6
70	3/1/2001	3/2/2001	21	4	25CF181	46.1	15.5	3.7	6.4	0.0	20.0	3.3	10.6	3.1	0.0	4.7	4.4	13.1	130.9
Total						6,973	3,552	321	1,325	733	3,375	1,151	696	692	293	733	1,132	960	21,934
Mean (Average)						99.6	50.7	4.6	18.9	10.5	48.2	16.4	9.9	9.9	4.2	10.5	16.2	13.7	313

Table B-2
Percentage of Each Primary Waste Category in Each Sample

Sample number	Waste collection date	Sampling & sorting date	Section	Route	Truck number	Paper	Food waste	Yard waste	Other degradables	Bulk wood	Plastic	Textiles	Glass & ceramics	Metal	Large composites	Nondegradable fines	Other nondegradables	Unclassifiable fines	Total
1	2/24/2001	2/26/2001	24	3	25BR245	35.8%	19.2%	0.0%	4.3%	7.7%	13.5%	5.5%	1.4%	4.7%	0.0%	5.0%	0.7%	2.1%	99.9%
2	2/24/2001	2/26/2001	24	3	25BR245	31.5%	17.8%	0.3%	5.2%	8.9%	12.3%	3.9%	1.7%	6.3%	0.0%	5.9%	5.2%	1.1%	100.0%
3	2/24/2001	2/26/2001	22	4	25CN362	26.5%	17.6%	0.8%	10.3%	7.5%	17.0%	0.0%	3.5%	2.5%	0.0%	7.0%	3.4%	3.9%	99.9%
4	2/24/2001	2/26/2001	22	4	25CN362	21.7%	8.8%	13.7%	3.3%	0.9%	15.8%	1.9%	8.3%	2.6%	0.0%	7.1%	12.2%	3.6%	100.0%
5	2/24/2001	2/26/2001	21	2	25CF179	26.5%	20.0%	0.1%	7.8%	9.2%	13.2%	9.4%	2.7%	1.7%	0.0%	2.5%	4.9%	2.0%	100.0%
6	2/24/2001	2/26/2001	21	2	25CF179	33.6%	12.3%	0.0%	10.7%	1.1%	15.4%	7.2%	1.0%	3.1%	0.0%	6.1%	8.9%	0.6%	100.1%
7	2/24/2001	2/26/2001	24	1	25CF167	34.9%	18.1%	0.0%	4.4%	2.1%	13.6%	4.5%	3.6%	3.3%	0.0%	1.4%	10.3%	3.8%	100.0%
8	2/24/2001	2/26/2001	24	1	25CF167	31.3%	17.3%	0.0%	1.7%	3.3%	18.6%	2.9%	3.9%	4.0%	0.0%	0.5%	12.2%	4.3%	100.0%
9	2/24/2001	2/26/2001	23	3	25CN040	33.0%	19.1%	0.0%	6.7%	2.6%	16.3%	6.6%	4.0%	2.2%	0.0%	3.8%	1.8%	4.0%	100.0%
10	2/24/2001	2/26/2001	23	3	25CN040	34.4%	10.1%	10.0%	3.9%	2.4%	13.2%	3.6%	5.1%	5.6%	0.0%	1.9%	4.9%	5.0%	100.0%
11	2/24/2001	2/26/2001	22	1	25BR170	27.6%	17.7%	0.0%	12.1%	7.5%	12.5%	8.4%	4.6%	2.4%	0.0%	3.1%	0.3%	3.7%	100.0%
12	2/24/2001	2/26/2001	23	1	25CN056	35.3%	15.3%	0.0%	13.9%	1.7%	15.6%	1.9%	5.6%	2.2%	0.0%	4.1%	0.9%	3.7%	100.0%
13	2/24/2001	2/26/2001	23	1	25CN056	34.2%	17.2%	5.8%	8.3%	4.3%	11.6%	1.1%	4.8%	3.0%	0.0%	2.4%	3.2%	4.2%	100.0%
14	2/24/2001	2/26/2001	21	4	25CF181	34.6%	10.4%	11.2%	3.1%	2.0%	16.1%	7.1%	2.0%	2.5%	3.5%	2.2%	3.0%	2.3%	100.0%
15	2/26/2001	2/27/2001	24	6	25BF781	37.0%	17.5%	0.1%	2.8%	1.8%	18.8%	5.6%	1.7%	2.6%	0.0%	5.2%	1.6%	5.2%	100.0%
16	2/26/2001	2/27/2001	24	6	25BF781	36.9%	24.0%	0.0%	0.0%	1.9%	20.1%	2.3%	1.4%	3.6%	0.0%	0.4%	2.7%	6.6%	100.0%
17	2/26/2001	2/27/2001	22	3	25BR170	30.1%	14.2%	0.0%	15.0%	9.6%	12.7%	1.5%	0.7%	6.6%	0.0%	3.0%	0.7%	5.8%	100.0%
18	2/26/2001	2/27/2001	22	3	25BR170	30.1%	13.2%	0.3%	4.0%	6.3%	19.2%	4.6%	7.5%	4.5%	0.0%	3.9%	1.7%	4.7%	100.0%
19	2/26/2001	2/27/2001	21	5	25BR288	38.9%	12.9%	0.0%	4.7%	1.4%	16.2%	10.0%	1.2%	3.4%	0.0%	1.3%	3.3%	6.7%	100.0%
20	2/26/2001	2/27/2001	21	5	25BR288	34.2%	17.0%	0.5%	7.8%	0.1%	15.8%	1.1%	3.0%	2.9%	0.0%	3.4%	9.0%	5.2%	100.0%
21	2/26/2001	2/27/2001	23	2	25CN056	33.5%	15.0%	0.2%	10.3%	0.9%	21.4%	2.3%	4.4%	2.7%	0.0%	1.6%	1.8%	5.9%	100.0%
22	2/26/2001	2/27/2001	23	2	25CN056	36.0%	23.6%	0.0%	7.8%	0.2%	18.4%	2.0%	1.2%	2.8%	0.0%	1.3%	1.3%	5.2%	100.0%
23	2/26/2001	2/27/2001	24	4	25BR302	36.5%	17.4%	0.0%	6.3%	0.8%	18.9%	2.8%	2.6%	3.7%	1.4%	1.6%	3.6%	4.3%	100.0%
24	2/26/2001	2/27/2001	24	4	25BR302	31.6%	10.7%	0.6%	3.2%	4.0%	14.0%	2.0%	4.1%	3.1%	16.0%	3.7%	3.5%	3.4%	100.0%
25	2/26/2001	2/27/2001	24	2	25CF101	37.6%	18.8%	0.0%	5.3%	9.1%	11.6%	3.6%	1.8%	2.5%	0.0%	1.6%	1.7%	6.5%	100.0%
26	2/26/2001	2/27/2001	24	2	25CF101	40.4%	11.7%	0.1%	2.3%	2.2%	15.5%	9.4%	2.1%	2.0%	0.0%	0.2%	10.2%	3.9%	100.0%
27	2/26/2001	2/27/2001	21	3	25BR286	37.4%	7.0%	0.0%	4.2%	3.0%	14.5%	10.0%	1.0%	2.1%	0.0%	13.5%	2.6%	4.5%	99.8%
28	2/26/2001	2/27/2001	21	3	25BR286	23.1%	14.1%	5.0%	4.0%	4.3%	15.8%	3.5%	2.6%	7.4%	0.0%	0.3%	10.6%	9.3%	100.0%
29	2/27/2001	2/28/2001	24	3	25CF101	24.0%	17.3%	0.0%	10.1%	2.3%	17.7%	16.9%	1.9%	3.7%	0.0%	0.4%	1.8%	4.0%	100.2%
30	2/27/2001	2/28/2001	24	3	25CF101	39.9%	15.7%	0.8%	10.5%	1.3%	14.1%	5.0%	2.6%	5.1%	0.0%	1.0%	0.6%	3.3%	100.0%
31	2/27/2001	2/28/2001	23	1	25CN018	34.9%	10.3%	12.6%	2.1%	4.6%	19.8%	5.9%	1.7%	1.7%	0.0%	0.8%	3.5%	2.1%	100.0%
32	2/27/2001	2/28/2001	23	1	25CN018	36.0%	11.9%	0.0%	6.0%	1.0%	17.1%	0.9%	3.7%	2.7%	9.1%	0.5%	7.1%	4.1%	100.0%
33	2/27/2001	2/28/2001	21	4	25CF179	33.0%	10.5%	0.0%	2.6%	6.1%	21.0%	5.2%	10.2%	5.1%	0.0%	0.0%	3.0%	3.2%	100.0%
34	2/27/2001	2/28/2001	21	4	25CF179	36.6%	18.6%	0.8%	4.4%	5.2%	11.1%	2.6%	11.0%	2.0%	0.0%	0.9%	0.7%	6.0%	100.0%
35	2/27/2001	2/28/2001	21	2	25CN362	37.1%	14.0%	2.7%	6.7%	2.6%	12.3%	10.5%	2.3%	3.7%	0.0%	1.7%	0.7%	5.7%	100.0%
36	2/27/2001	2/28/2001	21	2	25CN362	31.9%	8.0%	8.6%	3.8%	3.1%	11.9%	1.9%	3.0%	1.9%	0.0%	2.5%	16.7%	6.8%	100.0%
37	2/27/2001	2/28/2001	22	5	25BR170	29.1%	13.7%	0.7%	1.6%	0.1%	14.2%	4.7%	2.1%	8.7%	0.0%	19.9%	0.2%	4.9%	100.0%
38	2/27/2001	2/28/2001	22	5	25BR170	28.2%	14.8%	0.3%	7.5%	7.9%	12.5%	3.3%	3.4%	3.9%	0.0%	8.9%	4.9%	4.4%	100.0%
39	2/27/2001	2/28/2001	23	4	25CN039	33.9%	15.6%	0.0%	5.7%	0.9%	16.2%	4.3%	2.1%	2.7%	5.8%	2.7%	6.1%	3.9%	100.0%
40	2/27/2001	2/28/2001	23	4	25CN039	41.6%	16.3%	0.6%	2.7%	0.0%	10.7%	13.0%	1.9%	1.6%	0.0%	2.0%	5.9%	3.7%	100.0%
41	2/27/2001	2/28/2001	22	2	25CF180	31.2%	11.9%	11.4%	0.0%	1.6%	21.4%	5.6%	2.2%	4.4%	0.0%	3.1%	0.2%	7.1%	100.0%
42	2/27/2001	2/28/2001	22	2	25CF180	28.4%	15.1%	0.0%	6.9%	6.3%	12.1%	5.5%	1.3%	3.3%	0.0%	3.7%	13.2%	4.2%	100.0%
43	2/28/2001	3/1/2001	24	2	25BR781	38.9%	16.2%	0.0%	5.8%	1.1%	20.9%	4.3%	3.5%	4.8%	0.0%	0.2%	2.7%	1.6%	100.0%
44	2/28/2001	3/1/2001	24	2	25BR781	34.5%	26.5%	0.3%	6.3%	0.7%	12.9%	1.1%	2.6%	3.7%	0.0%	2.3%	6.1%	3.0%	100.0%
45	2/28/2001	3/1/2001	22	3	25BR170	30.9%	13.5%	0.1%	9.2%	3.9%	17.1%	8.9%	2.2%	2.5%	0.0%	5.0%	1.9%	4.8%	100.0%
46	2/28/2001	3/1/2001	22	3	25BR170	39.4%	17.5%	0.0%	8.4%	3.2%	14.2%	3.5%	2.5%	2.9%	0.0%	2.8%	2.8%	2.8%	100.0%
47	2/28/2001	3/1/2001	21	4	25BR166	35.2%	18.5%	0.9%	9.1%	1.6%	16.7%	1.4%	5.0%	2.8%	0.0%	2.9%	1.8%	4.0%	100.0%
48	2/28/2001	3/1/2001	21	4	25BR166	33.7%	26.1%	0.0%	4.4%	2.6%	18.6%	3.3%	2.2%	2.7%	0.0%	1.1%	2.2%	3.2%	100.0%
49	2/28/2001	3/1/2001	22	6	25CN056	29.5%	14.3%	0.0%	10.5%	1.1%	16.9%	3.1%	14.3%	2.3%	0.0%	0.3%	2.5%	5.3%	100.0%
50	2/28/2001	3/1/2001	22	6	25CN056	35.9%	23.6%	0.6%	6.5%	2.5%	13.2%	3.2%	1.5%	2.5%	0.0%	4.5%	0.6%	5.4%	100.0%
51	2/28/2001	3/1/2001	23	3	25CN018	28.1%	18.1%	0.1%	5.9%	0.5%	12.5%	5.2%	1.7%	2.0%	0.0%	0.4%	23.9%	1.6%	100.0%
52	2/28/2001	3/1/2001	23	3	25CN018	30.7%	8.1%	0.0%	2.0%	0.0%	8.8%	0.8%	5.2%	1.6%	0.0%	4.5%	34.0%	4.3%	100.0%
53	2/28/2001	3/1/2001	21	1	25BR289	24.9%	19.2%	0.4%	6.3%	4.3%	18.3%	12.0%	3.2%	2.8%	0.0%	3.6%	1.0%	3.9%	100.0%
54	2/28/2001	3/1/2001	21	1	25BR289	29.4%	18.2%	0.0%	10.8%	2.5%	14.7%	6.6%	1.8%	3.4%	0.0%	3.4%	2.5%	6.6%	100.0%
55	2/28/2001	3/1/2001	22	1	25CN226	22.7%	9.0%	0.0%	2.6%	2.4%	12.5%	9.1%	0.7%	2.0%	32.8%	1.3%	1.6%	3.3%	100.0%
56	2/28/2001	3/1/2001	22	1	25CN226	35.7%	16.0%	0.0%	5.8%	4.4%	16.0%	5.7%	1.0%	3.0%	0.0%	3.1%	2.5%	6.9%	100.0%
57	3/1/2001	3/2/2001	24	5	25CF004	24.0%	15.0%	0.1%	6.9%	4.0%	14.8%	13.9%	3.3%	1.9%	0.0%	11.9%	1.3%	3.0%	100.0%
58	3/1/2001	3/2/2001	24	1	25BR781	43.0%	12.5%	0.5%	3.6%	3.5%	22.2%	1.7%	1.8%	2.8%	0.0%	2.0%	2.0%	4.5%	100.0%
59	3/1/2001	3/2/2001	23	1	25BR245	27.0%	12.5%	0.0%	1.5%	12.6%	18.8%	7.3%	5.7%	1.1%	0.0%	1.5%	8.2%	3.8%	100.0%
60	3/1/2001	3/2/2001	21	1	25CN406	22.0%	19.3%	4.2%	6.7%	8.0%	9.6%	2.9%	3.2%	1.9%	0.0%	1.7%	17.3%	3.2%	100.0%
61	3/1/2001	3/2/2001	24	3	25BR302	25.8%	14.9%	0.1%	1.7%	1.8%	24.4%	2.6%	1.9%	3.8%	0.0%	19.0%	1.7%	2.3%	100.0%
62	3/1/2001	3/2/2001	23	3	25CN040	31.8%	25.1%	0.0%	5.5%	1.3%	14.7%	7.9%	3.6%	3.9%	0.0%	1.3%	0.9%	4.0%	100.0%
63	3/1/2001	3/2/2001	21	4	25CF181	27.1%	10.5%	0.0%	7.3%	12.8%	9.9%	2.3%	1.4%	3.8%	0.0%	9.0%	10.6%	5.4%	100.0%
64	3/1/2001	3/2/2001	21	2	25CF006	34.8%	17.6%	3.0%	6.9%	1.7%	15.0%	5.4%	4.8%	3.3%	0.0%	2.9%	1.1%	3.5%	100.0%
65	3/1/2001	3/2/2001	24	5	25CF004	23.4%	23.6%	2.0%	4.4%	1.7%	9.6%	25.9%	2.1%	1.6%	0.0%	0.6%	2.5%	2.7%	100.0%
66	3/1/2001	3/2/2001	24	1	25BR781	27.7%	24.3%	0.0%	5.1%	1.5%	11.9%	11.2%	1.3%	2.0%	0.0%	5.7%	5.0%	4.2%	100.0%
67	3/1/2001	3/2/2001	23	1	25BR245	32.3%	19.4%	0.0%	3.2%	2.1%	17.7%	7.8%	2.8%	2.4%	0.0%	1.6%	7.1%	3.5%	100.0%
68	3/1/2001	3/2/2001	21	1	25CN406	22.9%	12.7%	8.4%	5.5%	5.1%	13.0%	0.9%	2.9%	1.9%	0.0%	2.0%	19.4%	5.4%	100.0%
69	3/1/2001	3/2/2001	23	3	25CN040	27.1%	15.3%	1.5%	18.4%	0.9%	21.0%	1.4%	0.8%	1.7%	0.0%	3.2%	3.0%	5.8%	100.0%
70	3/1/2001	3/2/2001	21	4	25CF181	35.2%	11.8%	2.8%	4.9%	0.0%	15.3%	2.5%	8.1%	2.4%	0.0%	3.6%	3.3%	10.0%	99.9%
Mean (Average)						32.1%	15.9%	1.6%	6.0%	3.4%	15.4%	5.3%	3.3%	3.1%	1.0%	3.5%	5.1%	4.3%	100.0%
Std. Deviation						5.2%	4.5%	3.4%	3.5%	3.0%	3.4%	4.3%	2.5%	1.4%	4.5%	3.8%	6.0%	1.7%	---

Table B-3
Pounds of Each Secondary Waste Category in Metal and "Other Nondegradables"

Sample number	Waste collection date	Sampling & sorting date	Section	Route	Aluminum	Brass	Copper	Lead	Pot metal	Ferrous metal	Electronics	Other electrical devices	Insulated wiring	Light bulbs	Fluorescent tubes	Gypsum board	Batteries	Other "other nondegradables"
1	2/24/2001	2/26/2001	24	3	1.7	0.0	0.012	0.0	0.0	9.1	0.0	0.7	0.0	0.0	0.0	0.0	1.08	0.1
2	2/24/2001	2/26/2001	24	3	1.0	0.1	0.0	0.0	0.0	19.7	0.9	15.6	0.0	0.05	0.0	0.2	0.00	0.3
3	2/24/2001	2/26/2001	22	4	1.6	0.5	0.0	0.0	0.3	4.2	0.0	1.9	0.2	0.2	0.0	0.0	0.63	6.4
4	2/24/2001	2/26/2001	22	4	2.7	0.0	0.2	0.0	0.4	7.3	0.1	1.8	2.9	0.1	0.0	19.5	0.39	24.8
5	2/24/2001	2/26/2001	21	2	1.8	0.1	0.0	0.0	0.6	3.3	3.1	2.8	0.4	0.1	0.0	10.5	0.15	0.0
6	2/24/2001	2/26/2001	21	2	1.0	0.1	0.0	0.0	0.0	6.6	0.0	15.3	0.0	0.0	0.0	0.0	0.56	5.8
7	2/24/2001	2/26/2001	24	1	1.6	1.3	0.0	0.0	0.3	8.0	0.0	1.3	0.4	0.1	0.0	27.8	0.03	4.9
8	2/24/2001	2/26/2001	24	1	2.3	0.3	0.0	0.0	0.0	9.7	0.7	0.0	0.05	0.0	0.0	0.0	0.73	36.1
9	2/24/2001	2/26/2001	23	3	2.4	0.1	0.0	0.0	0.0	4.1	0.3	2.4	0.1	0.05	0.0	0.0	0.79	1.9
10	2/24/2001	2/26/2001	23	3	1.6	0.4	0.0	0.0	0.0	15.8	1.5	0.0	0.1	0.05	0.0	9.6	0.54	3.7
11	2/24/2001	2/26/2001	22	1	4.5	0.0	0.0	0.0	0.0	6.5	0.3	0.0	0.0	0.0	0.0	0.0	0.00	1.1
12	2/24/2001	2/26/2001	23	1	1.2	0.3	0.0	0.0	0.0	4.7	0.0	1.6	0.0	0.05	0.0	0.0	0.15	0.8
13	2/24/2001	2/26/2001	23	1	2.0	0.0	0.0	0.0	0.0	6.4	0.0	0.9	0.0	0.05	0.0	0.0	0.15	7.7
14	2/24/2001	2/26/2001	21	4	1.4	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.00	8.3
15	2/26/2001	2/27/2001	24	6	4.6	0.7	0.006	0.5	0.0	8.6	2.1	5.1	0.6	0.05	0.0	0.0	0.30	0.5
16	2/26/2001	2/27/2001	24	6	3.7	0.2	0.0	0.0	0.0	12.7	1.3	0.1	0.0	0.05	0.0	7.8	1.05	2.1
17	2/26/2001	2/27/2001	22	3	2.2	0.4	0.0	0.0	0.0	29.3	0.0	0.1	0.0	0.3	0.0	0.0	1.91	1.3
18	2/26/2001	2/27/2001	22	3	2.7	0.0	0.0	0.0	0.0	8.9	0.4	0.0	1.9	0.05	0.0	0.0	0.05	1.9
19	2/26/2001	2/27/2001	21	5	3.4	0.5	0.0	0.0	0.0	11.5	2.1	3.6	0.0	0.2	0.0	0.0	0.17	8.6
20	2/26/2001	2/27/2001	21	5	2.6	0.2	0.0	0.0	0.0	13.6	0.2	0.1	0.2	0.05	0.0	47.2	0.05	3.1
21	2/26/2001	2/27/2001	23	2	6.0	0.0	0.0	0.0	0.0	8.0	1.5	0.0	0.0	0.05	0.0	0.0	1.08	6.6
22	2/26/2001	2/27/2001	23	2	4.8	0.7	0.0	0.0	0.0	6.1	0.05	0.0	0.05	0.1	0.0	0.0	0.35	5.1
23	2/26/2001	2/27/2001	24	4	2.5	0.0	0.004	0.0	0.0	12.2	4.1	2.1	0.1	0.05	0.0	0.0	0.45	7.6
24	2/26/2001	2/27/2001	24	4	3.8	0.0	0.0	0.0	0.05	10.5	1.1	0.0	0.0	0.05	0.0	0.0	0.03	14.8
25	2/26/2001	2/27/2001	24	2	0.7	0.1	0.0	0.0	0.0	3.9	2.5	0.5	0.05	0.05	0.0	0.0	0.00	0.0
26	2/26/2001	2/27/2001	24	2	1.2	0.0	0.2	0.1	0.0	2.3	16.8	1.7	0.0	0.0	0.0	0.0	0.00	0.6
27	2/26/2001	2/27/2001	21	3	0.4	0.0	0.0	0.0	0.0	3.0	0.0	0.1	0.5	0.0	0.0	0.0	1.01	2.9
28	2/26/2001	2/27/2001	21	3	2.8	0.05	0.0	0.0	0.0	22.1	2.6	0.1	0.4	0.1	0.0	30.5	0.25	1.5
29	2/27/2001	2/28/2001	24	3	1.9	0.0	0.024	0.0	0.0	8.1	0.0	0.0	0.0	0.05	0.0	2.2	0.87	1.5
30	2/27/2001	2/28/2001	24	3	2.9	0.0	0.1	0.0	0.0	5.0	0.0	0.0	0.2	0.0	0.0	0.6	0.10	0.0
31	2/27/2001	2/28/2001	23	1	0.2	0.0	0.0	0.0	0.0	1.5	1.2	0.1	1.9	0.2	0.0	0.0	0.05	0.2
32	2/27/2001	2/28/2001	23	1	1.3	0.0	0.006	0.0	0.0	3.4	9.8	0.0	0.5	0.1	0.0	0.5	0.56	0.8
33	2/27/2001	2/28/2001	21	4	2.1	0.0	0.0	0.0	0.0	9.3	0.0	2.1	0.05	0.05	0.0	0.0	0.10	4.4
34	2/27/2001	2/28/2001	21	4	2.2	0.0	0.0	0.0	0.0	4.7	0.0	0.5	0.2	0.05	0.0	0.0	0.17	1.5
35	2/27/2001	2/28/2001	21	2	4.8	0.0	0.0	0.0	0.0	6.2	0.0	0.0	0.05	0.05	0.0	1.3	0.10	0.6
36	2/27/2001	2/28/2001	21	2	1.7	0.05	0.0	0.0	0.0	5.0	2.4	41.4	0.0	0.1	0.0	0.0	0.41	13.1
37	2/27/2001	2/28/2001	22	5	1.8	0.0	0.0	0.0	0.0	22.4	0.0	0.0	0.0	0.1	0.0	0.0	0.05	0.5
38	2/27/2001	2/28/2001	22	5	1.0	0.0	0.0	0.0	0.0	9.3	0.6	6.0	0.0	0.05	0.0	0.0	0.10	6.1
39	2/27/2001	2/28/2001	23	4	2.8	0.05	0.03	0.0	0.0	11.1	25.2	0.3	0.0	0.05	0.0	2.7	0.38	3.7
40	2/27/2001	2/28/2001	23	4	1.0	0.0	0.0	0.0	0.0	2.9	0.1	6.7	0.0	0.2	0.0	0.0	0.10	7.2
41	2/27/2001	2/28/2001	22	2	1.9	0.0	0.0	0.0	0.0	6.7	0.0	0.0	0.3	0.0	0.0	0.0	0.00	0.0
42	2/27/2001	2/28/2001	22	2	1.7	0.0	0.0	0.0	0.0	7.1	0.3	0.1	0.2	0.05	0.0	31.5	0.18	3.3
43	2/28/2001	3/1/2001	24	2	7.3	0.0	0.0	0.0	0.0	5.7	0.0	0.0	0.05	0.1	0.0	0.0	0.15	7.1
44	2/28/2001	3/1/2001	24	2	4.3	0.0	0.0	0.0	0.0	7.3	5.4	5.1	0.1	0.2	0.0	4.4	0.15	3.7
45	2/28/2001	3/1/2001	22	3	2.7	0.0	0.0	0.0	0.8	5.3	5.8	0.0	0.0	0.05	0.0	0.0	0.58	0.0
46	2/28/2001	3/1/2001	22	3	2.8	0.1	0.006	0.0	0.0	6.9	2.8	0.2	0.05	0.05	0.0	0.0	0.72	5.5
47	2/28/2001	3/1/2001	21	4	2.8	0.0	0.0	0.0	0.0	5.6	0.0	0.4	1.5	1.0	0.0	0.1	0.50	1.9
48	2/28/2001	3/1/2001	21	4	3.9	0.0	0.0	0.0	0.0	4.9	1.7	1.3	0.5	0.1	0.0	0.0	0.24	3.1
49	2/28/2001	3/1/2001	22	6	1.2	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.1	0.2	0.0	0.6	0.50	4.3
50	2/28/2001	3/1/2001	22	6	3.2	0.0	0.0	0.0	0.1	4.9	0.0	0.1	0.1	0.5	0.0	0.5	0.35	0.6
51	2/28/2001	3/1/2001	23	3	1.7	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.05	0.0	0.0	0.0	0.40	63.2
52	2/28/2001	3/1/2001	23	3	1.9	0.6	0.0	0.0	0.0	2.2	2.9	11.1	0.0	0.0	0.0	6.4	1.25	79.9
53	2/28/2001	3/1/2001	21	1	2.2	0.0	0.0	0.0	0.0	7.5	0.0	0.0	0.0	0.05	0.0	0.0	0.00	3.3
54	2/28/2001	3/1/2001	21	1	2.7	0.1	0.006	0.0	0.0	8.3	0.0	0.0	0.0	0.05	0.0	5.6	0.00	2.7
55	2/28/2001	3/1/2001	22	1	2.4	0.1	0.1	0.0	0.0	7.1	0.4	0.05	0.0	0.05	0.0	3.6	0.20	3.3
56	2/28/2001	3/1/2001	22	1	4.3	0.0	0.0	0.0	0.0	5.7	0.9	2.7	0.05	0.05	0.0	0.5	0.40	3.9
57	3/1/2001	3/2/2001	24	5	1.3	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.1	0.0	0.0	0.45	1.5
58	3/1/2001	3/2/2001	24	1	2.3	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.1	0.0	1.5	0.00	1.5
59	3/1/2001	3/2/2001	23	1	0.2	1.1	0.0	0.0	0.0	2.2	0.0	5.6	0.0	0.05	0.0	16.2	0.00	4.6
60	3/1/2001	3/2/2001	21	1	1.8	0.0	0.0	0.0	0.0	4.3	0.3	0.0	0.0	0.05	0.0	1.1	0.10	55.4
61	3/1/2001	3/2/2001	24	3	3.2	0.4	0.078	0.0	0.0	8.0	0.3	0.8	0.0	0.05	0.0	0.0	0.32	3.9
62	3/1/2001	3/2/2001	23	3	3.0	0.1	0.0	0.0	0.0	13.3	1.0	1.0	0.6	0.05	0.0	0.0	0.55	0.6
63	3/1/2001	3/2/2001	21	4	1.5	0.05	0.1	0.0	0.0	8.7	0.4	0.1	2.6	0.3	0.0	2.6	0.03	23.2
64	3/1/2001	3/2/2001	21	2	1.7	0.05	0.0	0.0	0.0	6.9	1.8	0.1	0.05	0.0	0.0	0.0	0.00	1.0
65	3/1/2001	3/2/2001	24	5	1.8	0.0	0.0	0.0	0.0	4.6	0.0	6.9	0.0	0.1	0.0	0.0	0.03	2.6
66	3/1/2001	3/2/2001	24	1	1.5	0.0	0.0	0.0	0.0	4.5	0.1	1.1	0.0	0.1	0.0	2.5	0.74	10.5
67	3/1/2001	3/2/2001	23	1	2.8	0.05	0.0	0.0	0.0	4.4	0.2	0.2	0.0	0.05	0.0	20.5	0.20	0.2
68	3/1/2001	3/2/2001	21	1	1.7	0.0	0.0	0.0	0.0	5.5	1.7	0.9	0.1	0.0	0.0	64.2	0.05	5.3
69	3/1/2001	3/2/2001	23	3	1.4	0.0	0.0	0.0	0.0	2.3	0.2	0.0	0.0	0.05	0.0	0.0	0.00	6.3
70	3/1/2001	3/2/2001	21	4	0.6	0.3	0.0	0.0	0.0	2.2	0.05	0.1	0.05	1.3	0.0	0.0	0.41	2.5
Total					164	9.0	0.9	0.6	2.5	516	107	153	17	8	0.0	322	23	502
Mean (Average)					2.3	0.13	0.01	0.009	0.04	7.4	1.5	2.2	0.25	0.11	0.0	4.6	0.33	7.2

Table B-4
Percentage of Each Secondary Waste Category in Metal and "Other Nondegradables"

Sample number	Waste collection date	Sampling & sorting date	Section	Route	Alumi-num	Brass	Copper	Lead	Pot metal	Ferrous metal	Elec-tronics	Other elec-trical devices	Insu-lated wiring	Light bulbs	Fluores-cent tubes	Gypsum board	Batteries	Other "other nonde-gradables"
1	2/24/2001	2/26/2001	24	3	0.7%	0.00%	0.01%	0.00%	0.00%	4.0%	0.00%	0.31%	0.00%	0.00%	0.0%	0.0%	0.39%	0.04%
2	2/24/2001	2/26/2001	24	3	0.3%	0.03%	0.00%	0.00%	0.00%	6.0%	0.27%	4.8%	0.00%	0.02%	0.0%	0.1%	0.00%	0.08%
3	2/24/2001	2/26/2001	22	4	0.6%	0.19%	0.00%	0.00%	0.09%	1.6%	0.00%	0.72%	0.08%	0.08%	0.0%	0.0%	0.15%	2.4%
4	2/24/2001	2/26/2001	22	4	0.7%	0.00%	0.05%	0.00%	0.10%	1.8%	0.02%	0.44%	0.71%	0.02%	0.0%	4.8%	0.10%	6.1%
5	2/24/2001	2/26/2001	21	2	0.5%	0.03%	0.00%	0.00%	0.17%	0.9%	0.89%	0.80%	0.11%	0.03%	0.0%	3.0%	0.04%	0.0%
6	2/24/2001	2/26/2001	21	2	0.4%	0.04%	0.00%	0.00%	0.00%	2.7%	0.00%	6.2%	0.00%	0.00%	0.0%	0.0%	0.29%	2.4%
7	2/24/2001	2/26/2001	24	1	0.5%	0.39%	0.00%	0.00%	0.09%	2.4%	0.00%	0.39%	0.12%	0.03%	0.0%	8.3%	0.01%	1.5%
8	2/24/2001	2/26/2001	24	1	0.7%	0.10%	0.00%	0.00%	0.00%	3.1%	0.23%	0.00%	0.02%	0.00%	0.0%	0.0%	0.23%	11.7%
9	2/24/2001	2/26/2001	23	3	0.8%	0.03%	0.00%	0.00%	0.00%	1.3%	0.10%	0.79%	0.03%	0.02%	0.0%	0.0%	0.23%	0.6%
10	2/24/2001	2/26/2001	23	3	0.5%	0.13%	0.00%	0.00%	0.00%	4.9%	0.47%	0.00%	0.03%	0.02%	0.0%	3.0%	0.19%	1.1%
11	2/24/2001	2/26/2001	22	1	1.0%	0.00%	0.00%	0.00%	0.00%	1.4%	0.07%	0.00%	0.00%	0.00%	0.0%	0.0%	0.00%	0.2%
12	2/24/2001	2/26/2001	23	1	0.4%	0.10%	0.00%	0.00%	0.00%	1.6%	0.00%	0.56%	0.00%	0.02%	0.0%	0.0%	0.05%	0.3%
13	2/24/2001	2/26/2001	23	1	0.7%	0.00%	0.00%	0.00%	0.00%	2.3%	0.00%	0.32%	0.00%	0.02%	0.0%	0.0%	0.05%	2.8%
14	2/24/2001	2/26/2001	21	4	0.5%	0.00%	0.00%	0.00%	0.00%	1.9%	0.00%	0.00%	0.00%	0.00%	0.0%	0.0%	0.00%	3.0%
15	2/26/2001	2/27/2001	24	6	0.8%	0.12%	0.00%	0.09%	0.00%	1.6%	0.38%	0.92%	0.11%	0.01%	0.0%	0.0%	0.05%	0.08%
16	2/26/2001	2/27/2001	24	6	0.8%	0.04%	0.00%	0.00%	0.00%	2.8%	0.29%	0.02%	0.00%	0.01%	0.0%	1.7%	0.24%	0.5%
17	2/26/2001	2/27/2001	22	3	0.5%	0.08%	0.00%	0.00%	0.00%	6.1%	0.00%	0.02%	0.00%	0.06%	0.0%	0.0%	0.35%	0.3%
18	2/26/2001	2/27/2001	22	3	1.0%	0.00%	0.00%	0.00%	0.00%	3.4%	0.15%	0.00%	0.74%	0.02%	0.0%	0.0%	0.02%	0.7%
19	2/26/2001	2/27/2001	21	5	0.8%	0.11%	0.00%	0.00%	0.00%	2.6%	0.47%	0.80%	0.00%	0.04%	0.0%	0.0%	0.04%	1.9%
20	2/26/2001	2/27/2001	21	5	0.5%	0.04%	0.00%	0.00%	0.00%	2.4%	0.04%	0.02%	0.04%	0.01%	0.0%	8.4%	0.01%	0.6%
21	2/26/2001	2/27/2001	23	2	1.2%	0.00%	0.00%	0.00%	0.00%	1.5%	0.29%	0.00%	0.00%	0.01%	0.0%	0.0%	0.19%	1.3%
22	2/26/2001	2/27/2001	23	2	1.1%	0.17%	0.00%	0.00%	0.00%	1.5%	0.01%	0.00%	0.01%	0.02%	0.0%	0.0%	0.08%	1.2%
23	2/26/2001	2/27/2001	24	4	0.6%	0.00%	0.00%	0.00%	0.00%	3.1%	1.0%	0.53%	0.03%	0.01%	0.0%	0.0%	0.08%	1.9%
24	2/26/2001	2/27/2001	24	4	0.8%	0.00%	0.00%	0.00%	0.01%	2.3%	0.24%	0.00%	0.00%	0.01%	0.0%	0.0%	0.01%	3.3%
25	2/26/2001	2/27/2001	24	2	0.4%	0.05%	0.00%	0.00%	0.00%	2.1%	1.3%	0.27%	0.03%	0.03%	0.0%	0.0%	0.00%	0.0%
26	2/26/2001	2/27/2001	24	2	0.6%	0.00%	0.11%	0.05%	0.00%	1.2%	9.0%	0.91%	0.00%	0.00%	0.0%	0.0%	0.00%	0.3%
27	2/26/2001	2/27/2001	21	3	0.2%	0.00%	0.00%	0.00%	0.00%	1.9%	0.00%	0.06%	0.31%	0.00%	0.0%	0.0%	0.43%	1.8%
28	2/26/2001	2/27/2001	21	3	0.8%	0.01%	0.00%	0.00%	0.00%	6.6%	0.77%	0.03%	0.12%	0.03%	0.0%	9.1%	0.07%	0.4%
29	2/27/2001	2/28/2001	24	3	0.7%	0.00%	0.01%	0.00%	0.00%	3.0%	0.00%	0.00%	0.00%	0.02%	0.0%	0.8%	0.48%	0.5%
30	2/27/2001	2/28/2001	24	3	1.9%	0.00%	0.06%	0.00%	0.00%	3.2%	0.00%	0.00%	0.13%	0.00%	0.0%	0.4%	0.06%	0.0%
31	2/27/2001	2/28/2001	23	1	0.2%	0.00%	0.00%	0.00%	0.00%	1.5%	1.2%	0.10%	1.8%	0.19%	0.0%	0.0%	0.05%	0.15%
32	2/27/2001	2/28/2001	23	1	0.7%	0.00%	0.00%	0.00%	0.00%	2.0%	5.6%	0.00%	0.29%	0.06%	0.0%	0.3%	0.35%	0.5%
33	2/27/2001	2/28/2001	21	4	0.9%	0.00%	0.00%	0.00%	0.00%	4.2%	0.00%	0.95%	0.02%	0.02%	0.0%	0.0%	0.05%	2.0%
34	2/27/2001	2/28/2001	21	4	0.7%	0.00%	0.00%	0.00%	0.00%	1.4%	0.00%	0.15%	0.06%	0.01%	0.0%	0.0%	0.06%	0.4%
35	2/27/2001	2/28/2001	21	2	1.6%	0.00%	0.00%	0.00%	0.00%	2.1%	0.00%	0.00%	0.02%	0.02%	0.0%	0.4%	0.03%	0.2%
36	2/27/2001	2/28/2001	21	2	0.5%	0.01%	0.00%	0.00%	0.00%	1.4%	0.70%	12.0%	0.00%	0.03%	0.0%	0.0%	0.12%	3.8%
37	2/27/2001	2/28/2001	22	5	0.6%	0.00%	0.00%	0.00%	0.00%	8.0%	0.00%	0.00%	0.00%	0.04%	0.0%	0.0%	0.02%	0.16%
38	2/27/2001	2/28/2001	22	5	0.4%	0.00%	0.00%	0.00%	0.00%	3.5%	0.23%	2.3%	0.00%	0.02%	0.0%	0.0%	0.04%	2.3%
39	2/27/2001	2/28/2001	23	4	0.5%	0.01%	0.01%	0.00%	0.00%	2.1%	4.8%	0.06%	0.00%	0.01%	0.0%	0.5%	0.07%	0.7%
40	2/27/2001	2/28/2001	23	4	0.4%	0.00%	0.00%	0.00%	0.00%	1.2%	0.04%	2.8%	0.00%	0.08%	0.0%	0.0%	0.04%	2.9%
41	2/27/2001	2/28/2001	22	2	1.0%	0.00%	0.00%	0.00%	0.00%	3.4%	0.00%	0.00%	0.15%	0.00%	0.0%	0.0%	0.00%	0.0%
42	2/27/2001	2/28/2001	22	2	0.6%	0.00%	0.00%	0.00%	0.00%	2.6%	0.11%	0.04%	0.07%	0.02%	0.0%	11.6%	0.07%	1.2%
43	2/28/2001	3/1/2001	24	2	2.7%	0.00%	0.00%	0.00%	0.00%	2.1%	0.00%	0.00%	0.02%	0.04%	0.0%	0.0%	0.06%	2.6%
44	2/28/2001	3/1/2001	24	2	1.4%	0.00%	0.00%	0.00%	0.00%	2.3%	1.7%	1.6%	0.03%	0.06%	0.0%	1.4%	0.05%	1.2%
45	2/28/2001	3/1/2001	22	3	0.8%	0.00%	0.00%	0.00%	0.23%	1.5%	1.7%	0.00%	0.00%	0.01%	0.0%	0.0%	0.17%	0.0%
46	2/28/2001	3/1/2001	22	3	0.8%	0.03%	0.00%	0.00%	0.00%	2.0%	0.83%	0.06%	0.01%	0.01%	0.0%	0.0%	0.24%	1.6%
47	2/28/2001	3/1/2001	21	4	0.9%	0.00%	0.00%	0.00%	0.00%	1.9%	0.00%	0.13%	0.50%	0.33%	0.0%	0.0%	0.17%	0.6%
48	2/28/2001	3/1/2001	21	4	1.2%	0.00%	0.00%	0.00%	0.00%	1.5%	0.52%	0.40%	0.15%	0.03%	0.0%	0.0%	0.09%	1.0%
49	2/28/2001	3/1/2001	22	6	0.5%	0.00%	0.00%	0.00%	0.00%	1.8%	0.00%	0.00%	0.04%	0.09%	0.0%	0.3%	0.22%	1.9%
50	2/28/2001	3/1/2001	22	6	1.0%	0.00%	0.00%	0.00%	0.03%	1.5%	0.00%	0.03%	0.03%	0.15%	0.0%	0.2%	0.11%	0.2%
51	2/28/2001	3/1/2001	23	3	0.6%	0.00%	0.00%	0.00%	0.00%	1.4%	0.00%	0.00%	0.02%	0.00%	0.0%	0.0%	0.15%	23.8%
52	2/28/2001	3/1/2001	23	3	0.6%	0.20%	0.00%	0.00%	0.00%	0.7%	0.97%	3.7%	0.00%	0.00%	0.0%	2.1%	0.44%	26.7%
53	2/28/2001	3/1/2001	21	1	0.6%	0.00%	0.00%	0.00%	0.00%	2.2%	0.00%	0.00%	0.00%	0.01%	0.0%	0.0%	0.00%	1.0%
54	2/28/2001	3/1/2001	21	1	0.8%	0.03%	0.00%	0.00%	0.00%	2.5%	0.00%	0.00%	0.00%	0.02%	0.0%	1.7%	0.00%	0.8%
55	2/28/2001	3/1/2001	22	1	0.5%	0.02%	0.02%	0.00%	0.00%	1.5%	0.08%	0.01%	0.00%	0.01%	0.0%	0.7%	0.04%	0.7%
56	2/28/2001	3/1/2001	22	1	1.3%	0.00%	0.00%	0.00%	0.00%	1.7%	0.27%	0.80%	0.01%	0.01%	0.0%	0.1%	0.09%	1.2%
57	3/1/2001	3/2/2001	24	5	0.8%	0.00%	0.00%	0.00%	0.00%	1.0%	0.00%	0.00%	0.00%	0.06%	0.0%	0.0%	0.29%	0.9%
58	3/1/2001	3/2/2001	24	1	1.5%	0.00%	0.00%	0.00%	0.00%	1.3%	0.00%	0.00%	0.00%	0.06%	0.0%	1.0%	0.00%	1.0%
59	3/1/2001	3/2/2001	23	1	0.1%	0.34%	0.00%	0.00%	0.00%	0.7%	0.00%	1.7%	0.00%	0.02%	0.0%	5.0%	0.00%	1.4%
60	3/1/2001	3/2/2001	21	1	0.5%	0.00%	0.00%	0.00%	0.00%	1.3%	0.09%	0.00%	0.00%	0.02%	0.0%	0.3%	0.03%	16.8%
61	3/1/2001	3/2/2001	24	3	1.0%	0.13%	0.03%	0.00%	0.00%	2.6%	0.10%	0.26%	0.00%	0.02%	0.0%	0.0%	0.10%	1.2%
62	3/1/2001	3/2/2001	23	3	0.7%	0.01%	0.00%	0.00%	0.00%	3.2%	0.24%	0.24%	0.14%	0.01%	0.0%	0.0%	0.14%	0.13%
63	3/1/2001	3/2/2001	21	4	0.5%	0.02%	0.04%	0.00%	0.00%	3.2%	0.15%	0.02%	0.95%	0.11%	0.0%	0.9%	0.01%	8.5%
64	3/1/2001	3/2/2001	21	2	0.6%	0.02%	0.00%	0.00%	0.00%	2.6%	0.68%	0.04%	0.02%	0.00%	0.0%	0.0%	0.00%	0.4%
65	3/1/2001	3/2/2001	24	5	0.5%	0.00%	0.00%	0.00%	0.00%	1.2%	0.00%	1.8%	0.00%	0.03%	0.0%	0.0%	0.01%	0.7%
66	3/1/2001	3/2/2001	24	1	0.5%	0.00%	0.00%	0.00%	0.00%	1.5%	0.03%	0.37%	0.00%	0.03%	0.0%	0.8%	0.23%	3.5%
67	3/1/2001	3/2/2001	23	1	0.9%	0.02%	0.00%	0.00%	0.00%	1.5%	0.07%	0.07%	0.00%	0.02%	0.0%	6.9%	0.07%	0.05%
68	3/1/2001	3/2/2001	21	1	0.5%	0.00%	0.00%	0.00%	0.00%	1.5%	0.46%	0.24%	0.03%	0.00%	0.0%	17.2%	0.01%	1.4%
69	3/1/2001	3/2/2001	23	3	0.6%	0.00%	0.00%	0.00%	0.00%	1.0%	0.09%	0.00%	0.00%	0.02%	0.0%	0.0%	0.00%	2.8%
70	3/1/2001	3/2/2001	21	4	0.5%	0.23%	0.00%	0.00%	0.00%	1.7%	0.04%	0.08%	0.04%	0.99%	0.0%	0.0%	0.23%	1.9%
Mean (Average)					0.8%	0.04%	0.005%	0.002%	0.010%	2.3%	0.52%	0.70%	0.10%	0.05%	0.0%	1.3%	0.11%	2.4%
Std. Deviation					0.4%	0.08%	0.017%	0.012%	0.04%	1.4%	1.4%	1.8%	0.27%	0.13%	0.0%	3.1%	0.12%	4.8%

New York City MSW Composting Report

Appendix B
Marlborough Facility Scale Receipts

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
February 26, 2001

Trucks 1-3 = 49.23 tons

Truck 1 8:12 pm = 16.52 tons

21:20 2-26-2001
TIME IN 20:12
TICKET NUMBER 234
LOOP ID 365
68700 lb GROSS
35660 lb TARE
33040 lb NET
16.52
PRODUCT 000

20:12 2-26-2001
LOOP ID 365
INBOUND 68700 lb
PRODUCT 000

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
February 26, 2001

Trucks 1-3 = 49.23 tons
Truck 2 8:13 pm = 19.35 tons

20:13
LOOP ID 366
INBOUND 75200 lb
PRODUCT 000
2-26-2001

21:18
TIME IN 20:13
TICKET NUMBER 233
LOOP ID 366
75200 lb GROSS
36500 lb TARE
38700 lb NET
19.35
PRODUCT 000
2-26-2001

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
February 26, 2001

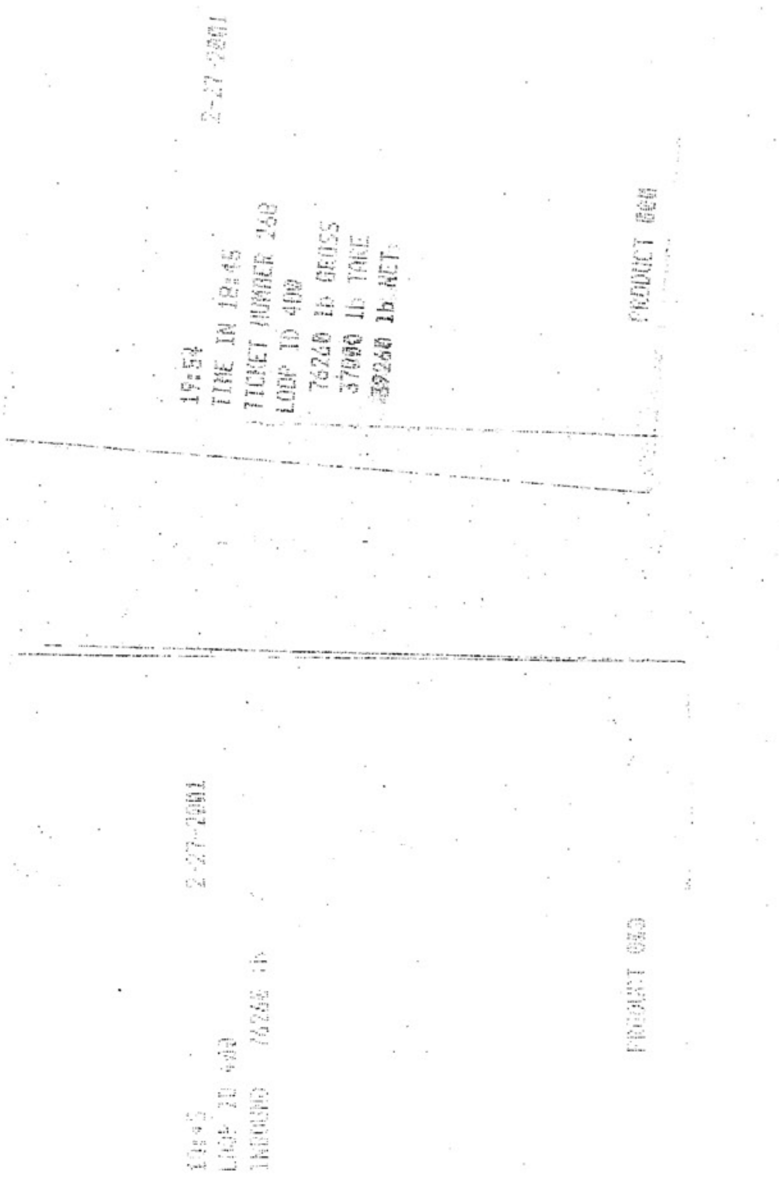
Trucks 1-3 = 49.23 tons
Truck 3 9:16 pm = 13.36 tons

2-26-2001
21:16
TIME IN 20:09
TICKET NUMBER 237
LOOP ID 364
62000 lb GROSS
35280 lb TARE
26720 lb NET
13.36
PRODUCT 000

2-26-2001
20:09
LOOP ID 364
INBOUND 62000 lb
PRODUCT 000

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
February 27, 2001

Trucks 1-3 = 54.64
Truck 1 7:54 pm = 19.63 tons

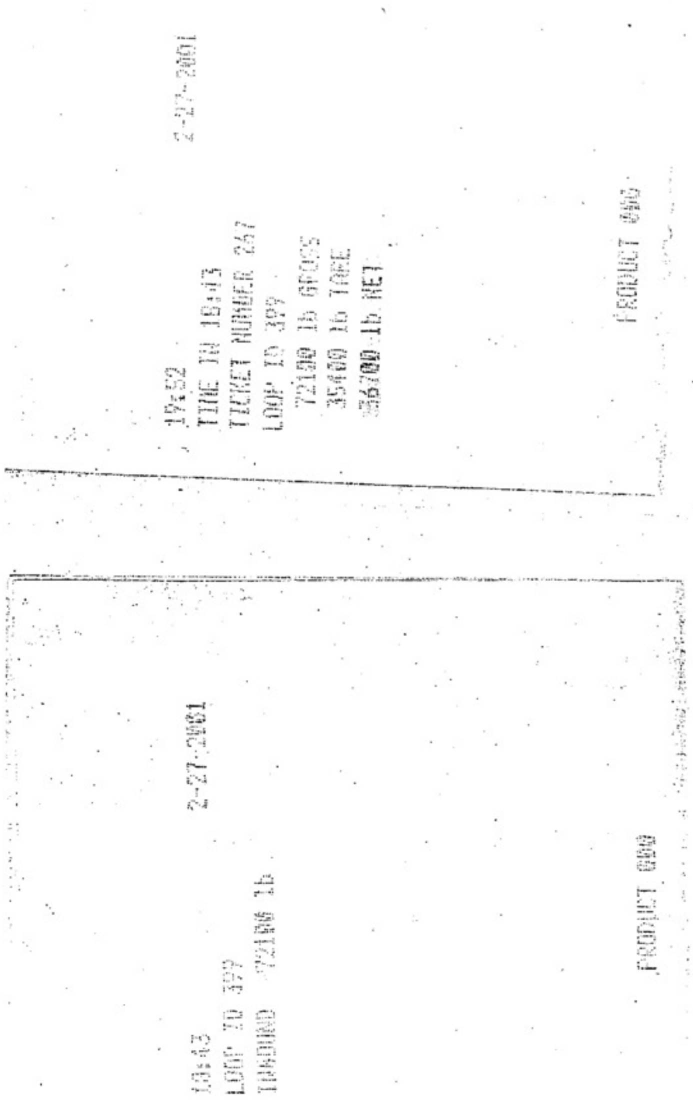

2-27-2001
19:52
TIME IN 18:45
TICKET NUMBER 288
LOOP ID 400
76240 lb GROSS
37000 lb TARE
39260 lb NET
PRODUCT 000

2-27-2001
18:45
LOOP ID 400
INBOUND 76240 lb
PRODUCT 000

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
February 27, 2001

Trucks 1-3 = 54.64

Truck 2 7:43 pm = 18.35 tons

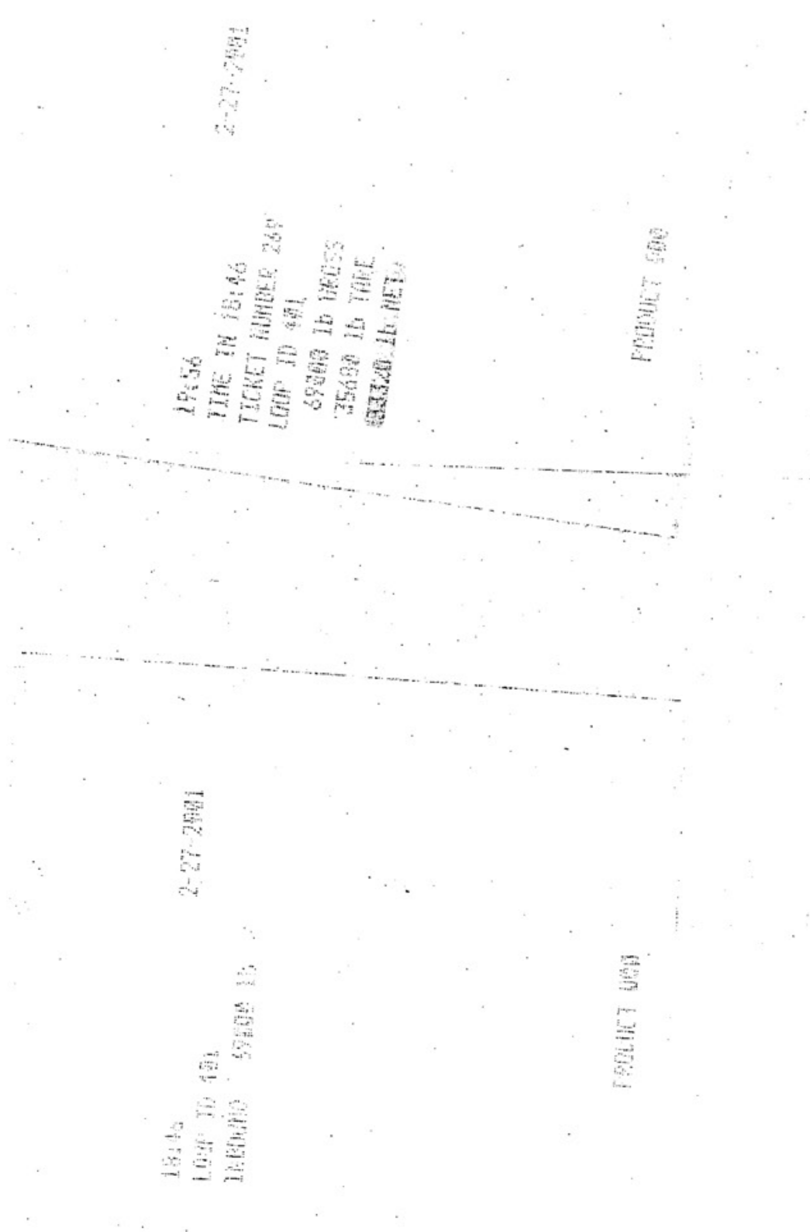


2-27-2001
19:52
TIME IN 19:43
TICKET NUMBER 267
LOOP ID 397
72100 lb GROSS
35400 lb TARE
36700 lb NET
PRODUCT 000

2-27-2001
19:43
LOOP ID 397
INBOUND 72100 lb
PRODUCT 000

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
February 27, 2001

Trucks 1-3 = 54.64
Truck 3 7:46 pm = 16.66 tons



2-27-2001
19:56
TIME IN 19:46
LOOP ID 401
69000 lb GROSS
35680 lb TARE
33320 lb NET
PRODUCT 500

2-27-2001
18:45
LOOP ID 401
PRODUCT 500

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
February 28, 2001

Trucks 1-3 = 53.99 tons
Truck 1 4:19 pm = 18.19 tons

17:21 2-28-2001
TIME IN 16:19
TICKET NUMBER 299
LOOP ID 436
72400 lb GROSS
36020 lb TARE
36380 lb NET

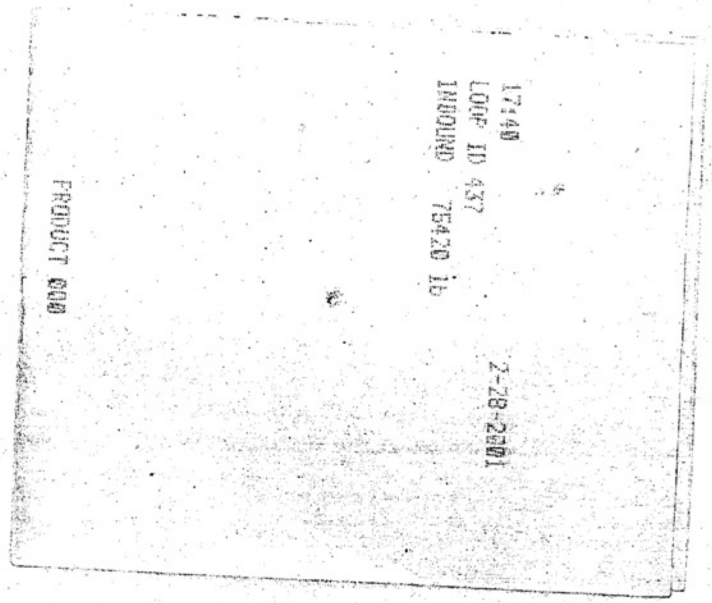
PRODUCT 000

16:19 2-28-2001
LOOP ID 436
INBOUND 72400 lb

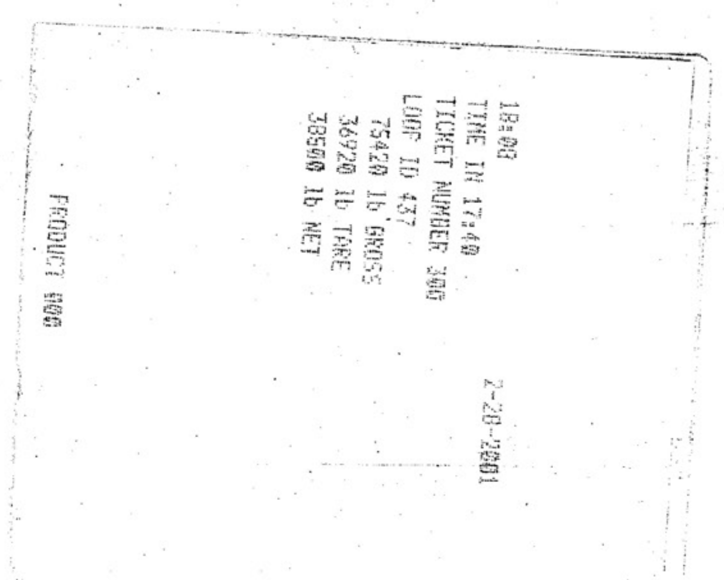
PRODUCT 000

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
February 28, 2001

Trucks 1-3 = 53.99 tons
Truck 2 5:40 pm = 19.25 tons



17:40
LOOP ID 437
INBOUND 75420 lb
2-28-2001
PRODUCT 000



18:00
TIME IN 17:40
TICKET NUMBER 300
LOOP ID 437
75420 lb GROSS
36920 lb TARE
38500 lb NET
2-28-2001
PRODUCT 000

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
February 28, 2001

Trucks 1-3 = 53.99 tons
Truck 3 5:48 pm = 16.55 tons

18:36 2-28-2001
TIME IN 17:48
TICKET NUMBER 301
LOOP ID 438
68600 lb GROSS
35500 lb TARE
33100 lb NET

PRODUCT 000

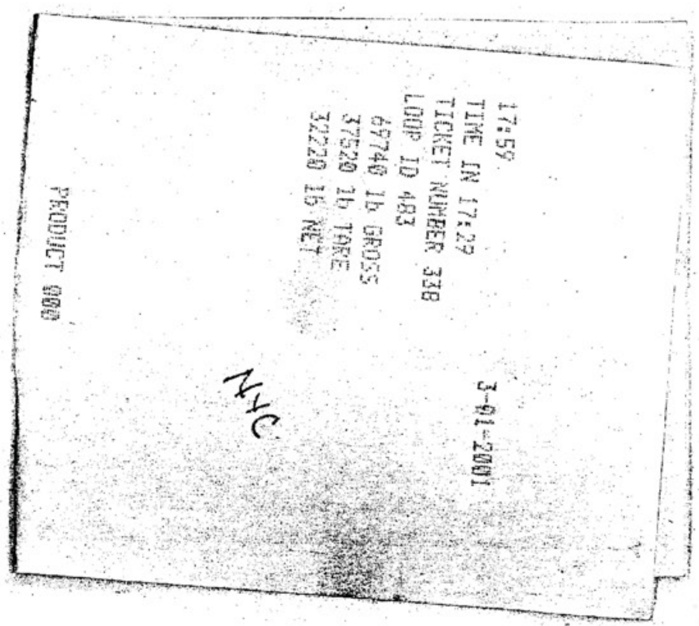
17:48 2-28-2001
LOOP ID 438
INBOUND 68600 lb

PRODUCT 000

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
March 1, 2001

Trucks 1-3 = 51.96 tons

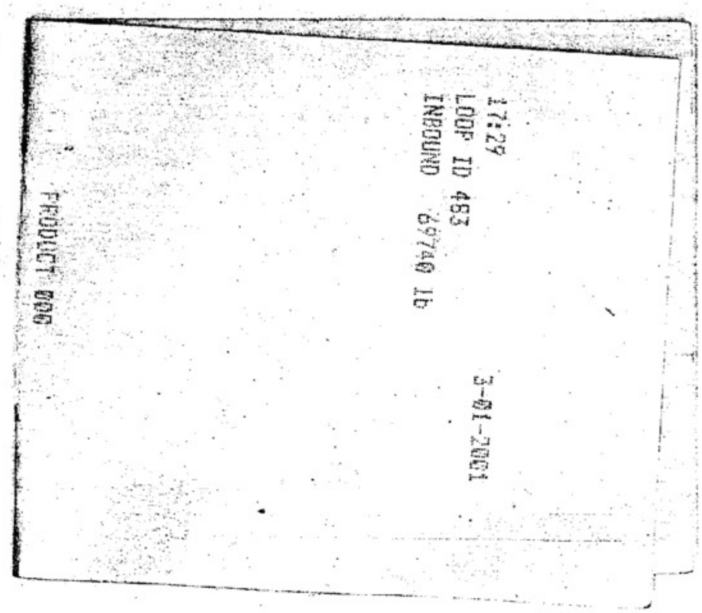
Truck 1 5:29 pm = 16.11 tons



17:59
TIME IN 17:29
TICKET NUMBER 338
LOOP ID 483
69740 lb GROSS
37520 lb TARE
32220 lb NET
PRODUCT 000

3-01-2001

NYC



17:29
LOOP ID 483
INBOUND 69740 lb
PRODUCT 000

3-01-2001

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
March 1, 2001

Trucks 1-3 = 51.96 tons

Truck 2 5:46 pm = 17.23 tons

18:38 3-01-2001
TIME IN 17:46
TICKET NUMBER 339
LOOP ID 404
71180 lb GROSS
36720 lb TARE
34460 lb NET

NYC

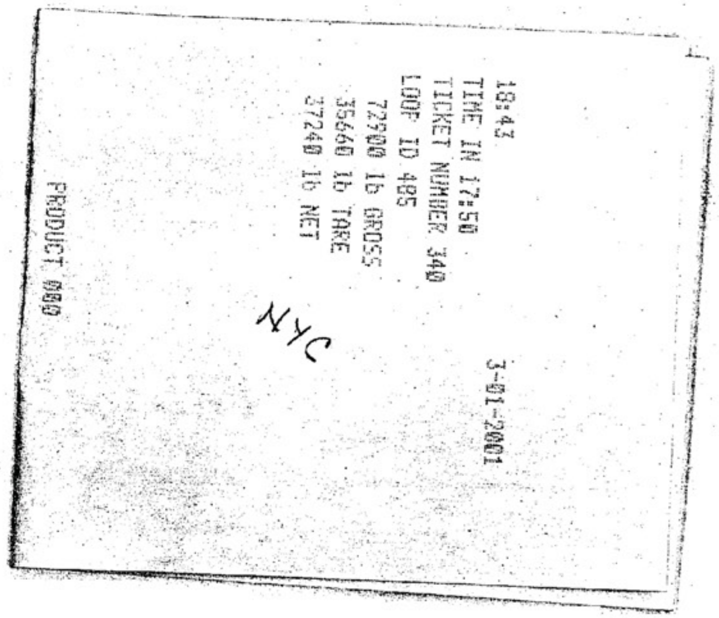
PRODUCT 000

17:46 3-01-2001
LOOP ID 404
INBOUND 71180 lb

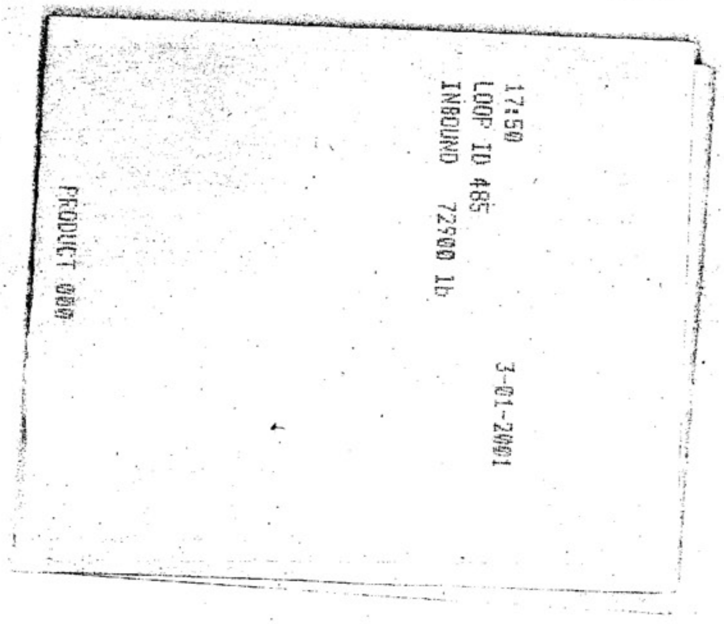
PRODUCT 000

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
March 1, 2001

Trucks 1-3 = 51.96 tons
Truck 3 5:50 pm = 18.62 tons



18:43
TIME IN 17:50
TICKET NUMBER 340
LOOP ID 485
72900 lb GROSS
35660 lb TARE
37240 lb NET
PRODUCT 000
3-01-2001
NYC



17:50
LOOP ID 485
INBOUND 72900 lb
PRODUCT 000
3-01-2001

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
March 2, 2001

Trucks 1-3 = 49.23 tons

Truck 1 4:15 pm = 16.53 tons

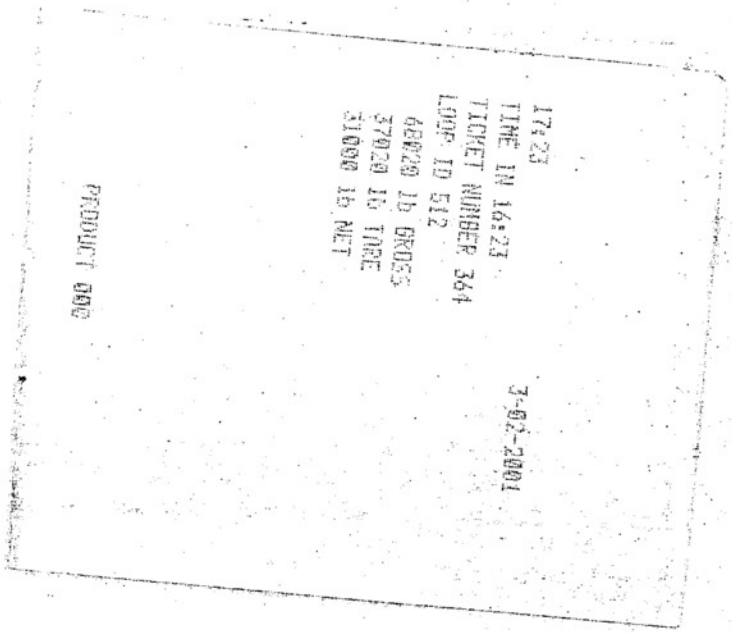
16:51
TIME IN 16:15
TICKET NUMBER 363
LOOP ID 511
69560 lb GROSS
36500 lb TARE
33060 lb NET
3-02-2001
PRODUCT 000

NYC

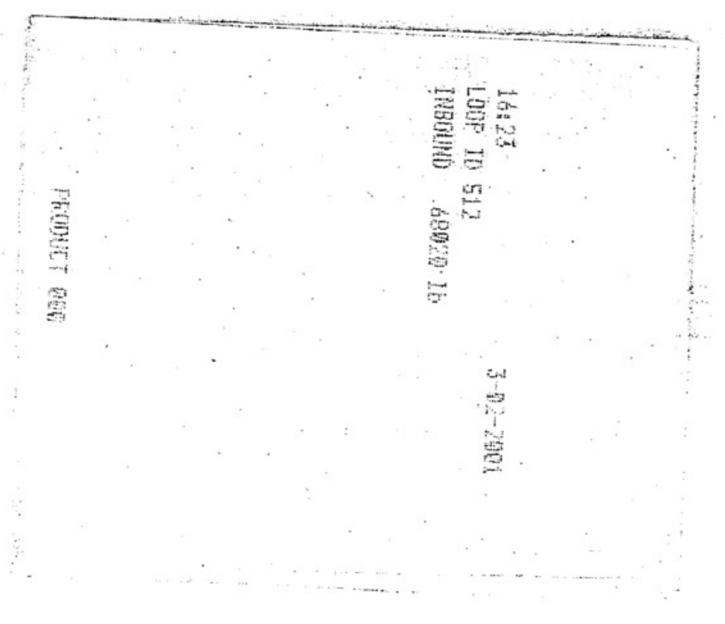
16:15
LOOP ID 511
INBOUND 69560 lb
3-02-2001
PRODUCT 000

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
March 2, 2001

Trucks 1-3 = 49.23 tons
Truck 2 4:23 pm = 15.5 tons


17:23
TIME IN 16:23
TICKET NUMBER 364
LOOP ID 512
68020 lb GROSS
37020 lb TARE
31000 lb NET
PRODUCT 000
3-02-2001

NYC


16:23
LOOP ID 512
INBOUND 68020 lb
PRODUCT 000
3-02-2001

Incoming NYC MSW
Marlborough Facility Scale
Truck Weight Tickets
March 2, 2001

Trucks 1-3 = 49.23 tons

Truck 3 4:25 pm = 17.2 tons

17:25
TIME IN 16:25
TICKET NUMBER 365
LOOP ID 513
70500 lb GROSS
36100 lb TARE
34400 lb NET

3-02-2001

PRODUCT 000

N/C

16:25
LOOP ID 513
INBOUND 70500 lb

3-02-2001

PRODUCT 000

Front-End Residue
Marlborough Facility Scale
Truck Weight Ticket
(with Waste Management Back-up)
for February 26, 2001

Trucks 1-2 = 7.21 tons
Truck 1 = 3.37 tons

7:54 2-27-2001
TIME IN 7:37
TICKET NUMBER 240
LOOP ID 372
42180 lb GROSS
35440 lb TARE
6740 lb NET

PRODUCT 812

ARBOR INDUSTRIES USA (631)738-9600

CUSTOMER: 8A / BEDMINSTER
ORIGIN: NA / Non App
TRUCK: WM404 LICENSE:
ROUTE: NA / Non App TRAILER #:
COMMENT:

COMMODITY	UNIT	NET/TONS
110 / MSW NON TRAILER	T	3.41
FUELSUR / FUEL SURCHARGE	U	

IN OPERATOR: DEREK LITCHFIELD
OUT OPERATOR: DEREK LITCHFIELD

WASTE MANAGEMENT
MARLBORO TRANSFER STATION

TICKET: 118522
DATE: 02/27/2001
TIME: 07:36 - 07:46

P.O.:
GROSS: 42300 LBS
TARE: 35480 LBS
NET: 6820 LBS

Front-End Residue
Marlborough Facility Scale
Truck Weight Ticket
(with Waste Management Back-up)
for February 26, 2001

Trucks 1-2 = 7.21 tons

Truck 2 = 3.84 tons

8:29 2-27-2001
TIME IN 8:01
TICKET NUMBER 242
LOOP ID 375
44120 lb GROSS
36260 lb TARE
7860 lb NET

PRODUCT 012

ARBOR INDUSTRIES USA (631)738-9600

WASTE MANAGEMENT
MARLBORO TRANSFER STATION
791 BOSTON POST ROAD
MARLBORO, MA 01752
TEL (508) 481-0336
FAX (508) 229-8520

TICKET: 110528
DATE: 02/27/2001
TIME: 07:59 - 08:21

CUSTOMER: 84 / BEDMINSTER

ORIGIN: NA / Non App
TRUCK: WM404/BED LICENSE:
ROUTE: NA / Non App TRAILER #:
COMMENT:

P.O.:
GROSS: 44300 LBS
TARE: 36420 LBS
NET: 7880 LBS

COMMODITY	UNIT	NET/TONS
110 / MSW NON TRAILER	T	3.94
FUELSUR / FUEL SURCHARGE	U	

IN OPERATOR: DEREK LITCHFIELD OUT OPERATOR: DEREK LITCHFIELD

Front-End Residue
Marlborough Facility Scale Truck Weight Ticket (with Waste Management Back-up) for February 27, 2001

Trucks 1-2 = 7.16 tons
Truck 1 = 4.52 tons

WASTE MANAGEMENT
MARLBORO TRANSFER STATION
791 BOSTON POST ROAD
MARLBORO, MA 01752
TEL: (508) 481-0336
FAX: (508) 229-8520

TICKET: 110623
DATE: 02/28/2001
TIME: 07:45 - 07:57

CUSTOMER: 84 / BEDMINSTER

ORIGIN: NA / Non App
TRUCK: WM404/BED LICENSE:
ROUTE: NA / Non App TRAILER #:
COMMENT:

P.O.:
GROSS: 45380 LBS
TARE: 36240 LBS
NET: 9140 LBS

COMMODITY	UNIT	NET/TONS
266 / BULKY WASTE - LARGE	U	2.00
110 / MSW NON TRAILER	T	4.57
FUELSUR / FUEL SURCHARGE	U	

IN OPERATOR: DEREK LITCHFIELD OUT OPERATOR: DEREK LITCHFIELD

ARBOR INDUSTRIES USA (631) 238-9600

4,52

NYC
wm
Brian

Front-End Residue
Marlborough Facility Scale
Truck Weight Ticket
(with Waste Management Back-up)
for February 27, 2001

Trucks 1-2 = 7.16 tons
Truck 2 = 2.64 tons

ARBOR INDUSTRIES USA (631)738-9600

WASTE MANAGEMENT
MARLBORO TRANSFER STATION
791 BOSTON POST ROAD
MARLBORO, MA 01752
TEL: (508) 481-0338
FAX: (508) 229-8520

TICKET: 110628
DATE: 02/28/2001
TIME: 08:11 - 08:24

CUSTOMER: B4 / BEDMINSTER

ORIGIN: NA / Non App
TRUCK: WM404/BED LICENSE:
ROUTE: NA / Non App TRAILER #:
COMMENT:

P.O.:
GROSS: 40920 LBS
TARE: 35640 LBS
NET: 5280 LBS

COMMODITY	UNIT	NET/TONS
110 / MSW NON TRAILER	T	2.64
FUELSUR / FUEL SURCHARGE	U	

IN OPERATOR: DEREK LITCHFIELD
OUT OPERATOR: DEREK LITCHFIELD

DRIVER: Brian

8:30
TIME IN 8:12
TICKET NUMBER 278
LOOP ID 411
40780 lb GROSS
35500 lb TARE
5280 lb NET
2-28-2001

2.64

PRODUCT 011

NYC

Brian
WM

Front-End Residue
Marlborough Facility Scale
Truck Weight Ticket
(with Waste Management Back-up)
for February 28, 2001

Trucks 1-2 = 6.86 tons
Truck 1 = 3.41 tons

7:35 3-01-2001
TIME IN 7:05
TICKET NUMBER 304
LOOP ID 443
42360 lb GROSS
35560 lb TARE
6820 lb NET

3.41

PRODUCT 012

NYC
WM
Brig

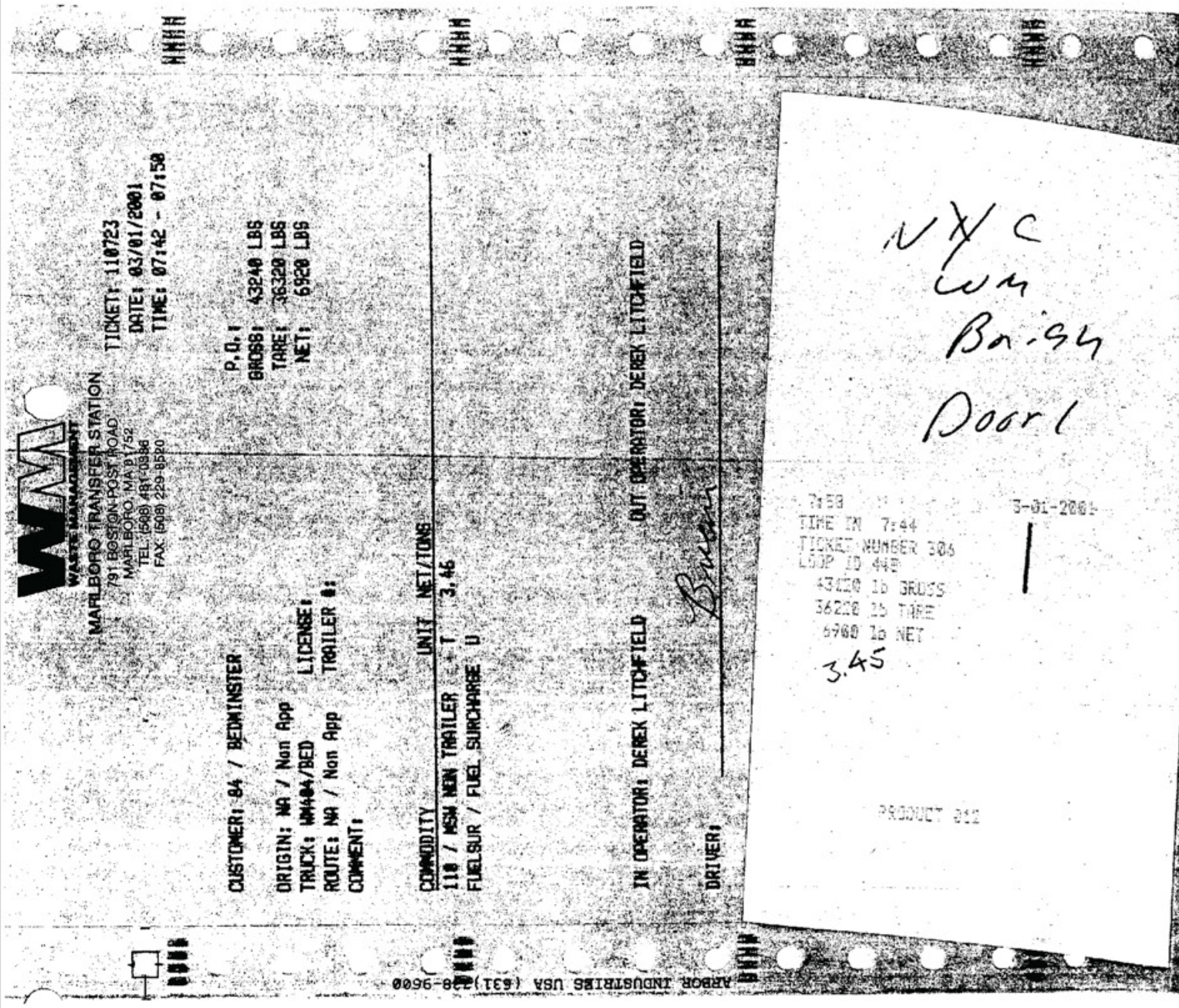
ARBOR INDUSTRIES USA

DRIVER:

IN OPERATOR: DEREK LITCHFIELD

Front-End Residue
Marlborough Facility Scale
Truck Weight Ticket
(with Waste Management Back-up)
for February 28, 2001

Trucks 1-2 = 6.86 tons
Truck 2 = 3.45 tons


WASTE MANAGEMENT
MARLBORO TRANSFER STATION
791 BOSTON POST ROAD
MARLBORO, MA 01752
TEL (508) 481-0386
FAX (508) 229-8520

TICKET: 110723
DATE: 03/01/2001
TIME: 07:42 - 07:58

CUSTOMER: 84 / BEDMINSTER

P.O.:
GROSS: 43240 LBS
TARE: 36320 LBS
NET: 6920 LBS

ORIGIN: NA / Non App
TRUCK: WM404/BED LICENSE:
ROUTE: NA / Non App TRAILER #:
COMMENT:

COMMODITY	UNIT	NET/TONS
110 / MSW NEW TRAILER	T	3.46
FUELSUR / FUEL SURCHARGE	U	

IN OPERATOR: DEREK LITCHFIELD
OUT OPERATOR: DEREK LITCHFIELD

DRIVER: Brian

ARBOR INDUSTRIES USA (631)228-9600

NYC
WM
Brian
Door 1

7:58 3-01-2001
TIME IN 7:44
TICKET NUMBER 306
LOOP ID 445
43120 lb GROSS
36220 lb TARE
6900 lb NET
3.45

1

PRODUCT 012

**Front-End Residue
Marlborough Facility Scale
Truck Weight Ticket
(with Waste Management Back-up)
for March 1, 2001**

Truck 1-2 = 6.97 tons
Truck 1 = 3.52 tons

WASTE MANAGEMENT
MARLBORO TRANSFER STATION
791 BOSTON POST ROAD
MARLBORO, MA 01752
TEL: (508) 481-0336
FAX: (508) 229-8520

TICKET: 110824
DATE: 03/02/2001
TIME: 07:46 - 07:54

CUSTOMER: 84 / BEDMINSTER
P.O.:

ORIGIN: NA / Non App
TRUCK: WM404/BED LICENSE:
ROUTE: NA / Non App TRAILER #:
COMMENT:

GROSS: 42260 LBS
TARE: 35060 LBS
NET: 7200 LBS

COMMODITY	UNIT	NET/TONS
110 / MSW NON TRAILER	T	3.60
FUELSUR / FUEL SURCHARGE	U	

IN OPERATOR: DEREK LITCHFIELD
OUT OPERATOR: DEREK LITCHFIELD

ARBOR INDUSTRIES USA (631) 328-9600

3.52

NYC
WM
Brian
Door 1

Front-End Residue
Marlborough Facility Scale
Truck Weight Ticket
(with Waste Management Back-Up)
for March 1, 2001

Truck 1-2 = 6.97 tons

Truck 2 = 3.45 tons

WASTE MANAGEMENT
MARLBORO TRANSFER STATION
791 BOSTON POST ROAD
MARLBORO, MA 01752
TEL: (508) 481-0336
FAX: (508) 229-8520

TICKET: 110826
DATE: 03/02/2001
TIME: 08:07 - 08:13

CUSTOMER: 84 / BEDMINSTER

P.O.:
GROSS: 43180 LBS
TARE: 36180 LBS
NET: 7000 LBS

ORIGIN: NA / Non App
TRUCK: WM404/BED LICENSE:
ROUTE: NA / Non App TRAILER #:
COMMENT:

COMMODITY	UNIT	NET/TONS
110 / MSW NON TRAILER	T	3.50
FUELSUR / FUEL SURCHARGE	U	
266 / BULKY WASTE - LARGE	U	1.00

IN OPERATOR: DEREK LITCHFIELD OUT OPERATOR: DEREK LITCHFIELD

DRIVER: Brian

ARBOR INDUSTRIES USA (631)738-9600

3.45

NYC
Lynn
Brian
Door 1

Front-End Residue
Marlborough Facility Scale
Truck Weight Ticket
(with Waste Management Back-up)
for March 2, 2001

Trucks 1-2 = 5.98 tons
Truck 1 = 2.59 tons

MARLBORO TRANSFER STATION
...STON POST ROAD
...LBORO, MA 01752
...: (508) 481-0300
FAX (508) 229-8520

TICKET: 110940
DATE: 03/03/2001
TIME: 08:24 - 08:29

P.O.:
GROSS: 41360 LBS
TARE: 36340 LBS
NET: 5020 LBS

CUSTOMER: 84 / BEDMINSTER
ORIGIN: NA / Non App
TRUCK: WM404/BED LICENSE:
ROUTE: NA / Non App TRAILER #:
COMMENT:

COMMODITY	UNIT	NET/TONS
110 / MSW NON TRAILER	T	2.51
FUELSUR / FUEL SURCHARGE	U	

IN OPERATOR: DEREK LITCHFIELD
OUT OPERATOR: DEREK LITCHFIELD
DRIVER: Brian

ARBOR INDUSTRIES USA (631)738-9600

8:35 3-03-2001
TIME IN 8:25
TICKET NUMBER 369
LOOP ID 518
41220 lb GROSS
36080 lb TARE
5140 lb NET

2.57 NYC
WM
Brian

PRODUCT 812
Door 1

[redacted]

Front-End Residue
Marlborough Facility Scale
Truck Weight Ticket
(with Waste Management Back-up)
for March 2, 2001

Trucks 1-2 = 5.98 tons
Truck 2 = 3.41 tons

8:59 3-03-2001
TIME IN 8:46
TICKET NUMBER 372
LOOP ID 621
41960 lb GROSS
35140 lb TARE
6820 lb NET

3.41

PRODUCT 012

NYC
WM
Brigr
Door 1

ARBOR INDUSTRIES USA (631)738-9600

WASTE MANAGEMENT
MARLBORO TRANSFER STATION
79 BOSTON POST ROAD
MARLBORO, MA 01752
TEL (508) 481-8336
FAX (508) 229-8620

TICKET: 110941
DATE: 03/03/2001
TIME: 08:45 - 08:52

CUSTOMER: 84 / BEDMINSTER
P.O.:
ORIGIN: MA / Non App
GROSS: 42180 LBS
TRUCK: WM404/BED LICENSE:
TARE: 35260 LBS
ROUTE: NA / Non App TRAILER #:
NET: 6920 LBS
COMMENT:

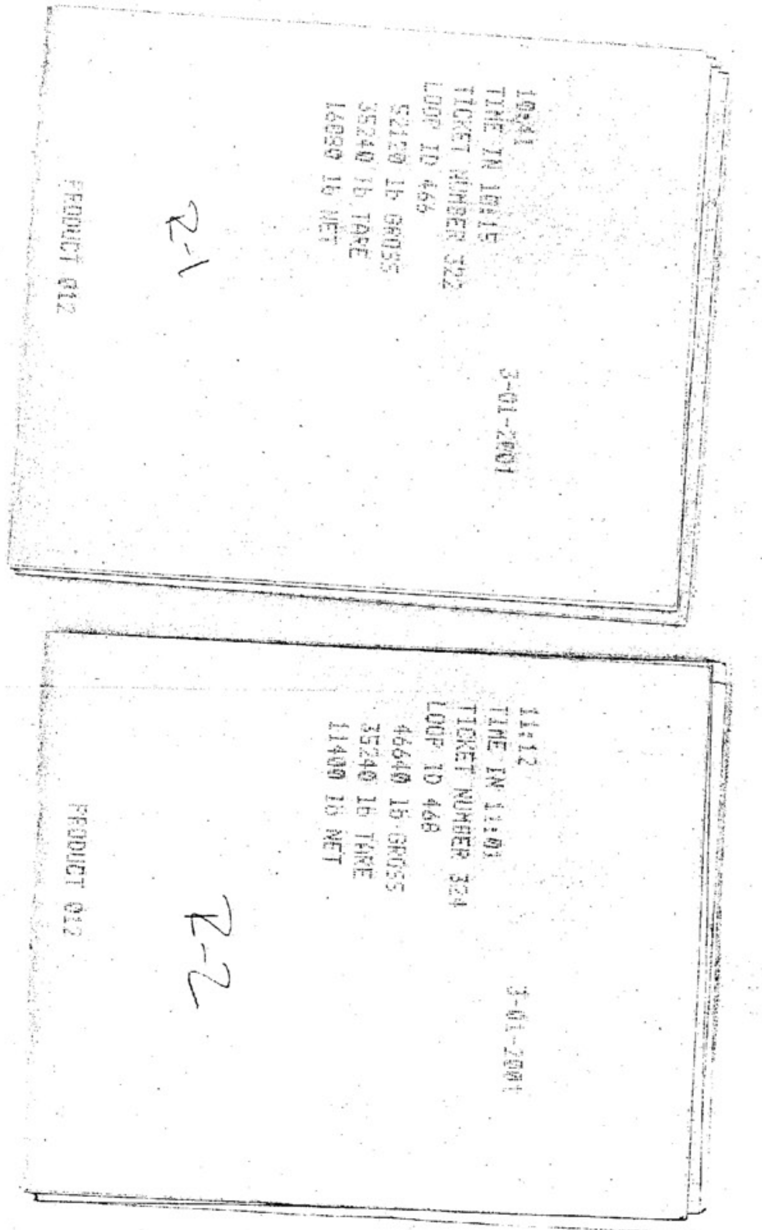
COMMODITY	UNIT	NET/TONS
110 / MSW NON TRAILER	T	3.46
FUELSUR / FUEL SURCHARGE	U	

IN-OPERATOR: DEREK LITCHFIELD
OUT-OPERATOR: DEREK LITCHFIELD

DRIVER: Brian

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 1, 2001

Trucks 1-2 = 14.14 tons



10:41
TIME IN 10:15
TICKET NUMBER 322
LOOP ID 466
52120 lb GROSS
35240 lb TARE
16880 lb NET
3-01-2001
PRODUCT 012
R-1

11:12
TIME IN 11:01
TICKET NUMBER 324
LOOP ID 468
46640 lb GROSS
35240 lb TARE
11400 lb NET
3-01-2001
PRODUCT 012
R-2

Primary Screen Unders
Marlborough Facility Scale
Front End Loader Weight Ticket
March 1, 2001

1 FEL Bucket = 3.24 tons
3.24 tons x 14 Buckets = 45.36 tons

9:13
LOOP ID 461
INBOUND 22040 lb
3-01-2001
PRODUCT 000

2-BUCKETS 01 MAR 01

9:27
TIME IN 9:13
TICKET NUMBER 317
LOOP ID 461
35000 lb GROSS
22040 lb TARE
12960 lb NET
3-01-2001
PRODUCT 000

COMPOST x2

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 2, 2001

1 FEL Bucket = 1.85 tons
1.85 tons x 8 Buckets = 14.83 tons

11:04 3-02-2001
LOOP ID 503
INBOUND 35220 lb
PRODUCT 012

R-1

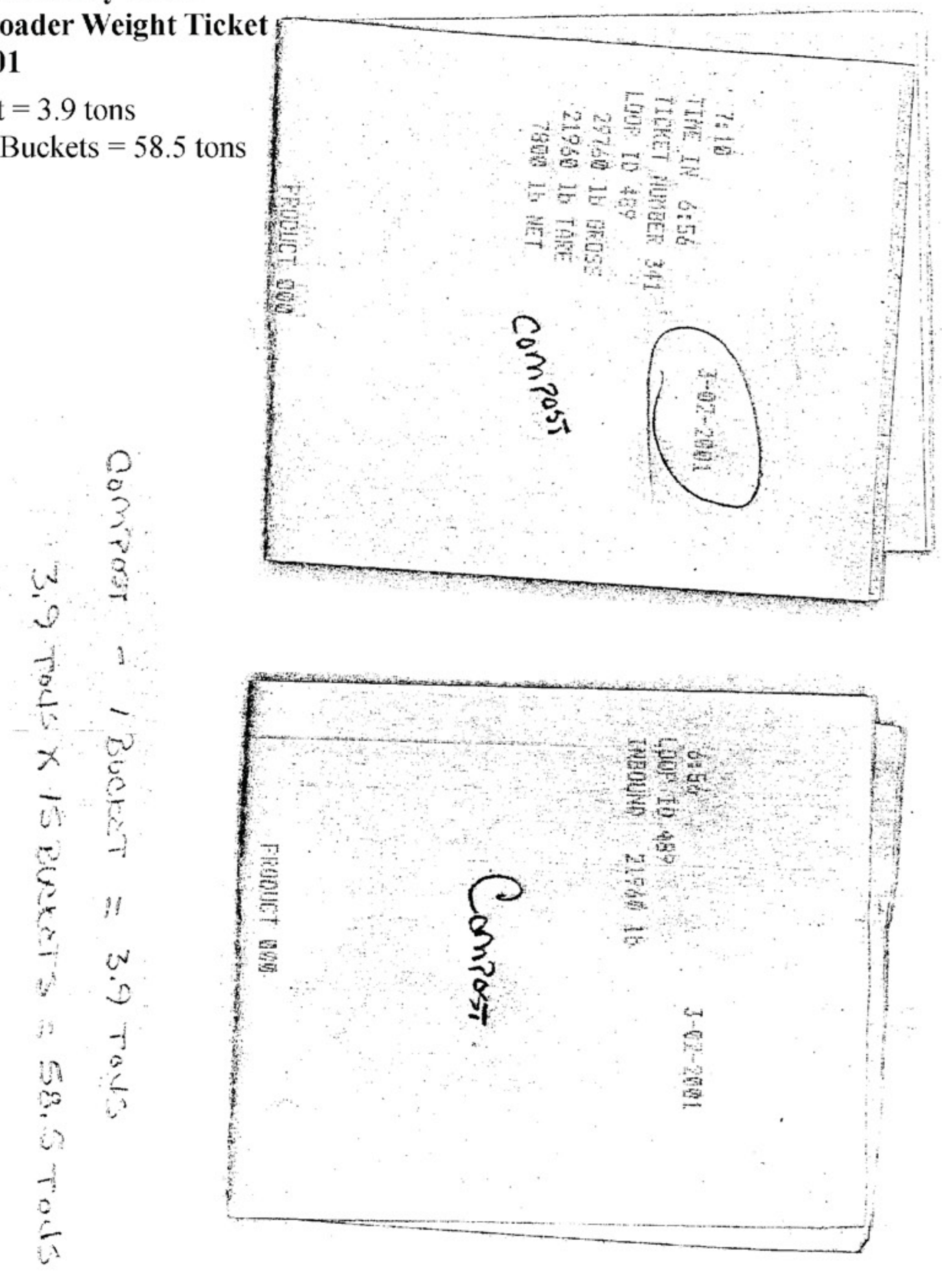
11:19 3-02-2001
TIME IN 11:04
TICKET NUMBER 356
LOOP ID 503
48200 lb GROSS
35220 lb TARE
12980 lb NET
PRODUCT 012

R-1

NET = 3.5 BUCKETS
8 BUCKETS OVERALL
14.83 TONS

Primary Screen Unders
Marlborough Facility Scale
Front End Loader Weight Ticket
March 2, 2001

1 FEL Bucket = 3.9 tons
3.9 tons x 15 Buckets = 58.5 tons

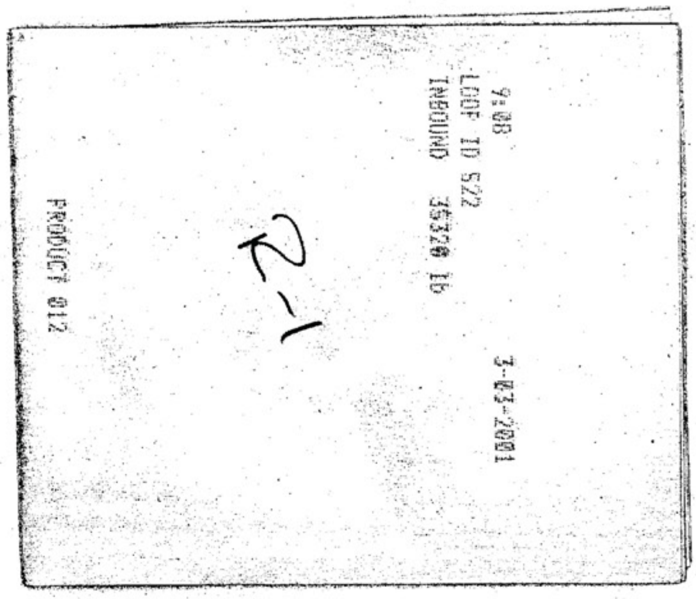

7:10
TIME IN 6:56
TICKET NUMBER 341
LOOP ID 489
29760 lb GROSS
21960 lb TARE
7800 lb NET
PRODUCT 000
3-02-2001
Compost

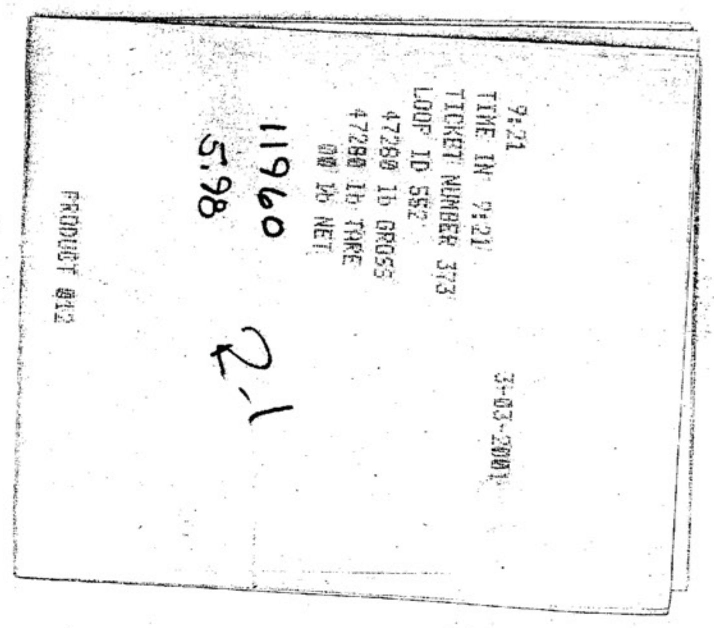
6:56
LOOP ID 489
INBOUND 21960 lb
PRODUCT 000
3-02-2001
Compost

Compost = 1 Bucket = 3.9 Tons
3.9 Tons x 15 Buckets = 58.5 Tons

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 3, 2001

Trucks 1-2 = 15.63 tons
Truck 1 = 5.98 tons

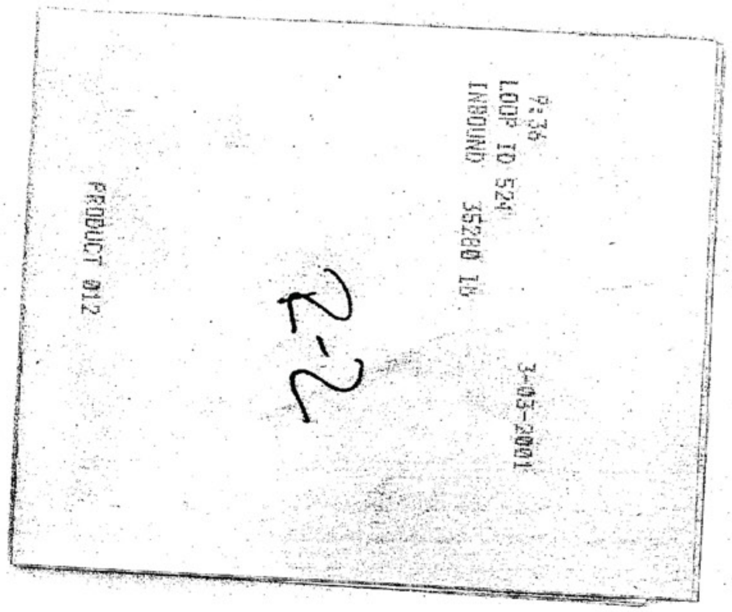

9:08 3-03-2001
LOOP ID 522
INBOUND 35320 lb
R-1
PRODUCT 012


9:21 3-03-2001
TIME IN 9:21
TICKET NUMBER 373
LOOP ID 552
47280 lb GROSS
47280 lb TARE
00 lb NET
11960
5.98
R-1
PRODUCT 012

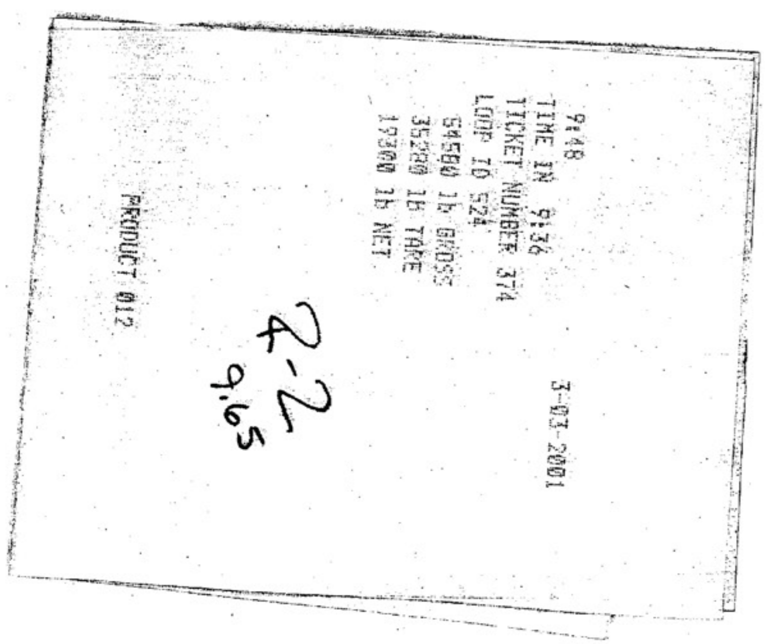
Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 3, 2001

Trucks 1-2 = 15.63 tons

Truck 2 = 9.65 tons



9:36
LOOP ID 524
INBOUND 35280 lb
3-03-2001
PRODUCT 012
2-2



9:48
TIME IN 9:36
TICKET NUMBER 374
LOOP ID 524
54580 lb GROSS
35280 lb TARE
19300 lb NET
3-03-2001
PRODUCT 012
2-2
9.65

Primary Screen Unders
Marlborough Facility Scale
Front End Loader Weight Ticket
March 3, 2001

1 FEL Bucket = 4.57 tons
4.57 tons x 8 Buckets = 36.56 tons

COMPOST - OUT = 2 BUCKETS

7:18
TIME IN 7:03
TICKET NUMBER 366
LOOP ID 514
40200 lb GROSS
21940 lb TARE
18260 lb NET
3-03-2001

PRODUCT 000

7:03
LOOP ID 514
INBOUND 21940 lb
3-03-2001

PRODUCT 000

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 5, 2001

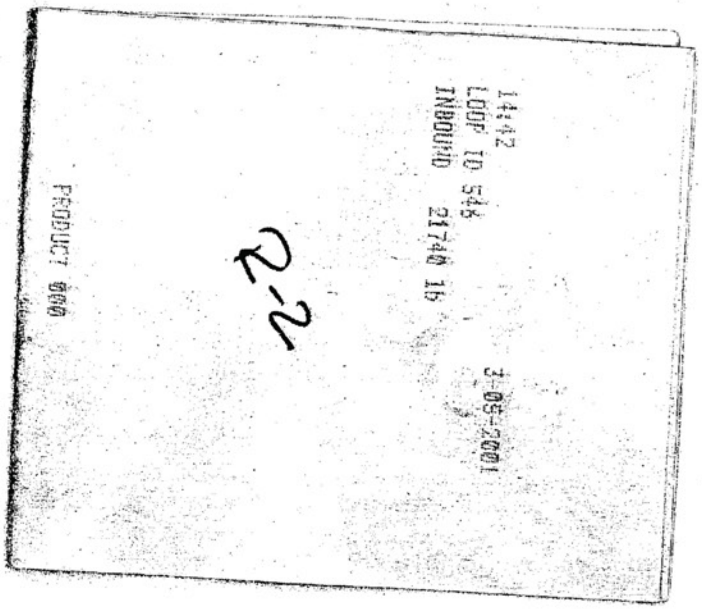
Trucks 1 - 6 = 18.19 tons
Truck 1 = 4.19 tons

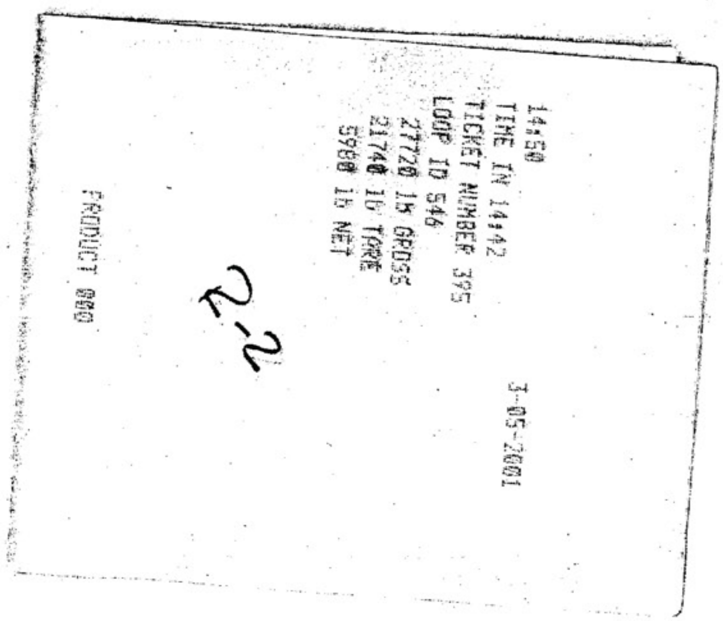
14:29
TIME IN 14:18
TICKET NUMBER 394
LOOP ID 545
30100 lb GROSS
21720 lb TARE
8380 lb NET
3-05-2001
PRODUCT 000
2-1

14:18
LOOP ID 545
INBOUND 21720 lb
3-05-2001
PRODUCT 000
2-1

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 5, 2001

Trucks 1 - 6 = 18.19 tons
Truck 2 = 2.99 tons

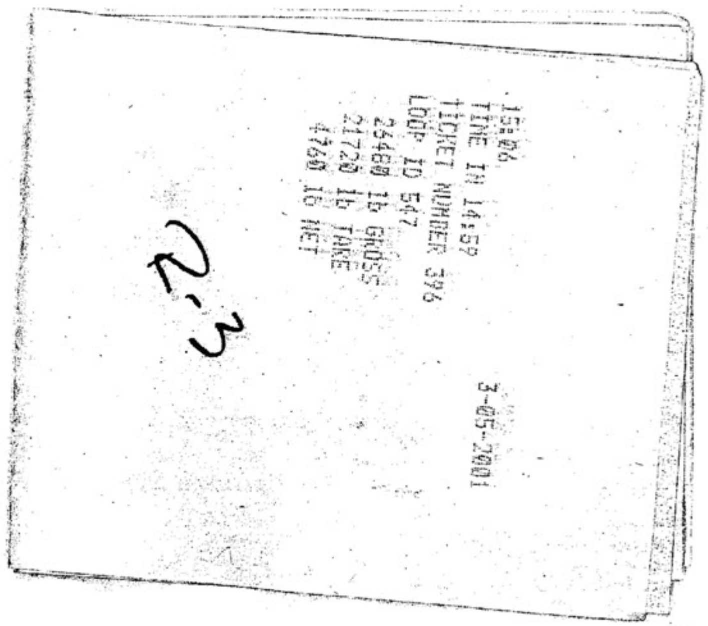

14:42
LOOP ID 546
INBOUND 21740 lb
3-05-2001
PRODUCT 000
2-2

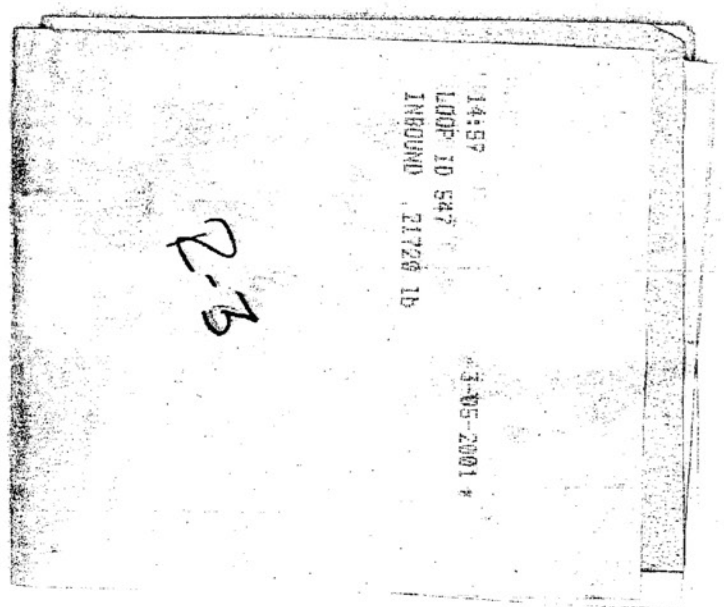

14:50
TIME IN 14:42
TICKET NUMBER 395
LOOP ID 546
27720 lb GROSS
21740 lb TARE
5980 lb NET
3-05-2001
PRODUCT 000
2-2

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 5, 2001

Trucks 1 - 6 = 18.19 tons

Truck 3 = 2.38 tons


15:06
TIME IN 14:59
TICKET NUMBER 396
LOOP ID 547
26480 lb GROSS
21720 lb TARE
4760 lb NET
3-05-2001
R-3


14:59
LOOP ID 547
INBOUND 21720 lb
3-05-2001
R-3

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 5, 2001

Trucks 1 - 6 = 18.19 tons
Truck 4 = 4.02 tons

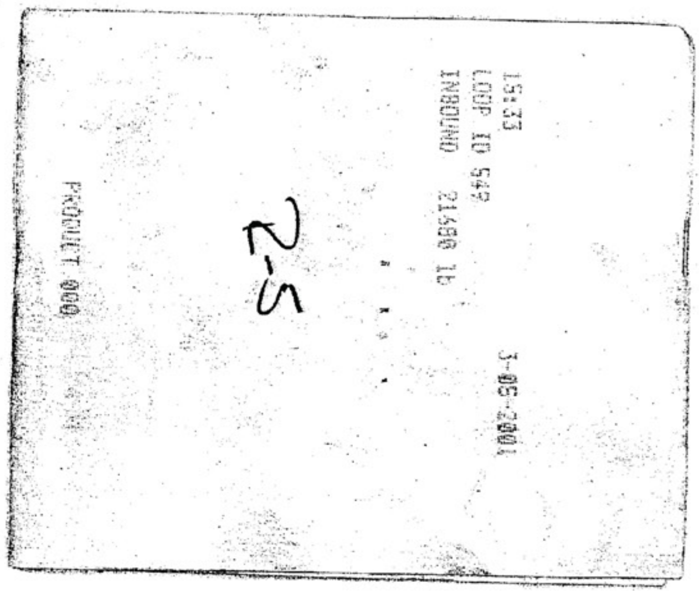
15:26 3-05-2001
TIME IN 15:14
TICKET NUMBER 397
LOOP ID 548
29800 lb GROSS
21760 lb TARE
8040 lb NET
PRODUCT 000

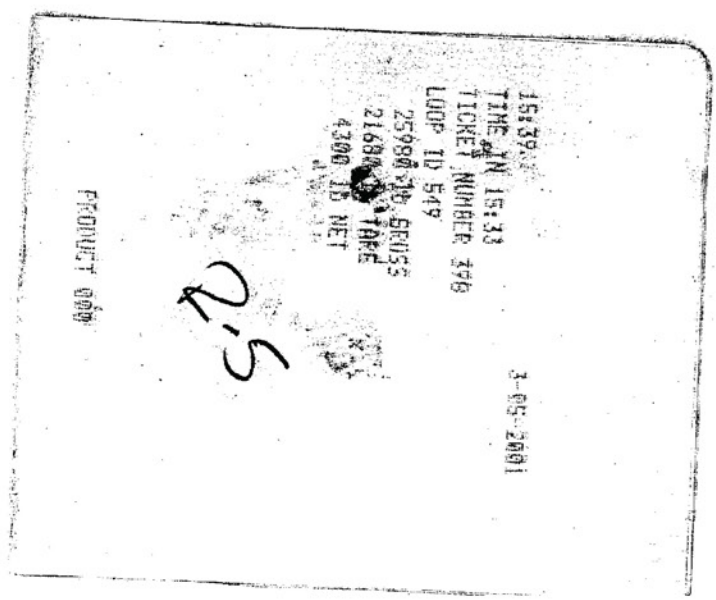
15:14 3-05-2001
LOOP ID 548
INBOUND 21760 lb
2-4
PRODUCT 000

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 5, 2001

Trucks 1 - 6 = 18.19 tons

Truck 5 = 2.15 tons

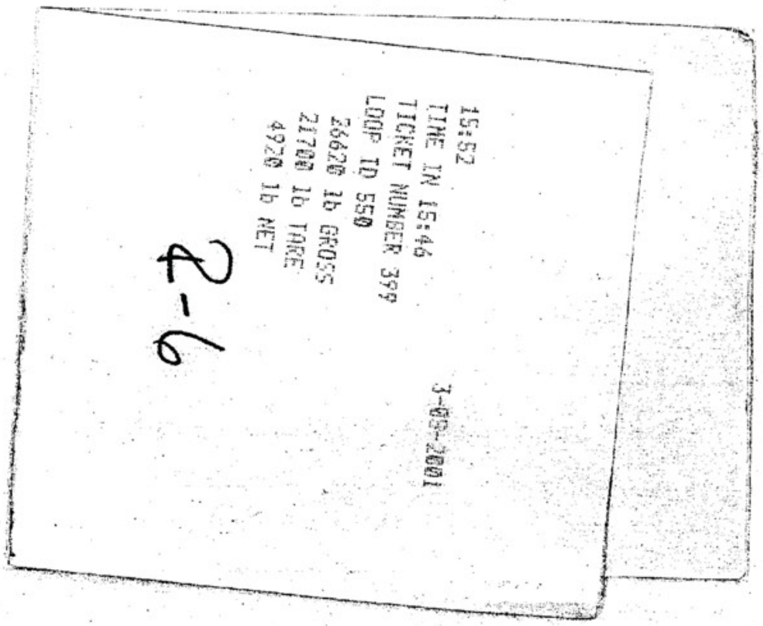

15:33
LOOP ID 549
INBOUND 21680 lb
3-05-2001
PRODUCT 000
2-5


15:39
TIME IN 15:33
TICKET NUMBER 396
LOOP ID 549
25980 lb GROSS
21680 lb TARE
4300 lb NET
3-05-2001
PRODUCT 000
2-5

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 5, 2001

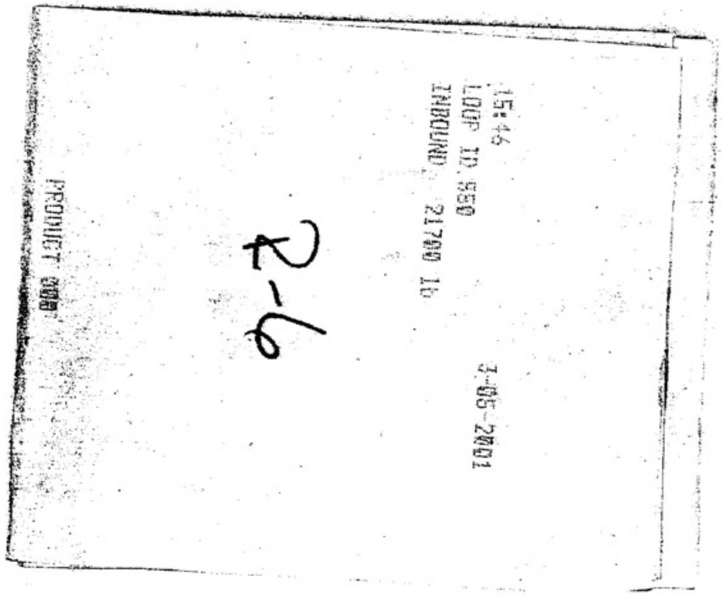
Trucks 1 - 6 = 18.19 tons

Truck 6 = 2.46 tons



15:52
TIME IN 15:46
TICKET NUMBER 399
LOOP ID 550
26620 lb GROSS
21700 lb TARE
4920 lb NET
3-05-2001

2-6

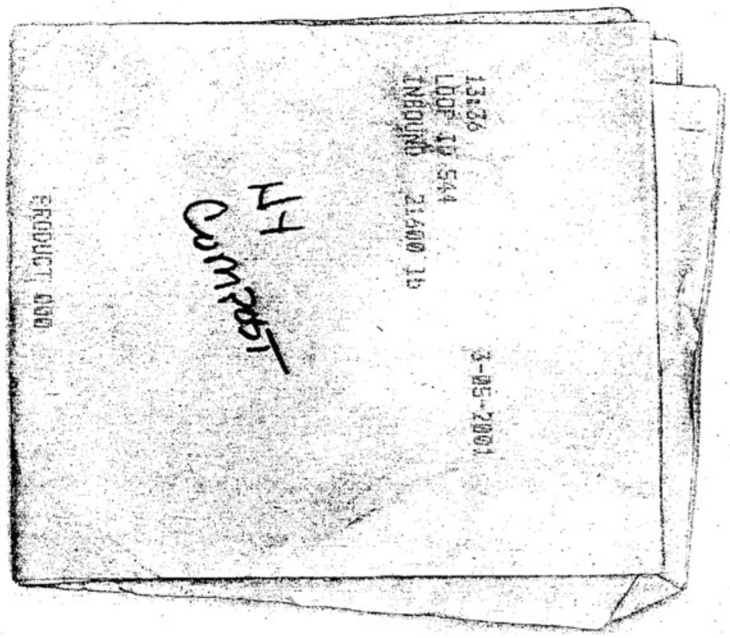


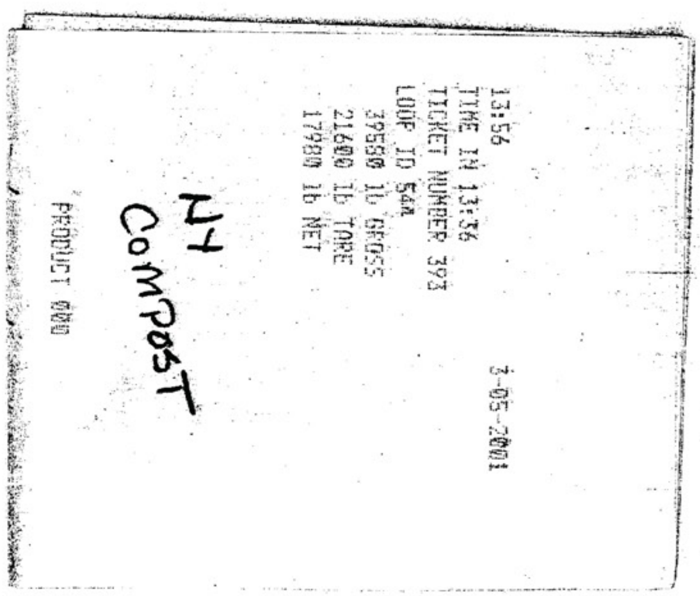
15:46
LOOP ID 550
INBOUND 21700 lb
PRODUCT 000
3-05-2001

2-6

Primary Screen Unders
Marlborough Facility Scale
Front End Loader Weight Ticket
March 5, 2001

1 Bucket = 4.5 tons
4.5 tons x 10 Buckets = 45.0


13:36
LOOP ID 544
INBOUND 21600 lb
3-05-2001
PRODUCT 000
H4
COMPOST


13:56
TIME IN 13:36
TICKET NUMBER 393
LOOP ID 544
39580 lb GROSS
21600 lb TARE
17980 lb NET
3-05-2001
PRODUCT 000
H4
COMPOST

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 7, 2001

Truck 1 = 12.12 tons

11:54
TIME IN 11:39
TICKET NUMBER 413
LOOP ID 565
56220 lb GROSS
31980 lb TARE
24240 lb NET
3-07-2001
PRODUCT 012
2-1

11:39
LOOP ID 565
INBOUND 56220 lb
3-07-2001
PRODUCT 012
2-1

Primary Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
March 7, 2001

Truck 2 = 3.75 tons

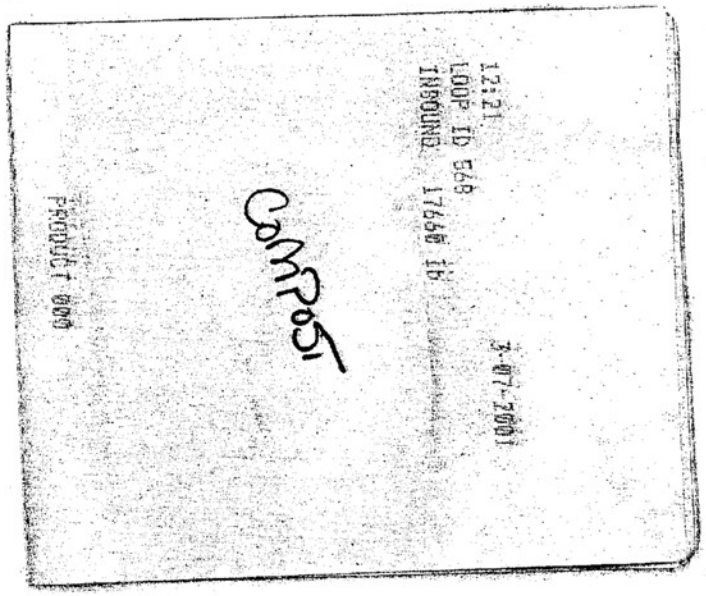
11:55
LOOP ID 566
INBOUND 31900 lb
3-07-2001
PRODUCT 012
2-2

12:17
TIME IN 11:55
TICKET NUMBER 414
LOOP ID 566
39400 lb GROSS
31900 lb TARE
7500 lb NET
3-07-2001
PRODUCT 012
2-2

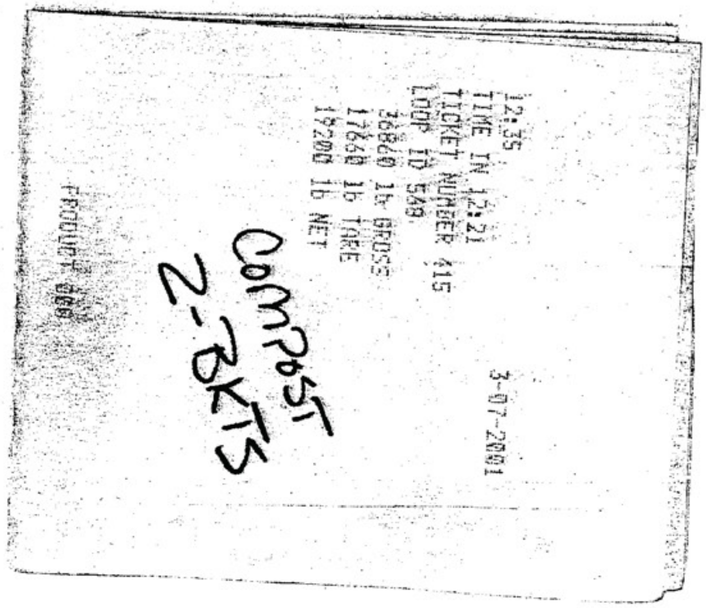
Primary Screen Unders
Marlborough Facility Scale
Front End Loader Weight Ticket
March 7, 2001

1 FEL Bucket = 4.8 tons

4.8 tons x 11 Buckets = 52.8 tons



12:21
LOOP ID 568
INBOUND 17660 lb
3-07-2001
PRODUCT 000
COMPOST



12:35
TIME IN 12:21
TICKET NUMBER 415
LOOP ID 568
36860 lb GROSS
17660 lb TARE
19200 lb NET
3-07-2001
PRODUCT 000
COMPOST
2-BKTS

Half-Inch Overs
Marlborough Facility Scale
Truck Weight Tickets
March 31, 2001

Trucks 1 - 4 = 16.59 tons

Truck 1 = 4.65 tons

12:04 3-31-2001
LOOP ID 1109
INBOUND 21780 lb
load 1
Rejects
N/C
PRODUCT 000

1/2 overs

12:20 3-31-2001
TIME IN 12:04
TICKET NUMBER 916
LOOP ID 1109
31080 lb GROSS
21780 lb TARE
9300 lb NET
PRODUCT 000

Half-Inch Overs
Marlborough Facility Scale
Truck Weight Tickets
March 31, 2001

Trucks 1 - 4 = 16.59 tons

Truck 2 = 4.89 tons

13:06 3-31-2001
LOOP ID 1110
INBOUND 21740 lb

load 2
Rejects
N/C

PRODUCT 000

1/2" overs

13:57 3-31-2001
TIME IN 13:06
TICKET NUMBER 917
LOOP ID 1110
31520 lb GROSS
21740 lb TARE
9780 lb NET

PRODUCT 000

Half-Inch Overs
Marlborough Facility Scale
Truck Weight Tickets
March 31, 2001

Trucks 1 - 4 = 16.59 tons

Truck 3 = 3.51 tons

14:14 3-31-2001
LOOP ID 1111
INBOUND 21740 lb

load 3
Rejects
NYC

PRODUCT 000

1/2" overs

14:26 3-31-2001
TIME IN 14:14
TICKET NUMBER 918
LOOP ID 1111
28760 lb GROSS
21740 lb TARE
7020 lb NET

PRODUCT 000

Half-Inch Overs
Marlborough Facility Scale
Truck Weight Tickets
March 31, 2001

Trucks 1 - 4 = 16.59 tons

Truck 4 = 3.54 tons

14:34
LOOP ID 1112
INBOUND 21720 lb
3-31-2001

load 4
Rejects
NYC

PRODUCT 000

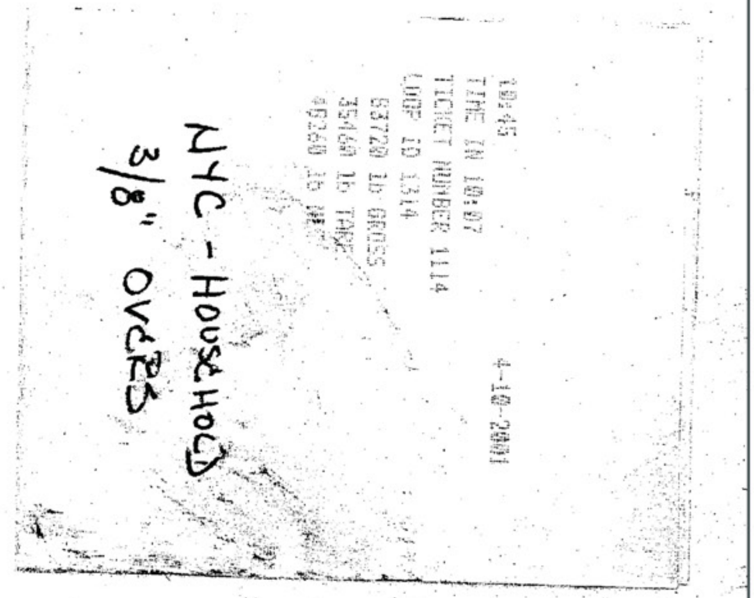
1/2 overs

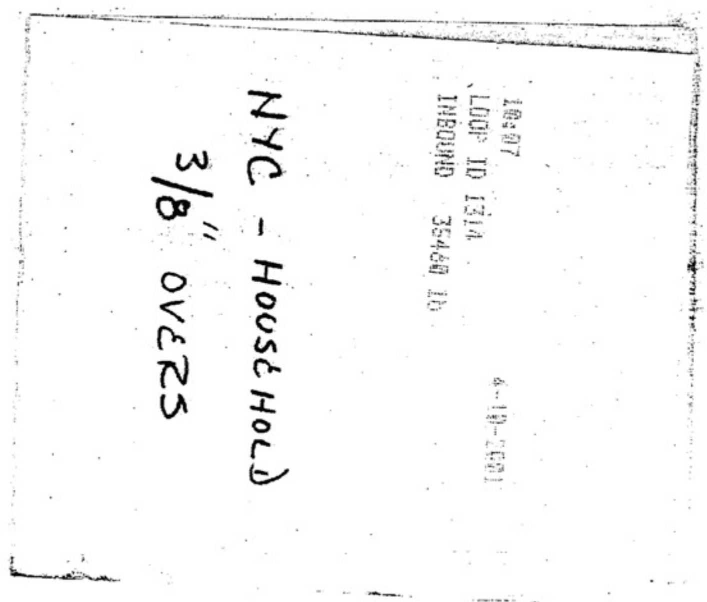
14:44
TIME IN 14:34
TICKET NUMBER 919
LOOP ID 1112
28800 lb GROSS
21720 lb TARE
7080 lb NET
3-31-2001

PRODUCT 000

Final 3/8" Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
April 10, 2001

Trucks 1-2 = 26.11 tons
Truck 1 = 24.13 tons

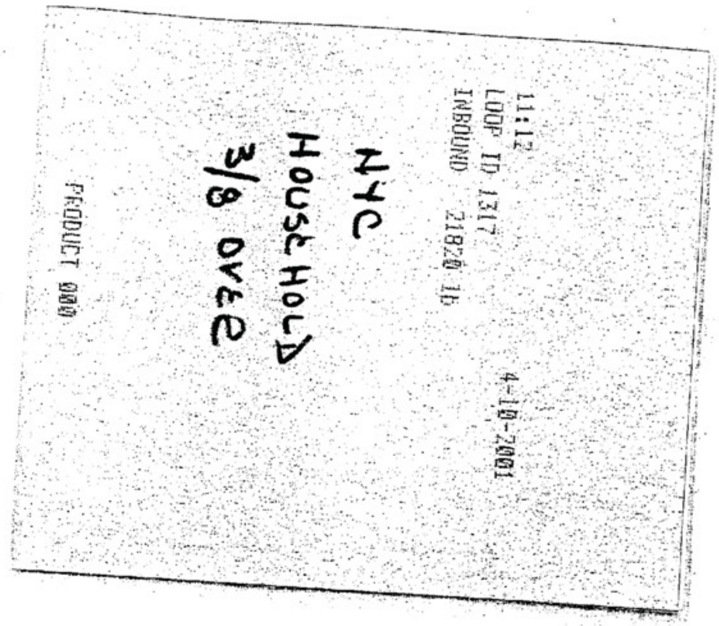

10:45
TIME IN 10:07
TICKET NUMBER 1114
LOOP ID 1314
63720 lb GROSS
35460 lb TARE
28260 lb NET
4-10-2001
NYC - HOUSEHOLD
3/8" OVERS


10:07
LOOP ID 1314
INBOUND 35460 lb
4-10-2001
NYC - HOUSEHOLD
3/8" OVERS

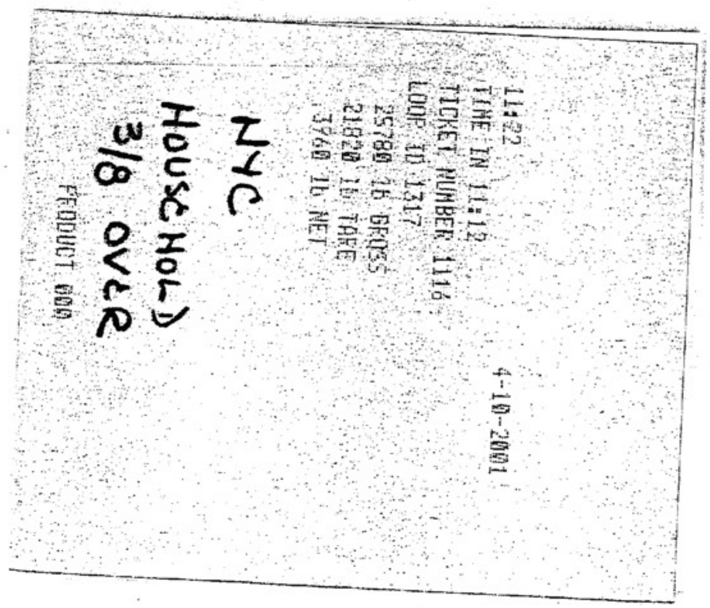
Final 3/8" Screen Overs
Marlborough Facility Scale
Truck Weight Tickets
April 10, 2001

Trucks 1-2 = 26.11 tons

Truck 2 = 1.98 tons



11:12
LOOP ID 1317
INBOUND 21820 lb
4-10-2001
NYC
HouseHold
3/8 over
PRODUCT 000



11:22
TIME IN 11:12
TICKET NUMBER 1116
LOOP ID 1317
25780 lb GROSS
21820 lb TARE
3960 lb NET
4-10-2001
NYC
HouseHold
3/8 over
PRODUCT 000

Final 3/8" Screen Unders
Marlborough Facility Scale
Truck Weight Tickets
April 11, 2001

Trucks 1-6 = 96.25 tons

Truck 1 = 19.2 tons

4:01 4-11-2001
TIME IN 3:08
TICKET NUMBER 1127
LOOP ID 1329
74220 lb GROSS
35820 lb TARE
38400 lb NET

NYC - HOUSEHOLD
3/8 UNDER

Final 3/8" Screen Unders
Marlborough Facility Scale
Truck Weight Tickets
April 11, 2001

Trucks 1-6 = 96.25 tons

Truck 2 = 21.71 tons

6:54
TIME IN 6:43
TICKET NUMBER 1129
LOOP ID 1332
79060 lb GROSS
35640 lb TARE
43420 lb NET
4-11-2001

NYC Household
3/8 under

6:43
LOOP ID 1332
INBOUND 35640 lb
4-11-2001

Final 3/8" Screen Unders
Marlborough Facility Scale
Truck Weight Tickets
April 12, 2001

Trucks 1-6 = 96.25 tons
Truck 3 = 20.47 tons

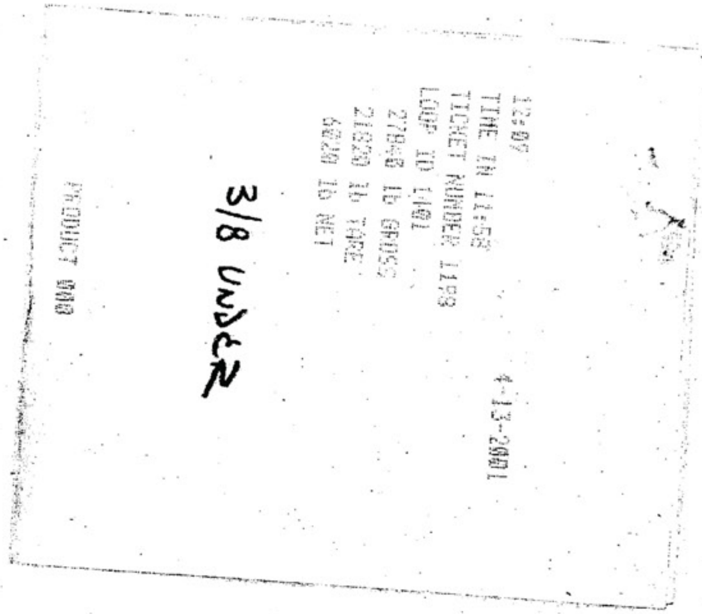
10:41 4-12-2001
TIME IN 10:01
TICKET NUMBER 1169
LOOP ID 1371
76600 lb GROSS
35660 lb TARE
40940 lb NET

NYC - HOUSEHOLD
3/8 UNDERS

Final 3/8" Screen Unders
Marlborough Facility Scale
Truck Weight Tickets
April 13, 2001

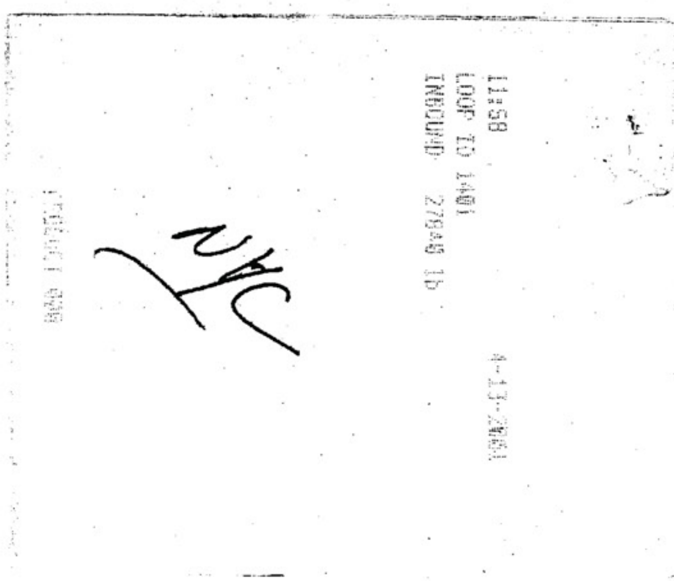
Trucks 1-6 = 96.25 tons

Truck 4 = 3.01 tons



12:07
TIME IN 11:58
TICKET NUMBER 1178
LOOP ID 1401
27840 lb GROSS
21820 lb TARE
6020 lb NET
PRODUCT 000
4-13-2001

3/8 UNDER



11:58
LOOP ID 1401
INBOUND 27840 lb
PRODUCT 000
4-13-2001

Final 3/8" Screen Unders
Marlborough Facility Scale
Truck Weight Tickets
April 13, 2001

Trucks 1-6 = 96.25 tons
Truck 5 = 24.41 tons

11:28 4-13-2001
TIME IN 11:04
TICKET NUMBER 1192
LOOP ID 1394
85220 lb GROSS
36400 lb TARE
48820 lb NET

DW

PRODUCT 00

NYC
COMPOST

3/8 UNDER

Final 3/8" Screen Unders
Marlborough Facility Scale
Truck Weight Tickets
April 13, 2001

Trucks 1-6 = 96.25 tons
Truck 6 = 7.45 tons

11:44 4-13-2001
TIME IN 11:19
TICKET NUMBER 1196
LOOP ID 1396
36700 lb GROSS
21800 lb TARE
14900 lb NET

3/8 UNDER

PRODUCT 000

11:19 4-13-2001
LOOP ID 1396
INBOUND 21800 lb

NYC

PRODUCT 000

New York City MSW Composting Report

Appendix C
Marlborough Facility Scale Receipts

Facility Temperature Data Sheet #1
Digester 2 (D2) = NYC Material

Operator: Vim Hogan

Date: 2-26-01 MON.
NYC

Digesters

D1

	1	2	3	4	5	F.S.
Moistures		68%			55%	52%
Temperatures	68	90	100	104	110	— 0500 —
	70	92	105	106	108	– 0800 —
Depths	2.5	3.5	3.5	6	7	
CO2	2%			1%		

D2

	1	2	3	4	5
Moistures		54%			
Temperatures	142	158	158	160	153
	142	158	160	160	152
Depths	1.5	3.5	3	3.5	4
CO2	2%			2%	

BioFilter

North End	Bay 1		Bay 2		Bay 3		Bay 4		Bay 5		South End
	1	2	3	4	5	6	7	8	9	10	
Back Pressure	3.9	3.9	3.8	3.8	3.7	3.6	3.6	3.2	3.4	3.3	0830
Depth ~~Moisture~~	7 7/8	7 3/4	7 1/8	9 1/2	6 7/8	8 3/4	12	7 1/4	6 1/4		
Depth	4 7/8	5 7/8	4 3/4	8 1/2	7 1/4	6 1/2	8 1/4	9 1/2	5 1/4		
VOC											
Dry Spots						H_2O					
Sprinklers											

Scrubbers

Back Pressure

BF # 3

IN	OUT	TOTAL
5.2	3.9	9.1

BF #4

IN	OUT	TOTAL
5.5	3.9	9.4

Notes/Comments:

Facility Temperature Data Sheet # 2
Digester 2 (D2) = NYC Material

Operator Jim Hogan Date 2-27-01

Digesters

D1

	1	2	3	4	5
Moistures	*	*			52%
Temperatures	60	80	110	120	120
Depths	8	9.5	9	11	11
CO2	off loading				

D2

	1	2	3	4	5
Moistures		53%			62%
Temperatures	110	140	160	160	160
Depths	5½	7½	7	7	5
CO2	off loading				

BioFilter

North End	Bay 1		Bay 2		Bay 3		Bay 4		Bay 5		South End
	1	2	3	4	5	6	7	8	9	10	
Back Pressure	3.9	3.8	3.6	3.8	3.6	3.2	3.5	3.3	3.4	3.3	0840
Moisture				53%			54%	62%			
Depth											
VOC											
Dry Spots						H_2O					
Sprinklers											

Scrubbers

Back Pressure

BF # 3

IN	OUT	TOTAL
5.5	3.9	9.4

BF #4

IN	OUT	TOTAL
5.8	3.8	9.6

Notes/Comments: * unable to get a good grab sample mostly dry paper + solids no sign of sludge 0830

Biofilter moisture samples taken @ 2' below surface

Worked on Monthly Composite paper work

Facility Temperature Data Sheet #3

Temperature Readings from Five Compartments of Digester with NYC Material

BEDMINSTER MARBOROUGH , LLC

DIGESTER DATA

BATCH NUMBER: D-2/ 02-27-0 Digester#-Month of Loading-Day of Loading-Year

BATCH MIX:

MSW ~~42.1~~ tons MSS 0 tons WATER 349 gallons

LOAD AND UNLOAD TIME 130 MIN. LOADING UNLOADING DISCHARGE DATE

DATE	TIME (AM/PM)	CMPRMNT #	TEMP (F)	MOISTURE CONTENT (% W BASIS)	CMPTMT DEPTH (feet)	PD BLOWER (CFM)	ph		
2/28/01	5:00AM	#1	80		4	~~[illegible]~~ HZ			
		#2	120		6				
		#3	140		6				
		#4	150		7				
		#5	150		5.5				
	5:00AM	#1				~~35~~ Hz			
		#2							
		#3							
		#4							
		#5							
	5:00AM	#1				~~25~~ Hz			
		#2							
		#3							
		#4							
		#5							

Facility Temperature Data Sheet #4
Digester 2 (D2) = NYC Material

Operator Jim Hogan

Date 3-1-01 Thurs

Digesters

D1

	1	2	3	4	5
Moistures		60%			57%
Temperatures	<50	72	98	110	108
Depths	6.5	7.5	7.5	7	8
CO2	0%			1%	

-0520-

D2

	1	2	3	4	5
Moistures		60%			51%
Temperatures	62	120	130	146	148
Depths					
CO2	2%			1%	

BioFilter

North End	Bay 1		Bay 2		Bay 3		Bay 4		Bay 5		South End
	1	2	3	4	5	6	7	8	9	10	
Back Pressure	3.3	3.1	3.1	3.2	3.2	2.9	3.1	3	3	2.9	
Moisture											
Depth											
VOC											
Dry Spots							H_2O				
Sprinklers											

Scrubbers

Back Pressure

BF # 3

IN	OUT	TOTAL
5.8	3.2	9

BF #4

IN	OUT	TOTAL
6	3.5	9.5

Notes/Comments:

Facility Temperature Data Sheet #5
Digester 2 (D2) = NYC Materials

Operator Jim Hogan

Date 3-2-01 FRI

Digesters

D1

	1	2	3	4	5
Moistures		51%			60%
Temperatures	50	56	90	110	110
Depths	6	8.5	8	9	10
CO_2	*				

F.S. 44%

D2

	1	2	3	4	5
Moistures		68%			49%
Temperatures	65	115	120	138	140
Depths	5.5	7	7.5	8	9
CO_2					

BioFilter

North End	1 (Bay 1)	2 (Bay 1)	3 (Bay 2)	4 (Bay 2)	5 (Bay 3)	6 (Bay 3)	7 (Bay 4)	8 (Bay 4)	9 (Bay 5)	10 (Bay 5)	South End
Back Pressure	3.2	3	3	3.1	3.1	3	3.1	2.9	3	3	0615
Moisture											
Depth											
VOC											
Dry Spots				H_2O							
Sprinklers											

Scrubbers

Back Pressure

BF # 3

IN	OUT	TOTAL
6	3.2	9.2

BF #4

IN	OUT	TOTAL
6	3.3	9.3

Notes/Comments: * have to order new tips for CO_2 test probe

Facility Temperature Data Sheet #1

Aeration Floor Compost Data

Date: 3/7/01

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O		12							
N			2-01-3-03						
E		14	2-01-3-02- 2-01-3-01	140 F	132 F	120 F			
#3		15	2-01-3-07 2-01-3-05	110 F	120 F	130 F			
Z			2-01-3-03						
O		17							
N		18							
E		19							
#4		20							

Facility Temperature Data Sheet #2

Aeration Floor Compost Data

Date: 3/9/01

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O			2-01-3-03						
N		13	2-01-3-02 2-01-3-01	110 F	120 F	120 F			
E		14	2-01-3-07 2-01-3-05	120 F	120 F	126 F			
#3			2-01-3-03-						
Z		16							
O		17							
N		18							
E		19							
#4		20							

Facility Temperature Data Sheet #3

Aeration Floor Compost Data

Date: 3/12/01

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O			2-01-3-03						
N		13	2-01-3-02 2-01-3-01	124 F	130 F	126 F			
E		14	2-01-3-07 2-01-3-05	120 F	114 F	116 F			
#3			2-01-3-03						
Z		16							
O		17							
N		18							
E		19							
#4		20							

Facility Temperature Data Sheet #4

Aeration Floor Compost Data

Date: 3/13/01

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O		12							
N			2-01-3-03						
E		14	2-01-3-02 2-01-3-01	100 F	138 F	130 F			
#3		15	2-01-3-07 2-01-3-05	136 F	132 F	130 F			
Z			2-01-3-03						
O		17							
N		18							
E		19							
#4		20							

Facility Temperature Data Sheet #5

Aeration Floor Compost Data

Date: 3/14/01

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O		12							
N			2-01-3-03						
E		14	2-01-3-02 2-01-3-01	150 F	144 F	152 F			
#3		15	2-01-3-07 2-01-3-05	146 F	140 F	138 F			
Z			2-01-3-03						
O		17							
N		18							
E		19							
#4		20							

Facility Temperature Data Sheet #6

Aeration Floor Compost Data

Date: 3/15/01

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O			2-01-3-03						
N		13	2-01-3-02 2-01-3-01	120 F	130 F	140 F			
E		14	2-01-3-07 2-01-3-05	150 F	136 F	140 F			
#3			2-01-3-03						
Z		16							
O		17							
N		18							
E		19							
#4		20							

Facility Temperature Data Sheet #7

Aeration Floor Compost Data

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Date: 3/20/01

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O			2-01-3-03						
N		13	2-01-3-02 2-01-3-01	120 F	122 F	124 F	122 F		
E		14	2-01-3-07 2-01-3-05	140 F	140 F	155 F	145 F		
#3			2-01-3-03						
Z		16	2-01-3-16 2-01-3-15	100	110	110	106.6 F		
O		17	2-01-3-20 2-01-3-19	102	102	110	104.6 F		
N			2-01-3-17						
E		19							
#4		20							

Facility Temperature Data Sheet #8

Aeration Floor Compost Data

Date: **3/21/01**

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z			2-01-3-03						
O		12	2-01-3-02 2-01-3-01	120 F	134 F	138 F	**130.6 F**		
N		13	2-01-3-07 2-01-3-05	140 F	140 F	136 F	**138.6 F**		
E			2-01-3-03						
#3		15	2-01-3-16 2-01-3-15	118 F	110 F	110 F	**112.6 F**		
Z		16	2-01-3-20 2-01-3-19	110 F	102 F	104 F	**105.3 F**		
O			2-01-3-17						
N		18							
E		19							
#4		20							

Facility Temperature Data Sheet #9

Aeration Floor Compost Data

Date: **3/22/01**

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z			2-01-3-03						
O		12	2-01-3-02 2-01-3-01	130 F	140 F	132 F	**134 F**		
N		13	2-01-3-07 2-01-3-05	142 F	140 F	140 F	**140.6 F**		
E			2-01-3-03						
#3		15	2-01-3-16 2-01-3-15	111 F	106 F	120 F	**112.3 F**		
Z		16	2-01-3-20 2-01-3-19	116 F	108 F	114 F	**112.6 F**		
O			2-01-3-17						
N		18							
E		19							
#4		20							

DATA TAKEN BY GENO

Facility Temperature Data Sheet #10

Aeration Floor Compost Data

Date: 3/23/01

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z			2-01-3-03						
O		12	2-01-3-02 2-01-3-01	156 F	142 F	140 F	**146 F**		
N		13	2-01-3-07 2-01-3-05	136 F	150 F	144 F	**143.3 F**		
E			2-01-3-03						
#3		15	2-01-3-16 2-01-3-15	108 F	112 F	122 F	**114 F**		
Z		16	2-01-3-20 2-01-3-19	110 F	109 F	110 F	109.6		
O			2-01-3-17						
N		18							
E		19							
#4		20							

DATA WRITEN BY GENO

Facility Temperature Data Sheet #11

Aeration Floor Compost Data

Date: 3/27/01

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z			2-01-3-01						
O		12	2-01-3-02 2-01-3-01	70 F	140 F	130 F	**113.3 F**		
N		13	2-01-3-07 2-01-3-05	138 F	136 F	132 F	**135.3 F**		
E			2-01-3-03						
#3		15	2-01-3-16 2-01-3-15	120 F	114 F	110 F	**114.6 F**		
Z		16	2-01-3-20 2-01-3-19	108 F	108 F	110 F	**108.6 F**		
O			2-01-3-17						
N		18							
E		19							
#4		20							

DATA WRITEN BY GENO

Facility Temperature Data Sheet #12

Aeration Floor Compost Data

Date: **3/28/01**

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z			2-01-3-03						
O		12	2-01-3-02 2-01-3-01	80 F	114 F	120 F	**104.6 F**		
N		13	2-01-3-07 2-01-3-05	120 F	126 F	130 F	**125.3 F**		
E			2-01-3-03						
#3		15	2-01-3-16 2-01-3-15	108 F	112 F	110 F	**110 F**		
Z		16	2-01-3-20 2-01-3-19	112 F	107 F	108 F	**109 F**		
O			2-01-3-17						
N		18							
E		19							
#4		20							

DATA WRITEN BY GENO

Facility Temperature Data Sheet #13

Aeration Floor Compost Data

Date: **3/29/01**

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O			2-01-3-03						
N		13	2-01-3-02 2-01-3-01	110	120	114	**114.6 F**		
E		14	2-01-3-07 2-01-3-05	100	150	150	**133.3 F**		
#3			2-01-3-03						
Z		16	2-01-3-16 2-01-3-15	110	114	116	**113.3 F**		
O		17	2-01-3-20 2-01-3-19	100	100	116	**105.3 F**		
N			2-01-3-17						
E		19							
#4		20							

DATA WRITEN BY GENO

Facility Temperature Data Sheet #14

Aeration Floor Compost Data

Date: **3/29/01**

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O			2-01-3-03						
N		13	2-01-3-02 2-01-3-01	110	120	114	**114.6 F**		
E		14	2-01-3-07 2-01-3-05	100	150	150	**133.3 F**		
#3			2-01-3-03						
Z		16	2-01-3-16 2-01-3-15	110	114	116	**113.3 F**		
O		17	2-01-3-20 2-01-3-19	100	100	116	**105.3 F**		
N			2-01-3-17						
E		19							
#4		20							

DATA WRITEN BY GENO

Facility Temperature Data Sheet #15

Aeration Floor Compost Data

Date: **3/31/01**

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O		12							
N		13							
E		14							
#3		15							
Z		16	2-01-3-16 2-01-3-15	120	122	112	**118 F**		
O		17	2-01-3-20 2-01-3-19	110	102	100	**104 F**		
N			2-01-3-17						
E		19							
#4		20							

DATA WRITEN BY GENO

Facility Temperature Data Sheet #16

Aeration Floor Compost Data

Date: **4/3/01**

Floor Number Format: Year/Month/Day Material Was Placed on Floor

Zone		Aeration Blower	Material Floor No.	Temperature (F)			AVG Temp	Moisture %	pH
Z		1							
O		2							
N		3							
E		4							
#1		5							
Z		6							
O		7							
N		8							
E		9							
#2		10							
Z		11							
O			2-01-3-07						
N		13	2-01-3-05 2-01-3-03	100	110	110	**106.6 F**		
E			2-01-3-02 2-01-3-01						
#3		15							
Z		16	2-01-3-16 2-01-3-15	120	112	110	**114 F**		
O		17	2-01-3-20 2-01-3-19	118	114	114	**115.3 F**		
N			2-01-3-17						
E		19							
#4		20							

DATA WRITEN BY GENO

New York City MSW Composting Report

Appendix D
New York City Institutional/Commercial/Industrial Organic Waste Composting Economic and Technical Viability Final Report

Report by City Green, Inc.

New York City
Institutional/Commercial/Industrial Organic Waste Composting
Economic and Technical Viability

Research & Development Project
Contract No. C003333

Final Report
December 2001

Prepared for
Environmental Services Unit
Empire State Development

Prepared by
City Green, Inc.
151 1st Avenue, #3
New York, NY 10003
www.CityGreen.net

Research & Development Project - Contract No. C003333
Final Report - December 2001

New York City Institutional/Commercial/Industrial
Organic Waste Composting Economic and Technical Viability

I. Summary of Findings and Conclusions

The project identified proven, drum-based compost technologies, and demonstrated their capacity to produce Class I compost from New York City industrial, commercial and institutional (ICI) waste, with minimal modification to existing waste collection methods. The project further identified potential compost markets that could absorb the output of a commercial-scale compost facility in NYC, and showed that such a facility, under certain favorable conditions, could offer a tipping fee competitive with existing alternative disposal options. Nevertheless, the difficulty in obtaining long term contracts for waste will make the financing of such a facility highly problematic. In addition, the private carter collection fee structure established by the City currently discourages the development of high organic content (heavy) collection routes, creating an additional obstacle to obtaining the desired waste stream. It is likely that, as with other commercial-scale facilities surveyed during the project, the development of composting capacity for NYC ICI organics will depend on a guarantee of tonnage from the City, i.e., a guaranteed baseline tonnage of residential and/or institutional waste from the NYC Department of Sanitation. This guarantee, combined with changes to the collection fee structure so that collectors of heavy waste are not penalized, could result in the development of a facility at which additional capacity could be added for ICI organics.

II. Changes to Work Plan

The original proposal called for conducting compost trials using demonstration-scale, mobile drum-based composting equipment, which was intended to represent a commercial-scale operation. However, during the course of the Project, it became possible to conduct composting trials at an actual operating drum-based composting facility in Marlborough, MA. This change to the original work plan was greatly beneficial with respect to our Learning Targets, providing the opportunity to conduct the trials under real world conditions.

III. Task-by-Task Report

The Project had two Learning Targets:

Target #1 - Determine the effectiveness of drum composting technology in processing various NYC ICI waste streams for recovery of organic materials. This was achieved by generating the data needed to answer the following questions:

A. How suitable for composting are the various ICI waste streams that are available in NYC, i.e., what is the moisture content, C:N ratio and % physical contaminants.

B. What quality of compost is produced from composting different ICI waste streams using a drum composter coupled with curing and screening.

C. What are the physical and chemical properties of the compost and how do they compare with regulatory and agronomic requirements and local and regional markets for compost products?

Target #2 - Determine the economic viability of a full-scale drum-based composting facility for private and public sector investors/developers in NYC. This was achieved by answering the following questions:

A. What type (and quantities) of potentially suitable waste might be available for a facility located in NYC, compared to the system size required to achieve economies of scale (e.g., 250 to 500 tons per day)?

B. What are the current and projected costs for recycling/disposal alternatives (including collection costs) compared to projected costs for tipping waste at a full-scale composting facility (including assumptions for residue disposal and compost sales)?

C. What opportunities exist for long term contracts that would facilitate facility financing?

Target #1

The primary task involved in addressing Target #1 was to conduct composting trials at a commercial scale composting facility that employs a drum-based technology. Trials took place at the Bedminster-Marlborough, LLC (BM) facility located in Marlborough, MA. A description of the BM facility is presented in **Attachment A**.

For the project, the New York City Department of Sanitation arranged for the BM facility to dedicate the use of one drum (the BM facility has two drums) and appropriate space within the facility to process NYC ICI material separately and keep it segregated from all other activities at the plant. Prior to loading the ICI material, the designated digester was purged of waste (a small amount of compost material remained to serve as an inoculant). During a period of five consecutive days (3/12/01- 3/16/01), ICI material was trucked from the Bronx to the BM facility, where it was loaded into the dedicated drum. A total of 305 tons (approximately 60 tons per day) of ICI waste were processed through the facility.

The ICI waste was taken from four collection routes operated by Isabella City Carting Corp. Waste characterization data from a 1997 study conducted at Metropolitan Transfer Station (MTS), where Isabella Carting brings its loads for transfer and export, was used in route selection. Based on the 1997 study and discussions with MTS and Isabella Carting, four high organic content routes were identified. **Attachment B** shows the make-up of the four selected routes by waste generator type. Combined, the four routes had 375 stops, 254 (68%) of which were high organic content waste generators (restaurants, food retail and hotels). Since these generators tended to produce more and/or heavier waste than other generators on the routes, it is estimated that high organic content waste generators accounted for more than 85% of the combined weight of the four routes.

As described in **Attachment A**, material received at the BM facility is initially sorted manually, and later mechanically screened to remove contaminants. At each stage where contaminants are removed, weight data for both compost and contaminant fractions was obtained in order to create a mass balance as the material flowed through the BM facility, over the course of 41days. The total residue or contaminant rate was approximately 30%, with one half of that comprised of designated recyclable materials (metal, glass and plastic). Approximately 20% of the residue consisted of film plastic, a large fraction of which is assumed to be inevitable, given the use of plastic bags for waste collection. The balance of the residue (approximately 30%, or 10% of the entire processed ICI waste stream) consisted of non-recyclable metal and plastic, wood, textiles and miscellaneous inert materials. Mass balance and contaminant (residue) characterization data is contained in **Attachment C**.

Protocol was developed for sampling and lab testing of the composting material during the composting process at the BM facility and throughout additional curing stages at Woods End Research Laboratory (WERL). All sampling of the ICI compost material at the BM facility was performed by City Green and samples were shipped directly to WERL for testing and additional curing. Lab results are contained in **Attachment D**, and summarized in **Section IV** below.

In addition to conducting composting trials with ICI waste at the BM facility, a survey was conducted of four operating, commercial-scale, drum-based composting facilities (including the BM facility). Data from these surveys was used to provide a broader picture of the economic and technical performance of drum-based composting systems in the U.S. and Canada. Facility surveys are contained in **Attachment A**.

Target #2

The primary tasks in support of Target #2 were gathering relevant economic data and performing life cycle economic analyses for two scenarios for a drum-based compost facility located in NYC. The full economic analyses are presented in **Attachment E**. The results of the economic investigation are summarized in **Section IV** below.

IV. Conclusions

Based on the results of the compost trials, data gathered from the facility surveys, existing NYC waste composition data and other information, the following conclusions can be drawn:

- The NYC ICI waste stream contains substantial amounts of compostable materials that could be accessed with minimal modification to existing collection methods;
- Drum-based composting technologies are suitable for composting this material and producing a Class I compost product; and
- A facility employing drum-type composting technology could be competitive with alternative export and landfilling costs.

Nevertheless, a significant obstacle to the development of a commercial-scale compost facility for ICI waste is the lack of availability of long term contracts committing any given waste stream. In addition, the City's current system for regulating commercial waste collection discourages the development of concentrated, wet, high-organic content routes. These obstacles and other project conclusions are described in greater detail below.

A. Quantities & Suitability for Composting of NYC ICI Waste

As described above, ICI waste for the composting trials undertaken at the BM facility was obtained through selection of specific routes known to be high in organic content. This was done in part because the short duration of the project made it impractical to establish new source-separation programs for organics. However, of equal or greater importance, this approach was taken because it represents a realistic method for future collection of ICI waste for a commercial-scale compost facility. In other words, through selective routing, a highly compostable waste stream could be collected from ICI sectors without additional collection costs.

The residue rate from the composting trials undertaken in this project was approximately 30%. This rate is comparable to the normal residue rate experienced at the BM facility and at the other commercial-scale facilities surveyed in this project. However, this rate could be substantially reduced through more careful routing (i.e., not collecting from certain generators), and through effective source-separation programs for mandated recyclables. Characterization of the residue showed that approximately 50% of it is composed of recyclables. In addition, there were materials that one would not expect to see if only high-organic content generators were part of the collection route. Consequently, it is not unreasonable to assume that a residue rate of 15% could be achieved with very modest changes to the current ICI collection system, and that of that 15%, close to half would be comprised of film plastic that is used in the collection process, and so is arguably not a contaminant, but instead a necessary by-product of the collection system.

ICI organics composted at the BM facility displayed close to optimal properties for composting, including a moisture content of 58.9% to 59.4% and a C:N ratio of 24.6 to 26.1. (Property data was obtained from digested ICI organics after discharge from the drum and formation into the initial windrow.)

According to existing waste composition data, the ICI sector generates approximately four million tons of solid waste a year. Of this, 1.2 million tons (or 30%) is generated by sectors that are considered have a high organic content waste stream. The table below summarizes waste generation and composition data for these sectors. It should be noted that generators from these sectors represented approximately 85% (by weight) of the four NYC commercial collection routes used in the composting trials undertaken during the project.

NYC High-Organic Content ICI Waste Generators (1)

Sector	Annual Generation (tons)	% Compostable (2)	Annual Generation of Compostables (tons)
Eating & Drinking Establishments	721,711	50-80	360,855 to 577,368
Food Stores	432,718	40-85	173,087 to 367,810
Hotels	61,569	50-75	30,784 to 46,176
Total	**1,215,998**		**564,726 to 991,354**

(1) Data from NYC DOS 1992 waste composition study.
(2) Figures vary depending on amount of paper included as "compostable" vs. recyclable.

The composting trials undertaken in this project demonstrated that high-organic content ICI waste suitable for drum-based composting can be obtained with minimal modifications to current NYC collection methods. And, as the figures above show, the quantities of ICI waste produced in NYC provide many possibilities for the creation of collection routes targeting organic waste.

B. Compost Quality & Markets

The following tables provide relevant data on the quality of the compost produced during the course of the trials. The first table provides New York State Department of Environmental Conservation Standards (6 NYCRR Part 360) for Class I compost, along with test results from two samples of compost derived from NYC ICI waste produced at the BM facility. Each compost sample was a composite, taken from composted material after screening through a 3/8 inch screen, 133 days after initial loading of the drum. The timing of the screening and sampling was dictated by the Carbon-to-Nitrogen ratio (C:N), as it correlates to compost stability. The product would be acceptable for soil blending and a variety of other end-uses at a much earlier, less mature stage. However, at day 133, the compost was considered to be a fully mature product usable in any permitted application.

The second table provides data on the agronomic properties of the compost that was produced from ICI waste during the course of this project. The samples tested were taken from the same screened, 133 day-old compost as was used for testing of regulated characteristics, as described above. For purposes of comparison, agronomic properties are also provided for a "Quality Garden Compost."

Compost Quality - Regulated Characteristics

Parameter (1)	NYS DEC Part 360	Sample A	Sample B
Mercury	10	1.4	1.1
Cadmium	10	4.8	4.0
Nickel	200	31.2	32.8
Lead	250	88.0	68.4
Chromium	100	36.4	32.8
Copper	1000	116.0	124.0
Zinc	2500	424.0	492.0
PCBs	1	<1	<1
Particle Size	<10mm	<10mm	<10mm

(1) Except where noted, all figures are for allowable concentrations in parts per million (ppm) dry weight.

Compost Quality - Agronomic/Horticultural Properties

Property	Survey Sample A	Survey Sample B	Standard (1)
Moisture, % of Saturation	79	88	35-85
Organic Matter (% of total solids)	60.9	58.7	20-75
Density (lbs/cu.yd.)	994	1146	600-1200
Total Nitrogen, % of total solids	2.8	2.8	1.0-4.0
Phosphorous (P), % of total solids	0.18	0.18	0.1-1.0
Potassium (K), % of total solids	0.32	0.34	0.1-2.0
pH	7.7	7.6	5.5-8.0
Conductivity/Salinity (mmhos/cm)	8.4	7.7	2-13
C:N	11	11	10-30
Solvita Maturity Index	6	6	6-8

(1) Standard for "Quality Garden Compost", as established by WERL.

Based on the compost properties described above, one would expect a facility processing ICI high-organic loads to produce a Class I compost. The following table lists some of the potential markets for a Class I compost product in the NYC area. Market figures were taken from the NYC Department of Sanitation's 1992 Comprehensive Solid Waste Management Plan for New York City. In the Plan, "low" and "high" ranges for potential compost markets in the NYC area were developed. The following table uses the more conservative "low range" figures.

Potential Compost Markets in the NYC Metropolitan Area

Market	Cubic Yards/Year
Public Sector	
NYC Parks & Recreation	69,150
NYC Housing Authority	36,500
NYC Shade Tree Commission	2,800
NY/NJ Port Authority	110,250
NY Department of Transportation	2,250
NYC Sanitation & Area Landfills	1,180,700
Subtotal (public sector)	**1,401,650**
Private Sector	
Landscapers	49,300
Nurseries	56,600
Golf Courses	7,300
Soil Dealers	75,000
Sod Farmers	97,500
Cemeteries	11,000
Mine Reclamation	14,000
Subtotal (private sector)	**310,700**
Total	**1,712,350**
Adjustment for double counting	87,000
Total	**1,625,350**

Assuming the above market conditions are even remotely accurate, the potential outlets for a Class I compost in the NYC area are substantial. The following information (figures in cubic yards) places the expected compost output from a 300 ton per day (tpd) compost plant in the context of these potential market figures:

–	Compost from a 300 ton per day facility	45,000 per year
–	"Low Range" potential NYC area markets	1,625,350 per year
–	"Low Range" potential markets (public sector only)	1,401,650 per year

For a 300 tpd facility, which was the basis for the economic analyses included in this report, a total market share of less than 3% would be required, or a slightly more than a 3% share of public sector purchases. At "High Range" market potential estimates, the output of a 300 ton per day plant would equal slightly more than 1% of the total market, and less than 2% of public sector purchases.

C. Economic Feasibility

An economic feasibility analysis was performed, based on two different scenarios. Both scenarios assume that the facility processes 300 tpd of ICI material. A 300 tpd capacity was selected because: a) It is a point at which certain economies of scale are reached; b) It is comparable to the capacity of other, operating, commercial-scale drum-based composting systems; c) It is a quantity that presumably could be easily diverted from the ICI waste stream; and d) It would generate a quantity of compost that could presumably absorbed by the NYC area market with relative ease.

Both scenarios assume collection costs for this material are the same as those for regular ICI solid waste, and that high-organic content is achieved at no additional cost by a combination of selective routing and the institution of effective source-separation programs for mandated recyclables. However, the scenarios differ in several ways that affect the tipping fee. Scenario one is a non-optimal scenario, whereas scenario two is based on favorable conditions. The following table highlights the different assumptions used for each scenario, as well as the resulting tip fees. It should be noted that the majority (approximately $29) of the tipping fee differential between the two scenarios can be attributed to the higher cost of capital in the private ownership and financing scenario (Scenario 1).

NYC ICI Compost Facility Scenarios

Variable	Scenario 1	Scenario 2
Residue Rate	30%	15%
Land	Purchase @ $250,000/acre	Provided by the City @ no cost
Compost Sales	$0 value	$15 per ton
Residue Disposal	$75/ton	$65/ton
Ownership/Financing	Private	Public
Tip Fee (per ton)	**$105**	**$55**

The facility survey undertaken during the project included identifying the tip fee charged for commercial waste at existing drum-based compost facilities was identified. A number of factors affect the tipping fee at each of these facilities. For example, they each vary in: the quantities of solid waste and biosolids they handle; ownership arrangements; the extent to which private capital was required for site acquisition and construction; and their municipal contractual relationships. Consequently, it is difficult to compare them to directly to the scenarios developed for a facility in New York City. Nevertheless, the rates these facilities charge for commercial waste do provide additional points for comparison with NYC commercial transfer station tip fees as of the end of 2001. These various tip fees are shown in the table below.

Tipping Fees By Facility

Facility	Tip Fee
Scenario 1	$120
Scenario 2	$55
Bedminster Marlboro	$70 to $85 *
Conporec	$45 (Canadian) *
Dano	$45 *
NYC Transfer Stations (end of 2001)	$57 to $80

* As noted, there are a number of factors that make these tip fees higher or lower than the hypothetical scenarios.

Based on tipping fees charged by the commercial-scale operating facilities in North America surveyed over the course of the project, and the analyses performed for two hypothetical facilities, a 300 tpd facility for ICI high-organic waste could be competitive with competing disposal alternatives, assuming certain favorable conditions. Nevertheless, there remain major obstacles to the financing of a facility for ICI material. These include:

- The difficulty of obtaining long term contracts for guaranteed tonnages. Current regulations guiding the private carting industry allow waste generators to break any hauling contract with 30 days notice. This effectively prohibits waste haulers from having a guaranteed waste stream.

- The City's rate structure establishes maximum rates that private haulers can charge waste generators, based on volume. Haulers pay to tip their loads at a transfer station based on weight. As a result, heavy, wet waste is the least profitable to collect. It is anticipated that a collection route targeting organic waste would result in a waste stream with a bulk density of between 500 and 1000 pounds per cubic yard, without compaction. The current maximum allowable charge per un-compacted cubic yard is $12.20. Thus, the most a waste hauler could charge for collection and disposal of concentrated, high organic waste would be between $24.40 and $48.80 per ton. Thus, even the maximum allowable charge is below the current tipping fee at commercial transfer stations and below the anticipated tip fee at a hypothetical compost facility, under either scenario (i.e., using favorable or unfavorable assumptions).

In summary, the project identified proven drum-based compost technologies, and demonstrated their capacity to produce a Class I compost from NYC ICI waste, with minimal modification to existing collection methods. The project further identified potential compost markets that could easily absorb the output of a commercial-scale facility in NYC, and showed that such a facility, under certain favorable conditions, could offer a tipping fee that is competitive with existing alternative disposal options. Nevertheless, the difficulty in obtaining long term contracts for waste make the financing of such a facility highly problematic, and current private carter collection regulations discourage the development of routes that are high in organic content.

While most of the compost facilities surveyed during the course of the project process ICI waste, this material is, by and large, obtained on the spot market (i.e, without long term contracts). For each of these facilities, the basis for financing was a committed residential waste stream, obtained from the local municipality(s). It is likely that, as with the commercial-scale facilities surveyed, the development of composting capacity for NYC ICI organics will depend on a guarantee of tonnage from the City, i.e., a guaranteed baseline tonnage of residential and/or institutional waste from the NYC Department of Sanitation. Typically, municipal put-or-pay contracts that are tied to new facility development, guarantee waste for a period of 15 to 20 years. Such a guarantee, combined with changes to the collection fee structure so that collectors of heavy waste are not penalized, could result in the development of a facility at which additional capacity could be created for ICI organics.

ATTACHMENT B

Bedminster-Marlborough Composting Trials
NYC ICI Waste Data By Generator

Route # 589A			
Category	**# of stops**	**% of route by weight (1)**	**tonnage to compost trials**
Restaurants	40	44	32.93
Food Retail	4	25	18.71
Hotels	1	20	14.97
Non-food Retail	15	5	3.74
Offices	4	6	4.5
subtotal	**64**	**100**	**74.85**
Route # 589B			
Category	**# of stops**	**% of route by weight (1)**	**tonnage to compost trials**
Restaurants	40	71	38.44
Food Retail	1	15	8.12
Hotels			
Non-food Retail	15	10	5.41
Offices	2	4	2.17
subtotal	**58**	**100**	**54.14**
Route # 590			
Category	**# of stops**	**% of route by weight (1)**	**tonnage to compost trials**
Restaurants	65	49	32.3
Food Retail	12	25	16.48
Hotels	1	4	2.64
Non-food Retail	20	12	7.9
Offices	30	10	6.59
subtotal	**128**	**100**	**65.91**
Route # 118			
Category	**# of stops**	**% of route by weight (1)**	**tonnage to compost trials**
Restaurants	75	66	72.49
Food Retail	15	25	27.46
Hotels			
Non-food Retail	25	5	5.49
Offices	10	4	4.39
subtotal	**125**	**100**	**109.83**
Summary			
Category	**# of stops**	**% of total weight (1)**	**tonnage to compost trials**
Restaurants	220	57.81	176.16
Food Retail	32	23.22	70.77
Hotels	2	5.78	17.61
Non-Food Retail	75	7.40	22.54
Offices	46	5.79	17.65
TOTAL	**375**	**100**	**304.73**
(1) Estimated by route operator, Isabella City Carting Corp.			

ATTACHMENT C
Mass Balance and Residue Characterization Data

NYC ICI Drum Composting Trials
Mass Balance Data
(all weights shown in tons)
(% based on weight)

	Received at BM scale	Front-end residue	Material into drum	Primary 2" screen unders	Primary 2" screen overs	Secondary 1/2" screen unders	Secondary 1/2" screen overs	Final 3/8" screen unders	Final 3/8" screen overs
3/12/01	62.45	2.61	59.84						
3/13/01	59.00	2.36	56.64						
3/14/01	61.95	2.62	59.33						
3/15/01	60.14	2.70	57.44	39.20	8.30				
3/16/01	61.19	1.72	59.47	65.52	17.36				
3/17/01				45.40	10.33				
3/19/01				39.92	7.41				
3/20/01				47.52	9.18				
4/21/01						162.74	26.54	156.07	6.67
Total	**304.73**	**12.01**	**292.72**	**237.56**	**52.58**	**162.74**	**26.54**	**156.07**	**6.67**
% of tons received	100.00	3.94	96.06	77.96	17.25	53.40	8.71	51.22	2.19

Mass Balance	tons	%
Total Residue	97.80	32.1%
Loss of Mass	50.86	16.7%
Material to Curing	156.07	51.2%
Total	304.73	100%

ATTACHMENT C
Mass Balance and Residue Characterization Data

NYC ICI Drum Composting Trials
Characterization of Residue
(all weights shown in tons)
(% based on weight)

Category	Front-end residue (1) (weight)	Overs at 2" screen (weight)	Overs at 2" screen (%)	Overs at 1/2" screen (weight)	Overs at 1/2" screen (%)	Overs at 3/8" screen (weight)	Overs at 3/8" screen (%)	Total residue (weight)	Total residue (%)	% of total ICI waste processed
Glass				15.92	60	4.82	72.3	20.74	21.21	6.81
Film Plastic		14.02	26.67	6.05	22.8	0.65	9.8	20.72	21.19	6.80
Recyclable Plastic (2)		10.5	19.97					10.5	10.74	3.45
Recyclable Metal (3)		15.65	29.76					15.65	16.00	5.14
Other Plastic (4)		2.59	5.66	2	7.5	0.59	8.8	5.18	5.30	1.70
Other Metal (5)		2.98	4.92	0.66	2.5	0.09	1.3	3.73	3.81	1.22
Textiles		2.62	2.37			0.02	0.3	2.64	2.70	0.87
Wood		1.24	4.98	0.93	3.5	0.16	2.4	2.33	2.38	0.76
Misc. Inert		2.18	4.14	0.48	1.8	0.34	5.1	3	3.07	0.98
Misc. Organic		0.8	1.52	0.5	1.9			1.3	1.33	0.43
Unsorted (1)	12.01							12.01	12.28	3.94
Total	**12.01**	**52.58**	**99.99**	**26.54**	**100**	**6.67**	**100**	**97.8**	**100.00**	**32.09**

(1) Front-end residue was weighed but not characterized. Based on visual observation, the following are the primary constituents: metal (pipes, tanks, frames and shelving), electronic equipment, glass bottles, auto parts, wooden and plastic crates and film plastic.
(2) HDPE (pails & bottles) and PET
(3) primarily bi-metal cans
(4) primarily container caps, flexible tubing, polypropylene and PVC
(5) primarily aerosol cans and auto related waste (old parts and oil filters)

Attachment D

NYC ICI Waste Compost Trials Testing Results

Bedminster Marlboro Composting Pilot

ICI PROJECT
City Green

data presented by:

Woods End Research Laboratory
INCORPORATED

20 Old Rome Road - Mt Vernon ME 04352

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx Project: 605
Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.2
Quality Checked : WD 9/19/01

COMPOSITION ANALYSIS

Sample Identification: Compost: NCI Day 133 WERL Cure, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	37	994 lbs/yd^3
Solids	%	100.0	47.4	948 lbs/ton
Moisture	%	0.0	52.6	126 gals/ton
est. water holding capacity	%	192	66	158 gals/ton
Inert and Oversize Matter	%	~	3.1	62.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.72	MedHigh
Free Carbonates (CO_3)	Rating	~	3	V High
Volatile Organic Acids	ppm	422	200	M Low
Organic Matter	%	60.9	28.9	577 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	8.4	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	11.7	11.7	M. Low
Respiration Rate/day	C% of Total-C	0.27	0.27	-
Carbon loss per day	% of total weight	0.09	0.04	0.9 lbs/ton
Dewar Self-Heating	°C rise	~	1	Grade V
Seedling Response Assay. Percent of Control				
Lepedium sativum Germination	%	~	100	No Phytotoxicity
Lepedium sativum Weight	%	~	79	Good
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx-Project: 605

Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.2

MINERALS ANALYSIS

Sample Identification: NCI Day 133 WERL Cure, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.809	1.331	26.6
Organic-Nitrogen	%	2.742	1.299	26.0
Phosphorus (P)	%	0.184	0.087	1.7
Potassium (K)	%	0.324	0.154	3.1
Sodium (Na)	%	0.540	0.256	5.1
Calcium (Ca)	%	4.400	2.086	41.7
Magnesium (Mg)	%	0.380	0.180	3.6
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	11	5	0.0
Nitrate-N	ppm	663	314	0.6
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5952	2821	5.64
Sulfate (SO_4–S)	ppm	2883	1367	2.73

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory. Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx-Project: 605

Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.2

METALS ANALYSIS

Sample Identification: NCI Day 133 WERL Cure, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	116.0	55.0	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	408.0	193.4	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	3080.0	1459.9	2.9
Zinc (Zn)	$mg \cdot kg^{-1}$	424.0	201.0	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	88.0	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	36.4	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	4.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	31.2	-	-
Arsenic (As)	$mg \cdot kg^{-1}$	2.4	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	1.4	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	2.93	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	1.8	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 2	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.7	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556	Code: CScyvdx Project: 605
· attn: Venetia Lannon	Date Received : 07/27/2001
· DOS Waste Prev. Reuse and Recycling	Date Reported : 09/18/2001
· 44 Beaver Street-8th floor	Lab ID Number : 5035.3
· New York NY 10004	Quality Checked : WD 9/19/01

COMPOSITION ANALYSIS

Sample Identification: NCI Day 133 WERL Cure, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs{\cdot}ft^3$	-	42	1146 lbs/yd^3
Solids	%	100.0	42.3	846 lbs/ton
Moisture	%	0.0	57.7	138 gals/ton
est. water holding capacity	%	186	65	156 gals/ton
Inert and Oversize Matter	%	~	7.1	142.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.66	MedHigh
Free Carbonates (CO_3)	Rating	~	3	V High
Volatile Organic Acids	ppm	709	300	M Low
Organic Matter	%	58.7	24.8	496 lbs/ton
Conductivity	$mmhos{\cdot}cm^{-1}$	~	7.7	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	11.2	11.2	M. Low
Respiration Rate/day	C% of Total-C	0.40	0.40	-
Carbon loss per day	% of total weight	0.13	0.05	1.1 lbs/ton
Dewar Self-Heating	°C rise	~	1	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	98	No Phytotoxicity
Lepedium sativum Weight	%	~	65	Fair
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes ppm = mg/kg < = less than MLD (minimum level of detection), nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx-Project: 605
Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.3

MINERALS ANALYSIS

Sample Identification: NCI Day 133 WERL Cure, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.819	1.192	23.8
Organic-Nitrogen	%	2.758	1.167	23.3
Phosphorus (P)	%	0.180	0.076	1.5
Potassium (K)	%	0.348	0.147	2.9
Sodium (Na)	%	0.620	0.262	5.2
Calcium (Ca)	%	4.040	1.709	34.2
Magnesium (Mg)	%	0.276	0.117	2.3
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	22	9	0.0
Nitrate-N	ppm	585	247	0.5
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5130	2170	4.34
Sulfate (SO_4-S)	ppm	2382	1008	2.02

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx-Project: 605

Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.3

METALS ANALYSIS

Sample Identification: NCI Day 133 WERL Cure, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg\cdot kg^{-1}$	124.0	52.5	0.1
Manganese (Mn)	$mg\cdot kg^{-1}$	444.0	187.8	0.4
Iron (Fe)	$mg\cdot kg^{-1}$	4480.0	1895.0	3.8
Zinc (Zn)	$mg\cdot kg^{-1}$	492.0	208.1	0.4
Lead (Pb)	$mg\cdot kg^{-1}$	68.4	-	-
Chromium (Cr)	$mg\cdot kg^{-1}$	32.8	-	-
Cadmium (Cd)	$mg\cdot kg^{-1}$	4.0	-	-
Nickel (Ni)	$mg\cdot kg^{-1}$	32.8	-	-
Arsenic (As)	$mg\cdot kg^{-1}$	2.7	-	-
Mercury (Hg)	$mg\cdot kg^{-1}$	1.1	-	-
Molybdenum (Mo)	$mg\cdot kg^{-1}$	2.74	-	-
Selenium (Se)	$mg\cdot kg^{-1}$	1.6	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 2	-	
Total *Salmonella* EPA503	MPN per 4g	< 2	-	

Notes: $mg\cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

WOODS END RESEARCH LABORATORY

Will Brinton
Box 297
MT VERNON ME 04352

Project: NYC-DOS

Certificate of Analysis

PCB's Method EPA 8082

Sample:	4910.1	Analyte	Result	Units	PQL
Collect Date:	4/23/2001	PCB 1242	ND	mg/Kg	0.2
Date Received:	4/25/2001	PCB 1254	ND	mg/Kg	0.2
Lab Sample #	01X0395-01	PCB 1232	ND	mg/Kg	0.2
Date Analyzed	5/2/2001	PCB 1260	ND	mg/Kg	0.2
Date Extracted	4/25/2001	PCB 1248	ND	mg/Kg	0.2
Surrogate(DCB) % Recovery	66.4 AR 30-150	PCB 1016	ND	mg/Kg	0.2
g Sample Extracted	Percent Solids 51.7	PCB 1221	ND	mg/Kg	0.2
Wt Basis	Dry wt Basis				
PCB 1260 Spike Amount (mg/Kg)					

Sample:	4910.2	Analyte	Result	Units	PQL
Collect Date:	4/23/2001	PCB 1242	ND	mg/Kg	0.2
Date Received:	4/25/2001	PCB 1254	ND	mg/Kg	0.2
Lab Sample #	01X0395-02	PCB 1232	ND	mg/Kg	0.2
Date Analyzed	5/2/2001	PCB 1260	ND	mg/Kg	0.2
Date Extracted	4/25/2001	PCB 1248	ND	mg/Kg	0.2
Surrogate(DCB) % Recovery	75.8 AR 30-150	PCB 1016	ND	mg/Kg	0.2
g Sample Extracted	Percent Solids 46.2	PCB 1221	ND	mg/Kg	0.2
Wt Basis	Dry wt Basis				
PCB 1260 Spike Amount (mg/Kg)					

Laboratory Supervisor 5/23/01

PQL Practical Quantitation Limit
PCB Report

ND Not Detected (<PQL)

Page 1 of 1

WOODS END RESEARCH LABORATORY

Will Brinton
Box 297
MT VERNON ME 04352

Project: NYC-DOS

Certificate of Analysis

Total Metals - Method EPA 6020/200.8

		Analyte	Result	Units	PQL	Method
Sample Name:	4910.1					
Sample Location:		Arsenic	1.0	mg/Kg	1.000	EPA 6020
Sampling Date:	4/23/2001	Mercury	0.9	mg/Kg	0.1000	EPA 7471A
Sampling Time:	14:00	Molybdenum	2.0	mg/Kg	1.000	EPA 6020
Date Received:	4/25/2001	Selenium	ND	mg/Kg	1.000	EPA 6020
Lab #:	01X0395-01					
Matrix:	SOIL					
Analysis Date:	5/2/2001					
% Solid:	51.7					

		Analyte	Result	Units	PQL	Method
Sample Name:	4910.2					
Sample Location:		Arsenic	1.1	mg/Kg	1.000	EPA 6020
Sampling Date:	4/23/2001	Mercury	1.5	mg/Kg	0.1000	EPA 7471A
Sampling Time:	14:00	Molybdenum	2.7	mg/Kg	1.000	EPA 6020
Date Received:	4/25/2001	Selenium	ND	mg/Kg	1.000	EPA 6020
Lab #:	01X0395-02					
Matrix:	SOIL					
Analysis Date:	5/2/2001					
% Solid:	46.2					

Lab Supervisor: John L. Cold

Report Date: 23-May-01

ND Not Detected PQL Practical Quantitation Limit

Metals Report Page 1 of 1

Attachment E

Life Cycle Financial Analyses

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 1: PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 1

12-Jan-02

ASSUMPTIONS:

Capital Costs:		Development Equity: First 6 Mos. of Proj Devel.	Second 6 Mos. of Proj Devel.	Upon Proj. Fin. $000	deprec. per. (Years)
Initial Marketing, RFP Response		$25,000			
Final Marketing, Prel Eng., Pricing & Contracting			$30,000		
Final Eng. & Des., Permitting & Dev. of Proj. Financing			$300,000		
Project Financing & Construction: ($000)					
Equip (Including 2 digest.)				$12,500	10
100,000 SF Bldg @	$70 per SF			$7,000	28
Biofilters				$3,000	28
5 Acre Site @	$250,000 per Acre plus 12% site improvement			$1,400	
Perf. Guarantee @10%				$1,250	28
Int Dur. Const (18 Months)				$1,000	28
Borrower's Counsel				$50	28
Conting.& spare pts @ 10%				$1,250	28
Debt Res. Fund				$2,636	
Financing:					
Placement Fee @ 3% assumes non rated debt				$762	
P. Agent's Counsel				$50	
Issuer's fee @ 1%, if required				$254	
Bond Counsel				$50	
Feas. Opin.				$125	
Trustee				$50	
Cusip, printing & Other				$50	
Financial Advis.				$75	
Other		$0	$0	$250	28
SUB TOTAL		$25,000	$330,000	$31,752	
TOTAL				$32,107	

Financing Assumptions:

	First 6 Mos.	Second 6 Mos.	Upon Proj. Fin.	
Debt (%/Amt)	0%	0%	80%	$25,401
Equity (%/Amt)	100%	100%	20%	$6,705
Total Capital				$32,107
Avg. % Equity			20.88%	
Debt Term			20	years
Debt Rate			8.25%	

Operating Costs (000):			Ann. Esc. Ra	/MSW Ton
O&M Cost + R&R Cost		$2,400	3.00%	$26.67
2,000,000 kwh/yr	$0.120	$240	3.00%	
Other (DSRF Int. @ 3.0%)		($79)	0.00%	($0.88)
Res. Disp. @ $75/T, 30%ICI		$2,025	3.00%	$22.50
TOTAL		$4,586		$50.95

Throughput:	TPD	DPY	TPY
ICI	300.00	300	90000

Fees per ton:

ICI Tip Fee (w/ Res Disp)	$105.00	3.00%
Sold Compost Rev (FOB Plnt)	$0.00	1.50%

Financial Results:

10 Year IRR	18.05%
20 Year IRR	24.56%
Debt Cov. Ratio:	
Year 1	0.97
Avg. Yr. 1-10	2.12
Avg. Yr. 1-20	2.54

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 1: PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 2

12-Jan-02

Year	1	2	3	4	5	6	7	8	9	10
Revenues:										
ICI Tons	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000
ICI Tip Fee	$105.00	$108.15	$111.39	$114.74	$118.18	$121.72	$125.38	$129.14	$133.01	$137.00
ICI Revenue	$9,450,000	$9,733,500	$10,025,505	$10,326,270	$10,636,058	$10,955,140	$11,283,794	$11,622,308	$11,970,977	$12,330,107
Compost Tons (50%ICI)	45000	45000	45000	45000	45000	45000	45000	45000	45000	45000
Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Compost Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue	$9,450,000	$9,733,500	$10,025,505	$10,326,270	$10,636,058	$10,955,140	$11,283,794	$11,622,308	$11,970,977	$12,330,107

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 1: PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 3

12-Jan-02

Year	11	12	13	14	15	16	17	18	19	20
Revenues:										
MSW Tons	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000
MSW Tip Fee	$141.11	$145.34	$149.70	$154.20	$158.82	$163.59	$168.49	$173.55	$178.76	$184.12
MSW Revenue	$12,700,010	$13,081,010	$13,473,440	$13,877,644	$14,293,973	$14,722,792	$15,164,476	$15,619,410	$16,087,992	$16,570,632
Compost Tons	45000	45000	45000	45000	45000	45000	45000	45000	45000	45000
Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Compost Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue	$12,700,010	$13,081,010	$13,473,440	$13,877,644	$14,293,973	$14,722,792	$15,164,476	$15,619,410	$16,087,992	$16,570,632

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 1: PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

Year	21	22	23	24	25	26	27	28	29	30
Revenues:										
MSW Tons	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000
MSW Tip Fee	$189.64	$195.33	$201.19	$207.23	$213.44	$219.85	$226.44	$233.24	$240.23	$247.44
MSW Revenue	$17,067,751	$17,579,784	$18,107,177	$18,650,393	$19,209,904	$19,786,201	$20,379,787	$20,991,181	$21,620,917	$22,269,544
Compost Tons	45000	45000	45000	45000	45000	45000	45000	45000	45000	45000
Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Compost Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue	$17,067,751	$17,579,784	$18,107,177	$18,650,393	$19,209,904	$19,786,201	$20,379,787	$20,991,181	$21,620,917	$22,269,544

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 1: PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

12-Jan-02

Debt Service:

Begining Principal	$25,401	
Term	20	Years
Rate	8.25%	

Year	Principal	Interest	Total	Outs. Balance
				$25,401
1	$540	$2,096	$2,636	$24,862
2	$584	$2,051	$2,636	$24,277
3	$633	$2,003	$2,636	$23,644
4	$685	$1,951	$2,636	$22,960
5	$741	$1,894	$2,636	$22,218
6	$803	$1,833	$2,636	$21,416
7	$869	$1,767	$2,636	$20,547
8	$940	$1,695	$2,636	$19,607
9	$1,018	$1,618	$2,636	$18,589
10	$1,102	$1,534	$2,636	$17,487
11	$1,193	$1,443	$2,636	$16,294
12	$1,291	$1,344	$2,636	$15,003
13	$1,398	$1,238	$2,636	$13,605
14	$1,513	$1,122	$2,636	$12,092
15	$1,638	$998	$2,636	$10,454
16	$1,773	$862	$2,636	$8,681
17	$1,919	$716	$2,636	$6,761
18	$2,078	$558	$2,636	$4,684
19	$2,249	$386	$2,636	$2,435
20	$2,435	$201	$2,636	$0
21	$0	$0	$0	$0
22	$0	$0	$0	$0
23	$0	$0	$0	$0
24	$0	$0	$0	$0
25	$0	$0	$0	$0
Total	$25,401	$27,309	$52,710	

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 1: PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

12-Jan-02

Depreciation & Operating Costs:

Year		1	2	3	4	5	6	7	8	9	10
O&M		$2,400	$2,472	$2,546	$2,623	$2,701	$2,782	$2,866	$2,952	$3,040	$3,131
Admin		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other		($79)	($79)	($79)	($79)	($79)	($79)	($79)	($79)	($79)	($79)
Residue Trans & Disp.		$2,025	$2,086	$2,148	$2,213	$2,279	$2,348	$2,418	$2,490	$2,565	$2,642
Total		$4,346	$4,479	$4,615	$4,756	$4,901	$5,051	$5,205	$5,363	$5,526	$5,695
Depreciation:											
10 Year	$12,500	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250
28 Year	$13,550	$484	$484	$484	$484	$484	$484	$484	$484	$484	$484
20 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$26,050	$1,734	$1,734	$1,734	$1,734	$1,734	$1,734	$1,734	$1,734	$1,734	$1,734

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 1: PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

12-Jan-02

Depreciation & Operating Costs:

Year	11	12	13	14	15	16	17	18	19	20
O&M	$3,225	$3,322	$3,422	$3,524	$3,630	$3,739	$3,851	$3,967	$4,086	$4,208
Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	($79)	($79)	($79)	($79)	($79)	($79)	($79)	($79)	($79)	($79)
Residue Trans & Disp.	$2,721	$2,803	$2,887	$2,974	$3,063	$3,155	$3,250	$3,347	$3,447	$3,551
Total	$5,868	$6,046	$6,230	$6,419	$6,614	$6,815	$7,022	$7,235	$7,454	$7,680
Depreciation:										
10 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
28 Year	$484	$484	$484	$484	$484	$484	$484	$484	$484	$484
20 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
										$0
Total	$484	$484	$484	$484	$484	$484	$484	$484	$484	$484

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 1: PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

Depreciation & Operating Costs:

Year	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
O&M	$4,335	$4,465	$4,599	$4,737	$4,879	$5,025	$5,176	$5,331	$5,491	$5,656
Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residue Trans & Disp.	$3,657	$3,767	$3,880	$3,997	$4,116	$4,240	$4,367	$4,498	$4,633	$4,772
Total	$7,992	$8,232	$8,479	$8,733	$8,995	$9,265	$9,543	$9,829	$10,124	$10,428
Depreciation:										
10 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
28 Year	$484	$484	$484	$484	$484	$484	$484	$484	$0	$0
20 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$484	$484	$484	$484	$484	$484	$484	$484	$0	$0

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 1: PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

12-Jan-02

Financial Results:

Year		Yr 1 (6 Mnths)	2	3	4	5	6	7	8	9	10
Revenues		$4,725,000	$9,733,500	$10,025,505	$10,326,270	$10,636,058	$10,955,140	$11,283,794	$11,622,308	$11,970,977	$12,330,107
Operating Exp		$2,172,967	$4,478,685	$4,615,417	$4,756,252	$4,901,311	$5,050,723	$5,204,616	$5,363,127	$5,526,392	$5,694,556
IBIT		$2,552,033	$5,254,815	$5,410,088	$5,570,018	$5,734,747	$5,904,417	$6,079,178	$6,259,181	$6,444,585	$6,635,550
Interest Exp		$2,095,615	$2,051,074	$2,002,858	$1,950,665	$1,894,166	$1,833,005	$1,766,799	$1,695,130	$1,617,549	$1,533,568
Depreciation		$866,967	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935
Taxable Income		($410,550)	$1,469,806	$1,673,294	$1,885,418	$2,106,646	$2,337,477	$2,578,444	$2,830,116	$3,093,100	$3,368,047
Tax @ 47%		($192,958)	$690,809	$786,448	$886,147	$990,124	$1,098,614	$1,211,869	$1,330,155	$1,453,757	$1,582,982
A. T. Income		($217,591)	$778,997	$886,846	$999,272	$1,116,523	$1,238,863	$1,366,575	$1,499,961	$1,639,343	$1,785,065
Depreciation		$866,967	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935	$1,733,935
Debt Principal		$539,891	$584,432	$632,647	$684,841	$741,340	$802,501	$868,707	$940,375	$1,017,956	$1,101,938
Net Cash Flow: ($355,000)	($6,350,348)	$109,485	$1,928,501	$1,988,134	$2,048,366	$2,109,118	$2,170,297	$2,231,804	$2,293,521	$2,355,322	$2,417,063
Total Equity	$6,705,348										

10 Year IRR	18.05%	Excludes Residual Value
22 Year IRR	24.56%	Excludes Residual Value

22 Yr NPV @:

7.50%	$11,372,048	Excludes Residual Value
10.00%	$7,871,005	Excludes Residual Value

	Yr 1 (6 Mnths)	2	3	4	5	6	7	8	9	10
Debt Coverage Ratio	0.97	1.99	2.05	2.11	2.18	2.24	2.31	2.37	2.45	2,52

Avg DCR:

year 1-10	2.12
Year 1-20	2.54

ASED COMPOSTING
INANCIAL ANALYSIS
PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
Y: R. S. Lynch & Company, Inc.

ults:

Year	11	12	13	14	15	16	17	18	19	20
Revenues	$12,700,010	$13,081,010	$13,473,440	$13,877,644	$14,293,973	$14,722,792	$15,164,476	$15,619,410	$16,087,992	$16,570,632
Operating Exp	$5,867,765	$6,046,170	$6,229,927	$6,419,197	$6,614,144	$6,814,941	$7,021,761	$7,234,786	$7,454,201	$7,680,199
IBIT	$6,832,245	$7,034,840	$7,243,514	$7,458,447	$7,679,829	$7,907,851	$8,142,715	$8,384,625	$8,633,791	$8,890,433
Interest Exp	$1,442,658	$1,344,248	$1,237,720	$1,122,402	$997,571	$862,442	$716,164	$557,818	$386,409	$200,858
Depreciation	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935
Taxable Income	$4,905,652	$5,206,657	$5,521,859	$5,852,110	$6,198,322	$6,561,475	$6,942,616	$7,342,871	$7,763,447	$8,205,640
Tax @ 47%	$2,305,656	$2,447,129	$2,595,274	$2,750,492	$2,913,212	$3,083,893	$3,263,030	$3,451,150	$3,648,820	$3,856,651
A. T. Income	$2,599,995	$2,759,528	$2,926,585	$3,101,618	$3,285,111	$3,477,582	$3,679,587	$3,891,722	$4,114,627	$4,348,989
Depreciation	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935
Debt Principal	$1,192,847	$1,291,257	$1,397,786	$1,513,103	$1,637,934	$1,773,064	$1,919,342	$2,077,688	$2,249,097	$2,434,647
Net Csh Flw	$1,891,083	$1,952,206	$2,012,734	$2,072,450	$2,131,111	$2,188,453	$2,244,180	$2,297,969	$2,349,465	$2,398,277
Debt Coverage Ratio	2.59	2.67	2.75	2.83	2.91	3.00	3.09	3.18	3.28	3.37

ASED COMPOSTING
INANCIAL ANALYSIS
PRIVATE OWNERSHIP / UNFAVORABLE ASSUMPTIONS
Y: R. S. Lynch & Company, Inc.

ults:

Year	21	22	23	24	25	26	27	28	29	30
Revenues	$17,067,751	$17,579,784	$18,107,177	$18,650,393	$19,209,904	$19,786,201	$20,379,787	$20,991,181	$21,620,917	$22,269,544
Operating Exp	$7,992,042	$8,231,803	$8,478,758	$8,733,120	$8,995,114	$9,264,967	$9,542,916	$9,829,204	$10,124,080	$10,427,802
IBIT	$9,075,709	$9,347,980	$9,628,420	$9,917,272	$10,214,790	$10,521,234	$10,836,871	$11,161,977	$11,496,837	$11,841,742
Interest Exp	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$0	$0
Taxable Income	$8,591,774	$8,864,045	$9,144,485	$9,433,337	$9,730,855	$10,037,299	$10,352,936	$10,678,042	$11,496,837	$11,841,742
Tax @ 47%	$4,038,134	$4,166,101	$4,297,908	$4,433,668	$4,573,502	$4,717,531	$4,865,880	$5,018,680	$5,403,513	$5,565,619
A. T. Income	$4,553,640	$4,697,944	$4,846,577	$4,999,669	$5,157,353	$5,319,769	$5,487,056	$5,659,362	$6,093,323	$6,276,123
Depreciation	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$483,935	$0	$0
Debt Principal	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Csh Flw	$5,037,575	$5,181,879	$5,330,512	$5,483,604	$5,641,288	$5,803,704	$5,970,991	$6,143,297	$6,093,323	$6,276,123
Debt Coverage Ratio	*****************	*****************	*****************	*****************	*****************					

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 1

09-Jan-02

ASSUMPTIONS:

Capital Costs:		Development Equity: First 6 Mos. of Proj Devel.	Second 6 Mos. of Proj Devel.	Upon Proj. Fin. $000	deprec. per. (Years)
Initial Marketing, RFP Response		$0			
Final Marketing, Prel Eng., Pricing & Contracting			$30,000		
Final Eng. & Des., Permitting & Dev. of Proj. Financing			$300,000		
Project Financing & Construction: ($000)					
Equip (Including 2 digest.)				$12,500	
100,000 SF Bldg @	$70 per SF			$7,000	
Biofilters				$3,000	
5 Acre Site Improvements				$150	
Perf. Guarantee @10%				$1,250	
Int Dur. Const (18 Months)				$2,139	
Barrower's Counsel				$50	
Conting.& spare pts @ 10%				$1,250	
Debt Res. Fund				$0	
Financing:					
Underwritting Fee @ 1% assumes G.O. Debt				$288	
Underwritters's Counsel				$50	
Issuer's fee @ 1%, if required				$288	
Bond Counsel				$50	
Feas. Opin.				$125	
Trustee				$50	
Cusip, printing & Other				$50	
Financial Advis.				$25	
Other		$0	$0	$250	28
SUB TOTAL		$0	$330,000	$28,516	
TOTAL				$28,846	

Financing Assumptions:

Debt (%/Amt)	100%	100%	100%	$28,846
Equity (%/Amt)	0%	0%	0%	$0
Total Capital				$28,846
Avg. % Equity			0.00%	
Debt Term			20	years
Debt Rate			5.00%	

Operating Costs (000):			Ann. Esc. Rate	per ICI Ton
O&M + R&R Cost		$2,400	3.00%	$26.67
2,000,000 kwh/yr @	$0.120	$240	3.00%	
Other (DSRF Int. @ 3.0%)		$-0	0.00%	$-0.00
Res. Disp. @ $65/T, 15%ICI		$878	3.00%	$9.75
TOTAL		$3,518		$39.08

Throughput:	TPD	DPY	TPY
ICI	300.00	300	90000

Fees per ton:		
ICI Tip Fee (w/ Res Disp)	$55.00	3.00%
Sold Compost Rev (FOB Plnt)	$15.00	1.50%

Financial Results:

10 Year IRR	NA
20 Year IRR	NA

Debt Cov. Ratio:	
Year 1	0.51
Avg. Yr. 1-10	1.09
Avg. Yr. 1-20	1.28

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 2

09-Jan-02

Year	1	2	3	4	5	6	7	8	9	10
Revenues:										
ICI Tons	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000
ICI Tip Fee	$55.00	$56.65	$58.35	$60.10	$61.90	$63.76	$65.67	$67.64	$69.67	$71.76
ICI Revenue	$4,950,000	$5,098,500	$5,251,455	$5,408,999	$5,571,269	$5,738,407	$5,910,559	$6,087,876	$6,270,512	$6,458,627
Compost Tons (50%ICI)	45000	45000	45000	45000	45000	45000	45000	45000	45000	45000
Rev/T	$15.00	$15.23	$15.45	$15.69	$15.92	$16.16	$16.40	$16.65	$16.90	$17.15
Compost Revenue	$675,000	$685,125	$695,402	$705,833	$716,420	$727,167	$738,074	$749,145	$760,382	$771,788
Total Revenue	$5,625,000	$5,783,625	$5,946,857	$6,114,832	$6,287,689	$6,465,573	$6,648,633	$6,837,021	$7,030,894	$7,230,415

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 3

09-Jan-02

Year	11	12	13	14	15	16	17	18	19	20
Revenues:										
MSW Tons	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000
MSW Tip Fee	$73.92	$76.13	$78.42	$80.77	$83.19	$85.69	$88.26	$90.91	$93.63	$96.44
MSW Revenue	$6,652,386	$6,851,958	$7,057,516	$7,269,242	$7,487,319	$7,711,939	$7,943,297	$8,181,596	$8,427,044	$8,679,855
Compost Tons	45000	45000	45000	45000	45000	45000	45000	45000	45000	45000
Rev/T	$17.41	$17.67	$17.93	$18.20	$18.48	$18.75	$19.03	$19.32	$19.61	$19.90
Compost Revenue	$783,365	$795,116	$807,042	$819,148	$831,435	$843,907	$856,565	$869,414	$882,455	$895,692
Total Revenue	$7,435,751	$7,647,073	$7,864,559	$8,088,390	$8,318,754	$8,555,845	$8,799,862	$9,051,010	$9,309,499	$9,575,547

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

Year	21	22	23	24	25	26	27	28	29	30
Revenues:										
MSW Tons	90000	90000	90000	90000	90000	90000	90000	90000	90000	90000
MSW Tip Fee	$99.34	$102.32	$105.39	$108.55	$111.80	$115.16	$118.61	$122.17	$125.84	$129.61
MSW Revenue	$8,940,251	$9,208,458	$9,484,712	$9,769,253	$10,062,331	$10,364,201	$10,675,127	$10,995,381	$11,325,242	$11,664,999
Compost Tons	45000	45000	45000	45000	45000	45000	45000	45000	45000	45000
Rev/T	$20.20	$20.51	$20.81	$21.13	$21.44	$21.76	$22.09	$22.42	$22.76	$23.10
Compost Revenue	$909,127	$922,764	$936,605	$950,655	$964,914	$979,388	$994,079	$1,008,990	$1,024,125	$1,039,487
Total Revenue	$9,849,378	$10,131,222	$10,421,317	$10,719,908	$11,027,245	$11,343,589	$11,669,206	$12,004,371	$12,349,367	$12,704,486

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

09-Jan-02

Debt Service:

Begining Principal	$28,846	
Term	20	Years
Rate	5.00%	

Year	Principal	Interest	Total	Outs. Balance
				$28,846
1	$872	$1,442	$2,315	$27,973
2	$916	$1,399	$2,315	$27,057
3	$962	$1,353	$2,315	$26,095
4	$1,010	$1,305	$2,315	$25,086
5	$1,060	$1,254	$2,315	$24,025
6	$1,113	$1,201	$2,315	$22,912
7	$1,169	$1,146	$2,315	$21,743
8	$1,228	$1,087	$2,315	$20,515
9	$1,289	$1,026	$2,315	$19,226
10	$1,353	$961	$2,315	$17,873
11	$1,421	$894	$2,315	$16,452
12	$1,492	$823	$2,315	$14,960
13	$1,567	$748	$2,315	$13,393
14	$1,645	$670	$2,315	$11,748
15	$1,727	$587	$2,315	$10,021
16	$1,814	$501	$2,315	$8,208
17	$1,904	$410	$2,315	$6,303
18	$1,999	$315	$2,315	$4,304
19	$2,099	$215	$2,315	$2,204
20	$2,204	$110	$2,315	$0
21	$0	$0	$0	$0
22	$0	$0	$0	$0
23	$0	$0	$0	$0
24	$0	$0	$0	$0
25	$0	$0	$0	$0
Total	$28,846	$17,447	$46,293	

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 6

09-Jan-02

Depreciation & Operating Costs:

Year		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
O&M		$2,400	$2,472	$2,546	$2,623	$2,701	$2,782	$2,866	$2,952	$3,040	$3,131
Admin		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other		$-0	$-0	$-0	$-0	$-0	$-0	$-0	$-0	$-0	$-0
Residue Trans & Disp.		$878	$904	$931	$959	$988	$1,017	$1,048	$1,079	$1,112	$1,145
Total		$3,278	$3,376	$3,477	$3,581	$3,689	$3,800	$3,914	$4,031	$4,152	$4,276
Depreciation:											
10 Year	$12,500	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250	$1,250
28 Year	$14,689	$525	$525	$525	$525	$525	$525	$525	$525	$525	$525
20 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$27,189	$1,775	$1,775	$1,775	$1,775	$1,775	$1,775	$1,775	$1,775	$1,775	$1,775

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 7

09-Jan-02

Depreciation & Operating Costs:

Year	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
O&M	$3,225	$3,322	$3,422	$3,524	$3,630	$3,739	$3,851	$3,967	$4,086	$4,208
Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$-0	$-0	$-0	$-0	$-0	$-0	$-0	$-0	$-0	$-0
Residue Trans & Disp.	$1,179	$1,215	$1,251	$1,289	$1,327	$1,367	$1,408	$1,450	$1,494	$1,539
Total	$4,405	$4,537	$4,673	$4,813	$4,958	$5,106	$5,259	$5,417	$5,580	$5,747
Depreciation:										
10 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
28 Year	$525	$525	$525	$525	$525	$525	$525	$525	$525	$525
20 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
										$0
Total	$525	$525	$525	$525	$525	$525	$525	$525	$525	$525

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

Depreciation & Operating Costs:

Year	21	22	23	24	25	26	27	28	29	30
O&M	$4,335	$4,465	$4,599	$4,737	$4,879	$5,025	$5,176	$5,331	$5,491	$5,656
Admin	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Residue Trans & Disp.	$1,585	$1,632	$1,681	$1,732	$1,784	$1,837	$1,892	$1,949	$2,008	$2,068
Total	$5,920	$6,097	$6,280	$6,468	$6,662	$6,862	$7,068	$7,280	$7,499	$7,724
Depreciation:										
10 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
28 Year	$525	$525	$525	$525	$525	$525	$525	$525	$0	$0
20 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$525	$525	$525	$525	$525	$525	$525	$525	$0	$0

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

09-Jan-02

Financial Results:

Year	Yr 1 (6 Mnths)	2	3	4	5	6	7	8	9	10
Revenues	$2,812,500	$5,783,625	$5,946,857	$6,114,832	$6,287,689	$6,465,573	$6,648,633	$6,837,021	$7,030,894	$7,230,415
Operating Exp	$1,638,750	$3,375,825	$3,477,100	$3,581,413	$3,688,855	$3,799,521	$3,913,506	$4,030,912	$4,151,839	$4,276,394
IBIT	$1,173,750	$2,407,800	$2,469,757	$2,533,419	$2,598,834	$2,666,053	$2,735,127	$2,806,109	$2,879,055	$2,954,021
Debt Service	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644
Debt Coverage Ratio	0.51	1.04	1.07	1.09	1.12	1.15	1.18	1.21	1.24	1.28

Avg DCR:

year 1-10	1.09
Year 1-20	1.28

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 10

Financial Results:

Year	11	12	13	14	15	16	17	18	19	20
Revenues	$7,435,751	$7,647,073	$7,864,559	$8,088,390	$8,318,754	$8,555,845	$8,799,862	$9,051,010	$9,309,499	$9,575,547
Operating Exp	$4,404,686	$4,536,827	$4,672,931	$4,813,119	$4,957,513	$5,106,238	$5,259,425	$5,417,208	$5,579,724	$5,747,116
IBIT	$3,031,065	$3,110,247	$3,191,627	$3,275,271	$3,361,241	$3,449,607	$3,540,437	$3,633,801	$3,729,774	$3,828,431
Debt Service	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644	$2,314,644
Debt Coverage Ratio	1.31	1.34	1.38	1.42	1.45	1.49	1.53	1.57	1.61	1.65

NYC DRUM BASED COMPOSTING
LIFE CYCLE FINANCIAL ANALYSIS
SCENARIO 2: PUBLIC OWNERSHIP / FAVORABLE ASSUMPTIONS
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 11

Financial Results:

Year	21	22	23	24	25	26	27	28	29	30
Revenues	$9,849,378	$10,131,222	$10,421,317	$10,719,908	$11,027,245	$11,343,589	$11,669,206	$12,004,371	$12,349,367	$12,704,486
Operating Exp	$5,919,530	$6,097,115	$6,280,029	$6,468,430	$6,662,483	$6,862,357	$7,068,228	$7,280,275	$7,498,683	$7,723,643
IBIT	$3,929,848	$4,034,107	$4,141,288	$4,251,478	$4,364,763	$4,481,232	$4,600,978	$4,724,096	$4,850,684	$4,980,843
Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Debt Coverage Ratio	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR

New York City MSW Composting Report

Appendix E
Data on New York City's Biosolids (2001/2002)

2001 Wet Ton Production of all NYC Wastewater Treatment Plants

Date	Wards Island					North River					Hunts Point					26th Ward				
	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day
Jan-01	2,865	2.0	1,805	7,220	233	2,523	1.0	795	3,179	103	1,362	2.1	901	3,604	116	745	2.5	586	2,346	76
Feb-01	2,352	2.3	1,704	6,816	243	2,287	1.1	792	3,170	113	1,139	2.5	897	3,589	128	798	2.7	678	2,713	97
Mar-01	3,014	2.3	2,184	8,735	282	2,190	1.3	897	3,587	116	1,210	2.5	952	3,810	123	749	2.7	637	2,548	82
Apr-01	3,422	2.1	2,264	9,054	302	2,285	1.3	936	3,743	125	1,431	2.7	1,217	4,869	162	775	2.8	683	2,734	91
May-01	3,685	1.8	2,090	8,358	270	2,083	1.3	853	3,412	110	2,030	2.5	1,599	6,395	206	774	2.3	561	2,244	72
Jun-01	4,188	1.8	2,375	9,499	317	2,232	1.3	914	3,655	122	1,681	2.4	1,270	5,082	169	769	2.8	678	2,712	90
Jul-01	3,854	1.6	1,942	7,770	251	2,839	1.2	1,073	4,293	138	1,864	2.2	1,292	5,167	167	776	2.5	611	2,446	79
Aug-01	3,984	1.5	1,882	7,530	243	2,598	1.2	982	3,929	127	1,646	2.2	1,141	4,562	147	1,053	1.9	631	2,522	81
Sep-01	4,467	1.5	2,111	8,443	281	2,274	1.4	1,003	4,011	134	1,894	1.9	1,133	4,533	151	851	1.9	509	2,038	68
Oct-01	4,056	1.5	1,917	7,666	247	2,565	1.3	1,050	4,201	136	1,791	2.1	1,185	4,738	153	740	1.9	443	1,772	57
Nov-01	3,216	1.7	1,722	6,888	230	2,416	1.5	1,141	4,566	152	1,805	2.0	1,137	4,548	152	771	1.9	462	1,846	62
Dec-01	3,415	1.7	1,829	7,315	236	2,275	1.3	931	3,726	120	1,513	2.0	953	3,813	123	903	1.9	541	2,162	70

Date	Red Hook					Jamaica					Tallman Island					Bowery Bay				
	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day
Jan-01	437	2.1	289	1,155	37	1,387	1.7	742	2,970	96	1,130	2.0	712	2,848	92	1,376	2.1	910	3,641	117
Feb-01	427	2.4	323	1,292	46	1,245	1.3	510	2,039	73	876	2.2	607	2,429	87	1,138	2.2	788	3,153	113
Mar-01	592	2.4	447	1,790	58	1,641	1.3	672	2,688	87	955	2.4	722	2,887	93	1,426	2.7	1,213	4,853	157
Apr-01	463	2.0	292	1,167	39	1,396	1.8	791	3,165	105	1,112	2.4	840	3,362	112	1,430	2.5	1,126	4,504	150
May-01	385	2.1	255	1,019	33	1,613	1.8	914	3,657	118	1,419	2.1	939	3,755	121	2,087	2.0	1,315	5,258	170
Jun-01	341	2.3	247	989	33	1,535	1.8	870	3,481	116	1,103	2.0	695	2,781	93	1,952	2.0	1,230	4,919	164
Jul-01	398	2.1	263	1,053	34	1,720	1.7	921	3,684	119	1,224	1.9	733	2,931	95	2,263	1.7	1,212	4,848	156
Aug-01	474	2.1	313	1,254	40	1,698	1.7	909	3,636	117	1,381	1.9	826	3,305	107	2,450	1.7	1,312	5,247	169
Sep-01	405	2.2	280	1,122	37	1,480	1.8	839	3,357	112	1,242	1.7	665	2,659	89	2,071	1.6	1,044	4,175	139
Oct-01	468	1.9	280	1,120	36	1,712	1.7	917	3,667	118	1,125	1.6	567	2,269	73	2,036	1.6	1,026	4,105	132
Nov-01	550	1.8	312	1,247	42	1,593	1.7	853	3,411	114	1,221	1.8	692	2,769	92	1,730	1.6	872	3,487	116
Dec-01	572	1.6	288	1,154	37	1,550	1.6	781	3,124	101	1,098	1.8	623	2,491	80	1,560	1.7	835	3,341	108

Values Based on Thickened Sludge Production
Total solid value used to calculate wet tons per day is 25%.

2001 Wet Ton Production of all NYC Wastewater Treatment Plants

Date	Coney Island					Owls Head					Newtown Creek				
	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day
Jan-01	1,505	1.7	806	3,224	104	1,678	1.9	1,004	4,016	130	2,471	1.9	1,479	5,915	191
Feb-01	1,282	1.9	767	3,070	110	1,463	2.1	968	3,872	138	2,408	2.1	1,593	6,372	228
Mar-01	1,271	1.9	761	3,043	98	1,672	2.1	1,106	4,425	143	2,520	2.1	1,667	6,669	215
Apr-01	1,055	2.1	698	2,791	93	1,820	2.0	1,146	4,585	153	2,342	2.2	1,623	6,492	216
May-01	1,359	1.9	813	3,252	105	1,930	1.9	1,155	4,620	149	2,327	2.1	1,539	6,156	199
Jun-01	1,584	1.9	948	3,791	126	1,887	2.1	1,248	4,992	166	2,351	2.3	1,704	6,814	227
Jul-01	1,721	1.7	922	3,686	119	2,317	1.7	1,240	4,962	160	2,358	2.3	1,708	6,833	220
Aug-01	1,987	1.5	939	3,755	121	2,514	1.5	1,188	4,751	153	2,476	2.0	1,560	6,238	201
Sep-01	1,883	1.5	890	3,559	119	1,719	1.6	866	3,466	116	2,469	2.2	1,711	6,844	228
Oct-01	2,013	1.4	888	3,551	115	2,204	1.5	1,041	4,165	134	2,217	2.0	1,396	5,586	180
Nov-01	1,838	1.4	811	3,243	108	2,390	1.3	979	3,914	130	2,317	2.0	1,460	5,839	195
Dec-01	1,736	1.6	875	3,500	113	2,065	1.7	1,106	4,422	143	2,437	2.1	1,612	6,447	208

Date	Rockaway					Oakwood Beach					Port Richmond				
	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day
Jan-01	203	1.5	96	384	12	727	1.4	321	1,283	41	561	1.5	259	1,038	33
Feb-01	192	1.4	85	338	12	595	1.3	244	974	35	459	1.6	228	910	33
Mar-01	208	1.5	98	393	13	740	1.5	350	1,399	45	484	1.7	256	1,024	33
Apr-01	233	1.6	117	469	16	715	1.7	383	1,530	51	460	1.7	249	995	33
May-01	258	1.6	130	520	17	812	1.4	358	1,432	46	496	1.6	253	1,012	33
Jun-01	185	1.5	87	350	12	767	1.3	314	1,257	42	481	1.7	255	1,021	34
Jul-01	188	1.5	89	355	11	795	1.3	325	1,302	42	499	1.7	262	1,046	34
Aug-01	189	1.6	95	382	12	779	1.2	294	1,178	38	360	1.6	187	747	24
Sep-01	212	1.4	93	373	12	753	1.3	308	1,233	41	540	1.7	289	1,156	39
Oct-01	216	1.4	95	381	12	713	1.3	292	1,168	38	531	1.4	241	965	31
Nov-01	226	1.4	99	398	13	677	1.3	277	1,109	37	459	1.4	209	835	28
Dec-01	222	1.4	98	392	13	749	1.2	283	1,132	37	490	1.4	223	892	29

Values Based on Thickened Sludge Production
Total solid value used to calculate wet tons per day is 25%.

2002 Wet Ton Production of all NYC Wastewater Treatment Plants

Date	Wards Island					North River					Hunts Point					26th Ward				
	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day
Jan-02	3,574	1.7	1,914	7,656	247	2,414	1.2	912	3,648	118	1,525	2.0	961	3,844	124	704	1.7	377	1,508	49
Feb-02	3,244	1.7	1,737	6,948	248	2,033	1.5	960	3,840	137	1,335	2.2	925	3,700	132	769	1.6	387	1,548	55
Mar-02	3,873	1.8	2,196	8,784	314	2,173	1.4	958	3,832	137	1,665	2.3	1,207	4,828	172	625	1.6	315	1,260	45

Date	Red Hook					Jamaica					Tallman Island					Bowery Bay				
	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day
Jan-02	497	1.6	250	1,000	32	1,573	1.7	842	3,368	109	1,121	2.1	741	2,964	96	1,449	1.6	730	2,920	94
Feb-02	343	1.5	162	648	23	1,433	1.7	767	3,068	110	1,030	2.0	649	2,596	93	1,107	1.9	663	2,652	95
Mar-02	320	1.5	151	604	22	1,533	1.7	821	3,284	117	996	2.0	627	2,508	90	1,231	2.0	775	3,100	111

Date	Coney Island					Owls Head					Newtown Creek				
	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day
Jan-02	1,629	1.6	821	3,284	106	1,754	1.7	939	3,756	121	3,180	2.0	2,004	8,016	259
Feb-02	1,518	1.7	813	3,252	116	1,643	1.8	932	3,728	133	2,841	2.0	1,790	7,160	256
Mar-02	1,713	1.7	917	3,668	131	1,996	1.6	1,006	4,024	144	2,962	2.0	1,866	7,464	267

Date	Rockaway					Oakwood Beach					Port Richmond				
	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day	Cu Ft x 1000	% Solids to Dewatering	Dry Tons	Wet Tons Month	Wet Tons day
Jan-02	202	1.5	95	380	12	745	1.5	352	1,408	45	445	1.2	167	668	22
Feb-02	176	1.6	89	356	13	614	1.6	309	1,236	44	477	1.1	171	684	24
Mar-02	227	1.5	107	428	15	722	1.6	364	1,456	52	496	1.3	364	1,456	52

Values Based on Thickened Sludge Production
Total solid value used to calculate wet tons per day is 25%

DEP Biosolids Data
Percent Total Solids
per Dewatering Facility
2001-2002

MONTHLY PERCENT TOTAL SOLIDS DATA FROM DEWATERING FACILITIES

Plant / Month-Year	Wards Island	Hunts Point	26th Ward	Red Hook	Jamaica	Tallman Island	Bowery Bay	Oakwood Beach	Systemwide Weighted Avg. (dry tons)	Systemwide Weighted Avg. (wet tons)	Systemwide Arithmetic Avg.	Plant / Month-Year
Jan-01	26.2%	27.9%	24.1%	21.5%	24.4%	22.9%	24.4%	24.1%	25.5%	25.5%	24.4%	Jan-01
Feb-01	27.1%	28.4%	24.8%	21.6%	24.6%	23.4%	24.3%	25.6%	26.2%	26.2%	25.0%	Feb-01
Mar-01	26.9%	28.3%	25.8%	21.5%	26.7%	23.5%	25.4%	26.0%	26.6%	26.5%	25.5%	Mar-01
Apr-01	28.2%	29.1%	26.2%	24.1%	27.7%	24.4%	27.9%	26.4%	27.7%	27.6%	26.8%	Apr-01
May-01	27.5%	27.3%	26.6%	23.2%	26.9%	24.3%	25.7%	26.4%	26.8%	26.7%	26.0%	May-01
Jun-01	27.1%	28.7%	27.3%	22.3%	25.9%	25.1%	26.7%	27.1%	27.2%	27.2%	26.3%	Jun-01
Jul-01	27.3%	28.2%	27.4%	23.0%	25.8%	24.8%	25.6%	26.6%	27.0%	27.0%	26.1%	Jul-01
Aug-01	28.0%	28.4%	26.4%	22.9%	26.1%	24.8%	25.5%	26.0%	27.1%	27.0%	26.0%	Aug-01
Sep-01	27.9%	28.2%	26.3%	23.1%	26.1%	25.0%	25.9%	26.0%	27.1%	27.0%	26.1%	Sep-01
Oct-01	26.5%	27.8%	26.4%	22.5%	25.2%	23.5%	24.5%	25.4%	26.2%	26.1%	25.2%	Oct-01
Nov-01	26.2%	27.0%	25.7%	20.9%	25.2%	23.5%	22.9%	23.7%	25.4%	25.4%	24.4%	Nov-01
Dec-01	26.4%	28.0%	25.2%	19.1%	26.3%	22.0%	23.9%	22.6%	25.6%	25.4%	24.2%	Dec-01
Jan-02	25.7%	26.8%	24.6%	18.8%	26.6%	22.2%	23.0%	23.7%	25.1%	25.1%	23.9%	Jan-02
Feb-02	25.9%	26.7%	25.9%	19.9%	26.2%	22.2%	25.7%	25.0%	25.8%	25.7%	24.7%	Feb-02
Mar-02	25.7%	27.2%	25.8%	20.3%	26.4%	22.5%	23.4%	24.8%	25.6%	25.5%	24.5%	Mar-02
Apr-02												Apr-02
May-02												May-02
Jun-02												Jun-02
Jul-02												Jul-02
Aug-02												Aug-02
Sep-02												Sep-02
Oct-02												Oct-02
Nov-02												Nov-02
Dec-02												Dec-02
Average	**26.8%**	**27.9%**	**25.9%**	**21.6%**	**26.0%**	**23.6%**	**25.0%**	**25.3%**	**26.3%**	**26.3%**	**25.3%**	**Average**
Minimum	**25.7%**	**26.7%**	**24.1%**	**18.8%**	**24.4%**	**22.0%**	**22.9%**	**22.6%**	**25.1%**	**25.1%**	**23.9%**	**Minimum**
Maximum	**28.2%**	**29.1%**	**27.4%**	**24.1%**	**27.7%**	**25.1%**	**27.9%**	**27.1%**	**27.7%**	**27.6%**	**26.8%**	**Maximum**

DEP Biosolids Data
Nutrient Data
26th Ward Facility
2001-2002

New York City Department of Environmental Protection

26th Ward Dewatering Facility

Monthly Nutrient Concentrations

Month	Liquid Sludge Sources	Total Solids %	Volatile Solids %	Nutrients P %	K %	TKN %	NH3 %	Fe %	NO2 mg/Kg	NO3 mg/Kg	pH
Jan 01	26, CI, JA	23.23	70.75	2.10	0.33	7.64	1.26	2.47	26.25	7.78	7.9
Feb 01	26, CI, JA	24.51	69.03	1.90	0.58	7.43	1.86	2.47	9.92	28.30	8.0
Mar 01	26, CI, JA	26.00	50.48	1.63	1.18	6.43	1.21	2.64	11.10	34.20	7.9
Apr 01	26, CI, JA	25.71	52.89	2.16	0.46	5.40	1.06	2.80	12.52	28.87	8.0
May 01	26, CI	25.45	52.59	2.45	0.16	5.18	1.06	3.15	6.63	7.75	8.0
Jun 01	26, CI	25.94	56.01	2.45	0.13	5.79	1.24	2.84	22.81	43.87	7.9
Jul 01	26, CI, RK	26.38	54.82	2.13	0.10	5.18	1.32	2.94	15.86	37.72	8.1
Aug 01	26, CI	25.75	57.45	2.23	0.10	6.71	1.12	2.99	66.12	28.18	8.0
Sep 01	26, CI, RK	25.71	55.08	2.34	0.29	5.80	1.28	2.99	10.76	87.56	7.8
Oct 01	26, CI, RK, OH	25.63	63.93	2.09	0.09	6.15	1.19	2.88	14.16	21.36	8.0
Nov 01	26, CI, RK, OH, NC	27.64	70.79	2.00	0.25	5.98	1.20	2.64	17.10	33.88	7.9
Dec 01	26, CI, RK, OH	24.33	72.88	2.45	0.09	6.50	1.41	2.40	10.85	22.45	8.3
Jan 02	26, CI, RK, OH	23.89	69.43	3.13	0.12	5.59	1.36	2.57	28.96	16.82	8.1
Feb 02	26, CI, RK, OH	24.95	69.07	1.92	0.14	9.94	0.99	2.86	8.81	15.80	7.9
Average		25.37	61.80	2.21	0.29	6.41	1.25	2.76	18.70	29.61	8.0

Notes:

17-Apr-2002

1. Blank spaces indicate data is unavailable.
2. Plant Key: BB - Bowery Bay, CI - Coney Island, HP - Hunts Point, JA - Jamaica, NC - Newtown Creek, NR - North River, OB - Oakwood Beach, OH - Owls Head, PR - Port Richmond, RH - Red Hook, RK - Rockaway, TI - Tallman Island, 26 - 26th Ward, WI - Wards Island

Bowery Bay Dewatering Facility
Monthly Nutrient Concentrations

Month	Liquid Sludge Sources	Total Solids %	Volatile Solids %	Nutrients P %	K %	TKN %	NH3 %	Fe %	NO2 mg/Kg	NO3 mg/Kg	pH
Jan 01	BB	23.7	76.2	3.48	0.73	6.85	1.83	2.02	11.57	1.58	8.1
Feb 01	BB	24.4	70.0	1.54	1.21	5.78	1.55	2.07	9.13	49.60	8.0
Mar 01	BB	25.6	45.3	3.20	1.31	5.42	1.74	2.10	16.86	20.39	7.9
Apr 01	BB	27.4	57.1	3.03	0.53	5.19	1.60	1.62	8.91	14.51	8.1
May 01	BB	26.7	62.5	3.00	0.17	6.22	2.28	2.06	10.34	12.30	7.8
Jun 01	BB	26.6	58.2	2.56	0.16	6.31	1.51	1.72	6.14	0.93	7.9
Jul 01	BB	25.8	70.2	1.73	0.09	7.57	1.73	2.12	17.67	28.03	8.1
Aug 01	BB	25.3	57.8	2.20	0.11	8.35	1.84	2.41	0.66	3.44	7.7
Sep 01	BB	25.7	59.4	1.34	0.11	7.50	2.40	2.36	0.83	0.68	7.4
Oct 01	BB	24.8	60.2	3.29	0.11	7.77	2.10	2.12	2.61	1.15	8.0
Nov-01	BB	23.6	83.1	1.47	0.11	8.72	1.29	1.89	2.64	0.70	7.6
Dec-01	BB	25.8	74.8	3.69	0.09	6.45	2.89	1.56	0.55	0.11	7.8
Jan 02	BB	23.6	73.5	1.78	0.10	6.62	1.94	2.10	6.51	11.22	7.9
Feb 02	BB	24.1	70.9	2.55	0.14	6.59	2.21	2.34	4.75	8.05	7.9
Average		25.22	65.64	2.49	0.36	6.81	1.92	2.04	7.08	10.91	7.9

Notes: 17-Apr-2002

1. Blank spaces indicate data is unavailable.
2. Plant Key: BB - Bowery Bay, CI - Coney Island, HP - Hunts Point, JA - Jamaica, NC - Newtown Creek, NR - North River, OB - Oakwood Beach, OH - Owls Head, PR - Port Richmond, RH - Red Hook, RK - Rockaway, TI - Tallman Island, 26 - 26th Ward, WI - Wards Island

DEP Biosolids Data
Nutrient Data
Hunts Point Facility
2001-2002

New York City Department of Environmental Protection
Hunts Point Dewatering Facility
Monthly Nutrient Concentrations

Month	Liquid Sludge Sources	Total Solids %	Volatile Solids %	Nutrients P %	K %	TKN %	NH3 %	Fe %	NO2 mg/Kg	NO3 mg/Kg	pH
Jan 01	HP, OH, NC	27.1	71.5	1.86	0.14	4.94	1.05	3.44	17.78	32.13	8.2
Feb 01	HP, OH, NC	29.1	65.8	2.47	0.33	4.52	1.51	2.69	13.99	17.77	8.1
Mar 01	HP, OH, NC	28.3	47.1	2.42	0.90	5.73	1.76	2.50	10.23	16.31	7.9
Apr 01	HP, OH, NC	28.6	50.1	2.58	0.92	3.99	1.38	2.54	11.47	25.07	7.9
May 01	HP, OH, NC	26.6	57.6	2.81	0.18	5.59	1.49	3.09	10.65	12.48	7.9
Jun 01	HP, OH, NC	27.3	53.0	2.69	0.14	5.44	1.56	3.00	12.55	20.65	8.0
Jul 01	HP, OH, NC	26.4	57.7	2.49	0.11	6.49	1.59	2.63	8.95	21.77	7.5
Aug 01	HP, OH, NC	26.4	56.1	2.48	0.11	6.21	1.39	2.85	14.45	22.61	8.0
Sep 01	HP, NC	26.7	47.2	2.60	0.11	8.88	1.88	3.05	12.75	24.43	8.0
Oct 01	HP, NC	27.7	46.0	2.81	0.13	8.16	1.66	3.41	6.22	5.11	7.9
Nov 01	HP, NC	26.0	71.1	1.44	0.13	10.51	1.90	3.15	14.65	9.46	7.7
Dec-01	HP, NC, OH	27.3	68.1	6.24	0.13	4.96	2.70	3.71	0.27	0.54	8.4
Jan 02	HP, NC, RH	25.5	65.2	3.83	0.12	5.15	1.81	2.90	7.20	11.48	8.1
Feb 02	HP, NC, RH, OH	27.4	67.5	3.24	0.13	5.66	1.61	2.73	3.23	7.09	8.0
Average		27.2	58.8	2.85	0.26	6.16	1.66	2.98	10.31	16.21	8.0

Notes:

17-Apr-2002

1. Blank spaces indicate data is unavailable.
2. Plant Key: BB - Bowery Bay, CI - Coney Island, HP - Hunts Point, JA - Jamaica, NC - Newtown Creek, NR - North River, OB - Oakwood Beach, OH - Owls Head, PR - Port Richmond, RH - Red Hook, RK - Rockaway, TI - Tallman Island, 26 - 26th Ward, WI - Wards Island

DEP Biosolids Data
Nutrient Data
Jamaica Bay Facility
2001-2002

New York City Department of Environmental Protection
Jamaica Dewatering Facility
Monthly Nutrient Concentrations

Month	Liquid Sludge Sources	Total Solids %	Volatile Solids %	Nutrients P %	K %	TKN %	NH3 %	Fe %	NO2 mg/Kg	NO3 mg/Kg	pH
Jan 01	JA	23.8	73.2	2.98	0.38	5.36	2.47	2.19	26.84	7.35	8.2
Feb 01	JA	24.8	72.5	2.49	0.77	6.39	2.08	2.45	7.98	5.31	8.0
Mar 01	JA	27.0	72.4	3.55	0.10	5.92	2.53	2.20	6.77	7.32	8.1
Apr 01	JA	27.2	59.4	2.58	0.42	5.98	1.63	2.13	5.81	13.71	7.9
May 01	JA	27.0	58.4	1.96	0.19	6.40	1.33	2.24	4.22	1.48	8.0
Jun 01	JA	25.8	70.7	2.50	0.20	5.27	1.83	1.63	4.91	3.89	8.2
Jul 01	JA	26.0	59.5	2.51	0.29	6.05	2.46	2.33	6.39	6.41	8.1
Aug 01	JA	26.1	44.1	1.37	0.26	10.23	1.20	1.52	8.52	15.06	8.0
Sep 01	JA	26.5	45.1	2.38	0.25	10.59	2.20	2.21	5.45	15.80	7.9
Oct 01	JA	25.5	60.9	2.46	0.30	9.93	2.15	2.52	6.10	7.03	8.1
Nov-01	JA	23.8	70.2	1.45	0.51	3.93	2.38	2.36	23.80	8.76	7.9
Dec-01	JA	25.8	74.7	2.18	0.31	9.01	1.97	2.22	3.62	3.92	8.0
Jan 02	JA	26.0	71.1	3.54	0.30	5.76	1.91	1.10	5.36	10.81	8.2
Feb 02	JA	26.4	71.5	2.10	0.25	6.38	1.76	1.97	4.06	7.25	8.2
Average		25.8	64.5	2.43	0.32	6.94	1.99	2.08	8.56	8.15	8.0

Notes:

1. Blank spaces indicate data is unavailable.
2. Plant Key: BB - Bowery Bay, CI - Coney Island, HP - Hunts Point, JA - Jamaica, NC - Newtown Creek, NR - North River, OB - Oakwood Beach,

17-Apr-2002

DEP Biosolids Data
Nutrient Data
Oakwood Beach Facility
2001-2002

New York City Department of Environmental Protection
Oakwood Beach Dewatering Facility
Monthly Nutrient Concentrations

Month	Liquid Sludge Sources	Total Solids %	Volatile Solids %	Nutrients P %	K %	TKN %	NH3 %	Fe %	NO2 mg/Kg	NO3 mg/Kg	pH
Jan 01	OB, PR, OH	23.8	62.9	2.84	0.42	5.4	1.27	1.9	23.9	16.9	7.9
Feb 01	OB, PR, OH	26.5	70.7	3.67	0.32	4.82	1.26	2.25	9.92	28.32	8.4
Mar 01	OB, PR, OH	25.7	61.0	2.95	0.87	6.55	1.55	2.23	16.2	45.9	8.2
Apr 01	OB, PR, OH	26.3	48.1	4.55	0.5	5.38	1.29	2.21	8.03	216.8	8.3
May 01	OB, PR, OH	26.2	47.7	3.73	0.13	5.99	1.15	2.47	6.13	17.5	8.1
Jun 01	OB, PR, OH	27.1	59.1	2.28	0.27	6.25	1.33	2.24	5.89	16.24	8.2
Jul 01	OB, PR, OH	26.7	47.5	2.28	0.27	5.48	1.33	2.36	5.14	41.1	7.9
Aug 01	OB, PR, OH	25.8	63.5	1.19	0.1	4.79	0.87	2.63	4.34	0.9	7.8
Sep 01	OB, PR, OH	24.9	44.2	1.24	0.41	6.15	1.44	2.48	6.38	14.82	8.1
Oct 01	OB, PR, OH	25.3	42.3	1.84	0.23	6.35	1.33	2.38	8.88	13.81	7.9
Nov-01	OB, PR, OH	23.4	72.3	1.21	0.41	5.44	0.89	2.48	7.99	15.57	7.0
Dec-01	OB, PR, OH	22.5	73.9	1.80	0.27	5.71	1.39	2.23	4.15	13.34	8.0
Jan 02	OB, PR, OH, NR	22.7	71.1	3.26	0.09	7.19	1.24	2.16	5.98	21.43	7.5
Feb 02	OB, PR, OH	24.8	69.5	3.46	0.12	5.68	1.15	2.52	5.41	23.00	7.9
Average		25.1	59.6	2.59	0.32	5.80	1.25	2.32	8.45	34.69	7.9

Notes:

1. Blank spaces indicate data is unavailable.
2. Plant Key: BB - Bowery Bay, CI - Coney Island, HP - Hunts Point, JA - Jamaica, NC - Newtown Creek, NR - North River, OB - Oakwood Beach, OH - Owls Head, PR - Port Richmond, RH - Red Hook, RK - Rockaway, TI - Tallman Island, 26 - 26th Ward, WI - Wards Island

New York City Department of Environmental Protection

Red Hook Dewatering Facility

Monthly Nutrient Concentrations

RED HOOK DEWATERING FACILITY

Month	Liquid Sludge Sources	Tot. Solids %	Vol. solids %	P %	K %	TKN %	NH3 %	Fe %	NUTRIENTS NO2 mg/Kg	NO3 mg/Kg	pH
Jan 01	RH	21.86	65.33	1.98	0.37	6.21	1.27	3.02	19.54	17.42	8.0
Feb 01	RH	22.17	66.67	2.49	0.18	5.00	1.75	2.83	15.53	30.73	8.0
Mar 01	RH	21.96	57.37	2.49	1.23	5.94	2.02	2.77	13.27	53.10	8.1
Apr 01	RH	24.07	59.81	2.56	0.42	4.74	1.26	2.91	16.58	25.17	8.1
May 01	RH	23.79	57.16	2.47	0.19	2.47	1.13	2.79	17.33	14.47	8.1
Jun 01	RH	22.78	58.24	2.11	0.15	5.91	1.20	2.49	12.99	23.29	8.1
Jul 01	RH	23.38	57.47	2.15	0.11	5.46	1.50	2.51	13.44	32.58	8.1
Aug 01	RH	22.63	63.45	2.14	0.11	5.56	1.19	2.72	55.00	135.92	8.1
Sep 01	RH	21.20	51.90	2.37	0.12	5.08	1.56	3.34	11.17	21.87	7.97
Oct 01	RH	21.34	56.08	2.24	0.12	5.77	1.61	2.83	9.70	15.48	8.07
Nov-01	RH	21.01	68.16	1.78	0.12	5.46	1.06	2.49	21.31	42.04	8.13
Dec-01	RH	19.33	64.51	2.28	0.12	6.18	1.49	2.44	14.99	32.06	8.01
Jan 02	RH	19.20	52.47	2.11	0.11	6.03	1.14	2.49	26.33	52.67	8.1
Feb 02	RH	20.56	70.16	2.39	0.15	6.42	1.58	2.03	13.30	25.68	7.9
Average		21.81	60.63	2.25	0.25	5.45	1.41	2.69	18.61	37.32	8.06

Notes:

1. Blank spaces indicate data is unavailable.
2. Plant Key: BB - Bowery Bay, CI - Coney Island, HP - Hunts Point, JA - Jamaica, NC - Newtown Creek, NR - North River, OB - Oakwood Beach,

DEP Biosolids Data
Nutrient Data
Tallman Island Facility
2001-2002

New York City Department of Environmental Protection
Tallman Island Dewatering Facility
Monthly Nutrient Concentrations

MONTH	Liquid Sludge Sources	Tot. Solids %	Vol. solids %	P %	K %	TKN %	NUTRIENTS NH3 %	Fe %	NO2 mg/Kg	NO3 mg/Kg	pH
Jan 01	TI	22.9	66.1	2.42	0.46	6.38	1.78	2.24	42.18	15.07	8.1
Feb 01	TI	23.6	69.9	2.44	0.45	5.97	1.62	2.27	12.22	19.62	8.0
Mar 01	TI	24.6	56.2	3.22	0.63	4.71	1.58	2.40	10.34	17.64	7.8
Apr 01	TI	23.8	57.2	2.55	0.56	5.10	1.69	2.46	6.96	25.75	7.9
May 01	TI	23.8	60.2	2.06	0.18	6.29	1.51	2.43	6.73	7.46	6.6
Jun 01	TI	24.5	57.1	2.55	0.27	5.11	1.10	2.90	5.38	7.46	7.6
Jul 01	TI	25.9	55.2	3.12	0.14	5.45	1.47	2.87	2.67	1.32	8.0
Aug 01	TI	24.9	53.9	2.17	0.15	5.66	1.05	2.89	6.83	10.99	8.0
Sep 01	TI	24.6	60.3	1.74	0.64	5.48	1.49	2.57	7.4	11.9	7.7
Oct 01	TI	23.1	51.5	3.30	0.14	6.46	1.16	1.78	10.4	8.19	8.0
Nov-01	TI	24.1	70.4	1.78	0.14	4.45	1.72	2.42	15.76	20.87	7.8
Dec-01	TI	22.7	72.3	2.48	0.14	7.97	1.31	2.15	3.56	3.49	8.0
Jan 02	TI	22.9	74.1	4.73	0.16	6.48	1.64	2.33	6.02	11.97	8.0
Feb 02	TI	22.5	68.9	3.98	0.17	6.11	1.78	2.53	6.61	11.18	8.1
Average		23.8	62.4	2.75	0.30	5.83	1.49	2.45	10.22	12.35	7.8

Notes:

1. Blank spaces indicate data is unavailable.
2. Plant Key: BB - Bowery Bay, CI - Coney Island, HP - Hunts Point, JA - Jamaica, NC - Newtown Creek, NR - North River, OB - Oakwood Beach, OH - Owls Head, PR - Port Richmond, RH - Red Hook, RK - Rockaway, TI - Tallman Island, 26 - 26th Ward, WI - Wards Island

DEP Biosolids Data
Nutrient Data
Wards Island Facility
2001-2002

New York City Department of Environmental Protection

Wards Island Dewatering Facility

Monthly Nutrient Concentrations

Month	Liquid Sludge Sources	Total Solids %	Volatile Solids %	Nutrients P %	K %	TKN %	NH3 %	Fe %	NO2 mg/Kg	NO3 mg/Kg	pH
Jan 01	WI, OH, NR, NC, RK	25.6	70.7	2.71	0.14	6.27	0.56	2.26	18.76	20.69	8.1
Feb 01	WI, OH, NR, RK	26.0	67.7	3.04	0.39	5.91	1.46	2.54	12.65	22.79	8.1
Mar 01	WI, OH, NR, RK, NC	26.2	64.4	2.75	0.66	6.11	1.33	2.40	188.84	42.34	8.0
Apr 01	WI, OH, NR, RK	26.8	57.0	3.27	0.38	4.95	1.18	2.60	14.60	28.93	7.6
May 01	WI, OH, NR, RK	25.4	52.3	3.27	0.13	5.77	1.61	1.76	11.38	16.96	8.0
Jun 01	WI, OH, NR, RK	27.3	51.7	3.15	0.12	5.38	1.50	2.57	8.13	11.40	7.9
Jul 01	WI, OH, NR, RK	25.6	57.9	2.38	0.09	6.76	1.42	2.02	12.28	20.32	8.1
Aug 01	WI, OH, NR, RK	25.7	60.3	1.82	0.08	10.34	2.01	2.51	17.65	23.77	8.0
Sep 01	WI, OH, NR, RK	27.3	52.9	1.88	0.38	8.56	1.36	2.57	7.79	10.48	7.5
Oct 01	WI, OH, NR, RK	27.6	60.1	2.48	0.45	8.13	1.49	2.65	5.30	4.24	7.9
Nov-01	WI, OH, NR, RK	25.0	70.9	1.89	0.18	7.35	1.06	2.31	15.83	28.46	7.9
Dec-01	WI, OH, NR, RK	25.5	71.3	2.14	0.10	7.46	1.16	2.28	10.67	18.19	7.8
Jan 02	WI, OH, NR, RK, RH	24.9	66.8	3.28	0.35	5.97	1.23	1.85	14.84	22.98	7.9
Feb 02	WI, OH, NR, RH, PR	26.5	72.1	2.29	0.11	6.11	1.20	2.29	4.17	7.64	8.0
Average		26.1	62.6	2.60	0.25	6.79	1.33	2.33	24.49	19.94	7.9

Notes:

17-Apr-2002

1. Blank spaces indicate data is unavailable.
2. Plant Key: BB - Bowery Bay, CI - Coney Island, HP - Hunts Point, JA - Jamaica, NC - Newtown Creek, NR - North River, OB - Oakwood Beach, OH - Owls Head, PR - Port Richmond, RH - Red Hook, RK - Rockaway, TI - Tallman Island, 26 - 26th Ward, WI - Wards Island

DEP Biosolids Data
Metals Data
26th Ward Facility
2001-2002

CITY OF NEW YORK
DEPT. OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTEWATER TREATMENT

BIOSOLIDS QUALITY

26TH WARD DEWATERING FACILITY

MONTH	METALS									
	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Copper mg/Kg	Lead mg/Kg	Mercury mg/Kg	Molybdenum mg/Kg	Nickel mg/Kg	Selenium mg/Kg	Zinc mg/Kg
Jan-01	4.8	4.4	34	605	129	2.1	4.8	23	2.6	793
Feb-01	4.1	5.1	43	582	177	2.5	7.5	26	2.9	828
Mar-01	2.7	4.4	57	627	190	1.9	7.6	26	3.7	837
Apr-01	3.5	3.5	43	610	217	2.1	7.1	27	3.1	923
May-01	3.4	3.8	53	687	214	2.0	6.6	26	2.9	937
Jun-01	4.5	4.0	56	701	248	2.2	12.1	28	5.0	1,043
Jul-01	4.8	5.7	51	662	259	2.3	11.2	29	4.2	1,076
Aug-01	4.6	4.8	58	726	225	1.9	11.3	29	4.4	1,081
Sep-01	10.3	4.6	38	685	213	2.5	10.4	23	5.3	1,043
Oct-01	9.4	4.0	40	734	185	3.3	9.4	24	4.9	1,091
Nov-01	6.0	3.2	48	711	185	3.3	10.3	26	5.4	957
Dec-01	4.3	3.5	45	734	161	2.3	12.0	25	4.1	949
Jan-02	3.7	4.8	43	667	151	2.5	11.1	25	10.0	945
Feb- 02	3.0	4.4	39	703	165	2.7	10.7	24	7.0	901
Average	**4.9**	**4.3**	**46**	**674**	**194**	**2.4**	**9.4**	**26**	**4.7**	**957**

DEP Biosolids Data
Metals Data
Bowery Bay Facility
2001-2002

CITY OF NEW YORK | **BIOSOLIDS QUALITY** | BOWERY BAY DEWATERING FACILITY

DEPT. OF ENVIRONMENTAL PROTECTION

BUREAU OF WASTEWATER TREATMENT

MONTH	METALS									
	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Copper mg/Kg	Lead mg/Kg	Mercury mg/Kg	Molybdenum mg/Kg	Nickel mg/Kg	Selenium mg/Kg	Zinc mg/Kg
Jan-01	2.9	1.1	52	582	84	1.5	42.0	28	2.8	761
Feb- 01	2.7	7.8	94	670	178	2.1	7.1	54	5.4	878
Mar-01	3.3	6.1	155	736	177	0.9	2.3	50	9.2	863
Apr-01	4.2	4.3	109	676	201	1.5	7.7	54	5.4	1,016
May-01	4.7	4.5	98	720	177	2.1	9.5	59	6.6	1,029
Jun-01	5.0	4.6	88	761	210	1.4	7.3	59	4.2	1,069
Jul-01	4.8	4.4	72	724	196	2.5	12.0	45	3.8	897
Aug-01	1.9	3.2	74	631	182	1.3	8.7	47	3.7	1,021
Sep-01	2.2	3.7	69	804	180	2.1	9.9	47	7.3	1,037
Oct-01	2.0	2.9	81	817	170	2.3	9.9	48	6.6	927
Nov-01	1.7	2.6	143	826	135	2.5	9.2	44	5.8	879
Dec-01	2.9	2.9	47	598	108	2.2	8.9	30	2.7	703
Jan-02	3.0	3.3	39	728	125	4.3	9.9	42	3.3	922
Feb- 02	2.4	5.3	56	741	136	2.6	10.6	35	5.2	974
Average	**3.1**	**4.1**	**84**	**715**	**161**	**2.1**	**11.1**	**46**	**5.1**	**927**

DEP Biosolids Data
Metals Data
Hunts Point Facility
2001-2002

CITY OF NEW YORK
DEPT. OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTEWATER TREATMENT

BIOSOLIDS QUALITY

HUNTS POINT DEWATERING FACILITY

MONTH	METALS									
	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Copper mg/Kg	Lead mg/Kg	Mercury mg/Kg	Molybdenum mg/Kg	Nickel mg/Kg	Selenium mg/Kg	Zinc mg/Kg
Jan-01	3.8	5.2	62	717	163	2.4	11.0	33	3.2	1,050
Feb-01	5.3	7.4	83	780	248	2.7	13.0	56	4.3	1,077
Mar-01	2.8	7.9	85	733	231	2.6	13.0	45	2.8	1,080
Apr-01	4.1	6.7	71	655	276	2.5	13.0	47	2.8	1,051
May-01	4.4	5.6	91	750	210	2.6	15.0	51	4.7	1,126
Jun-01	6.0	6.0	85	820	272	2.3	19.0	48	5.3	1,221
Jul-01	4.5	6.7	85	785	270	2.5	16.0	42	3.7	1,181
Aug-01	5.0	5.8	81	812	253	2.5	17.0	48	4.3	1,221
Sep-01	4.8	6.0	75	829	270	2.7	19.0	44	6.4	1,238
Oct-01	3.5	6.7	98	901	304	3.1	19.0	46	5.8	1,459
Nov-01	4.1	4.7	84	899	230	3.1	17.0	50	4.7	1,219
Dec-01	3.9	7.2	83	900	241	3.2	21.0	49	3.3	1,231
Jan-02	3.2	7.0	80	912	229	2.9	16.0	46	4.4	1,243
Feb-02	2.7	8.2	77	823	222	3.3	19.0	35	5.8	1,189
Average	**4.2**	**6.5**	**81**	**808**	**244**	**2.7**	**16.3**	**46**	**4.4**	**1,185**

DEP Biosolids Data
Metals Data
Jamaica Bay Facility
2001-2002

CITY OF NEW YORK
DEPT. OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTEWATER TREATMENT

BIOSOLIDS QUALITY

JAMAICA DEWATERING FACILITY

MONTH	METALS									
	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Copper mg/Kg	Lead mg/Kg	Mercury mg/Kg	Molybdenum mg/Kg	Nickel mg/Kg	Selenium mg/Kg	Zinc mg/Kg
Jan-01	3.9	2.9	24	623	102	2.9	8.9	15	4.4	912
Feb- 01	4.0	3.9	46	645	173	3.1	10	27	3.8	919
Mar-01	5.0	3.4	33	296	133	3.2	11	20	5.2	908
Apr-01	1.6	4.0	35	608	174	1.6	4.2	23	1.8	925
May-01	1.8	3.9	27	650	138	1.6	4.1	19	1.1	968
Jun-01	1.4	4.5	26	483	123	2.8	8	23	2.1	770
Jul-01	3.3	3.7	34	723	183	2.2	12	23	3.9	1,061
Aug-01	2.6	3.6	25	641	143	1.4	10.4	18	3.4	979
Sep-01	3.2	4.0	27	713	164	2.6	11.6	18	5.7	1,077
Oct-01	3.1	3.7	30	727	162	3	11	21	7.2	1,077
Nov-01	4.2	6.6	33	802	143	3.3	12.6	21	6.3	1,067
Dec-01	2.9	4.7	30	777	149	2.6	12	20	3.4	1,053
Jan-02	2.7	4.6	25	745	108	2.4	10.5	19	4.4	1,131
Feb- 02	2.0	5.5	21	662	119	2.5	8.4	14	6.9	931
Average	**3.0**	**4.2**	**30**	**650**	**144**	**2.5**	**9.6**	**20**	**4.3**	**984**

DEP Biosolids Data

Metals Data
Oakwood Beach Facility
2001-2002

CITY OF NEW YORK
DEPT. OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTEWATER TREATMENT

BIOSOLIDS QUALITY

OAKWOOD BEACH DEWATERING FACILITY

MONTH	METALS									
	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Copper mg/Kg	Lead mg/Kg	Mercury mg/Kg	Molybdenum mg/Kg	Nickel mg/Kg	Selenium mg/Kg	Zinc mg/Kg
Jan-01	4.7	2.1	37	484	126	1.9	4.8	29	2.8	666
Feb- 01	4.4	2.0	42	475	126	2.3	8.5	55	3.5	673
Mar-01	4.2	2.6	54	490	132	2.2	8.2	56	4.2	720
Apr-01	6.2	2.6	63	482	183	2.1	8.5	70	4.3	792
May-01	4.5	3.2	54	523	137	2.0	6.4	52	4.0	703
Jun-01	5.0	2.5	48	542	150	1.2	8.6	49	3.5	728
Jul-01	3.9	3.3	42	539	138	1.6	7.0	49	3.0	779
Aug-01	3.7	2.1	47	591	135	1.1	10.5	48	3.8	799
Sep-01	4.0	3.1	46	719	151	2.1	11.1	54	5.8	1,051
Oct-01	2.9	2.6	46	623	141	1.9	8.2	36	4.4	856
Nov-01	3.4	2.6	50	708	123	2.7	12.1	37	4.1	892
Dec-01	2.9	3.0	41	598	116	1.6	11.8	37	2.5	808
Jan-02	3.0	3.1	42	715	135	1.7	12.0	47	2.3	933
Feb- 02	3.6	4.1	35	543	107	2.0	10.6	54	5.3	727
Average	**4.0**	**2.8**	**46**	**574**	**136**	**1.9**	**9.2**	**48**	**3.8**	**795**

DEP Biosolids Data
Metals Data
Red Hook Facility
2001-2002

CITY OF NEW YORK

DEPT. OF ENVIRONMENTAL PROTECTION

BUREAU OF WASTEWATER TREATMENT

BIOSOLIDS QUALITY

RED HOOK DEWATERING FACILITY

MONTH	METALS									
	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Copper mg/Kg	Lead mg/Kg	Mercury mg/Kg	Molybdenum mg/Kg	Nickel mg/Kg	Selenium mg/Kg	Zinc mg/Kg
Jan-01	5.8	5.7	41	778	224	2.5	9.0	29	2.8	1,042
Feb-01	6.7	5.8	49	814	261	3.4	13.0	24	9.5	1,117
Mar-01	3.3	5.6	53	728	264	2.8	9.0	29	4.0	977
Apr-01	4.8	5.8	55	707	283	2.2	8.0	32	2.9	1,100
May-01	5.3	6.1	51	770	305	4.0	10.0	28	3.2	1,110
Jun-01	7.3	6.0	48	875	346	2.3	15.0	32	8.2	1,211
Jul-01	7.6	13.1	53	888	363	3.1	15.0	35	3.7	1,229
Aug-01	8.2	18.3	47	948	337	2.8	12.0	33	2.9	1,258
Sep-01	7.9	12.9	51	957	361	3.7	16.0	36	6.5	1,278
Oct-01	6.6	11.2	51	983	400	4.5	13.0	34	6.6	1,347
Nov-01	6.8	7.8	45	926	266	3.1	15.0	28	7.0	1,171
Dec-01	6.1	8.6	46	864	271	3.1	15.0	32	5.1	1,049
Jan-02	5.9	15.8	42	858	264	3.5	15.0	32	17.0	1,006
Feb-02	4.7	7.8	36	744	224	2.7	12.0	25	7.5	966
Average	**6.2**	**9.3**	**48**	**846**	**298**	**3.1**	**12.6**	**31**	**6.2**	**1,133**

DEP Biosolids Data
Metals Data
Tallman Island Facility
2001-2002

CITY OF NEW YORK
DEPT. OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTEWATER TREATMENT

BIOSOLIDS QUALITY

TALLMAN ISLAND DEWATERING FACILITY

MONTH	METALS									
	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Copper mg/Kg	Lead mg/Kg	Mercury mg/Kg	Molybdenum mg/Kg	Nickel mg/Kg	Selenium mg/Kg	Zinc mg/Kg
Jan-01	5.0	4.4	58	662	125	2.7	9.8	26	5.7	1,017
Feb- 01	3.4	4.4	73	640	147	2.5	11.1	29	5.1	1,031
Mar-01	5.0	4.8	76	671	135	2.4	11.0	31	54.0	972
Apr-01	4.9	5.2	72	641	142	1.7	6.4	31	4.1	1,062
May-01	3.9	5.9	65	696	153	2.0	7.1	32	3.2	1,069
Jun-01	3.5	4.8	61	660	164	1.8	5.9	35	2.0	996
Jul-01	2.2	5.7	58	700	151	1.8	6.8	37	2.2	1,282
Aug-01	3.0	5.5	61	854	149	1.9	9.5	31	4.8	1,060
Sep-01	4.5	5.4	63	835	149	3.3	11.5	27	5.8	1,046
Oct-01	3.5	4.9	61	842	157	2.9	9.9	31	6.3	981
Nov-01	5.4	5.2	58	826	129	2.6	11.9	27	5.2	1,034
Dec-01	3.9	4.4	50	702	112	2.9	11.0	24	3.2	835
Jan-02	4.0	4.5	54	805	147	2.7	11.2	27	3.9	1,061
Feb- 02	3.1	6.5	56	805	140	2.9	12.7	29	4.7	971
Average	**4.0**	**5.1**	**62**	**739**	**143**	**2.4**	**9.7**	**30**	**7.9**	**1,030**

DEP Biosolids Data
Metals Data
Wards Island Facility
2001-2002

CITY OF NEW YORK
DEPT. OF ENVIRONMENTAL PROTECTION
BUREAU OF WASTEWATER TREATMENT

BIOSOLIDS QUALITY

WARDS ISLAND DEWATERING FACILITY

MONTH	METALS									
	Arsenic mg/Kg	Cadmium mg/Kg	Chromium mg/Kg	Copper mg/Kg	Lead mg/Kg	Mercury mg/Kg	Molybdenum mg/Kg	Nickel mg/Kg	Selenium mg/Kg	Zinc mg/Kg
Jan-01	4.3	2.9	34	597	153	2.6	26.0	26	3.6	917
Feb- 01	4.1	4.7	52	748	205	3.5	16.0	28	5.0	999
Mar-01	4.6	4.6	52	740	202	2.8	14.0	32	6.7	959
Apr-01	5.1	4.4	56	717	250	2.9	15.0	39	4.7	1,070
May-01	3.5	4.4	56	631	215	3.0	17.0	34	4.9	965
Jun-01	5.0	4.2	53	812	252	2.6	20.0	35	4.5	1,051
Jul-01	4.5	4.2	45	808	251	2.7	16.6	29	4.0	1,053
Aug-01	3.8	5.9	45	812	232	4.0	16.4	30	3.6	1,097
Sep-01	2.9	3.2	37	714	358	2.8	62.1	29	6.2	1,044
Oct-01	4.0	3.4	58	823	220	3.2	12.6	30	5.9	1,019
Nov-01	4.2	3.3	64	854	184	2.5	15.9	28	5.7	975
Dec-01	4.1	4.0	49	813	179	3.0	17.4	27	4.3	947
Jan-02	3.8	4.2	33	758	148	2.8	21.0	27	7.0	960
Feb- 02	2.5	4.4	39	837	159	2.6	13.0	27	6.5	1,083
Average	**4.0**	**4.1**	**48**	**762**	**215**	**2.9**	**20.2**	**30**	**5.2**	**1,010**

Biosolids Data

Compost Quality Data
Compost Made with NYC Biosolids
Wetzel County Facility, WV
2002

MICROBAC LABORATORIES, INC.
209 SENATE AVE, SUITE 105
CAMP HILL, PA 17011
(717)763-0582

PA DEP Certification No. 21-133

JP Mascaro Sons, Inc.
Attn: Dennis McVeigh
320 Godshall Drive
Harleysville, PA 19483

Client Number: 3576
Project Number: 63141
Sample Number: 164695
Date Received: 02/22/02
Time Received: 10:34
Discard Date: 03/29/02

LABORATORY ANALYSIS REPORT
March 15, 2002

Sample Identification: Screened Compost 3B Wetzel co
Date Collected: 02/21/02 Time: 13:00 Collected By: MH

ANALYSIS	RESULTS	MEASUREMENT UNITS	QUANTITATION LIMIT	ANALYSIS METHOD	ANALYSIS DATE	ANALYST
PCBS-POLYCHLORINATED BIPHENYLS						
Aroclor 1016	None Detected	ug/kg Dry Wt.	3600	SW-846 8082	03/13/02	RNS
Aroclor 1221	None Detected	ug/kg Dry Wt.	3600	SW-846 8082	03/13/02	RNS
Aroclor 1232	None Detected	ug/kg Dry Wt.	3600	SW-846 8082	03/13/02	RNS
Aroclor 1242	None Detected	ug/kg Dry Wt.	3600	SW-846 8082	03/13/02	RNS
Aroclor 1248	None Detected	ug/kg Dry Wt.	3600	SW-846 8082	03/13/02	RNS
Aroclor 1254	None Detected	ug/kg Dry Wt.	3600	SW-846 8082	03/13/02	RNS
Aroclor 1260	None Detected	ug/kg Dry Wt.	3600	SW-846 8082	03/13/02	RNS
JP MASCARO MONTHLY METALS						
Arsenic, Total	5.39	mg/kg Dry Wt.	.02	SW-846 7060A	03/01/02	VBC
Cadmium, Total	2.88	mg/kg Dry Wt.	.04	SW-846 7130	02/28/02	VBC
Chromium, Total	40.0	mg/kg Dry Wt.	.07	SW-846 6010B	02/27/02	DJA
Copper, Total	969.	mg/kg Dry Wt.	.07	SW-846 6010B	02/26/02	DJA
Iron, Total	22200.	mg/kg Dry Wt.	.1	SW-846 6010B	02/27/02	DJA
Lead, Total	140.	mg/kg Dry Wt.	.4	SW-846 6010B	02/27/02	DJA
Mercury, Total	2.0	mg/kg Dry Wt.	.018	SW-846 7471A	02/28/02	VBC
Molybdenum, Total	10.	mg/kg Dry Wt.	.1	SW-846 6010B	03/01/02	DJA
Nickel, Total	33.8	mg/kg Dry Wt.	.1	SW-846 6010B	02/27/02	DJA
Potassium, Total	0.183	% Dry Wt.	.00007	SW-846 6010B	03/01/02	DJA
Selenium, Total	0.5	mg/kg Dry Wt.	.4	SW-846 6010B	02/28/02	DJA
Zinc, Total	637.	mg/kg Dry Wt.	.04	SW-846 7950	02/28/02	VBC
JP MASCARO MONTHLY WET CHEM						
Ammonia Nitrogen, Total	0.350	% Dry Wt.	.00009	SM18th 4500NF	03/01/02	BMG
Chloride	710.	mg/kg, Dry Wt.	2	EPA 300.0	02/27/02	MRS
Density	1.05	g/ml			02/22/02	GLF
Kjeldahl Nitrogen, Total	3.02	% Dry Wt.	.0081	SM18th 4500N	02/28/02	BMG
Nitrate Nitrogen	None Detected	mg/kg Dry Wt.	103	EPA 300.0	02/27/02	MRS
Nitrite Nitrogen	95.	mg/kg Dry Wt.	.4	EPA 300.0	02/27/02	MRS
Nitrogen - Organic, Total	2.07	% Dry Wt.	.0091	SM18th 4500NF	03/01/02	BMG
pH	7.80	pH Units		SW-846 9045C	02/22/02	GLF
Phosphorus, Total	2.17	% Dry Wt	.0004	SM18th 4500P	02/28/02	BMG
Solids, Total	54.8	%	.01	SM18th 2540G	02/26/02	GLF
Solids, Total Volatile	57.6	%	.01	SM18th 2540G	02/26/02	GLF

Landscapers' Advantage Class A Compost

Uses and application rates

Landscaper Advantage Class A Compost is an organic humus that improves the physical structure of soils and supplies nutrients for plant growth. This material is the product of aerobic biological decomposition of biosolids, yard waste and wood chips.

Typical uses and application rates:

- Lawn maintenance - broadcast a half (0.5) pound of Class A Compost per square foot of lawn, per year.
- New lawns, flower gardens - till one (1) pound of Class A Compost per square foot of lawn or flower bed.
- Nursery and house plants - mix one part Landscapers Advantage Class A Compost with three parts soil.
- Tree and shrub mulching - broadcast and or mix one (1) pound of Landscapers Advantage Class A Compost for every square foot of bed.

Compost and fertilizer application rates and pH adjustment requirements are influenced by plant selection, soil/media and site characteristics, compost quality and feed stock, and other factors.

For best results, before planting have your compost, soil, and soil/compost blends tested by a reputable laboratory and discuss the results of the tests with a trained agricultural professional.

40 CFR Part 503.14©(2) prohibits the application of material derived from exceptional quality sewage sludge to the land except in accordance with these instructions.

Landscapers Advantage Class A Compost should not be applied during periods of rain, applied on frozen or snow covered ground or stored or applied in a manner as to cause run off of compost material.

Typical analysis	**(dry weight)**
Total Nitrogen	2-4%
Phosphorous	1-2%
Potassium	0.3-0.5%
pH varies from 6.0 to 9.0	

Concentration of metals do not exceed PA DEP - Exceptional Quality Sludge Guidelines Table 3 meets class A Pathogen Reduction 40 CFR 503.32 (a) (7).

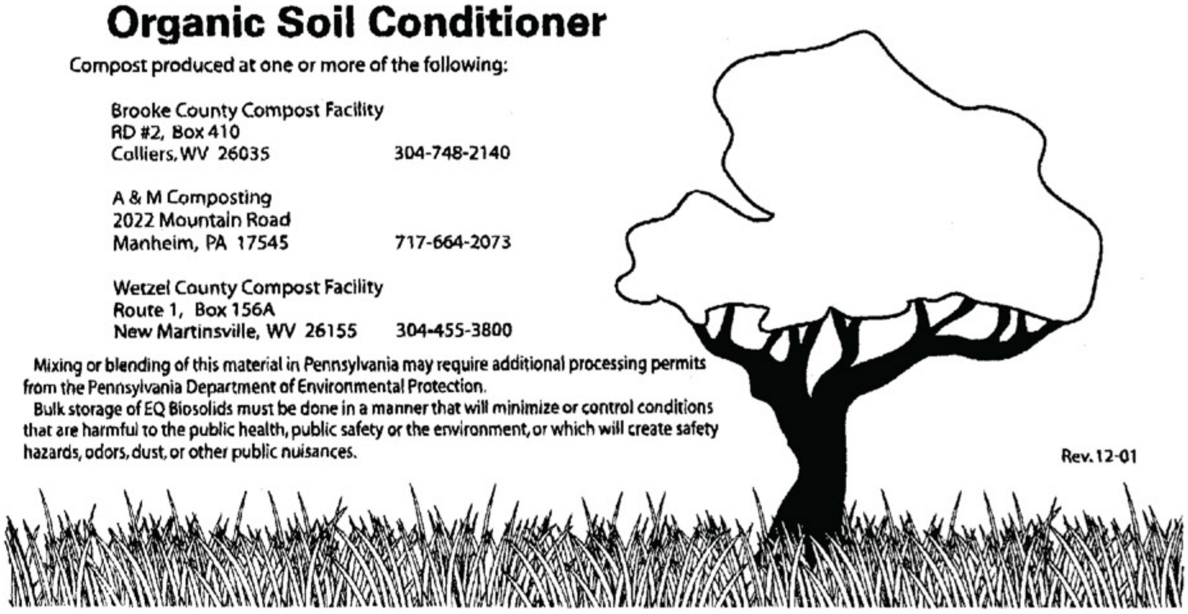
Organic Soil Conditioner

Compost produced at one or more of the following:

Brooke County Compost Facility
RD #2, Box 410
Colliers, WV 26035 304-748-2140

A & M Composting
2022 Mountain Road
Manheim, PA 17545 717-664-2073

Wetzel County Compost Facility
Route 1, Box 156A
New Martinsville, WV 26155 304-455-3800



Mixing or blending of this material in Pennsylvania may require additional processing permits from the Pennsylvania Department of Environmental Protection.

Bulk storage of EQ Biosolids must be done in a manner that will minimize or control conditions that are harmful to the public health, public safety or the environment, or which will create safety hazards, odors, dust, or other public nuisances.

Rev. 12-01

New York State Department of Environmental Conservation
6 NYCRR Part 360.5 Composting and Other Class A
Organic Waste Processing Facilities

Extended Parameters List for Analysis - Biosolids

VOLATILE ORGANIC COMPOUNDS

	POLLUTANT	CAS
1	Acrolein	107-02-8
2	Acrylonitrile	107-13-1
3	Benzene	71-43-2
4	Bromoform	75-25-2
5	Carbon tetrachloride	56-23-5
6	Chlorobenzene	108-90-7
7	Chlorodibromomethane	124-48-1
8	Chloroethane	75-00-3
9	2-chloroethylvinyl ether	110-75-8
10	Chloroform	67-66-3
11	Dichlorobromomethane	75-27-4
12	1,1-dichloroethane	75-34-3
13	1,2-dichloroethane	107-06-2
14	Trans-1,2-dichloroethylene	156-60-5
15	1,1-dichloroethylene	75-35-4
16	1,2-dichloropropane	78-87-5
17	1,3-dichloropropene	542-75-6
18	Ethylbenzene	100-41-4
19	Methyl bromide	74-83-9
20	Methyl chloride	74-87-3
21	Methylene chloride	75-09-2
22	1,1,2,2-tetrachloroethane	79-34-5
23	Tetrachloroethylene	127-18-4
24	Toluene	108-88-3
25	1,1,1-trichloroethane	71-55-6
26	1,1,2-trichloroethane	79-00-5
27	Trichloroethylene	79-01-6
28	Vinyl chloride	75-01-4

ACID-BASE-NEUTRAL COMPOUNDS

	POLLUTANT	CAS
	* Acid-extractable compounds	
1	4-chloro-3-methylphenol	59-50-7
2	2-chlorophenol	95-57-8
3	2,4-dichlorophenol	120-83-2
4	2,4-dimethylphenol	105-67-9
5	4,6-dinitro-2-methylphenol	534-52-1
6	2,4-dinitrophenol	51-28-5
7	2-nitrophenol	88-75-5
8	4-nitrophenol	100-02-7
9	Pentachlorophenol	87-86-5
10	Phenol	108-95-2
11	2,4,6-trichlorophenol	88-06-2
	*Base-Neutral compounds	
12	Acenapthene	83-32-9
13	Acenaphthylene	208-96-8
14	Anthracene	120-12-7
15	Benzidine	92-87-5
16	Benzo(a)anthracene	56-55-3
17	Benzo(a)pyrene	50-32-8
18	Benzo(b)fluoranthene	205-99-2
19	Benzo(g,h,i)perylene	191-24-2
20	Benzo(k)fluoranthene	207-08-9
21	Bis(2-chlorethoxy)methane	111-91-1
22	Bis(2-chloroethyl) ether	111-44-4
23	Bis(2-chloroisopropyl) ether	108-60-1
24	Bis(2-ethylhexyl) phthalate	117-81-7
25	4-bromophenyl phenyl ether	101-55-3
26	Butyl benzyl phthalate	85-68-7
27	2-chloronapthalene	91-58-7
28	4-chlorophenyl phenyl ether	7005-72-3
29	Chrysene	218-01-9
30	Di-n-butyl phthalate	84-74-2
31	Di-n-Octyl phthalate	117-84-0
32	Dibenzo(a,h)anthracene	53-70-3

ACID-BASE-NEUTRAL COMPOUNDS continued

	POLLUTANT	CAS
33	1,2-dichlorobenzene	95-50-1
34	1,3-dichlorobenzene	541-73-1
35	1,4-dichlorobenzene	106-46-7
36	3,3'-dichlorobenzidine	91-94-1
37	Diethyl phthalate	84-66-2
38	Dimethyl phthalate	131-11-3
39	2,4-dinitrotoluene	121-14-2
40	2,6-dinitrotoluene	606-20-2
41	1,2-diphenylhydrazine	122-66-7
42	Fluoranthene	206-44-0
43	Fluorene	86-73-7
44	Hexachlorobenzene	118-74-1
45	Hexachlorobutadiene	87-68-3
46	Hexachlorocyclopentadiene	77-47-4
47	Hexachloroethane	67-72-1
48	Indeno(1,2,3-cd)pyrene	193-39-5
49	Isophorone	78-59-1
50	Naphthalene	91-20-3
51	Nitrobenzene	98-95-3
52	N-nitrosodipropylamine	621-64-7
53	N-nitrosodimethylamine	62-75-9
54	N-nitrosodiphenylamine	86-30-6
55	Phenanthrene	85-01-8
56	Pyrene	129-00-0
57	1,2,4-trichlorobenzene	120-82-1

PESTICIDES/PCBs

	POLLUTANT	CAS
1	Aldrin	309-00-2
2	Alpha-BHC	319-84-6
3	Beta-BHC	319-85-7
4	Delta-BHC	319-86-8
5	Gamma-BHC [Lindane]	58-89-9
6	Alpha-chlordane	5103-71-9
7	Gamma-chlordane	5103-74-2
8	4,4'-DDD [p,p'-TDE]	72-54-8
9	4,4'-DDE [p,p'-DDX]	72-55-9
10	4,4'-DDT	50-29-3
11	Dieldrin	60-57-1
12	Alpha-endosulfan	959-98-8
13	Beta-endosulfan	33213-65-9
14	Endosulfan sulfate	1031-07-8
15	Endrin	72-20-8
16	Endrin aldehyde	7421-93-4
17	Heptachlor	76-44-8
18	Heptachlor epoxide	1024-57-3
19	PCB-1016 (Arochlor 1016)	12674-11-2
20	PCB-1221 (Arochlor 1221)	11104-28-2
21	PCB-1232 (Arochlor 1232)	11141-16-5
22	PCB-1242 (Arochlor 1242)	53469-21-9
23	PCB-1248 (Arochlor 1248)	12672-29-6
24	PCB-1254 (Arochlor 1254)	11097-69-1
25	PCB-1260 (Arochlor 1260)	11096-82-5
26	Toxaphene	8001-35-2

METALS (Total Recoverable) and CYANIDE

	POLLUTANT	CAS
1	Antimony	7440-36-0
2	Beryllium	7440-41-7
3	Silver	7440-22-4
4	Thallium	7440-28-0
5	Cyanide	57-12-5

Appendix F
Data from the New York City Composting Trials

NMS is the code name that the laboratory assigned to the New York City MSW (residential and institutional waste collected by the Department of Sanitation) as it moved through the Marlborough facility during the NYC Composting Trials.

WERL stands for the Woods End Research Lab, the location of all compost testing, as well as the extended, monitored curing of the compost produced during the NYC Composting Trials.

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: Cc402 502 M Project: 605
Date Received : 03/02/2001
Date Reported : 03/30/2001
Lab ID Number : 4854.0
Quality Checked : WD 3/30/01

COMPOSITION ANALYSIS

Sample Identification: NYC Trials Biosolids Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs{\cdot}ft^3$	-	63	1702 lbs/yd^3
Solids	%	100.0	14.7	294 lbs/ton
Moisture	%	0.0	85.3	205 gals/ton
est. water holding capacity	%	241.0	70.7	169 gals/ton
pH (1:1 H_2O)	$-logH^+$	~	6.06	V Low
Free Carbonates	Rating	~	1	None
Organic Matter	%	78.6	11.5	231 lbs/ton
Conductivity	$mmhos{\cdot}cm^{-1}$	~	5.2	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	8.2	8.2	V. Low
Solvita CO_2 Rate	(see chart)	~	1	Ex. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	1	Raw Waste!

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory. Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: Cc402 502 M-Project: 605

Date Received : 03/02/2001
Date Reported : 03/30/2001
Lab ID Number : 4854.0

MINERALS ANALYSIS

Sample Identification: NYC Trials Biosolids, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	5.142	0.756	15.1
Organic-Nitrogen	%	4.306	0.633	12.7
Phosphorus (P)	%	2.048	0.301	6.0
Potassium (K)	%	0.200	0.029	0.6
Sodium (Na)	%	0.149	0.022	0.4
Calcium (Ca)	%	1.080	0.159	3.2
Magnesium (Mg)	%	0.177	0.026	0.5
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	8352	1228	2.5
Nitrate-N	ppm	3	0	0.0
Nitrite-N	ppm	3	0	-
Chloride (Cl)	ppm	2277	335	0.67
Sulfate (SO_4–S)	ppm	<4	< 1	

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 536
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: Cc402 502 M-Project: 605

Date Received : 03/02/2001
Date Reported : 03/30/2001
Lab ID Number : 4854.0

METALS ANALYSIS

Sample Identification: NYC Trials Biosolids Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	192.0	28.2	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	1920.0	282.2	0.6
Iron (Fe)	$mg \cdot kg^{-1}$	8400.0	1234.8	2.5
Zinc (Zn)	$mg \cdot kg^{-1}$	328.0	48.2	<0.1
Lead (Pb)	$mg \cdot kg^{-1}$	24.8	3.6	4 grams
Chromium (Cr)	$mg \cdot kg^{-1}$	24.0	3.5	3.8 grams
Cadmium (Cd)	$mg \cdot kg^{-1}$	1.6	0.2	0.3 grams
Nickel (Ni)	$mg \cdot kg^{-1}$	59.6	8.8	9.5 grams
Fecal Coliform 503	MPN/g	5,200,000		
Salmonella 503	MPN/4g	<5.2		
Mercury (Hg)	$mg \cdot kg^{-1}$	0.57		
Arsenic (As)	$mg \cdot kg^{-1}$	15.0		
Molybdenum (Mo)	$mg \cdot kg^{-1}$	<5		
Selenium (Se)	$mg \cdot kg^{-1}$	<5		
Total PCB	$mg \cdot kg^{-1}$	<3.9		

Notes: ppm = $mg \cdot kg^{-1}$
< = less than MLD (minimum level of detection) for the particular mineral tested

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.6
Quality Checked : WO 4/23/01

COMPOSITION ANALYSIS

Sample Identification: NYC Trial Biosolids, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	62	1685 lbs/yd^3
Solids	%	100.0	16.4	328 lbs/ton
Moisture	%	0.0	83.6	200 gals/ton
est. water holding capacity	%	242	71	170 gals/ton
pH (paste, H_2O)	-logH$^+$	~	5.80	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Organic Matter	%	78.9	12.9	259 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	3.8	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	9.0	9.0	V. Low
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	4.737	0.777	15.5
Phosphorus (P)	%	2.140	0.351	7.0
Potassium (K)	%	0.160	0.026	0.5
Sodium (Na)	%	0.135	0.022	0.4
Calcium (Ca)	%	1.160	0.190	3.8
Magnesium (Mg)	%	0.164	0.027	0.5

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 | Code: x–Project: 605

· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.6

METALS ANALYSIS

Sample Identification: NYC Trials Biosolids Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	276.0	45.3	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	1800.0	295.2	0.6
Iron (Fe)	$mg \cdot kg^{-1}$	8520.0	1397.3	2.8
Zinc (Zn)	$mg \cdot kg^{-1}$	372.0	61.0	0.1
Lead (Pb)	$mg \cdot kg^{-1}$	32.0	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	27.2	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.0	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	47.6	-	-
Arsenic (As)	$mg \cdot kg^{-1}$	< 12	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	4.9	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	< 31	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	< 26	-	-
Total PCB	$mg \cdot kg^{-1}$	<3.8		

BACTERIOLOGIC ANALYSIS

Fecal coliform EPA503	MPN per g	68,000	-
Total *Salmonella* EPA503	MPN per 4g	< 0.49	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: Cv502 402 x Project: 605
Date Received : 03/05/2001
Date Reported : 03/30/2001
Lab ID Number : 4856.4
Quality Checked : WO 4/23/01

COMPOSITION ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 1-3, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	38	1028 lbs/yd^3
Solids	%	100.0	46.7	934 lbs/ton
Moisture	%	0.0	53.3	128 gals/ton
est. water holding capacity	%	240	71	169 gals/ton
Inert and Oversize Matter	%	~	10.2	204.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	5.68	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	22076	10309	V High
Organic Matter	%	78.3	36.6	732 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	10.4	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	30.9	30.9	Med-High
Respiration Rate/day	C% of Total-C	1.47	1.47	-
Carbon loss per day	% of total weight	0.62	0.29	5.8 lbs/ton
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	2	Very Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Appendix F

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: Cv502 402 x-Project: 605

Date Received : 03/05/2001
Date Reported : 03/30/2001
Lab ID Number : 4856.4

MINERALS ANALYSIS

Sample Identification: NMS Primary Screen 'Unders', Day 1-3, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.368	0.639	12.8
Organic-Nitrogen	%	1.032	0.482	9.6
Phosphorus (P)	%	0.428	0.200	4.0
Potassium (K)	%	0.204	0.095	1.9
Sodium (Na)	%	0.368	0.172	3.4
Calcium (Ca)	%	2.280	1.065	21.3
Magnesium (Mg)	%	0.192	0.090	1.8
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	3354	1566	3.1
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4756	2221	4.44
Sulfate (SO_4-S)	ppm	2715	1268	2.54

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: Cv502 402 x–Project: 605

Date Received : 03/05/2001
Date Reported : 03/30/2001
Lab ID Number : 4856.4

METALS ANALYSIS

Sample Identification: NMS Primary Screen 'Unders,' Day 1-3, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	90.0	42.0	<0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	352.0	164.4	0.3
Iron (Fe)	$mg{\cdot}kg^{-1}$	12800.0	5977.6	12.0
Zinc (Zn)	$mg{\cdot}kg^{-1}$	512.0	239.1	0.5
Lead (Pb)	$mg{\cdot}kg^{-1}$	236.0	110.2	0.2
Chromium (Cr)	$mg{\cdot}kg^{-1}$	38.0	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	32.0	-	-
Arsenic (As)	$mg{\cdot}kg^{-1}$	8.7	-	-
Mercury (Hg)	$mg{\cdot}kg^{-1}$	1.0	-	-
Molybdenum (Mo)	$mg{\cdot}kg^{-1}$	< 11	-	-
Selenium (Se)	$mg{\cdot}kg^{-1}$	21	-	-
Total PCB	$mg{\cdot}kg^{-1}$	<0.92		

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: Cv502 402 x Project: 605
Date Received : 03/05/2001
Date Reported : 03/30/2001
Lab ID Number : 4856.5
Quality Checked : WO 4/23/01

COMPOSITION ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 1-3, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	45	1213 lbs/yd^3
Solids	%	100.0	45.5	910 lbs/ton
Moisture	%	0.0	54.5	131 gals/ton
est. water holding capacity	%	242	71	170 gals/ton
Inert and Oversize Matter	%	~	19.7	394.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	5.92	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	20779	9454	High
Organic Matter	%	78.8	35.9	717 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	10.0	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	31.2	31.2	Med-High
Respiration Rate/day	C% of Total-C	1.73	1.73	-
Carbon loss per day	% of total weight	0.74	0.33	6.7 lbs/ton
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: Cv502 402 x–Project: 605

Date Received : 03/05/2001
Date Reported : 03/30/2001
Lab ID Number : 4856.5

MINERALS ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 1-3, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.364	0.621	12.4
Organic-Nitrogen	%	1.034	0.470	9.4
Phosphorus (P)	%	0.372	0.169	3.4
Potassium (K)	%	0.196	0.089	1.8
Sodium (Na)	%	0.396	0.180	3.6
Calcium (Ca)	%	2.140	0.974	19.5
Magnesium (Mg)	%	0.188	0.086	1.7
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	3298	1501	3.0
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4820	2193	4.39
Sulfate (SO_4–S)	ppm	2979	1356	2.71

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: Cv502 402 x–Project: 605

Date Received : 03/05/2001
Date Reported : 03/30/2001
Lab ID Number : 4856.5

METALS ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 1-3, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	80.0	36.4	<0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	332.0	151.1	0.3
Iron (Fe)	$mg{\cdot}kg^{-1}$	18200.0	8281.0	16.6
Zinc (Zn)	$mg{\cdot}kg^{-1}$	500.0	227.5	0.5
Lead (Pb)	$mg{\cdot}kg^{-1}$	216.0	98.3	0.2
Chromium (Cr)	$mg{\cdot}kg^{-1}$	42.0	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	3.2	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	32.0	-	-
Arsenic (As)	$mg{\cdot}kg^{-1}$	7.2	-	-
Mercury (Hg)	$mg{\cdot}kg^{-1}$	0.95	-	-
Molybdenum (Mo)	$mg{\cdot}kg^{-1}$	< 11	-	-
Selenium (Se)	$mg{\cdot}kg^{-1}$	19	-	-
Total PCB	$mg{\cdot}kg^{-1}$	<0.88		

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.2
Quality Checked : WD 4/23/01

COMPOSITION ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 3-5, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	46	1230 lbs/yd^3
Solids	%	100.0	38.0	760 lbs/ton
Moisture	%	0.0	62.0	149 gals/ton
est. water holding capacity	%	236	70	168 gals/ton
Inert and Oversize Matter	%	~→	9.7	194.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~→	5.83	ExLow
Free Carbonates (CO_3)	Rating	~→	1	None
Volatile Organic Acids	ppm	10797	4103	High
Organic Matter	%	76.8	29.2	583 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~→	9.0	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	25.2	25.2	Med-High
Respiration Rate/day	C% of Total-C	2.12	2.12	-
Carbon loss per day	% of total weight	0.88	0.33	6.7 lbs/ton
Solvita CO_2 Rate	(see chart)	~→	2	V. High
Solvita NH_3 Rate	(see chart)	~→	5	Absent
Maturity Index	(see chart)	~→	2	Very Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Appendix F

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x-Project: 605

Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.2

MINERALS ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 3-5, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.643	0.624	12.5
Organic-Nitrogen	%	1.348	0.512	10.2
Phosphorus (P)	%	0.436	0.166	3.3
Potassium (K)	%	0.208	0.079	1.6
Sodium (Na)	%	0.420	0.160	3.2
Calcium (Ca)	%	2.840	1.079	21.6
Magnesium (Mg)	%	0.235	0.089	1.8
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2949	1121	2.2
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5015	1906	3.81
Sulfate (SO_4-S)	ppm	5938	2257	4.51

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: x–Project: 605
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.2

METALS ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 3-5, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	82.8	31.5	<0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	364.0	138.3	0.3
Iron (Fe)	$mg{\cdot}kg^{-1}$	10040.0	3815.2	7.6
Zinc (Zn)	$mg{\cdot}kg^{-1}$	532.0	202.2	0.4
Lead (Pb)	$mg{\cdot}kg^{-1}$	94.0	-	-
Chromium (Cr)	$mg{\cdot}kg^{-1}$	40.8	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	35.6	-	-
Arsenic (As)	$mg{\cdot}kg^{-1}$	6.5	-	-
Mercury (Hg)	$mg{\cdot}kg^{-1}$	0.86	-	-
Molybdenum (Mo)	$mg{\cdot}kg^{-1}$	< 12	-	-
Selenium (Se)	$mg{\cdot}kg^{-1}$	18	-	-
Total PCB	$mg{\cdot}kg^{-1}$	<1.0		

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.3
Quality Checked : WD 4/23/01

COMPOSITION ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 3-5, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs-ft^3	-	49	1314 lbs/yd^3
Solids	%	100.0	37.5	750 lbs/ton
Moisture	%	0.0	62.5	150 gals/ton
est. water holding capacity	%	235	70	168 gals/ton
Inert and Oversize Matter	%	~	9.0	180.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	5.46	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	16522	6196	High
Organic Matter	%	76.4	28.7	573 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	8.5	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	26.0	26.0	Med-High
Respiration Rate/day	C% of Total-C	2.05	2.05	-
Carbon loss per day	% of total weight	0.85	0.32	6.4 lbs/ton
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	2	Very Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x-Project: 605
Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.3

MINERALS ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 3-5, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.585	0.594	11.9
Organic-Nitrogen	%	1.281	0.480	9.6
Phosphorus (P)	%	0.460	0.173	3.5
Potassium (K)	%	0.204	0.076	1.5
Sodium (Na)	%	0.400	0.150	3.0
Calcium (Ca)	%	2.980	1.118	22.4
Magnesium (Mg)	%	0.360	0.135	2.7
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	3038	1139	2.3
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5119	1920	3.84
Sulfate (SO_4-S)	ppm	5897	2211	4.42

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Page 3 of 3

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x-Project: 605

Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.3

METALS ANALYSIS

Sample Identification: NMS Primary Screen Unders, Day 3-5, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	80.4	30.2	<0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	352.0	132.0	0.3
Iron (Fe)	$mg{\cdot}kg^{-1}$	9680.0	3630.0	7.3
Zinc (Zn)	$mg{\cdot}kg^{-1}$	500.0	187.5	0.4
Lead (Pb)	$mg{\cdot}kg^{-1}$	86.0	-	-
Chromium (Cr)	$mg{\cdot}kg^{-1}$	38.0	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	32.8	-	-
Arsenic (As)	$mg{\cdot}kg^{-1}$	7.2	-	-
Mercury (Hg)	$mg{\cdot}kg^{-1}$	1.1	-	-
Molybdenum (Mo)	$mg{\cdot}kg^{-1}$	< 15	-	-
Selenium (Se)	$mg{\cdot}kg^{-1}$	16	-	-
Total PCB	$mg{\cdot}kg^{-1}$	<1.1		

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556	Code: x Project: 605
· Robert LaValva	Date Received : 03/08/2001
· Bur. of Waste Prev. Reuse and Recycling	Date Reported : 03/30/2001
· 44 Beaver Street-6th floor	Lab ID Number : 4858.4
· New York NY 10004	Quality Checked : WD 4/23/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 1 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	45	1213 lbs/yd^3
Solids	%	100.0	42.2	844 lbs/ton
Moisture	%	0.0	57.8	139 gals/ton
est. water holding capacity	%	237	70	169 gals/ton
Inert and Oversize Matter	%	~→	10.1	202.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~→	5.91	ExLow
Free Carbonates (CO_3)	Rating	~→	1	None
Volatile Organic Acids	ppm	19670	8301	High
Organic Matter	%	77.2	32.6	652 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~→	10.9	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	28.6	28.6	Med-High
Respiration Rate/day	C% of Total-C	1.40	1.40	-
Carbon loss per day	% of total weight	0.58	0.25	4.9 lbs/ton
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~→	78	Not Plant-toxic
Latuca sativa Weight	%	~→	66	Fair
Lepedium sativum Germination	%	~→	81	Mod. Toxic
Lepedium sativum Weight	%	~→	38	Low
Solvita CO_2 Rate	(see chart)	~→	3	High
Solvita NH_3 Rate	(see chart)	~→	4	Slight
Maturity Index	(see chart)	~→	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.4

MINERALS ANALYSIS

Sample Identification: NMS Day 1 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.459	0.616	12.3
Organic-Nitrogen	%	1.125	0.475	9.5
Phosphorus (P)	%	0.420	0.177	3.5
Potassium (K)	%	0.204	0.086	1.7
Sodium (Na)	%	0.428	0.181	3.6
Calcium (Ca)	%	2.460	1.038	20.8
Magnesium (Mg)	%	0.206	0.087	1.7
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	3342	1410	2.8
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5008	2113	4.23
Sulfate (SO_4–S)	ppm	4153	1753	3.51

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Page 3 of 3

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 | Code: x–Project: 605

· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.4

METALS ANALYSIS

Sample Identification: NMS Day 1 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	86.0	36.3	<0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	392.0	165.4	0.3
Iron (Fe)	$mg{\cdot}kg^{-1}$	12200.0	5148.4	10.3
Zinc (Zn)	$mg{\cdot}kg^{-1}$	520.0	219.4	0.4
Lead (Pb)	$mg{\cdot}kg^{-1}$	178.0	75.1	0.2
Chromium (Cr)	$mg{\cdot}kg^{-1}$	40.0	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	3.2	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	40.4	-	-
Total PCB	$mg{\cdot}kg^{-1}$	<0.87		
.... **BACTERIOLOGIC ANALYSIS**				
Fecal coliform EPA503	MPN per g	240	-	
Total *Salmonella* EPA503 ..	MPN per 4g	< 1.7	-	

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number

< signifies *less than MLD* (minimum level of detection) for the particular factor tested

‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.5
Quality Checked : WD 4/23/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 1 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs\cdot ft^3$	-	46	1230 lbs/yd^3
Solids	%	100.0	42.5	850 lbs/ton
Moisture	%	0.0	57.5	138 gals/ton
est. water holding capacity	%	238	70	169 gals/ton
Inert and Oversize Matter	%	~	15.6	312.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	5.43	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	22696	9646	High
Organic Matter	%	77.6	33.0	659 lbs/ton
Conductivity	$mmhos\cdot cm^{-1}$	~	10.9	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	29.4	29.4	Med-High
Respiration Rate/day	C% of Total-C	1.57	1.57	-
Carbon loss per day	% of total weight	0.66	0.28	5.6 lbs/ton
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	61	Slightly Plant Toxic
Latuca sativa Weight	%	~	60	Fair
Lepedium sativum Germination	%	~	86	Non-toxic
Lepedium sativum Weight	%	~	38	Low
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Page 2 of 3

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.5

MINERALS ANALYSIS

Sample Identification: NMS Day 1 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.423	0.605	12.1
Organic-Nitrogen	%	1.075	0.457	9.1
Phosphorus (P)	%	0.392	0.167	3.3
Potassium (K)	%	0.204	0.087	1.7
Sodium (Na)	%	0.420	0.178	3.6
Calcium (Ca)	%	2.720	1.156	23.1
Magnesium (Mg)	%	0.388	0.165	3.3
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	3481	1479	3.0
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5159	2193	4.39
Sulfate (SO_4–S)	ppm	4439	1887	3.77

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: x–Project: 605
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Date Received : 03/08/2001
Date Reported : 03/30/2001
Lab ID Number : 4858.5

METALS ANALYSIS

Sample Identification: NMS Day 1 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	81.6	34.7	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	388.0	164.9	0.3
Iron (Fe)	$mg \cdot kg^{-1}$	11800.0	5015.0	10.0
Zinc (Zn)	$mg \cdot kg^{-1}$	524.0	222.7	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	164.0	69.7	0.1
Chromium (Cr)	$mg \cdot kg^{-1}$	36.8	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	3.2	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	34.0	-	-
Total PCB	$mg \cdot kg^{-1}$	<1.4		
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	32	-	
Total *Salmonella* EPA503	MPN per 4g	< 2.0	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/16/2001
Date Reported : 04/19/2001
Lab ID Number : 4871.0
Quality Checked : WD 10/10/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 7 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	40	1078 lbs/yd^3
Solids	%	100.0	43.8	876 lbs/ton
Moisture	%	0.0	56.2	135 gals/ton
est. water holding capacity	%	232	70	168 gals/ton
Inert and Oversize Matter	%	~	15.9	318.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.71	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	27191	11910	V High
Organic Matter	%	75.3	33.0	659 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	7.7	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	30.2	30.2	Med-High
Respiration Rate/day	C% of Total-C	1.36	1.36	-
Carbon loss per day	% of total weight	0.55	0.24	4.8 lbs/ton
Dewar Self-Heating	°C rise	~	34	Grade II
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	67	Slightly Plant Toxic
Latuca sativa Weight	%	~	40	Low
Lepedium sativum Germination	%	~	103	Non-toxic
Lepedium sativum Weight	%	~	58	Fair
Solvita CO_2 Rate	(see chart)	~	5	Medium
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	5	Late-Active

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory. Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x-Project: 605

Date Received : 03/16/2001
Date Reported : 04/19/2001
Lab ID Number : 4871.0

MINERALS ANALYSIS

Sample Identification: NMS Day 7 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.344	0.589	11.8
Organic-Nitrogen	%	0.863	0.378	7.6
Phosphorus (P)	%	0.376	0.165	3.3
Potassium (K)	%	0.260	0.114	2.3
Sodium (Na)	%	0.460	0.201	4.0
Calcium (Ca)	%	2.532	1.109	22.2
Magnesium (Mg)	%	0.244	0.107	2.1
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	4810	2107	4.2
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4499	1971	3.94
Sulfate (SO_4–S)	ppm	3318	1453	2.91

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Page 3 of 3

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 — Code: x–Project: 605

· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Date Received : 03/16/2001
Date Reported : 04/19/2001
Lab ID Number : 4871.0

METALS ANALYSIS

Sample Identification: NMS Day 7 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	98.4	43.1	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	388.0	169.9	0.3
Iron (Fe)	$mg \cdot kg^{-1}$	13080.0	5729.0	11.5
Zinc (Zn)	$mg \cdot kg^{-1}$	504.0	220.8	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	210.0	92.0	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	40.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	3.6	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	40.8	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number

< signifies *less than MLD* (minimum level of detection) for the particular factor tested

‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/16/2001
Date Reported : 04/19/2001
Lab ID Number : 4871.1
Quality Checked : WD 10/10/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 7 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	39	1062 lbs/yd^3
Solids	%	100.0	43.5	870 lbs/ton
Moisture	%	0.0	56.5	135 gals/ton
est. water holding capacity	%	237	70	169 gals/ton
Inert and Oversize Matter	%	~	17.2	344.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.86	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	26294	11438	V High
Organic Matter	%	77.0	33.5	670 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	7.7	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	30.5	30.5	Med-High
Respiration Rate/day	C% of Total-C	1.51	1.51	-
Carbon loss per day	% of total weight	0.63	0.27	5.5 lbs/ton
Dewar Self-Heating	°C rise	~	47	Grade I
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	64	Slightly Plant Toxic
Latuca sativa Weight	%	~	40	Low
Lepedium sativum Germination	%	~	108	Non-toxic
Lepedium sativum Weight	%	~	64	Fair
Solvita CO_2 Rate	(see chart)	~	5	Medium
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	5	Late-Active

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x–Project: 605
Date Received : 03/16/2001
Date Reported : 04/19/2001
Lab ID Number : 4871.1

MINERALS ANALYSIS

Sample Identification: NMS Day 7 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.362	0.592	11.8
Organic-Nitrogen	%	0.857	0.373	7.5
Phosphorus (P)	%	0.376	0.164	3.3
Potassium (K)	%	0.260	0.113	2.3
Sodium (Na)	%	0.476	0.207	4.1
Calcium (Ca)	%	2.380	1.035	20.7
Magnesium (Mg)	%	0.212	0.092	1.8
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	5052	2198	4.4
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4377	1904	3.81
Sulfate (SO_4–S)	ppm	3167	1378	2.76

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: x-Project: 605

- Robert LaValva
- Bur. of Waste Prev. Reuse and Recycling
- 44 Beaver Street-6th floor
- New York NY 10004

Date Received : 03/16/2001
Date Reported : 04/19/2001
Lab ID Number : 4871.1

METALS ANALYSIS

Sample Identification: NMS Day 7 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	102.8	44.7	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	360.0	156.6	0.3
Iron (Fe)	$mg \cdot kg^{-1}$	13120.0	5707.2	11.4
Zinc (Zn)	$mg \cdot kg^{-1}$	516.0	224.5	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	218.0	94.8	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	36.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	4.4	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	44.0	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 02/22/2001
Date Reported : 04/23/2001
Lab ID Number : 4878.0
Quality Checked : WD 4/24/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 14 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	36	977 lbs/yd^3
Solids	%	100.0	47.7	954 lbs/ton
Moisture	%	0.0	52.3	125 gals/ton
est. water holding capacity	%	234	70	168 gals/ton
Inert and Oversize Matter	%	~	10.3	206.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	6.78	Med Low
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	35015	16702	V High
Organic Matter	%	76.1	36.3	726 lbs/ton
Conductivity	mmhos·cm^{-1}	~	9.9	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	31.8	31.8	Med-High
Respiration Rate/day	C% of Total-C	1.31	1.31	-
Carbon loss per day	% of total weight	0.54	0.26	5.2 lbs/ton
Dewar Self-Heating	°C rise	~	48	Grade I
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	59	Plant Toxic
Latuca sativa Weight	%	~	37	Low
Lepedium sativum Germination	%	~	95	Non-toxic
Lepedium sativum Weight	%	~	52	Fair
Solvita CO_2 Rate	(see chart)	~	7	Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	7	Mature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 02/22/2001
Date Reported : 04/23/2001
Lab ID Number : 4878.0

MINERALS ANALYSIS

Sample Identification: NMS Day 14 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.294	0.617	12.3
Organic-Nitrogen	%	0.777	0.371	7.4
Phosphorus (P)	%	0.368	0.176	3.5
Potassium (K)	%	0.240	0.114	2.3
Sodium (Na)	%	0.400	0.191	3.8
Calcium (Ca)	%	2.240	1.068	21.4
Magnesium (Mg)	%	0.190	0.091	1.8
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	5168	2465	4.9
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4705	2244	4.49
Sulfate (SO_4–S)	ppm	2624	1252	2.50

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: x–Project: 605

· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Date Received : 02/22/2001
Date Reported : 04/23/2001
Lab ID Number : 4878.0

METALS ANALYSIS

Sample Identification: NMS Day 14 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	108.0	51.5	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	364.0	173.6	0.3
Iron (Fe)	$mg \cdot kg^{-1}$	11560.0	5514.1	11.0
Zinc (Zn)	$mg \cdot kg^{-1}$	440.0	209.9	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	234.4	111.8	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	34.8	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	39.6	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 02/22/2001
Date Reported : 04/23/2001
Lab ID Number : 4878.1
Quality Checked : WD 4/24/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 14 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	36	977 lbs/yd^3
Solids	%	100.0	49.2	984 lbs/ton
Moisture	%	0.0	50.8	122 gals/ton
est. water holding capacity	%	223	69	166 gals/ton
Inert and Oversize Matter	%	~	13.0	260.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	6.87	Med Low
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	32648	16063	V High
Organic Matter	%	72.2	35.5	710 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	10.0	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	29.0	29.0	Med-High
Respiration Rate/day	C% of Total-C	1.59	1.59	-
Carbon loss per day	% of total weight	0.62	0.30	6.1 lbs/ton
Dewar Self-Heating	°C rise	~	48	Grade I
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	44	Plant Toxic
Latuca sativa Weight	%	~	44	Low
Lepedium sativum Germination	%	~	103	Non-toxic
Lepedium sativum Weight	%	~	55	Fair
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 02/22/2001
Date Reported : 04/23/2001
Lab ID Number : 4878.1

MINERALS ANALYSIS

Sample Identification: NMS Day 14 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.344	0.661	13.2
Organic-Nitrogen	%	0.769	0.378	7.6
Phosphorus (P)	%	0.384	0.189	3.8
Potassium (K)	%	0.232	0.114	2.3
Sodium (Na)	%	0.408	0.201	4.0
Calcium (Ca)	%	2.152	1.059	21.2
Magnesium (Mg)	%	0.202	0.099	2.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	5747	2828	5.7
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4593	2260	4.52
Sulfate (SO_4–S)	ppm	2844	1399	2.80

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory. Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 02/22/2001
Date Reported : 04/23/2001
Lab ID Number : 4878.1

METALS ANALYSIS

Sample Identification: NMS Day 14 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	102.4	50.4	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	376.0	185.0	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	12200.0	6002.4	12.0
Zinc (Zn)	$mg \cdot kg^{-1}$	460.0	226.3	0.5
Lead (Pb)	$mg \cdot kg^{-1}$	228.4	112.4	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	32.8	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	4.0	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	39.2	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/29/2001
Date Reported : 05/02/2001
Lab ID Number : 4888.0
Quality Checked : WD 5/16/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 21 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	32	876 lbs/yd^3
Solids	%	100.0	51.4	1028 lbs/ton
Moisture	%	0.0	48.6	117 gals/ton
est. water holding capacity	%	234	70	168 gals/ton
Inert and Oversize Matter	%	~	13.4	268.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.34	Med-Ideal
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	29499	15162	V High
Organic Matter	%	76.0	39.1	781 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	9.1	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	28.9	28.9	Med-High
Respiration Rate/day	C% of Total-C	1.44	1.44	-
Carbon loss per day	% of total weight	0.59	0.30	6.1 lbs/ton
Dewar Self-Heating	°C rise	~	46	Grade I
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	84	Not Plant-toxic
Latuca sativa Weight	%	~	52	Fair
Lepedium sativum Germination	%	~	100	Non-toxic
Lepedium sativum Weight	%	~	57	Fair
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 03/29/2001
Date Reported : 05/02/2001
Lab ID Number : 4888.0

MINERALS ANALYSIS

Sample Identification: NMS Day 21 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.418	0.729	14.6
Organic-Nitrogen	%	0.954	0.491	9.8
Phosphorus (P)	%	0.416	0.214	4.3
Potassium (K)	%	0.272	0.140	2.8
Sodium (Na)	%	0.420	0.216	4.3
Calcium (Ca)	%	2.440	1.254	25.1
Magnesium (Mg)	%	0.188	0.097	1.9
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	4634	2382	4.8
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5489	2821	5.64
Sulfate (SO_4–S)	ppm	3055	1570	3.14

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 03/29/2001
Date Reported : 05/02/2001
Lab ID Number : 4888.0

METALS ANALYSIS

Sample Identification: NMS Day 21 Facility Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	132.0	67.8	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	388.0	199.4	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	12200.0	6270.8	12.5
Zinc (Zn)	$mg \cdot kg^{-1}$	488.0	250.8	0.5
Lead (Pb)	$mg \cdot kg^{-1}$	228.0	117.2	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	31.2	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	3.2	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	68.0	35.0	0.1
Arsenic (As)	$mg \cdot kg^{-1}$	< 4.4	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	0.98	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	20	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	17	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	4.2	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.7	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Appendix F

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/29/2001
Date Reported : 05/02/2001
Lab ID Number : 4888.1
Quality Checked : WO 5/16/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 21 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	35	944 lbs/yd^3
Solids	%	100.0	53.8	1076 lbs/ton
Moisture	%	0.0	46.2	111 gals/ton
est. water holding capacity	%	219	69	165 gals/ton
Inert and Oversize Matter	%	~	12.4	248.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.31	Med-Ideal
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	25822	13892	V High
Organic Matter	%	70.6	38.0	760 lbs/ton
Conductivity	mmhos·cm^{-1}	~	9.1	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	30.0	30.0	Med-High
Respiration Rate/day	C% of Total-C	1.44	1.44	-
Carbon loss per day	% of total weight	0.55	0.30	5.9 lbs/ton
Dewar Self-Heating	°C rise	~	46	Grade I
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	66	Slightly Plant Toxic
Latuca sativa Weight	%	~	52	Fair
Lepedium sativum Germination	%	~	93	Non-toxic
Lepedium sativum Weight	%	~	51	Fair
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x-Project: 605
Date Received : 03/29/2001
Date Reported : 05/02/2001
Lab ID Number : 4888.1

MINERALS ANALYSIS

Sample Identification: NMS Day 21 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.269	0.683	13.7
Organic-Nitrogen	%	0.817	0.439	8.8
Phosphorus (P)	%	0.384	0.207	4.1
Potassium (K)	%	0.240	0.129	2.6
Sodium (Na)	%	0.408	0.220	4.4
Calcium (Ca)	%	2.180	1.173	23.5
Magnesium (Mg)	%	0.182	0.098	2.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	4523	2433	4.9
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5252	2825	5.65
Sulfate (SO_4–S)	ppm	2463	1325	2.65

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 03/29/2001
Date Reported : 05/02/2001
Lab ID Number : 4888.1

METALS ANALYSIS

Sample Identification: NMS Day 21 Facility Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	94.8	51.0	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	348.0	187.2	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	11600.0	6240.8	12.5
Zinc (Zn)	$mg \cdot kg^{-1}$	440.0	236.7	0.5
Lead (Pb)	$mg \cdot kg^{-1}$	202.0	108.7	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	29.6	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	39.2	-	-
Arsenic (As)	$mg \cdot kg^{-1}$	< 4.1	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	0.79	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	20	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	13	-	-

BACTERIOLOGIC ANALYSIS

Fecal coliform EPA503	MPN per g	60	-
Total *Salmonella* EPA503	MPN per 4g	< 1.6	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: n/a
Date Received : 04/13/2001
Date Reported : 05/23/2001
Lab ID Number : 4910.0
Quality Checked : WO 5/23/01

COMPOSITION ANALYSIS

Sample Identification: NMS Half-Inch 'Unders'

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	35	944 lbs/yd^3
Solids	%	100.0	56.6	1132 lbs/ton
Moisture	%	0.0	43.4	104 gals/ton
est. water holding capacity	%	222	69	165 gals/ton
pH (paste, H_2O)	$-logH^+$	~	8.05	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	1677	949	M Low
Organic Matter	%	71.8	40.6	813 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	6.1	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	20.2	20.2	Medium
Respiration Rate/day	C% of Total-C	1.11	1.11	-
Carbon loss per day	% of total weight	0.43	0.24	4.9 lbs/ton
Dewar Self-Heating	°C rise	~	33	Grade II
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	15	Extr. Plant Toxic
Latuca sativa Weight	%	~	62	Fair
Lepedium sativum Germination	%	~	90	Non-toxic
Lepedium sativum Weight	%	~	43	Low
Solvita CO_2 Rate	(see chart)	~	5	Medium
Solvita NH_3 Rate	(see chart)	~	2	High
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: n/a

Date Received : 04/13/2001
Date Reported : 05/23/2001
Lab ID Number : 4910.0

MINERALS ANALYSIS

Sample Identification: NMS Half-Inch 'Unders'

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.919	1.086	21.7
Organic-Nitrogen	%	1.513	0.856	17.1
Phosphorus (P)	%	0.360	0.204	4.1
Potassium (K)	%	0.260	0.147	2.9
Sodium (Na)	%	0.440	0.249	5.0
Calcium (Ca)	%	2.320	1.313	26.3
Magnesium (Mg)	%	0.212	0.120	2.4
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	4060	2298	4.6
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Volatile N as % of total-N	w:w	~	1.4	-
Chloride (Cl)	ppm	5350	3028	6.06
Sulfate (SO_4–S)	ppm	3373	1909	3.82

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Page 3 of 3

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: x–Project: n/a

· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 04/13/2001
Date Reported : 05/23/2001
Lab ID Number : 4910.0

METALS ANALYSIS

Sample Identification: NMS Half-Inch 'Unders'

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	128.0	72.4	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	420.0	237.7	0.5
Iron (Fe)	$mg \cdot kg^{-1}$	17200.0	9735.2	19.5
Zinc (Zn)	$mg \cdot kg^{-1}$	476.0	269.4	0.5
Lead (Pb)	$mg \cdot kg^{-1}$	236.0	133.6	0.3
Chromium (Cr)	$mg \cdot kg^{-1}$	36.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	3.6	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	50.0	28.3	0.1

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number

< signifies *less than MLD* (minimum level of detection) for the particular factor tested

‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/16/2001
Date Reported : 04/23/2001
Lab ID Number : 4875.0
Quality Checked : WD 4/23/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 7 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	48.2	964 lbs/ton
Moisture	%	0.0	51.8	124 gals/ton
est. water holding capacity	%	232	70	168 gals/ton
Inert and Oversize Matter	%	~	7.7	154.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.14	Med-Ideal
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	20729	9991	High
Organic Matter	%	75.2	36.3	725 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	8.7	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	22.0	22.0	Medium
Respiration Rate/day	C% of Total-C	1.16	1.16	-
Carbon loss per day	% of total weight	0.47	0.23	4.5 lbs/ton
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	54	Plant Toxic
Latuca sativa Weight	%	~	41	Low
Lepedium sativum Germination	%	~	103	Non-toxic
Lepedium sativum Weight	%	~	65	Fair
Solvita CO_2 Rate	(see chart)	~	1	Ex. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	1	Raw Waste!

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x–Project: 605
Date Received : 03/16/2001
Date Reported : 04/23/2001
Lab ID Number : 4875.0

MINERALS ANALYSIS

Sample Identification: NMS Day 7 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.848	0.891	17.8
Organic-Nitrogen	%	1.516	0.731	14.6
Phosphorus (P)	%	0.380	0.183	3.7
Potassium (K)	%	0.280	0.135	2.7
Sodium (Na)	%	0.532	0.256	5.1
Calcium (Ca)	%	2.700	1.301	26.0
Magnesium (Mg)	%	0.268	0.129	2.6
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	3317	1599	3.2
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5193	2503	5.01
Sulfate (SO_4–S)	ppm	3867	1864	3.73

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: x–Project: 605
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling Date Received : 03/16/2001
· 44 Beaver Street-6th floor Date Reported : 04/23/2001
· New York NY 10004 Lab ID Number : 4875.0

METALS ANALYSIS

Sample Identification: NMS Day 7 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	101.2	48.8	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	400.0	192.8	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	13000.0	6266.0	12.5
Zinc (Zn)	$mg \cdot kg^{-1}$	500.0	241.0	0.5
Lead (Pb)	$mg \cdot kg^{-1}$	203.6	98.1	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	39.6	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	3.2	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	45.6	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/16/2001
Date Reported : 04/23/2001
Lab ID Number : 4875.1
Quality Checked : WO 4/23/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 7 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	48.9	978 lbs/ton
Moisture	%	0.0	51.1	123 gals/ton
est. water holding capacity	%	227	69	166 gals/ton
Inert and Oversize Matter	%	~	12.0	240.0 lbs/ton
pH (paste, H_2O)	-logH^+	~	7.17	Med-Ideal
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	22685	11093	V High
Organic Matter	%	73.3	35.8	717 lbs/ton
Conductivity	mmhos·cm^{-1}	~	8.9	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	20.8	20.8	Medium
Respiration Rate/day	C% of Total-C	1.60	1.60	-
Carbon loss per day	% of total weight	0.63	0.31	6.2 lbs/ton
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	44	Plant Toxic
Latuca sativa Weight	%	~	35	Low
Lepedium sativum Germination	%	~	95	Non-toxic
Lepedium sativum Weight	%	~	64	Fair
Solvita CO_2 Rate	(see chart)	~	1	Ex. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	1	Raw Waste!

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
Robert LaValva
Bur. of Waste Prev. Reuse and Recycling
44 Beaver Street-6th floor
New York NY 10004

Code: x-Project: 605
Date Received : 03/16/2001
Date Reported : 04/23/2001
Lab ID Number : 4875.1

MINERALS ANALYSIS

Sample Identification: NMS Day 7 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.902	0.930	18.6
Organic-Nitrogen	%	1.559	0.763	15.3
Phosphorus (P)	%	0.380	0.186	3.7
Potassium (K)	%	0.276	0.135	2.7
Sodium (Na)	%	0.528	0.258	5.2
Calcium (Ca)	%	2.640	1.291	25.8
Magnesium (Mg)	%	0.268	0.131	2.6
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	3423	1674	3.3
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4967	2429	4.86
Sulfate (SO_4-S)	ppm	3634	1777	3.55

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x-Project: 605

Date Received : 03/16/2001
Date Reported : 04/23/2001
Lab ID Number : 4875.1

METALS ANALYSIS

Sample Identification: NMS Day 7 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	100.0	48.9	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	416.0	203.4	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	13840.0	6767.8	13.5
Zinc (Zn)	$mg \cdot kg^{-1}$	508.0	248.4	0.5
Lead (Pb)	$mg \cdot kg^{-1}$	232.8	113.8	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	44.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	46.0	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.

Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/23/2001
Date Reported : 04/25/2001
Lab ID Number : 4879.0
Quality Checked : WD 4/25/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 14 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	52.6	1052 lbs/ton
Moisture	%	0.0	47.4	114 gals/ton
est. water holding capacity	%	222	69	165 gals/ton
Inert and Oversize Matter	%	~	16.4	328.0 lbs/ton
pH (paste, H_2O)	-logH^+	~	7.75	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	6468	3402	M High
Organic Matter	%	71.6	37.6	753 lbs/ton
Conductivity	mmhos·cm^{-1}	~	10.5	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	19.0	19.0	Medium
Respiration Rate/day	C% of Total-C	0.16	0.16	-
Carbon loss per day	% of total weight	0.06	0.03	0.6 lbs/ton
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	51	Plant Toxic
Latuca sativa Weight	%	~	40	Low
Lepedium sativum Germination	%	~	97	Non-toxic
Lepedium sativum Weight	%	~	57	Fair
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 03/23/2001
Date Reported : 04/25/2001
Lab ID Number : 4879.0

MINERALS ANALYSIS

Sample Identification: NMS Day 14 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.029	1.067	21.3
Organic-Nitrogen	%	1.745	0.918	18.4
Phosphorus (P)	%	0.404	0.213	4.3
Potassium (K)	%	0.284	0.149	3.0
Sodium (Na)	%	0.496	0.261	5.2
Calcium (Ca)	%	2.760	1.452	29.0
Magnesium (Mg)	%	0.222	0.117	2.3
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2834	1491	3.0
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5279	2777	5.55
Sulfate (SO_4–S)	ppm	4043	2127	4.25

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: x–Project: 605

· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Date Received : 03/23/2001
Date Reported : 04/25/2001
Lab ID Number : 4879.0

METALS ANALYSIS

Sample Identification: NMS Day 14 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	124.0	65.2	0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	460.0	242.0	0.5
Iron (Fe)	$mg{\cdot}kg^{-1}$	14080.0	7406.1	14.8
Zinc (Zn)	$mg{\cdot}kg^{-1}$	540.0	284.0	0.6
Lead (Pb)	$mg{\cdot}kg^{-1}$	240.0	126.2	0.3
Chromium (Cr)	$mg{\cdot}kg^{-1}$	308.8	162.4	0.3
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	3.6	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	78.4	41.2	0.1

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/23/2001
Date Reported : 04/25/2001
Lab ID Number : 4879.1
Quality Checked : 4/25/01 WD

COMPOSITION ANALYSIS

Sample Identification: NMS Day 14 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	54.3	1086 lbs/ton
Moisture	%	0.0	45.7	110 gals/ton
est. water holding capacity	%	212	68	163 gals/ton
Inert and Oversize Matter	%	~	15.0	300.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.71	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	11060	6006	High
Organic Matter	%	67.8	36.8	737 lbs/ton
Conductivity	$mmhos{\cdot}cm^{-1}$	~	11.4	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	16.9	16.9	M. Low
Respiration Rate/day	C% of Total-C	1.83	1.83	-
Carbon loss per day	% of total weight	0.67	0.36	7.3 lbs/ton
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	49	Plant Toxic
Latuca sativa Weight	%	~	40	Low
Lepedium sativum Germination	%	~	100	Non-toxic
Lepedium sativum Weight	%	~	60	Fair
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556

Code: x–Project: 605

· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Date Received : 03/23/2001
Date Reported : 04/25/2001
Lab ID Number : 4879.1

MINERALS ANALYSIS

Sample Identification: NMS Day 14 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.172	1.179	23.6
Organic-Nitrogen	%	1.873	1.017	20.3
Phosphorus (P)	%	0.452	0.245	4.9
Potassium (K)	%	0.276	0.150	3.0
Sodium (Na)	%	0.476	0.258	5.2
Calcium (Ca)	%	2.772	1.505	30.1
Magnesium (Mg)	%	0.226	0.123	2.5
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2986	1621	3.2
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5330	2894	5.79
Sulfate (SO_4–S)	ppm	3921	2129	4.26

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· Bur. of Waste Prev. Reuse and Recycling
· 44 Beaver Street-6th floor
· New York NY 10004

Code: x-Project: 605

Date Received : 03/23/2001
Date Reported : 04/25/2001
Lab ID Number : 4879.1

METALS ANALYSIS

Sample Identification: NMS Day 14 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	120.0	65.2	0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	476.0	258.5	0.5
Iron (Fe)	$mg{\cdot}kg^{-1}$	13720.0	7450.0	14.9
Zinc (Zn)	$mg{\cdot}kg^{-1}$	548.0	297.6	0.6
Lead (Pb)	$mg{\cdot}kg^{-1}$	236.0	128.1	0.3
Chromium (Cr)	$mg{\cdot}kg^{-1}$	42.4	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	4.0	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	50.0	27.1	0.1

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/30/2001
Date Reported : 05/02/2001
Lab ID Number : 4891.0
Quality Checked : WD 5/16/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 21 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs-ft^3	-	27	725 lbs/yd^3
Solids	%	100.0	64.9	1298 lbs/ton
Moisture	%	0.0	35.1	84 gals/ton
est. water holding capacity	%	209	68	162 gals/ton
Inert and Oversize Matter	%	~	17.0	340.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.75	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	1695	1100	Medium
Organic Matter	%	67.0	43.5	870 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	9.4	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	17.6	17.6	Medium
Respiration Rate/day	C% of Total-C	1.50	1.50	-
Carbon loss per day	% of total weight	0.54	0.35	7.1 lbs/ton
Dewar Self-Heating	°C rise	~	30	Grade III
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	73	Slightly Plant Toxic
Latuca sativa Weight	%	~	42	Low
Lepedium sativum Germination	%	~	95	Non-toxic
Lepedium sativum Weight	%	~	48	Low
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	4	Med-Active

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 03/30/2001
Date Reported : 05/02/2001
Lab ID Number : 4891.0

MINERALS ANALYSIS

Sample Identification: NMS Day 21 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.059	1.336	26.7
Organic-Nitrogen	%	1.809	1.174	23.5
Phosphorus (P)	%	0.408	0.265	5.3
Potassium (K)	%	0.300	0.195	3.9
Sodium (Na)	%	0.540	0.350	7.0
Calcium (Ca)	%	3.160	2.051	41.0
Magnesium (Mg)	%	0.268	0.174	3.5
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2496	1620	3.2
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	7311	4745	9.49
Sulfate (SO_4–S)	ppm	6633	4305	8.61

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 03/30/2001
Date Reported : 05/02/2001
Lab ID Number : 4891.0

METALS ANALYSIS

Sample Identification: NMS Day 21 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	106.0	68.8	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	476.0	308.9	0.6
Iron (Fe)	$mg \cdot kg^{-1}$	11800.0	7658.2	15.3
Zinc (Zn)	$mg \cdot kg^{-1}$	560.0	363.4	0.7
Lead (Pb)	$mg \cdot kg^{-1}$	244.0	158.4	0.3
Chromium (Cr)	$mg \cdot kg^{-1}$	39.6	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	4.0	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	58.0	37.6	0.1
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 3.0	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.2	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 605
Date Received : 03/30/2001
Date Reported : 05/02/2001
Lab ID Number : 4891.1
Quality Checked : WD 5/16/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 21 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	26	708 lbs/yd^3
Solids	%	100.0	64.3	1286 lbs/ton
Moisture	%	0.0	35.7	86 gals/ton
est. water holding capacity	%	216	68	164 gals/ton
Inert and Oversize Matter	%	~	18.3	366.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.74	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	1244	800	M Low
Organic Matter	%	69.4	44.6	892 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	8.6	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	18.7	18.7	Medium
Respiration Rate/day	C% of Total-C	1.43	1.43	-
Carbon loss per day	% of total weight	0.54	0.34	6.9 lbs/ton
Dewar Self-Heating	°C rise	~	31	Grade II
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	78	Not Plant-toxic
Latuca sativa Weight	%	~	43	Low
Lepedium sativum Germination	%	~	98	Non-toxic
Lepedium sativum Weight	%	~	50	Fair
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	4	Med-Active

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: 605
Date Received : 03/30/2001
Date Reported : 05/02/2001
Lab ID Number : 4891.1

MINERALS ANALYSIS

Sample Identification: NMS Day 21 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.007	1.291	25.8
Organic-Nitrogen	%	1.750	1.125	22.5
Phosphorus (P)	%	0.436	0.280	5.6
Potassium (K)	%	0.336	0.216	4.3
Sodium (Na)	%	0.580	0.373	7.5
Calcium (Ca)	%	3.020	1.942	38.8
Magnesium (Mg)	%	0.264	0.170	3.4
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2565	1649	3.3
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	7306	4698	9.40
Sulfate (SO_4–S)	ppm	6901	4438	8.88

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x-Project: 605

Date Received : 03/30/2001
Date Reported : 05/02/2001
Lab ID Number : 4891.1

METALS ANALYSIS

Sample Identification: NMS Day 21 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	116.0	74.6	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	464.0	298.4	0.6
Iron (Fe)	$mg \cdot kg^{-1}$	11160.0	7175.9	14.4
Zinc (Zn)	$mg \cdot kg^{-1}$	608.0	390.9	0.8
Lead (Pb)	$mg \cdot kg^{-1}$	220.4	141.7	0.3
Chromium (Cr)	$mg \cdot kg^{-1}$	39.6	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	3.6	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	57.6	37.0	0.1
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 3.0	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.2	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Appendix F

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
Robert LaValva
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Code: x Project: n/a
Date Received : 04/30/2001
Date Reported : 06/04/2001
Lab ID Number : 4931.0
Quality Checked : WD 6/4/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 59, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	29	775 lbs/yd^3
Solids	%	100.0	76.5	1530 lbs/ton
Moisture	%	0.0	23.5	56 gals/ton
est. water holding capacity	%	223	69	166 gals/ton
Inert and Oversize Matter	%	~	7.5	150.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.47	Med-Ideal
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1046	800	M Low
Organic Matter	%	72.0	55.1	1102 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	7.8	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	25.9	25.9	Med-High
Respiration Rate/day	C% of Total-C	3.23	3.23	-
Carbon loss per day	% of total weight	1.25	0.96	19.2 lbs/ton
Dewar Self-Heating	°C rise	~	40	Grade II
Seedling Response Assay, Percent of Control				
Latuca sativa Germination	%	~	7	Extr. Plant Toxic
Latuca sativa Weight	%	~	1	V. Poor
Lepedium sativum Germination	%	~	88	Non-toxic
Lepedium sativum Weight	%	~	42	Low
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	2	Very Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: x–Project: n/a

· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 04/30/2001
Date Reported : 06/04/2001
Lab ID Number : 4931.0

MINERALS ANALYSIS

Sample Identification: NMS Day 59, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.503	1.150	23.0
Organic-Nitrogen	%	1.279	0.978	19.6
Phosphorus (P)	%	0.424	0.324	6.5
Potassium (K)	%	0.296	0.226	4.5
Sodium (Na)	%	0.560	0.428	8.6
Calcium (Ca)	%	2.640	2.020	40.4
Magnesium (Mg)	%	0.388	0.297	5.9
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2243	1716	3.4
Nitrate-N	ppm	<2	< 2	nd
Nitrite-N	ppm	<2	< 2	nd
Chloride (Cl)	ppm	6350	4858	9.72
Sulfate (SO_4–S)	ppm	4034	3086	6.17

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x-Project: n/a

Date Received : 04/30/2001
Date Reported : 06/04/2001
Lab ID Number : 4931.0

METALS ANALYSIS

Sample Identification: NMS Day 59, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	150.8	115.4	0.2
Manganese (Mn)	$mg{\cdot}kg^{-1}$	428.0	327.4	0.7
Iron (Fe)	$mg{\cdot}kg^{-1}$	12120.0	9271.8	18.5
Zinc (Zn)	$mg{\cdot}kg^{-1}$	568.0	434.5	0.9
Lead (Pb)	$mg{\cdot}kg^{-1}$	239.6	183.3	0.4
Chromium (Cr)	$mg{\cdot}kg^{-1}$	40.8	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	4.0	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	57.6	44.1	0.1

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

NMS Day 59 WERL Cure

Woods End® Research Laboratory INCORPORATED

Certificate of Analysis

Total Metals - Method EPA 6020/200.8

		Analyte	Result	Units	PQL	Method
Sample Name:	4931.0	Arsenic	4.6	mg/Kg	1.0	EPA 6020
Sample Location:		Mercury	1.0	mg/Kg	0.1	EPA 7471A
Sampling Date:	8/16/2001	Molybdenum	5.5	mg/Kg	1.0	EPA 6020
Sampling Time:	15:00	Selenium	1.4	mg/Kg	1.0	EPA 6020
Date Received:	8/17/2001	Boron	37.0	mg/Kg	10.0	EPA 6020
Lab #:	01X1007-01	Cobalt	4.2	mg/Kg	1.0	EPA 6020
Matrix:	SOIL					
Analysis Date:	8/23/2001					
% Solid:	76.4					

Lab Supervisor:

Report Date: 04-Sep-01

ND Not Detected PQL Practical Quantitation Limit

Metals Report

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 605
Date Received : 05/11/2001
Date Reported : 06/20/2001
Lab ID Number : 4945.0
Quality Checked : WD 6/29/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 70, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	37	994 lbs/yd^3
Solids	%	100.0	55.9	1118 lbs/ton
Moisture	%	0.0	44.1	106 gals/ton
est. water holding capacity	%	202	67	160 gals/ton
Inert and Oversize Matter	%	~	6.7	134.0 lbs/ton
pH (paste, H_2O)	-logH^+	~	7.38	Med-Ideal
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	1431	800	M Low
Organic Matter	%	64.3	35.9	718 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	7.6	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	17.9	17.9	Medium
Respiration Rate/day	C% of Total-C	1.77	1.77	-
Carbon loss per day	% of total weight	0.61	0.34	6.9 lbs/ton
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	98	No Phytotoxicity
Lepedium sativum Weight	%	~	36	Low
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 05/11/2001
Date Reported : 06/20/2001
Lab ID Number : 4945.0

MINERALS ANALYSIS

Sample Identification: NMS Day 70, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.937	1.083	21.7
Organic-Nitrogen	%	1.931	1.080	21.6
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	55	31	0.1
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	7350	4109	8.22
Sulfate (SO_4–S)	ppm	3051	1705	3.41

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Appendix F

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 605
Date Received : 05/21/2001
Date Reported : 07/02/2001
Lab ID Number : 4958.0
Quality Checked : WO 7/2/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 80, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	34	910 lbs/yd^3
Solids	%	100.0	54.4	1088 lbs/ton
Moisture	%	0.0	45.6	109 gals/ton
est. water holding capacity	%	188	65	157 gals/ton
Inert and Oversize Matter	%	~	8.5	170.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.41	Med-Ideal
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1285	699	M Low
Organic Matter	%	59.3	32.2	645 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	7.0	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	13.2	13.2	M. Low
Respiration Rate/day	C% of Total-C	0.95	0.95	-
Carbon loss per day	% of total weight	0.30	0.17	3.3 lbs/ton
Dewar Self-Heating	°C rise	~	20	Grade IV
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	95	No Phytotoxicity
Lepedium sativum Weight	%	~	50	Fair
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: x-Project: 605
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 05/21/2001
Date Reported : 07/02/2001
Lab ID Number : 4958.0

MINERALS ANALYSIS

Sample Identification: NMS Day 80, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.427	1.320	26.4
Organic-Nitrogen	%	2.416	1.314	26.3
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	112	61	0.1
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	7393	4022	8.04
Sulfate (SO_4–S)	ppm	4158	2262	4.52

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: snyx Project: 605
Date Received : 06/01/2001
Date Reported : 07/09/2001
Lab ID Number : 4968.0
Quality Checked : WO 7/9/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 91, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	37	1011 lbs/yd^3
Solids	%	100.0	47.0	940 lbs/ton
Moisture	%	0.0	53.0	127 gals/ton
est. water holding capacity	%	188	65	156 gals/ton
Inert and Oversize Matter	%	~	8.5	170.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	8.21	High
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	744	350	M Low
Organic Matter	%	59.2	27.8	556 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	9.3	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	13.2	13.2	M. Low
Respiration Rate/day	C% of Total-C	0.60	0.60	-
Carbon loss per day	% of total weight	0.19	0.09	1.8 lbs/ton
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	95	No Phytotoxicity
Lepedium sativum Weight	%	~	57	Fair
Solvita CO_2 Rate	(see chart)	~	5	Medium
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	5	Late-Active

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: snyx–Project: 605

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 06/01/2001
Date Reported : 07/09/2001
Lab ID Number : 4968.0

MINERALS ANALYSIS

Sample Identification: NMS Day 91, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.421	1.138	22.8
Organic-Nitrogen	%	2.341	1.100	22.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	793	373	0.7
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	7285	3424	6.85
Sulfate (SO_4–S)	ppm	3808	1790	3.58

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: snyx Project: 605
Date Received : 06/15/2001
Date Reported : 07/17/2001
Lab ID Number : 4985.0
Quality Checked : WD 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 105, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	41	1112 lbs/yd^3
Solids	%	100.0	45.9	918 lbs/ton
Moisture	%	0.0	54.1	130 gals/ton
est. water holding capacity	%	158	61	147 gals/ton
Inert and Oversize Matter	%	~	7.7	154.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	8.03	MedHigh
Free Carbonates (CO_3)	Rating	~	3	V High
Volatile Organic Acids	ppm	1090	500	M Low
Organic Matter	%	48.5	22.3	446 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	6.3	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	9.8	9.8	V. Low
Respiration Rate/day	C% of Total-C	0.69	0.69	-
Carbon loss per day	% of total weight	0.18	0.08	1.7 lbs/ton
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	83	Slight Phytotoxicity
Lepedium sativum Weight	%	~	49	Low
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: snyx–Project: 605

Date Received : 06/15/2001
Date Reported : 07/17/2001
Lab ID Number : 4985.0

MINERALS ANALYSIS

Sample Identification: NMS Day 105, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.667	1.224	24.5
Organic-Nitrogen	%	2.554	1.173	23.5
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	1123	515	1.0
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Volatile N as % of total-N	w:w	~	0.3	-
Chloride (Cl)	ppm	6841	3140	6.28
Sulfate (SO_4–S)	ppm	3771	1731	3.46

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ssncyvdx Project: 605
Date Received : 07/05/2001
Date Reported : 08/07/2001
Lab ID Number : 5005.0
Quality Checked : WD 8/7/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 125, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	41	1112 lbs/yd^3
Solids	%	100.0	44.8	896 lbs/ton
Moisture	%	0.0	55.2	132 gals/ton
est. water holding capacity	%	182	65	155 gals/ton
Inert and Oversize Matter	%	~	10.7	214.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.08	Med-Ideal
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	4128	1849	Medium
Organic Matter	%	57.2	25.6	512 lbs/ton
Conductivity	mmhos·cm^{-1}	~	8.3	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	12.6	12.6	M. Low
Respiration Rate/day	C% of Total-C	0.45	0.45	-
Carbon loss per day	% of total weight	0.14	0.06	1.2 lbs/ton
Dewar Self-Heating	°C rise	~	6	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	66	Phytotoxic
Lepedium sativum Weight	%	~	83	Excellent
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ssncyvdx-Project: 605
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 07/05/2001
· 44 Beaver Street-8th floor Date Reported : 08/07/2001
· New York NY 10004 Lab ID Number : 5005.0

MINERALS ANALYSIS

Sample Identification: NMS Day 125, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.455	1.100	22.0
Organic-Nitrogen	%	2.252	1.009	20.2
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	287	129	0.3
Nitrate-N	ppm	439	196	0.4
Nitrite-N	ppm	1300	582	-
Chloride (Cl)	ppm	6842	3065	6.13
Sulfate (SO_4–S)	ppm	4990	2235	4.47

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Appendix F

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx Project: 605
Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.0
Quality Checked : WD 9/19/01

COMPOSITION ANALYSIS

Sample Identification: NMS Day 147 WERL Cure (<3/8"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	42	1129 lbs/yd^3
Solids	%	100.0	45.7	914 lbs/ton
Moisture	%	0.0	54.3	130 gals/ton
est. water holding capacity	%	171	63	151 gals/ton
Inert and Oversize Matter	%	~	7.0	140.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.27	Med-Ideal
Free Carbonates (CO_3)	Rating	~	3	V High
Volatile Organic Acids	ppm	656	300	M Low
Organic Matter	%	52.9	24.2	484 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	8.9	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	13.9	13.9	M. Low
Respiration Rate/day	C% of Total-C	0.19	0.19	-
Carbon loss per day	% of total weight	0.05	0.02	0.5 lbs/ton
Dewar Self-Heating	°C rise	~	1	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	103	No Phytotoxicity
Lepedium sativum Weight	%	~	67	Fair
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx–Project: 605

Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.0

MINERALS ANALYSIS

Sample Identification: NMS Day 147 WERL Cure (<3/8"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.063	0.943	18.9
Organic-Nitrogen	%	1.883	0.861	17.2
Phosphorus (P)	%	0.260	0.119	2.4
Potassium (K)	%	0.316	0.144	2.9
Sodium (Na)	%	0.580	0.265	5.3
Calcium (Ca)	%	3.960	1.810	36.2
Magnesium (Mg)	%	0.352	0.161	3.2
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	11	5	0.0
Nitrate-N	ppm	1783	815	1.6
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4811	2199	4.40
Sulfate (SO_4–S)	ppm	3287	1502	3.00

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: CScyvdx–Project: 605
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 07/27/2001
· 44 Beaver Street-8th floor Date Reported : 09/18/2001
· New York NY 10004 Lab ID Number : 5035.0

METALS ANALYSIS

Sample Identification: NMS Day 147 WERL Cure (<3/8"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	164.0	74.9	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	520.0	237.6	0.5
Iron (Fe)	$mg \cdot kg^{-1}$	4640.0	2120.5	4.2
Zinc (Zn)	$mg \cdot kg^{-1}$	468.0	213.9	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	170.0	77.7	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	44.8	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	5.6	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	45.2	-	-
Arsenic (As)	$mg \cdot kg^{-1}$	2.9	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	1.1	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	3.86	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	1.8	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 2	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.9	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

NMS Day 147 WERL Cure (<3/8")
Sample A & Sample B

Woods End® Research Laboratory
INCORPORATED

Certificate of Analysis

Total Metals - Method EPA 6020/200.8

		Analyte	Result	Units	PQL	Method
Sample Name:	5035.0	Arsenic	2.9	mg/Kg	1.0	EPA 6020
Sample Location:		Mercury	1.1	mg/Kg	0.1	EPA 7471A
Sampling Date:	8/6/2001	Molybdenum	3.86	mg/Kg	1.0	EPA 6020
Sampling Time:	14:00	Selenium	1.8	mg/Kg	1.0	EPA 6020
Date Received:	8/7/2001	Boron	27.2	mg/Kg	10.0	EPA 6020
Lab #:	01X0935-01	Cobalt	3.4	mg/Kg	1.0	EPA 6020
Matrix:	SOIL					
Analysis Date:	8/15/2001					
% Solid:	67.9					

		Analyte	Result	Units	PQL	Method
Sample Name:	5035.1	Arsenic	2.9	mg/Kg	1.0	EPA 6020
Sample Location:		Mercury	1.1	mg/Kg	0.1	EPA 7471A
Sampling Date:	8/6/2001	Molybdenum	4.56	mg/Kg	1.0	EPA 6020
Sampling Time:	14:00	Selenium	1.5	mg/Kg	1.0	EPA 6020
Date Received:	8/7/2001	Boron	29.2	mg/Kg	10.0	EPA 6020
Lab #:	01X0935-02	Cobalt	3.8	mg/Kg	1.0	EPA 6020
Matrix:	SOIL					
Analysis Date:	8/15/2001					
% Solid:	67.7					

ND Not Detected PQL Practical Quantitation Limit Metals Report

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Code: CScyvdx Project: 605
Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.1
Quality Checked : WD 9/19/01

COMPOSITION ANALYSIS

Sample Identification: Day 147 WERL Cure (<3/8"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	39	1062 lbs/yd^3
Solids	%	100.0	50.3	1006 lbs/ton
Moisture	%	0.0	49.7	119 gals/ton
est. water holding capacity	%	173	63	152 gals/ton
Inert and Oversize Matter	%	~	5.3	106.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.32	Med-Ideal
Free Carbonates (CO_3)	Rating	~	3	V High
Volatile Organic Acids	ppm	596	300	M Low
Organic Matter	%	53.7	27.0	540 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	806.0	V. High
Carbon:Nitrogen (C:N) Ratio	w:w	12.0	12.0	M. Low
Respiration Rate/day	C% of Total-C	0.22	0.22	-
Carbon loss per day	% of total weight	0.06	0.03	0.7 lbs/ton
Dewar Self-Heating	°C rise	~	1	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	103	No Phytotoxicity
Lepedium sativum Weight	%	~	69	Fair
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx–Project: 605

Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.1

MINERALS ANALYSIS

Sample Identification: NMS Day 147 WERL Cure (<3/8"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.408	1.211	24.2
Organic-Nitrogen	%	2.215	1.114	22.3
Phosphorus (P)	%	0.192	0.097	1.9
Potassium (K)	%	0.292	0.147	2.9
Sodium (Na)	%	0.500	0.252	5.0
Calcium (Ca)	%	3.800	1.911	38.2
Magnesium (Mg)	%	0.292	0.147	2.9
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	10	5	0.0
Nitrate-N	ppm	1919	965	1.9
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4936	2483	4.97
Sulfate (SO_4–S)	ppm	3667	1845	3.69

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: CScyvdx-Project: 605
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 07/27/2001
Date Reported : 09/18/2001
Lab ID Number : 5035.1

METALS ANALYSIS

Sample Identification: NMS Day 147 WERL Cure (<3/8"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	148.0	74.4	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	520.0	261.6	0.5
Iron (Fe)	$mg \cdot kg^{-1}$	3880.0	1951.6	3.9
Zinc (Zn)	$mg \cdot kg^{-1}$	460.0	231.4	0.5
Lead (Pb)	$mg \cdot kg^{-1}$	181.6	91.3	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	44.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	4.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	44.0	-	-
Arsenic (As)	$mg \cdot kg^{-1}$	2.9	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	1.1	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	4.56	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	1.5	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 2	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.6	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: 605

Date Received : 05/21/2001
Date Reported : 07/02/2001
Lab ID Number : 4958.0

SUPPLEMENTAL ANALYSIS

Sample Identification: NMS Day 80, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
.... **BACTERIOLOGIC ANALYSIS**				
Fecal coliform EPA503	MPN per g	50	-	
Total *Salmonella* EPA503 ..	MPN per 4g	< 0.2	-	

Notes: mg·kg^{-1} = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Appendix F

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ssncyvdx–Project: 605

Date Received : 07/05/2001
Date Reported : 08/07/2001
Lab ID Number : 5005.0

SUPPLEMENTAL ANALYSIS

Sample Identification: NMS Day 125, WERL Cure

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 4.3	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.7	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End® Research Laboratory
INCORPORATED

NMS Day 21, Sample A

Sample Matrix: COMPOST
Sample Description: 4888.0
Sample Type: Unknown

Parameter	Result	Unit	Detection Limit	Method	Preparation Date	Analysis Date	Analyst
PCB in solids						04/10/01	
TCMX	102	%	40	EPA 8082	04/04/01	04/10/01	KAP
DCB (Surrogate)	98	%	40	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1016	Not Detected	mg/Kg	1.2	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1221	Not Detected	mg/Kg	1.2	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1232	Not Detected	mg/Kg	1.2	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1242	Not Detected	mg/Kg	1.2	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1248	Not Detected	mg/Kg	1.2	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1254	Not Detected	mg/Kg	1.2	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1260	Not Detected	mg/Kg	1.2	EPA 8082	04/04/01	04/10/01	KAP
Arsenic Total	<4.4	mg/Kg	4.4	EPA 6010B	04/11/01	04/12/01	MRB
Fecal Coliform 503 MPN	4.2	MPN/g DW	4.2	SM9221E.1	03/31/01		BAG
Mercury Total	0.98	mg/Kg	0.02	EPA 7471A	04/05/01	04/05/01	BW
Molybdenum Total	20	mg/Kg	11	EPA 6010B	04/11/01	04/12/01	MRB
Salmonella 503 MPN	<1.7	MPN/4g DW	1.7	SM9260D.1	03/31/01		BAG
Selenium Total	17	mg/Kg	9.2	EPA 6010B	04/11/01	04/12/01	MRB
Solids, Percent	48	%	0.01	SM 2540G	04/06/01	04/06/01	CAH

Comments:

Duplicate Confirmation

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

Woods End® Research Laboratory INCORPORATED

NMS Day 21, Sample B

Sample Matrix: COMPOST
Sample Description: 4888.1
Sample Type: Unknown

Parameter	Result	Unit	Detection Limit	Method	Preparation Date	Analysis Date	Analyst
PCB in solids						04/10/01	
DCB (Surrogate)	86	%	40	EPA 8082	04/04/01	04/10/01	KAP
TCMX	92	%	40	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1016	Not Detected	mg/Kg	1.3	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1221	Not Detected	mg/Kg	1.3	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1232	Not Detected	mg/Kg	1.3	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1242	Not Detected	mg/Kg	1.3	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1248	Not Detected	mg/Kg	1.3	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1254	Not Detected	mg/Kg	1.3	EPA 8082	04/04/01	04/10/01	KAP
AROCLOR 1260	Not Detected	mg/Kg	1.3	EPA 8082	04/04/01	04/10/01	KAP
Arsenic Total	<4.1	mg/Kg	4.1	EPA 6010B	04/11/01	04/12/01	MRB
Fecal Coliform 503 MPN	60	MPN/g DW	4.0	SM9221E.1	03/31/01		BAG
Mercury Total	0.79	mg/Kg	0.02	EPA 7471A	04/05/01	04/05/01	BW
Molybdenum Total	20	mg/Kg	10	EPA 6010B	04/11/01	04/12/01	MRB
Salmonella 503 MPN	<1.6	MPN/4g DW	1.6	SM9260D.1	03/31/01		BAG
Selenium Total	13	mg/Kg	8.5	EPA 6010B	04/11/01	04/12/01	MRB
Solids, Percent	50	%	0.01	SM 2540G	04/06/01	04/06/01	CAH

Comments:

Duplicate Confirmation

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

NMS Day 147 WERL Cure (<3/8")
Sample A & Sample B

Woods End® Research Laboratory INCORPORATED

Certificate of Analysis

PCB's Method EPA 8082

		Analyte	Result	Units	PQL
Sample:	5035.0	PCB 1242	ND	mg/Kg	0.2
Collect Date:	8/6/2001	PCB 1254	ND	mg/Kg	0.2
Date Received:	8/7/2001	PCB 1232	ND	mg/Kg	0.2
Lab Sample #	01X0935-01	PCB 1260	ND	mg/Kg	0.2
Date Analyzed	8/13/2001	PCB 1248	ND	mg/Kg	0.2
Date Extracted	8/8/2001	PCB 1016	ND	mg/Kg	0.2
Surrogate(DCB) % Recovery	55.5 AR 30-150	PCB 1221	ND	mg/Kg	0.2
g Sample Extracted	Percent Solids 67.9				
Wt Basis	Dry wt Basis				

		Analyte	Result	Units	PQL
Sample:	5035.1	PCB 1242	ND	mg/Kg	0.2
Collect Date:	8/6/2001	PCB 1254	ND	mg/Kg	0.2
Date Received:	8/7/2001	PCB 1232	ND	mg/Kg	0.2
Lab Sample #	01X0935-02	PCB 1260	ND	mg/Kg	0.2
Date Analyzed	8/13/2001	PCB 1248	ND	mg/Kg	0.2
Date Extracted	8/8/2001	PCB 1016	ND	mg/Kg	0.2
Surrogate(DCB) % Recovery	56.3 AR 30-150	PCB 1221	ND	mg/Kg	0.2
g Sample Extracted	Percent Solids 67.7				
Wt Basis	Dry wt Basis				

PQL Practical Quantitation Limit

ND Not Detected (<PQL)

PCB Report

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

NMS Primary Screen Overs (>2") Day 1-3, Sample A [#4856.2]

NMS Primary Screen Unders (<2") Day 1-3, Sample A& B [#4856.4 & #4856.5]

Woods End® Research Laboratory INCORPORATED

Certificate of Analysis

TCLP Metals - Method EPA 1311, 6020,7470A

Sample Name:	4856.2	**Analyte**	**Result**	**Units**	**PQL**	**EPA MCL**
Sample Location:	COMPOST	TCLP Arsenic	ND	ppm	0.05	5.0
Sampling Date:	4/16/2001	TCLP Barium	0.36	ppm	0.05	100
Sampling Time:	12:00	TCLP Cadmium	ND	ppm	0.05	1.0
Date Received:	4/18/2001	TCLP Chromium	0.05	ppm	0.05	5.0
Lab #:	01X0366-01	TCLP Mercury	ND	ppm	0.01	0.2
Matrix:	SOIL	TCLP Lead	0.13	ppm	0.05	5.0
Analysis Date:	4/20/2001	TCLP Selenium	ND	ppm	0.05	1.0
		TCLP Silver	ND	ppm	0.05	5.0

Sample Name:	4856.4	**Analyte**	**Result**	**Units**	**PQL**	**EPA MCL**
Sample Location:	COMPOST	TCLP Arsenic	ND	ppm	0.05	5.0
Sampling Date:	4/16/2001	TCLP Barium	0.42	ppm	0.05	100
Sampling Time:	12:00	TCLP Cadmium	ND	ppm	0.05	1.0
Date Received:	4/18/2001	TCLP Chromium	0.09	ppm	0.05	5.0
Lab #:	01X0366-02	TCLP Mercury	ND	ppm	0.01	0.2
Matrix:	SOIL	TCLP Lead	0.10	ppm	0.05	5.0
Analysis Date:	4/20/2001	TCLP Selenium	ND	ppm	0.05	1.0
		TCLP Silver	ND	ppm	0.05	5.0

Sample Name:	4856.5	**Analyte**	**Result**	**Units**	**PQL**	**EPA MCL**
Sample Location:	COMPOST	TCLP Arsenic	ND	ppm	0.05	5.0
Sampling Date:	4/16/2001	TCLP Barium	0.44	ppm	0.05	100
Sampling Time:	12:00	TCLP Cadmium	ND	ppm	0.05	1.0
Date Received:	4/18/2001	TCLP Chromium	0.10	ppm	0.05	5.0
Lab #:	01X0366-03	TCLP Mercury	ND	ppm	0.01	0.2
Matrix:	SOIL	TCLP Lead	0.08	ppm	0.05	5.0
Analysis Date:	4/20/2001	TCLP Selenium	ND	ppm	0.05	1.0
		TCLP Silver	ND	ppm	0.05	5.0

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

NMS Primary Screen Overs (>2") Day 3-5, Sample A [#4858.0]

NMS Primary Screen Unders (<2") Day 3-5, Sample A & B [#4858.2 & #4858.3]

Woods End® Research Laboratory

INCORPORATED

Certificate of Analysis

TCLP Metals - Method EPA 1311, 6020,7470A

Sample Name:	4858.0	Analyte	Result	Units	PQL	EPA MCL
Sample Location:	COMPOST	TCLP Arsenic	ND	ppm	0.05	5.0
Sampling Date:	4/16/2001	TCLP Barium	0.26	ppm	0.05	100
Sampling Time:	12:00	TCLP Cadmium	ND	ppm	0.05	1.0
Date Received:	4/18/2001	TCLP Chromium	ND	ppm	0.05	5.0
Lab #:	01X0366-04	TCLP Mercury	ND	ppm	0.01	0.2
Matrix:	SOIL	TCLP Lead	ND	ppm	0.05	5.0
Analysis Date:	4/20/2001	TCLP Selenium	ND	ppm	0.05	1.0
		TCLP Silver	ND	ppm	0.05	5.0

Sample Name:	4858.2	Analyte	Result	Units	PQL	EPA MCL
Sample Location:	COMPOST	TCLP Arsenic	ND	ppm	0.05	5.0
Sampling Date:	4/16/2001	TCLP Barium	0.44	ppm	0.05	100
Sampling Time:	12:00	TCLP Cadmium	ND	ppm	0.05	1.0
Date Received:	4/18/2001	TCLP Chromium	0.05	ppm	0.05	5.0
Lab #:	01X0366-05	TCLP Mercury	ND	ppm	0.01	0.2
Matrix:	SOIL	TCLP Lead	ND	ppm	0.05	5.0
Analysis Date:	4/20/2001	TCLP Selenium	ND	ppm	0.05	1.0
		TCLP Silver	ND	ppm	0.05	5.0

Sample Name:	4858.3	Analyte	Result	Units	PQL	EPA MCL
Sample Location:	COMPOST	TCLP Arsenic	ND	ppm	0.05	5.0
Sampling Date:	4/16/2001	TCLP Barium	0.46	ppm	0.05	100
Sampling Time:	12:00	TCLP Cadmium	ND	ppm	0.05	1.0
Date Received:	4/18/2001	TCLP Chromium	0.06	ppm	0.05	5.0
Lab #:	01X0366-06	TCLP Mercury	ND	ppm	0.01	0.2
Matrix:	SOIL	TCLP Lead	ND	ppm	0.05	5.0
Analysis Date:	4/20/2001	TCLP Selenium	ND	ppm	0.05	1.0
		TCLP Silver	ND	ppm	0.05	5.0

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: n/a
Date Received : 04/06/2001
Date Reported : 05/17/2001
Lab ID Number : 4905.0
Quality Checked : WD 5/17/01

TCLP METALS ANALYSIS

Sample Identification: NMS Half-Inch Overs (>1/2")

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
TCLP Arsenic	$mg \cdot kg^{-1}$	ND	–	–
TCLP Barium	$mg \cdot kg^{-1}$	0.65	–	–
TCLP Cadmium	$mg \cdot kg^{-1}$	ND	–	–
TCLP Chromium	$mg \cdot kg^{-1}$	ND	–	–
TCLP Mercury	$mg \cdot kg^{-1}$	ND	–	–
TCLP Lead	$mg \cdot kg^{-1}$	0.07	–	–
TCLP Selenium	$mg \cdot kg^{-1}$	ND	–	–
TCLP Silver	$mg \cdot kg^{-1}$	ND	–	–

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: n/a
Date Received : 04/10/2001
Date Reported : 05/17/2001
Lab ID Number : 4907.0
Quality Checked : WO 5/17/01

TCLP METALS ANALYSIS

Sample Identification: NMS Final Facility 3/8" 'Overs' Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
TCLP Arsenic	$mg \cdot kg^{-1}$	ND	–	–
TCLP Barium	$mg \cdot kg^{-1}$	0.63	–	–
TCLP Cadmium	$mg \cdot kg^{-1}$	ND	–	–
TCLP Chromium	$mg \cdot kg^{-1}$	0.05	–	–
TCLP Mercury	$mg \cdot kg^{-1}$	ND	–	–
TCLP Lead	$mg \cdot kg^{-1}$	ND	–	–
TCLP Selenium	$mg \cdot kg^{-1}$	ND	–	–
TCLP Silver	$mg \cdot kg^{-1}$	ND	–	–

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· Robert LaValva
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: n/a
Date Received : 04/10/2001
Date Reported : 05/17/2001
Lab ID Number : 4907.1
Quality Checked : WD 5/17/01

TCLP METALS ANALYSIS

Sample Identification: NMS Final Facility 3/8" 'Overs', Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
TCLP Arsenic	$mg \cdot kg^{-1}$	ND	–	–
TCLP Barium	$mg \cdot kg^{-1}$	0.58	–	–
TCLP Cadmium	$mg \cdot kg^{-1}$	ND	–	–
TCLP Chromium	$mg \cdot kg^{-1}$	0.06	–	–
TCLP Mercury	$mg \cdot kg^{-1}$	ND	–	–
TCLP Lead	$mg \cdot kg^{-1}$	0.06	–	–
TCLP Selenium	$mg \cdot kg^{-1}$	ND	–	–
TCLP Silver	$mg \cdot kg^{-1}$	ND	–	–

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

NMS Day 147 WERL Cure Overs (>3/8")

Woods End® Research Laboratory INCORPORATED

Certificate of Analysis

TCLP Metals - Method EPA 1311, 6020,7470A

Sample Name:	5035.4
Sample Location:	
Sampling Date:	8/6/2001
Sampling Time:	14:00
Date Received:	8/7/2001
Lab #:	01X0935-05
Matrix:	SOIL
Analysis Date:	8/13/2001

Analyte	Result	Units	PQL	EPA MCL
TCLP Arsenic	ND	ppm	0.05	5.0
TCLP Barium	0.48	ppm	0.05	100
TCLP Cadmium	ND	ppm	0.05	1.0
TCLP Chromium	ND	ppm	0.05	5.0
TCLP Mercury	ND	ppm	0.01	0.2
TCLP Lead	ND	ppm	0.05	5.0
TCLP Selenium	ND	ppm	0.05	1.0
TCLP Silver	ND	ppm	0.05	5.0

Lab Supervisor: Wayne Davis

Report Date: 04-Sep-01

ND Not Detected PQL Practical Quantitation Limit
MCL Maximum Contaminant Level

TCLP Metals Report

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

Woods End Research Laboratory, Inc.

20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *8-Oct-01*
Project: 605
Acct# 556
Initials EE
Ref:

Lab No: 4856.2, -.3 Description: NMS Primary Screen Overs (>2"), Sample A

FRACTION: **Over 0.25 "**	LAB SORT	percent of whole
Glass	42	0.2%
Plastic-Hard	3637	18.1%
Plastic-Film	5450	27.2%
Metal	1034	5.2%
Textile, fibers	5512	27.5%
Paper	200	1.0%
Wood	691	3.4%
Stones	1	0.0%
Food, bone, shell	181	0.9%
Under 0.25 "	3303	16.5%
TOTAL WEIGHT	20051	100.0%

Lab No: 4858.0, -1 Description: NMS Primary Screen Overs (>2"), Sample B

FRACTION: **Over 0.25 "**	LAB SORT	percent of whole
Glass	120	0.5%
Plastic-Hard	2741	10.3%
Plastic-Film	11450	43.1%
Metal	983	3.7%
Textile, fibers	7378	27.8%
Paper	0	0.0%
Wood	1542	5.8%
Stones	40	0.2%
Food, bone, shell	5	0.0%
Under 0.25 "	2300	8.7%
TOTAL WEIGHT	26559	100.0%

10-08-01

Printed:

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *8-Oct-01*
Project: 605
Acct# 556

Initials EE
Ref:

Lab No: 4905.0 Description: NMS Half-Inch Overs (>1/2")

FRACTION: **Over 0.25 "**	**LAB SORT**	**percent of whole**
Glass	193	11.3%
Plastic-Hard	316	18.6%
Plastic-Film	374	22.0%
Metal	94	5.5%
Textile, fibers	59	3.5%
Paper	0	0.0%
Wood	40	2.4%
Stones	167	9.8%
Food	28	1.6%
Bone, shell, seeds	0	0.0%
Under 0.25 "	430	25.3%
TOTAL WEIGHT	1701	100.0%

Lab No: 4910.0 Description: NMS Half-Inch Unders (<1/2")

FRACTION: **Over 0.25 "**	**LAB SORT**	**percent of whole**
Glass	5	0.6%
Plastic-Hard	2	0.3%
Plastic-Film	4	0.4%
Metal	1	0.1%
Textile, fibers	4	0.5%
Paper	1	0.2%
Wood	1	0.1%
Stones	1	0.1%
Food	2	0.2%
Bone, shell, seeds	0	0.0%
Under 0.25 "	865	97.6%
TOTAL WEIGHT	886	100.0%

Printed: 10-08-01

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *27-Jul-01*
Project: 605
Acct# 556
Initials EE
Ref:

Lab No: **4907.2** **Description:** NMS Final Screen Unders (<3/8"), Sample A

Weight In, g: 911 0.55

FRACTION: Over 10mm	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.0	0.0	0.00%	0.0%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	0.0	0.0	0.00%	0.0%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	0.0	0.0	0.0%	0.0%

Total Man-made Inerts Matter = 0.0%

Weight In, g: 911.10

FRACTION: Under 10mm	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	1.0	1.0	0.20%	0.2%
Plastic-Film	0.4	0.4	0.08%	0.1%
Metal	0.1	0.1	0.02%	0.0%
Textile, fibers	2.1	1.2	0.23%	0.2%
Paper	2.9	1.6	0.32%	0.3%
Wood	0.5	0.3	0.05%	0.1%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.1	0.1	0.01%	0.0%
Compost + Fines	904.0	497.2	99.09%	99.1%
TOTAL WEIGHT	911.1	501.8	100.0%	100.0%

> 4mm

Total Man-made Inerts Matter = 0.5%

Printed: 10-19-01

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *27-Jul-01*
Project: 605
Acct# 556

Initials ЄЄ
Ref:

Lab No: **4907.3** **Description:** NMS Final Screen Unders (<3/8"), Sample B

Weight In, g: 686.00 0.55

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.0	0.0	0.00%	0.0%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	0.0	0.0	0.00%	0.0%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	0.0	0.0	0.0%	0.0%

Total Man-made Inerts Matter = 0.0%

Weight In, g: 665.80

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.7	0.7	0.19%	0.2%
Plastic-Film	0.2	0.2	0.05%	0.1%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	1.6	0.9	0.24%	0.2%
Paper	2.2	1.2	0.33%	0.3%
Wood	0.1	0.1	0.02%	0.0%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost + Fines	661.0	363.6	99.17%	99.2%
TOTAL WEIGHT	665.8	366.6	100.0%	100.0%

> 4mm

Total Man-made Inerts Matter = 0.5%

Printed: 10-19-01

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *10-Apr-01*
Project: 605
Acct# 556
Initials ЄЄ
Ref:

Lab No: 4907.0 Description: NMS Final Facility Overs (>3/8"), Sample A

FRACTION: **Over 0.25 "**	**LAB SORT**	**dry weight, grams**	**percent, dry basis**
Glass	103	103	17.6%
Plastic-Hard	14	14	2.4%
Plastic-Film	0	0	0.0%
Metal	5	5	0.9%
Textile, fibers	248	114	19.5%
Paper	0	0	0.0%
Wood	9	4	0.7%
Stones	14	6	1.1%
Food	0	0	0.0%
Bone, shell, seeds	0	0	0.0%
Under 0.25 "	738	339	

Total Man-made Inerts > 1/4" = 40.3%

Lab No: 4907.1 Description: NMS Final Facility Overs (>3/8"), Sample B

FRACTION: **Over 0.25 "**	**LAB SORT**	**dry weight, grams**	**percent, dry basis**
Glass	68	68	15.6%
Plastic-Hard	6	6	1.4%
Plastic-Film	0	0	0.0%
Metal	0	0	0.0%
Textile, fibers	128	59	13.6%
Paper	0	0	0.0%
Wood	0	0	0.0%
Stones	10	10	2.3%
Food	0	0	0.0%
Bone, shell, seeds	0	0	0.0%
Under 0.25 "	634	292	

Total Man-made Inerts > 1/4" = 30.6%

Printed: 10-22-01

Woods End Research Laboratory, Inc.

20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *9-Oct-01*
Project: 610
Acct# 556

Initials EE
Ref:

Lab No: **5119.0** **Description:** NYC Leaf Compost A

Weight In, g: 1043	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
FRACTION: **Over 10mm**				
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.0	0.0	0.00%	0.0%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	7.8	3.5	0.37%	7.5%
Stones	43.6	43.6	4.56%	92.5%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	51.4	47.1	4.9%	100.0%

Total Man-made Inerts Matter = 0.0%

Weight In, g: 1042.37	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm, dry basis
FRACTION: **Under 10mm'**				
Glass	1.0	1.0	0.20%	0.2%
Plastic-Hard	1.0	1.0	0.20%	0.2%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	58.0	26.1	5.11%	5.4%
Stones	70.0	70.0	13.71%	14.4%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost + Fines	861.0	387.5	75.86%	79.8%
TOTAL WEIGHT	991.0	485.6	95.1%	100.0%

> 4mm

Total Man-made Inerts Matter = 0.4%

Printed: 10-23-01

Woods End Research Laboratory, Inc.

20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *9-Oct-01*
Project: 610
Acct# 556
Initials EE
Ref:

Lab No: **5119.1** **Description:** NYC Leaf Compost B

Weight In, g: 1309

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	1.6	1.6	0.14%	4.0%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	10.0	4.5	0.39%	11.2%
Stones	34.0	34.0	2.95%	84.8%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	45.6	40.1	3.5%	100.0%

Total Man-made Inerts Matter = 4.0%

Weight In, g: 774.27

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.2	0.2	0.05%	0.1%
Plastic-Film	0.1	0.1	0.03%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	35.0	15.8	4.12%	4.3%
Stones	59.0	59.0	15.44%	16.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost + Fines	653.0	293.9	76.88%	79.7%
TOTAL WEIGHT	747.3	368.9	96.5%	100.0%

> 4mm

Total Man-made Inerts Matter = 0.1%

Printed: 10-23-01

New York City MSW Composting Report

Appendix G
Interpretation of Waste and Compost Tests

Woods End Research Laboratory, Inc.

Woods End Research Laboratory INCORPORATED

INTERPRETATION OF WASTE & COMPOST TESTS

Woods End Research Laboratory

SOLIDS / MOISTURE: There is no absolute moisture level which is ideal for manure, composts or waste products. Ideal moisture is relative to processing goals and to the sample's water holding capacity (WHC). The Woods End report gives WHC% on a dry and as is basis. Optimal biological activity in compost occurs at 60 – 80% saturation of WHC. The "squeeze-test" for moisture when done carefully reflects accurately the relative relationship of water to the sample's water holding capacity. Thus, a low organic matter material (i.e. 30% OM), is adequately wet at 30 to 40% moisture. A high organic sample, typical of a fresh compost mix, will require from 45 to 65% to be ideally moistened.

Water holding capacity diminishes during biodegradation, due to loss of organic content, and thus the ideal level of moisture will likewise diminish, often significantly.

pH and **Carbonates**: The pH of any material must be interpreted in view of the origin and the intended use. Lime-treated wastes normally have moderately to very high pH. In conjunction with elevated pH, free lime (carbonates) may be present and are reported on a scale of low, med and high. The significance of pH and presence of carbonates is frequently underestimated. Ideally, the pH of any product, particularly compost, should be neutral to slightly acid (6.0 – 7.5) and efforts should be made to control it if it exceeds about 8.5. Lowering a high pH will help lower ammonia volatilization and reduce odors, as it will also favor a balanced microbial population. In potting soils, pH adjustment is important for reasons of healthy plant growth.

ORGANIC MATTER / Volatile Solids : Organic matter is reported in terms of total OM (weight loss on ignition minus total nitrogen). Volatile solids are normally simply reported from weight loss. There is no absolute level of organic matter which is ideal, rather the quantities must be viewed in relation to the age of a material, its nitrogen content, and its intended use. It is useful for purposes of composting to report the initial OM and contrast it with OM determined periodically at later points. This gives an idea of the extent of decomposition. Organic matter may be lower than expected because of incorporation of soil or sand. The OM test forms the basis for determining the sample's C:N ratio (see later). Conversion to organic carbon is based on the factor OM x 0.54 and is based on actual correlation analyses.

NITROGEN: total-Kjeldahl-N, organic-N, ammonium, nitrate, nitrite: The quantity and form of nitrogen present in manure or compost is important in shaping the material's quality. In the Woods End test, you will notice several entries for nitrogen. For mature compost, it is desirable that most of the nitrogen be organic, and that the ammonia fraction be small. In advanced composting we expect to see nitrate generation. If this is not evident by test, it may indicate insufficient oxygen causing gaseous loss by denitrification, a high pH causing inhibition of nitrifying microorganisms, or other factors which are generally discussed. We report the percent of total nitrogen which is found to be immediately soluble, useful where fertilization is concerned. Also reported is the amount of nitrogen which is immediately volatile as ammonia vapor, i.e. which is subject to loss if the material is surface spread, or otherwise mistreated. Values exceeding 15% are considered to be high. Volatility of ammonia is determined by pH, so if you have a medium to low pH you need not worry about the ammonia losses. Concerning nitrogen release over the season, one should estimate this by considering the climate and the sample's intrinsic rate of decomposition (for example, as determined in our respiration test). Using either one of the two factors alone to judge the amount of nitrogen release may prove misleading. Our research indicates that nitrogen release from similar manures applied to the same soil may vary from as little as 20% up to 75% of total-N.

CARBON:NITROGEN RATIO: It is customary to use C:N figures to assess the rate of decomposition of compost mixtures. If we know that a material has undergone composting, C:N ratios may accurately reflect when ripeness has been reached. However, caution is necessary before taking any actions based on the C:N figures alone. One must consider that not all the total carbon is actually available for microbial use. Or, if nitrogen is lost, C:N ratios may go up not down during late stages of composting. C:N values must be weighed against observed decomposition traits. Compost may be considered finished anywhere around a C:N of 17 or less, unless coarse woody material remains.

MINERALS- Phosphorus, Potassium, Calcium, Magnesium, Sodium, Chloride, Sulfate: These minerals are reported in their total rather than available forms. The amounts actually available will be an unknown but generally significant fraction. In the case of potassium and sodium experience has shown that more than 80% of the total is likely to be immediately available, whereas with phosphorus, calcium and magnesium the availability will range from as little as 25% up to about 75%. More P, Ca and Mg are available under acidic soil conditions. An optional test can be performed to determine the official amount of available P. For estimating the amount of nutrients available the first season, we suggest you take 50% of the P, Ca and Mg figures and 85% of the K and Na figures.

SALINITY, ELECTRICAL CONDUCTIVITY: Soluble salt level (salinity) in a sample is estimated based on measurement of the electrical conductivity of a saturated paste. Components contributing most to salinity are sodium, potassium, chloride, nitrate, sulfate, ammonia, and VOA. Low levels are expected for potting composts (<2) whereas in the case of fresh composts the values may be acceptable in the range of from 3 –10, and higher, depending on use. Low values will indicate a lack of available minerals, while high values indicating a large amount of soluble minerals may inhibit biological activity or cause problems with land application if large quantities of the material are used. The units of conductivity in the report is the traditional mmhos/cm, which is equivalent to dS/m or dS m^{-1}.

Evaluation of SALINTY in Compost Tests, mmhos/ cm				
< 1.0	1 - 2	2 - 5	5 - 10	> 10
V - LOW may be used as direct substitute for soils	M - LOW topsoil substitute, container media	MEDIUM dilute 2- to 5-fold for most applications	M - HIGH dilute 3- to 10-fold for most applications	V - HIGH use only at low application rates

INERT CONTENT: Materials that do not contribute to compost activity are excluded from all analyses (except fresh density --- see below) and shown in the report as *inert of oversized matter.* This category includes man-mades such as metals, plastic, glass, and tar greater than 1/8", and stones and wood greater than 1/4".

DENSITY: Woods End measures density on the sample as it is received, at a packing pressure simulating a pile depth of four feet. The result is reported in lbs/cu.ft, and lbs/cu.yd. The fresh density of compost gives a good indication of *porosity*, which determines the rate that air and oxygen can move through a pile, either by natural or mechanical ventilation or by diffusion. Active compost should have a porosity—*i.e.* percent air volume— of 40-60% to ensure adequate oxygenation, also depending on pile size, oxygen demand rate, and means of ventilation. Porosity of most compost can be estimated from the reported density according to the following table:

Density lbs/cu.yd.	400	750	1100	1450	1800
Porosity, % Air Volume	80	60	40	20	0

RESPIRATION RATE: (Carbon-Dioxide Evolution): This test contributes to understanding stability and maturity from a microbiological basis. Woods End reports decomposition in two ways. The carbon evolved *in relation to total carbon* indicates freshness or stability of organic matter (see table below). The total quantity of carbon evolution *in relation to wet weight* indicates the potential for self-heating and weight/volume reduction. Both results must be taken into account in order to properly understand compost condition and behavior. The actual procedure is based on capturing carbon-dioxide in lab incubation (after a 24-hr equilibration period) at 34°C. Samples that are received dry are re-moistened to the ideal range before the test is performed.

	STABILITY OF ORGANIC MATTER				
Relative Stability	High	Med - High	Medium	Med - Low	V - Low
C-loss,% of Total C	< 0.2	0.2 — 0.8	0.8 — 1.5	1.5 — 2.5	> 2.5
mg CO_2-C / g VS	< 1.0	1 -- 4	4 -- 8	8 -- 13	> 13
Self-Heating Potential	V-Low	Low	Medium	High	V-High

Interpretation of stability is based on Woods End's own extensive research. Interpretation of self-heating is based on correlation trials between compost and its actual heating, seen in the following table and figure. Stability results from advanced humification acting to reduce the rate of decomposition. Self-heating is dependent on rate of decomposition in relation to the total quantity or mass. If the content of organic matter is high enough, (or if the pile is too large), even a low relative rate can still translate into some heating and oxygen deprivation.

DEWAR SELF-HEATING TEST: The self-heating test is based on a European method for determining "compost ripeness". The test utilizes a special 1-liter Dewar vessel filled with a compost moistened to ideal moisture for the test. The Dewar test is currently listed as a stability/maturity procedure in several states. The Dewar method gives information that differs from other stability tests. It allows for positive feedback during because compost may generate enough respiration to heat up, and when it heats the respiration increases as a function of temperature. With the Dewar test, the highest temperature achieved within a 3-7 days period is recorded and used to rate the stability based on a scoring chart. The Dewar test is not as sensitive to immaturity as is a respiration or Solvita test.

MAX TEMP RISE over ambient	CLASS OF STABILITY	DESCRIPTION OF STABILITY	SELF-HEATING POTENTIAL	TYPE
0 – 10°C	V	Mature to very mature compost	V-Low	Finished
10 – 20°	IV	Curing compost	Low	Curing
20 – 30°	III	Moderately active, immature	Medium	Active Compost
30 – 40°	II	Very active, unstable compost	M-High	
40 – 50°	I	Fresh, raw compost!	High	Raw Feedstock

HEAVY METALS: Heavy metals are regulated in certain types of waste, including bio-solids or composts derived from operations that exceed certain minimum annual tonnage limits (consult your state rules). To evaluate the significance of the levels of metals in any material, it is important to understand both the concentration in the sample *and* the loading rate to soil. In other western countries, the final soil concentration is also regulated.
The federal EPA503 rule establishes acceptable levels and loading rates for sludge (biosolids) compost where more stringent state rules do not already apply. The following table gives the guidelines. For all other composts (and raw wastes), the EPA 503 levels are often used by individual states. European countries have metal limits for horticultural use which are considerably stricter than EPA biosolids rules and are generally used by all composters and universally applied by organic growers. These levels are also shown in the following table. Certification under Woods End's QSAP program also requires achieving European metal limits in contrast to the EPA limits.

HEAVY METALS: Allowed Concentrations in Biosolids and Composts.

ELEMENT	SYM-BOL	EPA Sludge Rule Max. Allowed Conc. of Pollutant mg/kg (pre-1993) — 503		EPA Max Annual Loading Rate, kg/ha — lb/a		Woods End QSAP and European Maximum Limits, ppm
Arsenic	As	10	41	2.0	1.8	n/a — n/a
Cadmium	Cd	10	39	1.9	1.7	2.0
Chromium	Cr	1000	1200	150	134	100
Copper	Cu	1000	1500	75	67	100
Lead	Pb	700	300	15	13	150
Mercury	Hg	10	17	0.85	0.76	0.5
Nickel	Ni	200	420	21	19	50
Zinc	Zn	2000	2800	140	125	400
Boron	B	300*	300*	6	4*	300
Molybdenum	Mo	-	18	0.90	0.80	10
Selenium	Se	36	36	5.0	4.5	25

VOLATILE ORGANIC ACIDS (VOA): The presence of volatile organic acids such as acetic, butyric, propionic and lactic is an indicator of partial anaerobic fermentation and instability in so far as composting is concerned. Woods End has adapted the test to interpretation of composting efficiency and potential phytotoxicity. A compost may be immature and not contain appreciable VOA, yet it is unusual that a mature compost should have appreciable VOA. VOAs are moderately odorous and are responsible for a considerable amount of nuisance complaints at composting operations. In addition, VOAs are largely responsible for phytotoxicity (plant-seedling toxicity). For compost quality interpretation, the following levels are suggested by Woods End:

VOA Rating	V-Low	Med-Low	Medium	High	V-High
VOA, ppm (dry)	< 200	200-1,000	1,000-4,000	4,000-10,000	>10,000

PHYTOTOXICITY and Seedling Growth Response: Phytotoxicity or poor plant response can result from several factors including high amounts of heavy metals, oxygen demand, salts, ammonia, and volatile organic acids. With compost materials it is generally the latter three which trigger a toxicity to plants. The importance of the phytotoxicity tests using actual plants as opposed to mere interpretation of analytical data is that the plant tests do not always necessarily correlate with quantitative lab tests which may not clearly indicate a potential for phytotoxicity. Furthermore, the application of composts to soils and for potting-mix formulation requires verified absence of toxicity factors. Woods End has standardized a phytotoxicity procedure using cress and wheat seedlings in a blended peat based mix. Germination rate and seedling weight are reported as a percent of the control (Pro-Mix BX) and are judged as follows:

Germination,% of Pro-Mix Control	Phytotoxicity Classification	Plant Weight, % of Pro-Mix Control	Phytotoxicity Classification
> 85	V — Non-Toxic	> 90	V — Excellent
70 – 85	IV — Moderately Toxic	80 – 90	IV — Good
50 – 70	III — Toxic	65 – 80	III — Fair
30 – 50	II — Very Toxic	40 – 65	II — Poor
< 30	I — Extremely Toxic	< 40	I — Extremely Poor

SOLVITA® MATURITY TEST: The Solvita test measures respiration and ammonia evolution in a specified volume of compost and gives a semi-quantitative color response accurate over a very wide range of CO_2 and NH_3 levels. The test may be used both in the lab and on-site as a field procedure to enable producers and users to make on-the-spot stability determinations. The Solvita test is currently accepted as an official respiration test in 9 states and also in Denmark, Sweden and Norway, where Solvita values of >6 are generally regarded as acceptable for finished compost. The Solvita Maturity Index is derived from both the CO_2 rate and the volatile ammonia result (see tables provided with the Solvita test).

SOLVITA MATURITY INDEX	APPROXIMATE STAGE OF THE COMPOSTING PROCESS	MAJOR CLASS
8	Highly matured, well aged compost, for all uses	"FINISHED" COMPOST
7	Well matured compost, cured, ready for most uses	
6	Compost finishing curing; erady for some uses	"ACTIVE" COMPOST
5	Curing can be started; limited uses	
4	Compost in moderately active stage	
3	Very active compost; not read for most uses	
2	Very active, fresh compost	"RAW" COMPOST
1	Fresh, raw compost; extremely unstable	

Appendix G

PATHOGENIC ORGANISMS: The content of potential human pathogens depends on the treatment and age of any biosolids or organic waste material. EPA regulates content of potential pathogens in biosolids (sludge). In some cases, the same regulations are applied by states to determine safety of food waste or other composts. Woods End can provide details of the regulations for each state. The pathogen tests required under EPA-503 rule include *Salmonella*, fecal *Coliform* and in certain cases *Helminth Ova* and *Enteric viruses*. The EPA 503 specified procedure is started on samples received within 24 hrs of sampling. Results are reported per unit gram or 4g of sample, on a dry basis, as most-probable-number (MPN), colony-forming-units (cfu/g) test or plaque-forming-units. Materials containing more than 1000/g fecal coliform or 3 units/4g *Salmonella* are not acceptable as type A materials.

QUALITY SEAL OF APPROVAL- Compost classification is performed by Woods End as part of the Quality Seal (QSAP) program offered. There are 6 types of compost which recognized and approved as distinct groups. For each group, specific minimum test traits must be achieved. Please request separate information for this.

Recognized "TYPE"	DESCRIPTION OF THE DEFINING TEST PROPERTIES	USES ALLOWED UNDER QSAP
Seed Starter	Fine texture, high air volume and water-holding capacity, mature organic matter, low salinity, low NH_4, high available-N, moderate nutrient release potential	General plant substrate for starting seedlings in shallow containers for general gardening and later transplanting.
Container Mix	High air volume and water holding capacity, mature organic matter, low salinity, low NH_4, moderate to coarse texture, moderate nutrient release potential	Medium to large containers for growing out, nursery stock, house plants, and flowers.
Garden Compost	Med-high organic matter, moderate to high available nutrients and nutrient release potential, mature organic matter, M to MH salinity; low C:N ratio, low NH_4:NO_3 ratio	All-purpose garden usage and in greenhouses, incorporation in soil or container media at medium to medium high rates appropriate to soluble nutrient levels.
Topsoil Blend	Simulates rich native topsoil, moderate to high (for soil) organic matter, low C:N ratio, low salinity, stable, low NH_4:NO_3 ratio	Topsoil replacement, direct seeding, lawn-care, soil repair and garden raised beds.
Mulch	High organic matter, moderate to high C:N ratio, low to very low salinity and soluble nutrients, low NH_4:NO_3 ratio	A course blend for surface application only, under shrubs and for general non-growth purposes; and surface organic matter improvement
Natural Fertilizer	Dry-stable, spreadable, low dust, passes pathogen tests, high available nutrients, and rapid nutrient release potential	A high nutrient product best suited to be used sparingly to add nutrients to soil.

COMPOST ANALYTICAL PROCEDURES REFERENCE

Physical Parameters	Units	METHODS REF
Density	lbs/yd^3 g/cc	ASA 41¶
Water Holding Capacity (WHC)	% as is	TMECC Ø
Total Solids (alt. Moisture Content)	TS%	EPA 160.3 †
Dewar Self-Heating	Temp. max °C	IEPA-94°, BGK
Chemical Parameters		
pH	- logH$^+$	EPA 150.1
Volatile Organic Acids (VOA)	ppm dm	SM 5560C
Cation Exchange Capacity (CEC)	cmol / kg	ASA 41-2.2
Conductivity (Salinity)	mmhos/cm - dS/m	EPA 120.1
Volatile Solids (VS)	VS% dm	EPA 160.4
Organic Matter (OM)	VS-TKN%	modified EPA 160.4
Total Kjeldahl Nitrogen (TKN)	TKN% dm	EPA 351.3
Ammonium Nitrogen (NH_3 + NH_4)	NH_4-N ppm	SM 4500-NH3G
Nitrate and Nitrite Nitrogen	NO_3-N, NO_2-N ppm	SM 4110 B‡
Minerals and Metals: P K Ca Na Mg Cl Fe Mn Cu Zn Cr Pb Cd Ni Al B Hg Mo	mg /kg	EPA Methods 202.1 — 265.3
Biological Microbiological Parameters		
Respiration Rate (CO_2-Evolution)	CO_2-C / g VS / day	ASA 41-2.2, TMECC Ø
Nitrogen-Mineralization	ppm NO_3/ 11 weeks	
Salmonella (EPA 503) *Fecal Coliform* (EPA 503) Helminth Ova Enteric Virus	MPN/4g TS cfu / g TS ova / g TS pfu / g TS	SM 9260 D SM 9222 D EPA 600/1-87-014 ASTM D4994-89
Cress Test, Phytotoxicity	% germination % growth	WPCF* TMECC Method
Solvita Test CO_2-respiration and NH_3-volatilization	0 - 8 CO_2 1 - 5 NH_3	TMECC Method; Approved in; CA, CT, TX, FL, IL, ME, MN, NJ. NM OH, WA **

Notes:

¶ Methods of Soil Analysis, American Society of Agronomy, Soil Sci. Soc., Madison WI

Ø TMECC - Test Methods for Examination of Compost. DRAFT (2000) A Compost Council recommended procedures manual. U.S. Compost Council (manuscript only)

† EPA-600 Methods for Chemical Analysis of Water and Wastes. US EPA (RCRA) (and/or) SW-846 Test Methods for Evaluating Solid Waste USEPA 1987 (NPDES)

BGK - Bundesgutegemeinschaft Kompost (Germany Compost Association) Test Manual 1998

° IEPA– Illinois EPA Regulatory Methods 1994

‡ SM = Standard Methods for the Examination of Water & Wastewater, 20th ED. WEF

* Research Journal, WPCF Vol 62:7:853–859

** Required by: WA-DOT, CalTrans, TX-DOT, NM-BM, CT-DOT, Mass-DOT. Approved for substitute to lab respiration/stability testing in all other states listed

ASTM- American Society of Testing Methods, Philadephia

P.O. Box 297, Mt Vernon, ME 04352
www.woodsend.org — info@woodsend.org

this document available on internet at www.woodsend.org/compost.pd

Journal of the Woods End Research Laboratory ©1998-2000 Vol 1. No 4

Appendix G

New York City MSW Composting Report

Appendix H
Data from the Four-Facility Survey

Facility names have been coded for anonymity. Fecal coliform and Salmonella test results can be found on the respective, final Facility "Metals Analysis" lab data sheets, with the exception of Facility NRC, where these results appear on the Facility primary screen unders "Metals Analysis" lab data sheets. There is no inerts analysis for facility NRC since this facility did not produce a finished compost product at the time of the survey.

"The Inerts Characterization data, summarized in Table 3-7 of the body of the report can be found in the "Inerts" section for each of the facilities. Specifically, the data is derived from the respective facility final screen unders, the "Under 10mm" fraction found in the lower right-hand column, titled "percent of under-10mm dry basis." The relevant data is highlighted.

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling .
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccvd Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.0
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Primary Screen Unders (<3"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	38	1028 lbs/yd^3
Solids	%	100.0	44.8	896 lbs/ton
Moisture	%	0.0	55.2	132 gals/ton
est. water holding capacity	%	214	68	163 gals/ton
Inert and Oversize Matter	%	~	12.9	258.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	5.23	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	25235	11305	V High
Organic Matter	%	68.8	30.8	616 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	7.5	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	23.2	23.2	Med-High
Respiration Rate/day	C% of Total-C	2.19	2.19	-
Carbon loss per day	% of total weight	0.81	0.36	7.3 lbs/ton
Dewar Self-Heating	°C rise	~	38	Grade II
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	2	Very Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccvd–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 06/27/2001
· 44 Beaver Street-8th floor Date Reported : 07/25/2001
· New York NY 10004 Lab ID Number : 4996.0

MINERALS ANALYSIS

Sample Identification: NAL Primary Screen Unders (<3"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.603	0.718	14.4
Organic-Nitrogen	%	1.333	0.597	11.9
Phosphorus (P)	%	0.280	0.125	2.5
Potassium (K)	%	0.736	0.330	6.6
Sodium (Na)	%	0.288	0.129	2.6
Calcium (Ca)	%	1.900	0.851	17.0
Magnesium (Mg)	%	0.224	0.100	2.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2702	1210	2.4
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4943	2215	4.43
Sulfate (SO_4–S)	ppm	2024	907	1.81

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccvd–Project: 610

Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.0

METALS ANALYSIS

Sample Identification: NAL Primary Screen Unders (<3"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	43.6	19.5	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	164.0	73.5	0.1
Iron (Fe)	$mg \cdot kg^{-1}$	8040.0	3601.9	7.2
Zinc (Zn)	$mg \cdot kg^{-1}$	408.0	182.8	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	84.0	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	52.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	34.8	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccvd Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.1
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Primary Screen Unders (<3"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	37	1011 lbs/yd^3
Solids	%	100.0	43.7	874 lbs/ton
Moisture	%	0.0	56.3	135 gals/ton
est. water holding capacity	%	225	69	166 gals/ton
Inert and Oversize Matter	%	~	8.2	164.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	5.06	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	2749	1201	Medium
Organic Matter	%	72.7	31.8	636 lbs/ton
Conductivity	mmhos·cm^{-1}	~	7.2	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	23.5	23.5	Med-High
Respiration Rate/day	C% of Total-C	2.13	2.13	-
Carbon loss per day	% of total weight	0.83	0.36	7.3 lbs/ton
Dewar Self-Heating	°C rise	~	40	Grade II
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccvd–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.1

MINERALS ANALYSIS

Sample Identification: NAL Primary Screen Unders (<3"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.671	0.730	14.6
Organic-Nitrogen	%	1.388	0.607	12.1
Phosphorus (P)	%	0.280	0.122	2.4
Potassium (K)	%	0.756	0.330	6.6
Sodium (Na)	%	0.308	0.135	2.7
Calcium (Ca)	%	1.808	0.790	15.8
Magnesium (Mg)	%	0.224	0.098	2.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2795	1221	2.4
Nitrate-N	ppm	30	13	0.0
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5328	2328	4.66
Sulfate (SO_4–S)	ppm	1946	850	1.70

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Page 3 of 3

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccvd–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.1

METALS ANALYSIS

Sample Identification: NAL Primary Screen Unders (<3"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	49.2	21.5	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	156.0	68.2	0.1
Iron (Fe)	$mg \cdot kg^{-1}$	6480.0	2831.8	5.7
Zinc (Zn)	$mg \cdot kg^{-1}$	304.0	132.8	0.3
Lead (Pb)	$mg \cdot kg^{-1}$	50.0	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	50.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	40.8	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: svd Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.2
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 7, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	34	927 lbs/yd^3
Solids	%	100.0	42.7	854 lbs/ton
Moisture	%	0.0	57.3	137 gals/ton
est. water holding capacity	%	200	67	160 gals/ton
Inert and Oversize Matter	%	↝	9.8	196.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	↝	7.30	Med-Ideal
Free Carbonates (CO_3)	Rating	↝	1	None
Volatile Organic Acids	ppm	19430	8297	High
Organic Matter	%	63.7	27.2	544 lbs/ton
Conductivity	mmhos·cm^{-1}	↝	8.6	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	21.5	21.5	Medium
Dewar Self-Heating	°C rise	↝	40	Grade II
Solvita CO_2 Rate	(see chart)	↝	3	High
Solvita NH_3 Rate	(see chart)	↝	4	Slight
Maturity Index	(see chart)	↝	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.599	0.683	13.7

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: svd Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.3
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 7, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	45	1213 lbs/yd^3
Solids	%	100.0	38.5	770 lbs/ton
Moisture	%	0.0	61.5	147 gals/ton
est. water holding capacity	%	214	68	163 gals/ton
Inert and Oversize Matter	%	~→	14.3	286.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~→	6.37	V Low
Free Carbonates (CO_3)	Rating	~→	1	None
Volatile Organic Acids	ppm	27922	10750	V High
Organic Matter	%	68.8	26.5	530 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~→	5.8	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	24.6	24.6	Med-High
Dewar Self-Heating	°C rise	~→	34	Grade II
Solvita CO_2 Rate	(see chart)	~→	2	V. High
Solvita NH_3 Rate	(see chart)	~→	4	Slight
Maturity Index	(see chart)	~→	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.512	0.582	11.6

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: svd Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.4
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 14, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	37	994 lbs/yd^3
Solids	%	100.0	48.8	976 lbs/ton
Moisture	%	0.0	51.2	123 gals/ton
est. water holding capacity	%	193	66	158 gals/ton
Inert and Oversize Matter	%	~	12.3	246.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	8.58	Very High
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	11177	5454	High
Organic Matter	%	61.2	29.9	598 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	5.0	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	18.8	18.8	Medium
Dewar Self-Heating	°C rise	~	13	Grade IV
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	3	Medium
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.763	0.860	17.2

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: svd Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.5
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 14, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	42	1129 lbs/yd^3
Solids	%	100.0	40.8	816 lbs/ton
Moisture	%	0.0	59.2	142 gals/ton
est. water holding capacity	%	203	67	161 gals/ton
Inert and Oversize Matter	%	~	14.4	288.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	6.81	Med Low
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	29181	11906	V High
Organic Matter	%	64.7	26.4	528 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	5.3	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	26.2	26.2	Med-High
Dewar Self-Heating	°C rise	~	34	Grade II
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	3	Medium
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.335	0.545	10.9

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: svd Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.6
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 21, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	34	927 lbs/yd^3
Solids	%	100.0	65.0	1300 lbs/ton
Moisture	%	0.0	35.0	84 gals/ton
est. water holding capacity	%	180	64	154 gals/ton
Inert and Oversize Matter	%	~	24.6	492.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.94	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1847	1201	Medium
Organic Matter	%	56.4	36.6	733 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	5.6	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	15.7	15.7	M. Low
Dewar Self-Heating	°C rise	~	16	Grade IV
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.940	1.261	25.2

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: svd Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.7
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 21, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	38	1028 lbs/yd^3
Solids	%	100.0	56.4	1128 lbs/ton
Moisture	%	0.0	43.6	105 gals/ton
est. water holding capacity	%	178	64	153 gals/ton
Inert and Oversize Matter	%	~	19.4	388.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	8.29	High
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1152	650	M Low
Organic Matter	%	55.5	31.3	626 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	3.8	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	15.9	15.9	M. Low
Dewar Self-Heating	°C rise	~	27	Grade III
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.885	1.063	21.3

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.8
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Final Screen Unders (<8mm), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs{\cdot}ft^3$	-	39	1045 lbs/yd^3
Solids	%	100.0	65.8	1316 lbs/ton
Moisture	%	0.0	34.2	82 gals/ton
est. water holding capacity	%	171	63	151 gals/ton
Inert and Oversize Matter	%	~	6.8	136.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.95	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	912	600	M Low
Organic Matter	%	53.2	35.0	700 lbs/ton
Conductivity	$mmhos{\cdot}cm^{-1}$	~	5.6	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	14.2	14.2	M. Low
Respiration Rate/day	C% of Total-C	1.77	1.77	-
Carbon loss per day	% of total weight	0.51	0.33	6.7 lbs/ton
Dewar Self-Heating	°C rise	~	20	Grade IV
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	19	Ex. Phytotoxic
Lepedium sativum Weight	%	~	30	V. Poor
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx–Project: 610

Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.8

MINERALS ANALYSIS

Sample Identification: NAL Final Screen Unders (<8mm), Sample A A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.024	1.332	26.6
Organic-Nitrogen	%	1.888	1.242	24.8
Phosphorus (P)	%	0.536	0.353	7.1
Potassium (K)	%	0.440	0.290	5.8
Sodium (Na)	%	0.344	0.226	4.5
Calcium (Ca)	%	2.944	1.937	38.7
Magnesium (Mg)	%	0.380	0.250	5.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	1361	896	1.8
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4246	2794	5.59
Sulfate (SO_4-S)	ppm	1412	929	1.86

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: CScyvdx–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.8

METALS ANALYSIS

Sample Identification: NAL Final Screen Unders (<8mm), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	168.0	110.5	0.2
Manganese (Mn)	$mg \cdot kg^{-1}$	336.0	221.1	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	14400.0	9475.2	19.0
Zinc (Zn)	$mg \cdot kg^{-1}$	516.0	339.5	0.7
Lead (Pb)	$mg \cdot kg^{-1}$	124.0	81.6	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	168.0	110.5	0.2
Cadmium (Cd)	$mg \cdot kg^{-1}$	6.0	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	65.6	43.2	0.1
Arsenic (As)	$mg \cdot kg^{-1}$	6.00	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	1.29	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	5.12	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	3.08	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	1200	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.2	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number

< signifies *less than MLD* (minimum level of detection) for the particular factor tested

‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Code: CScyvdx Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.9
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Final Screen Unders (<8mm), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	39	1062 lbs/yd^3
Solids	%	100.0	65.1	1302 lbs/ton
Moisture	%	0.0	34.9	84 gals/ton
est. water holding capacity	%	175	64	153 gals/ton
Inert and Oversize Matter	%	~	4.9	98.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	8.14	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	1459	950	M Low
Organic Matter	%	54.5	35.5	709 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	6.3	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	14.5	14.5	M. Low
Respiration Rate/day	C% of Total-C	1.98	1.98	-
Carbon loss per day	% of total weight	0.58	0.38	7.6 lbs/ton
Dewar Self-Heating	°C rise	~	38	Grade II
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	45	Very Phytotoxic
Lepedium sativum Weight	%	~	31	Low
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: CScyvdx–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 06/27/2001
· 44 Beaver Street-8th floor Date Reported : 07/25/2001
· New York NY 10004 Lab ID Number : 4996.9

MINERALS ANALYSIS

Sample Identification: NAL Final Screen Unders (<8mm), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.031	1.322	26.4
Organic-Nitrogen	%	1.889	1.230	24.6
Phosphorus (P)	%	0.556	0.362	7.2
Potassium (K)	%	0.444	0.289	5.8
Sodium (Na)	%	0.356	0.232	4.6
Calcium (Ca)	%	3.040	1.979	39.6
Magnesium (Mg)	%	0.384	0.250	5.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	1420	924	1.8
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Volatile N as % of total-N	w:w	~	0.6	-
Chloride (Cl)	ppm	4361	2839	5.68
Sulfate (SO_4–S)	ppm	1341	873	1.75

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx-Project: 610

Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4996.9

METALS ANALYSIS

Sample Identification: NAL Final Screen Unders (<8mm), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	180.0	117.2	0.2
Manganese (Mn)	$mg \cdot kg^{-1}$	320.0	208.3	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	14920.0	9712.9	19.4
Zinc (Zn)	$mg \cdot kg^{-1}$	528.0	343.7	0.7
Lead (Pb)	$mg \cdot kg^{-1}$	118.0	76.8	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	168.0	109.4	0.2
Cadmium (Cd)	$mg \cdot kg^{-1}$	6.0	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	53.2	34.6	0.1
Arsenic (As)	$mg \cdot kg^{-1}$	6.81	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	1.25	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	5.23	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	2.44	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	2500	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.2	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4997.2
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 90, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	34	910 lbs/yd^3
Solids	%	100.0	70.3	1406 lbs/ton
Moisture	%	0.0	29.7	71 gals/ton
est. water holding capacity	%	181	64	154 gals/ton
Inert and Oversize Matter	%	~→	1.7	34.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~→	8.38	High
Free Carbonates (CO_3)	Rating	~→	2	Med-High
Volatile Organic Acids	ppm	711	500	M Low
Organic Matter	%	56.8	39.9	798 lbs/ton
Conductivity	mmhos·cm^{-1}	~→	9.4	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	12.6	12.6	M. Low
Respiration Rate/day	C% of Total-C	0.80	0.80	-
Carbon loss per day	% of total weight	0.24	0.17	3.4 lbs/ton
Dewar Self-Heating	°C rise	~→	10	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~→	67	Phytotoxic
Lepedium sativum Weight	%	~→	62	Fair
Solvita CO_2 Rate	(see chart)	~→	4	Med-High
Solvita NH_3 Rate	(see chart)	~→	4	Slight
Maturity Index	(see chart)	~→	4	Med-Active

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx–Project: 610

Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4997.2

MINERALS ANALYSIS

Sample Identification: NAL Day 90, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.436	1.713	34.3
Organic-Nitrogen	%	2.353	1.654	33.1
Phosphorus (P)	%	0.216	0.152	3.0
Potassium (K)	%	0.388	0.273	5.5
Sodium (Na)	%	0.588	0.413	8.3
Calcium (Ca)	%	3.760	2.643	52.9
Magnesium (Mg)	%	0.344	0.242	4.8
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	832	585	1.2
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4545	3195	6.39
Sulfate (SO_4–S)	ppm	2254	1584	3.17

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx–Project: 610

Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4997.2

METALS ANALYSIS

Sample Identification: NAL Day 90, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	244.0	171.5	0.3
Manganese (Mn)	$mg \cdot kg^{-1}$	452.0	317.8	0.6
Iron (Fe)	$mg \cdot kg^{-1}$	6880.0	4836.6	9.7
Zinc (Zn)	$mg \cdot kg^{-1}$	652.0	458.4	0.9
Lead (Pb)	$mg \cdot kg^{-1}$	129.6	91.1	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	103.6	72.8	0.1
Cadmium (Cd)	$mg \cdot kg^{-1}$	6.4	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	57.6	40.5	0.1
Arsenic (As)	$mg \cdot kg^{-1}$	4.77	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	1.90	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	7.17	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	2.54	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 2.9	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.2	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx Project: 610
Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4997.3
Quality Checked : WD 7/25/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 90, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	32	859 lbs/yd^3
Solids	%	100.0	76.6	1532 lbs/ton
Moisture	%	0.0	23.4	56 gals/ton
est. water holding capacity	%	183	65	155 gals/ton
Inert and Oversize Matter	%	~	0.6	12.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	8.54	Very High
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	587	450	M Low
Organic Matter	%	57.5	44.1	881 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	9.7	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	14.2	14.2	M. Low
Respiration Rate/day	C% of Total-C	1.24	1.24	-
Carbon loss per day	% of total weight	0.38	0.29	5.9 lbs/ton
Dewar Self-Heating	°C rise	~	39	Grade II
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	40	Very Phytotoxic
Lepedium sativum Weight	%	~	41	Low
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx–Project: 610

Date Received : 06/27/2001
Date Reported : 07/25/2001
Lab ID Number : 4997.3

MINERALS ANALYSIS

Sample Identification: NAL Day 90, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.189	1.677	33.5
Organic-Nitrogen	%	1.991	1.525	30.5
Phosphorus (P)	%	0.236	0.181	3.6
Potassium (K)	%	0.436	0.334	6.7
Sodium (Na)	%	0.672	0.515	10.3
Calcium (Ca)	%	3.960	3.033	60.7
Magnesium (Mg)	%	0.364	0.279	5.6
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	1983	1519	3.0
Nitrate-N	ppm	<2	< 2	nd
Nitrite-N	ppm	<2	< 2	nd
Volatile N as % of total-N	w:w	~	1.6	-
Chloride (Cl)	ppm	6249	4787	9.57
Sulfate (SO_4–S)	ppm	2696	2065	4.13

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: CScyvdx–Project: 610
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling Date Received : 06/27/2001
44 Beaver Street-8th floor Date Reported : 07/25/2001
New York NY 10004 Lab ID Number : 4997.3

METALS ANALYSIS

Sample Identification: NAL Day 90, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	240.0	183.8	0.4
Manganese (Mn)	$mg \cdot kg^{-1}$	400.0	306.4	0.6
Iron (Fe)	$mg \cdot kg^{-1}$	7440.0	5699.0	11.4
Zinc (Zn)	$mg \cdot kg^{-1}$	668.0	511.7	1.0
Lead (Pb)	$mg \cdot kg^{-1}$	140.0	107.2	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	98.0	75.1	0.2
Cadmium (Cd)	$mg \cdot kg^{-1}$	5.6	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	55.6	42.6	0.1
Arsenic (As)	$mg \cdot kg^{-1}$	4.62	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	1.81	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	7.52	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	2.28	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 2.6	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.0	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 07/10/2001
Date Reported : 08/07/2001
Lab ID Number : 5009.2
Quality Checked : WD 8/7/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 7 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	47.3	946 lbs/ton
Moisture	%	0.0	52.7	126 gals/ton
est. water holding capacity	%	218	69	164 gals/ton
Inert and Oversize Matter	%	~	6.6	132.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	5.39	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	21465	10153	V High
Organic Matter	%	70.0	33.1	662 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	6.5	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	24.0	24.0	Med-High
Solvita CO_2 Rate	(see chart)	~	7	Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	7	Mature
Total Mineral Nutrients				
Total Nitrogen	%	1.577	0.746	14.9

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 07/10/2001
Date Reported : 08/07/2001
Lab ID Number : 5009.3
Quality Checked : WO 8/7/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 7 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	44.7	894 lbs/ton
Moisture	%	0.0	55.3	133 gals/ton
est. water holding capacity	%	221	69	165 gals/ton
Inert and Oversize Matter	%	~	4.5	90.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	5.49	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	21456	9591	High
Organic Matter	%	71.4	31.9	638 lbs/ton
Conductivity	mmhos·cm^{-1}	~	4.7	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	25.2	25.2	Med-High
Solvita CO_2 Rate	(see chart)	~	7	Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	7	Mature
Total Mineral Nutrients				
Total Nitrogen	%	1.531	0.684	13.7

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 07/17/2001
Date Reported : 08/13/2001
Lab ID Number : 5019.0
Quality Checked : WD 8/13/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 14 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	55.0	1100 lbs/ton
Moisture	%	0.0	45.0	108 gals/ton
est. water holding capacity	%	211	68	163 gals/ton
Inert and Oversize Matter	%	~	9.9	198.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	8.42	High
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	1456	801	M Low
Organic Matter	%	67.6	37.2	743 lbs/ton
Conductivity	$mmhos\cdot cm^{-1}$	~	4.8	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	18.2	18.2	Medium
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	2.006	1.103	22.1

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 07/17/2001
Date Reported : 08/13/2001
Lab ID Number : 5019.1
Quality Checked : WO 8/13/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 14 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	52.2	1044 lbs/ton
Moisture	%	0.0	47.8	115 gals/ton
est. water holding capacity	%	212	68	163 gals/ton
Inert and Oversize Matter	%	~	4.1	82.0 lbs/ton
pH (paste, H_2O)	-logH^+	~	8.30	High
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	1628	850	M Low
Organic Matter	%	68.2	35.6	712 lbs/ton
Conductivity	mmhos·cm^{-1}	~	5.8	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	19.2	19.2	Medium
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.918	1.001	20.0

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: syvx Project: 610
Date Received : 07/24/2001
Date Reported : 08/24/2001
Lab ID Number : 5027.0
Quality Checked : WD 8/24/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 21 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	21	556 lbs/yd^3
Solids	%	100.0	63.8	1276 lbs/ton
Moisture	%	0.0	36.2	87 gals/ton
est. water holding capacity	%	204	67	161 gals/ton
Inert and Oversize Matter	%	~	11.6	232.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	8.05	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1489	950	M Low
Organic Matter	%	65.0	41.5	829 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	4.7	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	17.5	17.5	Medium
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	53	Phytotoxic
Lepedium sativum Weight	%	~	30	V. Poor
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	2.005	1.279	25.6

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: syvx Project: 610
Date Received : 07/24/2001
Date Reported : 08/24/2001
Lab ID Number : 5027.1
Quality Checked : WD 8/24/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 21 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	22	607 lbs/yd^3
Solids	%	100.0	66.6	1332 lbs/ton
Moisture	%	0.0	33.4	80 gals/ton
est. water holding capacity	%	195	66	158 gals/ton
Inert and Oversize Matter	%	~	7.6	152.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.97	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	2777	1849	Medium
Organic Matter	%	61.7	41.1	821 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	4.5	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	14.9	14.9	M. Low
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	76	Slight Phytotoxicity
Lepedium sativum Weight	%	~	38	Low
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	2.233	1.487	29.7

Notes: ppm = mg/kg < = less than MLD (minimum level of detection), nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Code: Ccyvd Project: 610
Date Received : 08/24/2001
Date Reported : 09/24/2001
Lab ID Number : 5073.0
Quality Checked : WO 9/24/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 52 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	59.0	1180 lbs/ton
Moisture	%	0.0	41.0	98 gals/ton
est. water holding capacity	%	174	63	152 gals/ton
Inert and Oversize Matter	%	~	13.1	262.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	8.52	Very High
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1186	700	M Low
Organic Matter	%	54.1	31.9	638 lbs/ton
Conductivity	mmhos-cm^{-1}	~	8.3	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	12.8	12.8	M. Low
Respiration Rate/day	C% of Total-C	0.77	0.77	-
Carbon loss per day	% of total weight	0.22	0.13	2.6 lbs/ton
Dewar Self-Heating	°C rise	~	1	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	92	No Phytotoxicity
Lepedium sativum Weight	%	~	45	Low
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	4	Med-Active

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccyvd–Project: 610

attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date Received : 08/24/2001
Date Reported : 09/24/2001
Lab ID Number : 5073.1

MINERALS ANALYSIS

Sample Identification: NAL Day 52 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.482	1.353	27.1
Organic-Nitrogen	%	2.388	1.302	26.0
Phosphorus (P)	%	0.479	0.261	5.2
Potassium (K)	%	1.014	0.553	11.1
Sodium (Na)	%	0.491	0.268	5.4
Calcium (Ca)	%	2.774	1.512	30.2
Magnesium (Mg)	%	0.387	0.211	4.2
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	935	510	1.0
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	8666	4723	9.45
Sulfate (SO_4-S)	ppm	2851	1554	3.11

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccyvd–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 08/24/2001
Date Reported : 09/24/2001
Lab ID Number : 5073.0

METALS ANALYSIS

Sample Identification: NAL Day 52 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	91.7	54.1	0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	233.2	137.6	0.3
Iron (Fe)	$mg{\cdot}kg^{-1}$	10010.1	5906.0	11.8
Zinc (Zn)	$mg{\cdot}kg^{-1}$	389.9	230.0	0.5
Lead (Pb)	$mg{\cdot}kg^{-1}$	100.5	59.3	0.1
Chromium (Cr)	$mg{\cdot}kg^{-1}$	72.4	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	4.0	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	37.4	-	-

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Code: Ccyvd Project: 610
Date Received : 08/24/2001
Date Reported : 09/24/2001
Lab ID Number : 5073.1
Quality Checked : WD 9/24/01

COMPOSITION ANALYSIS

Sample Identification: NAL Day 52 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	54.5	1090 lbs/ton
Moisture	%	0.0	45.5	109 gals/ton
est. water holding capacity	%	169	63	151 gals/ton
Inert and Oversize Matter	%	~	12.6	252.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	8.72	Very High
Free Carbonates (CO_3)	Rating	~	1	None
Organic Matter	%	52.4	28.6	571 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	7.8	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	11.4	11.4	M. Low
Respiration Rate/day	C% of Total-C	0.85	0.85	-
Carbon loss per day	% of total weight	0.24	0.13	2.6 lbs/ton
Dewar Self-Heating	°C rise	~	1	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	84	Slight Phytotoxicity
Lepedium sativum Weight	%	~	49	Low
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	3	Medium
Maturity Index	(see chart)	~	5	Late-Active

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccyvd–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 08/24/2001
Date Reported : 09/24/2001
Lab ID Number : 5073.1

METALS ANALYSIS

Sample Identification: NAL Day 52 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	83.8	45.7	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	231.5	126.2	0.3
Iron (Fe)	$mg \cdot kg^{-1}$	9900.2	5395.6	10.8
Zinc (Zn)	$mg \cdot kg^{-1}$	367.3	200.2	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	88.6	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	73.9	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	4.0	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	35.1	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

NAL Final Screen Unders (<8mm)
Sample A

Woods End
Research Laboratory
INCORPORATED

Certificate of Analysis

EPA Method 8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name:	4996.8
Sample Location:	
Sampling Date:	7/9/2001
Sampling Time:	15:00
Date Received:	7/11/2001
Lab #:	01X0774-01
Matrix:	SOIL
Analyst:	HY
Extract Date:	7/13/2001
Analysis Date:	7/24/2001

Analyte	Result	Units	PQL
alpha-BHC:	ND	mg/Kg	0.02
gamma-BHC (Lindane):	ND	mg/Kg	0.02
Heptachlor:	ND	mg/Kg	0.02
Aldrin:	ND	mg/Kg	0.02
beta-BHC:	ND	mg/Kg	0.02
delta-BHC:	ND	mg/Kg	0.02
Heptachlor Epoxide:	ND	mg/Kg	0.02
Endosulfan I:	ND	mg/Kg	0.02
4,4'-DDE:	ND	mg/Kg	0.02
Dieldrin:	ND	mg/Kg	0.02
Endrin:	ND	mg/Kg	0.02
Endosulfan II:	ND	mg/Kg	0.02
4,4'-DDD:	ND	mg/Kg	0.02
4,4'-DDT:	ND	mg/Kg	0.02
Endrin Aldehyde:	ND	mg/Kg	0.02
Endosulfan Sulfate:	ND	mg/Kg	0.02
Methoxychlor:	ND	mg/Kg	0.10
Endrin Ketone:	ND	mg/Kg	0.02
Chlordane:	ND	mg/Kg	0.02
Toxaphene:	ND	mg/Kg	0.2
Arochlor 1016:	ND	mg/Kg	0.2
Arochlor 1221:	ND	mg/Kg	0.2
Arochlor 1232:	ND	mg/Kg	0.2
Arochlor 1242:	ND	mg/Kg	0.2
Arochlor 1248:	ND	mg/Kg	0.2
Arochlor 1254:	ND	mg/Kg	0.2
Arochlor 1260:	ND	mg/Kg	0.2

Surrogate Standard	% Recovery
TCX %R	62.8

ND Not Detected PQL Practical Quantitation Limit EPA 8081 Report

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

NAL Final Screen Unders (<8mm)
Sample B

Woods End®
Research Laboratory
INCORPORATED

Certificate of Analysis

EPA Method 8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name:	4996.9
Sample Location:	
Sampling Date:	7/9/2001
Sampling Time:	15:00
Date Received:	7/11/2001
Lab #:	01X0774-02
Matrix:	SOIL
Analyst:	HY
Extract Date:	7/13/2001
Analysis Date:	7/24/2001

Analyte	Result	Units	PQL
alpha-BHC:	ND	mg/Kg	0.02
gamma-BHC (Lindane):	ND	mg/Kg	0.02
Heptachlor:	ND	mg/Kg	0.02
Aldrin:	ND	mg/Kg	0.02
beta-BHC:	ND	mg/Kg	0.02
delta-BHC:	ND	mg/Kg	0.02
Heptachlor Epoxide:	ND	mg/Kg	0.02
Endosulfan I:	ND	mg/Kg	0.02
4,4'-DDE:	ND	mg/Kg	0.02
Dieldrin:	ND	mg/Kg	0.02
Endrin:	ND	mg/Kg	0.02
Endosulfan II:	ND	mg/Kg	0.02
4,4'-DDD:	ND	mg/Kg	0.02
4,4'-DDT:	ND	mg/Kg	0.02
Endrin Aldehyde:	ND	mg/Kg	0.02
Endosulfan Sulfate:	ND	mg/Kg	0.02
Methoxychlor:	ND	mg/Kg	0.10
Endrin Ketone:	ND	mg/Kg	0.02
Chlordane:	ND	mg/Kg	0.02
Toxaphene:	ND	mg/Kg	0.2
Arochlor 1016:	ND	mg/Kg	0.2
Arochlor 1221:	ND	mg/Kg	0.2
Arochlor 1232:	ND	mg/Kg	0.2
Arochlor 1242:	ND	mg/Kg	0.2
Arochlor 1248:	ND	mg/Kg	0.2
Arochlor 1254:	ND	mg/Kg	0.2
Arochlor 1260:	ND	mg/Kg	0.2

Surrogate Standard	% Recovery
TCX %R	57.9

ND Not Detected **PQL** Practical Quantitation Limit

EPA 8081 Report Page 2 of 4

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

NAL Day 90, Sample A

Woods End Research Laboratory
INCORPORATED

Certificate of Analysis

EPA Method 8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name:	4997.2
Sample Location:	
Sampling Date:	7/9/2001
Sampling Time:	15:00
Date Received:	7/11/2001
Lab #:	01X0774-03
Matrix:	SOIL
Analyst:	HY
Extract Date:	7/13/2001
Analysis Date:	7/24/2001

Analyte	Result	Units	PQL
alpha-BHC:	ND	mg/Kg	0.02
gamma-BHC (Lindane):	ND	mg/Kg	0.02
Heptachlor:	ND	mg/Kg	0.02
Aldrin:	ND	mg/Kg	0.02
beta-BHC:	ND	mg/Kg	0.02
delta-BHC:	ND	mg/Kg	0.02
Heptachlor Epoxide:	ND	mg/Kg	0.02
Endosulfan I:	ND	mg/Kg	0.02
4,4'-DDE:	ND	mg/Kg	0.02
Dieldrin:	ND	mg/Kg	0.02
Endrin:	ND	mg/Kg	0.02
Endosulfan II:	ND	mg/Kg	0.02
4,4'-DDD:	ND	mg/Kg	0.02
4,4'-DDT:	ND	mg/Kg	0.02
Endrin Aldehyde:	ND	mg/Kg	0.02
Endosulfan Sulfate:	ND	mg/Kg	0.02
Methoxychlor:	ND	mg/Kg	0.10
Endrin Ketone:	ND	mg/Kg	0.02
Chlordane:	ND	mg/Kg	0.02
Toxaphene:	ND	mg/Kg	0.2
Arochlor 1016:	ND	mg/Kg	0.2
Arochlor 1221:	ND	mg/Kg	0.2
Arochlor 1232:	ND	mg/Kg	0.2
Arochlor 1242:	ND	mg/Kg	0.2
Arochlor 1248:	ND	mg/Kg	0.2
Arochlor 1254:	ND	mg/Kg	0.2
Arochlor 1260:	ND	mg/Kg	0.2

Surrogate Standard	% Recovery
TCX %R	61.9

ND Not Detected PQL Practical Quantitation Limit

EPA 8081 Report

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

Appendix H

NAL Day 90, Sample B

Woods End® Research Laboratory INCORPORATED

Certificate of Analysis

EPA Method 8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name:	4997.3
Sample Location:	
Sampling Date:	7/9/2001
Sampling Time:	15:00
Date Received:	7/11/2001
Lab #:	01X0774-04
Matrix:	SOIL
Analyst:	HY
Extract Date:	7/13/2001
Analysis Date:	7/24/2001

Analyte	Result	Units	PQL
alpha-BHC:	ND	mg/Kg	0.02
gamma-BHC (Lindane):	ND	mg/Kg	0.02
Heptachlor:	ND	mg/Kg	0.02
Aldrin:	ND	mg/Kg	0.02
beta-BHC:	ND	mg/Kg	0.02
delta-BHC:	ND	mg/Kg	0.02
Heptachlor Epoxide:	ND	mg/Kg	0.02
Endosulfan I:	ND	mg/Kg	0.02
4,4'-DDE:	ND	mg/Kg	0.02
Dieldrin:	ND	mg/Kg	0.02
Endrin:	ND	mg/Kg	0.02
Endosulfan II:	ND	mg/Kg	0.02
4,4'-DDD:	ND	mg/Kg	0.02
4,4'-DDT:	ND	mg/Kg	0.02
Endrin Aldehyde:	ND	mg/Kg	0.02
Endosulfan Sulfate:	ND	mg/Kg	0.02
Methoxychlor:	ND	mg/Kg	0.10
Endrin Ketone:	ND	mg/Kg	0.02
Chlordane:	ND	mg/Kg	0.02
Toxaphene:	ND	mg/Kg	0.2
Arochlor 1016:	ND	mg/Kg	0.2
Arochlor 1221:	ND	mg/Kg	0.2
Arochlor 1232:	ND	mg/Kg	0.2
Arochlor 1242:	ND	mg/Kg	0.2
Arochlor 1248:	ND	mg/Kg	0.2
Arochlor 1254:	ND	mg/Kg	0.2
Arochlor 1260:	ND	mg/Kg	0.2

Surrogate Standard	% Recovery
TCX %R	81.9

Lab Supervisor: Wayne Davis

Report Date: 25-Jul-01

ND Not Detected PQL Practical Quantitation Limit

EPA 8081 Report

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

Woods End Research Laboratory, Inc.

20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *27-Jun-01*
Project: 610
Acct# 556

Initials EE
Ref:

Lab No: 4996.8 Description: NAL Final Facility Unders (<8mm), Sample A

Weight In, g: 380

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.0	0.0	0.00%	0.0%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	0.0	0.0	0.00%	0.0%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	0.0	0.0	0.0%	0.0%

Total Man-made Inerts Matter = 0.0%

Weight In, g: 379.90

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	3.3	3.3	1.30%	1.3%
Plastic-Hard	3.0	3.0	1.18%	1.2%
Plastic-Film	1.2	1.2	0.47%	0.5%
Metal	0.2	0.2	0.08%	0.1%
Textile, fibers	1.6	1.1	0.42%	0.4%
Paper	8.5	5.6	2.21%	2.2%
Wood	3.4	2.2	0.89%	0.9%
Stones	0.3	0.3	0.12%	0.1%
Bone, shell	0.4	0.3	0.10%	0.1%
Compost + Fines	358.0	236.3	93.22%	93.2%
TOTAL WEIGHT	379.9	253.5	100.0%	100.0%

> 4mm

Total Man-made Inerts Matter = 3.5%

Printed: 10-19-01

Appendix H

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *27-Jun-01*
Project: 610
Acct# 556

Initials ϵE
Ref:

Lab No: **4996.9** **Description:** NAL Final Facility Unders (<8mm), Sample B

Weight In, g: 769

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.0	0.0	0.00%	0.0%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	0.0	0.0	0.00%	0.0%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	0.0	0.0	0.0%	0.0%

Total Man-made Inerts Matter = 0.0%

Weight In, g: 769.30

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	11.5	11.5	2.27%	2.3%
Plastic-Hard	5.7	5.7	1.12%	1.1%
Plastic-Film	1.6	1.6	0.32%	0.3%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	2.4	1.6	0.31%	0.3%
Paper	19.0	12.4	2.43%	2.4%
Wood	9.2	6.0	1.18%	1.2%
Stones	2.1	2.1	0.41%	0.4%
Bone, shell	1.8	1.2	0.23%	0.2%
Compost + Fines	716.0	465.4	91.73%	91.7%
TOTAL WEIGHT	769.3	507.4	100.0%	100.0%

> 4mm

Total Man-made Inerts Matter = 4.0%

Printed: 10-19-01

Woods End Research Laboratory, Inc.

20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *27-Jun-01*
Project: 610
Acct# 556
Initials
Ref:

Lab No: 4997.0 Description: NAL Final Facility Overs (>8mm), Sample A

Weight In, g: 1703

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	98.0	98.0	6.57%	11.7%
Plastic-Hard	151.0	151.0	10.12%	18.0%
Plastic-Film	124.0	124.0	8.31%	14.8%
Metal	55.0	55.0	3.68%	6.6%
Textile, fibers	79.0	52.1	3.49%	6.2%
Paper	24.0	15.8	1.06%	1.9%
Wood	117.0	77.2	5.17%	9.2%
Stones	182.0	182.0	12.19%	21.7%
Bone, shell	128.0	84.5	5.66%	10.1%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	958.0	839.7	56.3%	100.0%

Total Man-made Inerts Matter = 57.2%

Weight In, g: 272.25

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	3.1	3.1	1.63%	3.7%
Plastic-Hard	0.4	0.4	0.21%	0.5%
Plastic-Film	5.2	5.2	2.73%	6.2%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	7.1	4.7	2.46%	5.6%
Paper	15.1	10.0	5.23%	12.0%
Wood	1.5	1.0	0.52%	1.2%
Stones	5.3	5.3	2.78%	6.4%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost + Fines	81.4	53.7	28.19%	64.4%
TOTAL WEIGHT	119.1	83.4	43.7%	100.0%

> 4mm

Total Man-made Inerts Matter = 16.1%

Printed: 10-19-01

Appendix H

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *27-Jun-01*
Project: 610
Acct# 556
Initials
Ref:

Lab No: 4997.1 Description: NAL Final Facility Overs (>8mm), Sample B

1351 Weight In, g: 1351

	FRACTION: **Over 10mm**	**LAB SORT**	**dry weight, grams**	**percent of whole, dry basis**	**percent of over-10 mm, dry basis**
152.0	Glass	152.0	152.0	12.26%	23.9%
135.0	Plastic-Hard	135.0	135.0	10.89%	21.2%
143.0	Plastic-Film	143.0	143.0	11.54%	22.5%
17.0	Metal	17.0	17.0	1.37%	2.7%
95.0	Textile, fibers	95.0	62.7	5.06%	9.9%
10.0	Paper	10.0	6.6	0.53%	1.0%
58.0	Wood	58.0	38.3	3.09%	6.0%
78.0	Stones	78.0	78.0	6.29%	12.3%
5.0	Bone, shell	5.0	3.3	0.27%	0.5%
0.0	Compost	0.0	0.0	0.00%	0.0%
	TOTAL WEIGHT	693.0	635.9	51.3%	100.0%

Total Man-made Inerts Matter = 80.2%

Weight In, g: 285.80

	FRACTION: **Under 10mm**	**LAB SORT**	**dry weight, grams**	**percent of whole, dry basis**	**percent of under-10 mm dry basis**
4.2	Glass	4.2	4.2	2.11%	4.3%
1.3	Plastic-Hard	1.3	1.3	0.65%	1.3%
4.8	Plastic-Film	4.8	4.8	2.41%	4.9%
0.1	Metal	0.1	0.1	0.05%	0.1%
[illegible]	Textile, fibers	3.6	2.4	1.19%	2.4%
> 4mm	Paper	4.6	3.0	1.52%	3.1%
2.4	Wood	2.4	1.6	0.79%	1.6%
5.2	Stones	5.2	5.2	2.61%	5.4%
0.0	Bone, shell	0.0	0.0	0.00%	0.0%
113.0	Compost + Fines	113.0	74.6	37.38%	76.7%
	TOTAL WEIGHT	139.2	97.2	48.7%	100.0%

Total Man-made Inerts Matter = 13.1%

Printed: 10-19-01

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556	Code: Ccvd Project: 610
· attn: Venetia Lannon	Date Received : 07/19/2001
· DOS Waste Prev. Reuse and Recycling	Date Reported : 09/12/2001
· 44 Beaver Street-8th floor	Lab ID Number : 5021.0
· New York NY 10004	Quality Checked : WD 9/12/01

COMPOSITION ANALYSIS

Sample Identification: NML Primary Screen Unders (<2"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	46	1230 lbs/yd^3
Solids	%	100.0	37.5	750 lbs/ton
Moisture	%	0.0	62.5	150 gals/ton
est. water holding capacity	%	252	72	172 gals/ton
Inert and Oversize Matter	%	~	7.5	150.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	6.13	V Low
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	17977	6741	High
Organic Matter	%	82.7	31.0	620 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	7.0	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	33.7	33.7	Med-High
Respiration Rate/day	C% of Total-C	2.31	2.31	-
Carbon loss per day	% of total weight	1.03	0.39	7.7 lbs/ton
Dewar Self-Heating	°C rise	~	42	Grade I
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	2	Very Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 | Code: Ccvd-Project: 610
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date Received : 07/19/2001
Date Reported : 09/12/2001
Lab ID Number : 5021.0

MINERALS ANALYSIS

Sample Identification: NML Primary Screen Unders (<2"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.325	0.497	9.9
Organic-Nitrogen	%	1.044	0.391	7.8
Phosphorus (P)	%	0.424	0.159	3.2
Potassium (K)	%	0.216	0.081	1.6
Sodium (Na)	%	0.360	0.135	2.7
Calcium (Ca)	%	1.776	0.666	13.3
Magnesium (Mg)	%	0.169	0.063	1.3
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2810	1054	2.1
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	2950	1106	2.21
Sulfate (SO_4–S)	ppm	1236	463	0.93

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccvd–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 07/19/2001
Date Reported : 09/12/2001
Lab ID Number : 5021.0

METALS ANALYSIS

Sample Identification: NML Primary Screen Unders (<2"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	84.8	31.8	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	800.0	300.0	0.6
Iron (Fe)	$mg \cdot kg^{-1}$	9200.0	3450.0	6.9
Zinc (Zn)	$mg \cdot kg^{-1}$	392.0	147.0	0.3
Lead (Pb)	$mg \cdot kg^{-1}$	78.8	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	36.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.4	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	30.4	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number

< signifies *less than MLD* (minimum level of detection) for the particular factor tested

‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556	Code: Ccvd Project: 610
· attn: Venetia Lannon	Date Received : 07/19/2001
· DOS Waste Prev. Reuse and Recycling	Date Reported : 09/12/2001
· 44 Beaver Street-8th floor	Lab ID Number : 5021.1
· New York NY 10004	Quality Checked : WD 9/12/01

COMPOSITION ANALYSIS

Sample Identification: NML Primary Screen Unders (<2"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	44	1196 lbs/yd^3
Solids	%	100.0	40.8	816 lbs/ton
Moisture	%	0.0	59.2	142 gals/ton
est. water holding capacity	%	249	71	171 gals/ton
Inert and Oversize Matter	%	~	7.6	152.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	6.25	V Low
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	22202	9058	High
Organic Matter	%	81.6	33.3	666 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	6.5	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	32.8	32.8	Med-High
Respiration Rate/day	C% of Total-C	2.22	2.22	-
Carbon loss per day	% of total weight	0.98	0.40	8.0 lbs/ton
Dewar Self-Heating	°C rise	~	40	Grade II
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	2	Very Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 | Code: Ccvd–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling | Date Received : 07/19/2001
· 44 Beaver Street-8th floor | Date Reported : 09/12/2001
· New York NY 10004 | Lab ID Number : 5021.1

MINERALS ANALYSIS

Sample Identification: NML Primary Screen Unders (<2"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.344	0.548	11.0
Organic-Nitrogen	%	1.085	0.443	8.9
Phosphorus (P)	%	0.496	0.202	4.0
Potassium (K)	%	0.228	0.093	1.9
Sodium (Na)	%	0.360	0.147	2.9
Calcium (Ca)	%	1.764	0.720	14.4
Magnesium (Mg)	%	0.182	0.074	1.5
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	2588	1056	2.1
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	3059	1248	2.50
Sulfate (SO_4–S)	ppm	965	394	0.79

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccvd–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 07/19/2001
· 44 Beaver Street-8th floor Date Reported : 09/12/2001
· New York NY 10004 Lab ID Number : 5021.1

METALS ANALYSIS

Sample Identification: NML Primary Screen Unders (<2"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	84.0	34.3	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	784.0	319.9	0.6
Iron (Fe)	$mg \cdot kg^{-1}$	9400.0	3835.2	7.7
Zinc (Zn)	$mg \cdot kg^{-1}$	400.0	163.2	0.3
Lead (Pb)	$mg \cdot kg^{-1}$	80.0	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	36.4	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.4	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	31.6	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: svd Project: 610
Date Received : 07/19/2001
Date Reported : 09/12/2001
Lab ID Number : 5021.7
Quality Checked : WO 9/12/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 7, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	46	1230 lbs/yd^3
Solids	%	100.0	43.4	868 lbs/ton
Moisture	%	0.0	56.6	136 gals/ton
est. water holding capacity	%	244	71	170 gals/ton
Inert and Oversize Matter	%	~	5.7	114.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	5.66	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	9110	3954	M High
Organic Matter	%	79.6	34.5	691 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	8.3	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	32.6	32.6	Med-High
Dewar Self-Heating	°C rise	~	47	Grade I
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.317	0.572	11.4

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: svd Project: 610
· attn: Venetia Lannon Date Received : 07/19/2001
· DOS Waste Prev. Reuse and Recycling Date Reported : 09/12/2001
· 44 Beaver Street-8th floor Lab ID Number : 5021.8
· New York NY 10004 Quality Checked : WO 9/12/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 7, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	46	1230 lbs/yd^3
Solids	%	100.0	42.5	850 lbs/ton
Moisture	%	0.0	57.5	138 gals/ton
est. water holding capacity	%	245	71	170 gals/ton
Inert and Oversize Matter	%	~	5.5	110.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	5.50	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	9995	4248	High
Organic Matter	%	80.1	34.0	681 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	8.6	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	33.1	33.1	Med-High
Dewar Self-Heating	°C rise	~	40	Grade II
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.307	0.555	11.1

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: svd Project: 610
Date Received : 07/19/2001
Date Reported : 09/12/2001
Lab ID Number : 5021.9
Quality Checked : WO 9/12/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 14, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	38	1028 lbs/yd^3
Solids	%	100.0	46.7	934 lbs/ton
Moisture	%	0.0	53.3	128 gals/ton
est. water holding capacity	%	247	71	171 gals/ton
Inert and Oversize Matter	%	~	4.3	86.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	6.91	Med Low
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	24068	11240	V High
Organic Matter	%	80.7	37.7	753 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	8.2	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	35.4	35.4	High
Dewar Self-Heating	°C rise	~	43	Grade I
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	3	Medium
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.232	0.575	11.5

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556	Code: svd Project: 610
· attn: Venetia Lannon	Date Received : 07/19/2001
· DOS Waste Prev. Reuse and Recycling	Date Reported : 09/12/2001
· 44 Beaver Street-8th floor	Lab ID Number : 5022.0
· New York NY 10004	Quality Checked : wO 9/12/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 14, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	40	1078 lbs/yd^3
Solids	%	100.0	45.6	912 lbs/ton
Moisture	%	0.0	54.4	130 gals/ton
est. water holding capacity	%	247	71	171 gals/ton
Inert and Oversize Matter	%	~	3.1	62.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	6.34	V Low
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	26233	11962	V High
Organic Matter	%	80.7	36.8	736 lbs/ton
Conductivity	mmhos·cm^{-1}	~	8.2	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	33.6	33.6	Med-High
Dewar Self-Heating	°C rise	~	41	Grade I
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	3	Medium
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.297	0.591	11.8

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx Project: 610
Date Received : 07/19/2001
Date Reported : 09/12/2001
Lab ID Number : 5022.1
Quality Checked :

COMPOSITION ANALYSIS

Sample Identification: NML Day 21, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	41	1112 lbs/yd^3
Solids	%	100.0	47.1	942 lbs/ton
Moisture	%	0.0	52.9	127 gals/ton
est. water holding capacity	%	236	70	168 gals/ton
Inert and Oversize Matter	%	~	3.4	68.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	6.16	V Low
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	38561	18162	V High
Organic Matter	%	76.7	36.1	722 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	9.6	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	37.0	37.0	High
Respiration Rate/day	% of Total-C	<0.1	<0.1	-
Carbon loss per day	% of total weight	0.03	0.01	0.3 lbs/ton
Dewar Self-Heating	°C rise	~	33	Grade II
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	93	No Phytotoxicity
Lepedium sativum Weight	%	~	53	Fair
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx Project: 610
Date Received : 07/19/2001
Date Reported : 09/12/2001
Lab ID Number : 5022.2
Quality Checked : WO 9/12/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 21, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	45	1213 lbs/yd^3
Solids	%	100.0	41.7	834 lbs/ton
Moisture	%	0.0	58.3	140 gals/ton
est. water holding capacity	%	240	71	169 gals/ton
Inert and Oversize Matter	%	~	4.3	86.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	5.97	ExLow
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	58397	24352	V High
Organic Matter	%	78.3	32.6	653 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	10.3	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	40.8	40.8	High
Respiration Rate/day	% of Total-C	<0.1	<0.1	-
Carbon loss per day	% of total weight	<0.01	<0.01	-
Dewar Self-Heating	°C rise	~	43	Grade I
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	83	Slight Phytotoxicity
Lepedium sativum Weight	%	~	44	Low
Solvita CO_2 Rate	(see chart)	~	8	V. Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	8	Very Mature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: CScyvdx–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 07/19/2001
Date Reported : 09/12/2001
Lab ID Number : 5022.1

MINERALS ANALYSIS

Sample Identification: NML Day 21, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.120	0.528	10.6
Organic-Nitrogen	%	0.686	0.323	6.5
Phosphorus (P)	%	0.388	0.183	3.7
Potassium (K)	%	0.204	0.096	1.9
Sodium (Na)	%	0.364	0.171	3.4
Calcium (Ca)	%	2.200	1.036	20.7
Magnesium (Mg)	%	0.196	0.092	1.8
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	4334	2041	4.1
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	3674	1731	3.46
Sulfate (SO_4–S)	ppm	1606	757	1.51

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: CScyvdx-Project: 610

Date Received : 07/19/2001
Date Reported : 09/12/2001
Lab ID Number : 5022.2

MINERALS ANALYSIS

Sample Identification: NML Day 21, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.036	0.432	8.6
Organic-Nitrogen	%	1.022	0.426	8.5
Phosphorus (P)	%	0.444	0.185	3.7
Potassium (K)	%	0.208	0.087	1.7
Sodium (Na)	%	0.392	0.163	3.3
Calcium (Ca)	%	1.872	0.781	15.6
Magnesium (Mg)	%	0.166	0.069	1.4
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	133	55	0.1
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	3509	1463	2.93
Sulfate (SO_4-S)	ppm	1163	485	0.97

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: CScyvdx-Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 07/19/2001
· 44 Beaver Street-8th floor Date Reported : 09/12/2001
· New York NY 10004 Lab ID Number : 5022.1

METALS ANALYSIS

Sample Identification: NML Day 21, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	96.8	45.6	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	472.0	222.3	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	9120.0	4295.5	8.6
Zinc (Zn)	$mg \cdot kg^{-1}$	388.0	182.7	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	97.2	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	26.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	38.0	-	-
Arsenic (As)	$mg \cdot kg^{-1}$	3.1	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	0.65	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	5.9	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	1.6	-	-

BACTERIOLOGIC ANALYSIS

Fecal coliform EPA503	MPN per g	< 4.0	-
Total *Salmonella* EPA503	MPN per 4g	< 1.6	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: CScyvdx-Project: 610
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling Date Received : 07/19/2001
44 Beaver Street-8th floor Date Reported : 09/12/2001
New York NY 10004 Lab ID Number : 5022.2

METALS ANALYSIS

Sample Identification: NML Day 21, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	101.2	42.2	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	388.0	161.8	0.3
Iron (Fe)	$mg \cdot kg^{-1}$	9320.0	3886.4	7.8
Zinc (Zn)	$mg \cdot kg^{-1}$	412.0	171.8	0.3
Lead (Pb)	$mg \cdot kg^{-1}$	86.8	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	29.2	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	33.2	-	-
Arsenic (As)	$mg \cdot kg^{-1}$	3.0	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	0.62	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	3.6	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	1.8	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	< 4.8	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.9	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 610
Date Received : 09/07/2001
Date Reported : 10/02/2001
Lab ID Number : 5084.0
Quality Checked : WD 10/2/01

COMPOSITION ANALYSIS

Sample Identification: NML Final Product Loam Blend (<3/8"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	79.2	1584 lbs/ton
Moisture	%	0.0	20.8	50 gals/ton
est. water holding capacity	%	50	33	80 gals/ton
Organic Matter	%	9.1	7.2	144 lbs/ton
Solvita CO_2 Rate	(see chart)	~→	7	Low
Solvita NH_3 Rate	(see chart)	~→	5	Absent
Maturity Index	(see chart)	~→	7	Mature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 07/27/2001
Date Reported : 08/27/2001
Lab ID Number : 5030.0
Quality Checked : WD 8/27/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 7 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft³	-	34	927 lbs/yd³
Solids	%	100.0	41.7	834 lbs/ton
Moisture	%	0.0	58.3	140 gals/ton
est. water holding capacity	%	240	71	169 gals/ton
Inert and Oversize Matter	%	~	5.1	102.0 lbs/ton
pH (paste, H_2O)	-logH+	~	7.55	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	7080	2952	M High
Organic Matter	%	78.2	32.6	653 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	3.1	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	31.2	31.2	Med-High
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	2	High
Maturity Index	(see chart)	~	1	Raw Waste!
Total Mineral Nutrients				
Total Nitrogen	%	1.353	0.564	11.3

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 07/27/2001
Date Reported : 08/27/2001
Lab ID Number : 5030.1
Quality Checked : 8/27/01 ws

COMPOSITION ANALYSIS

Sample Identification: NML Day 7 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	37	994 lbs/yd^3
Solids	%	100.0	40.8	816 lbs/ton
Moisture	%	0.0	59.2	142 gals/ton
est. water holding capacity	%	246	71	170 gals/ton
Inert and Oversize Matter	%	~	7.2	144.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.60	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	2452	1000	Medium
Organic Matter	%	80.3	32.8	655 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	3.0	Med-Low
Carbon:Nitrogen (C:N) Ratio	w:w	30.6	30.6	Med-High
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	3	Medium
Maturity Index	(see chart)	~	1	Raw Waste!
Total Mineral Nutrients				
Total Nitrogen	%	1.419	0.579	11.6

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 08/03/2001
Date Reported : 09/13/2001
Lab ID Number : 5045.0
Quality Checked : WD 9/13/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 14 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	42	1129 lbs/yd^3
Solids	%	100.0	39.9	798 lbs/ton
Moisture	%	0.0	60.1	144 gals/ton
est. water holding capacity	%	235	70	168 gals/ton
Inert and Oversize Matter	%	~	13.2	264.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.49	Med-Ideal
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	1506	601	M Low
Organic Matter	%	76.2	30.4	608 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	3.5	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	27.7	27.7	Med-High
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.483	0.592	11.8

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 08/03/2001
Date Reported : 09/13/2001
Lab ID Number : 5045.1
Quality Checked : WD 9/13/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 14 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	35	944 lbs/yd^3
Solids	%	100.0	43.0	860 lbs/ton
Moisture	%	0.0	57.0	137 gals/ton
est. water holding capacity	%	233	70	168 gals/ton
Inert and Oversize Matter	%	~	7.9	158.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.35	Med-Ideal
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	1510	649	M Low
Organic Matter	%	75.8	32.6	652 lbs/ton
Conductivity	mmhos·cm^{-1}	~	2.5	Med-Low
Carbon:Nitrogen (C:N) Ratio	w:w	27.7	27.7	Med-High
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.480	0.636	12.7

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556	Code: svyx Project: 610
attn: Venetia Lannon	Date Received : 08/10/2001
DOS Waste Prev. Reuse and Recycling	Date Reported : 09/20/2001
44 Beaver Street-8th floor	Lab ID Number : 5054.0
New York NY 10004	Quality Checked : WD 9/20/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 21 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	52.7	1054 lbs/ton
Moisture	%	0.0	47.3	113 gals/ton
est. water holding capacity	%	193	66	158 gals/ton
Inert and Oversize Matter	%	~	8.0	160.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.64	MedHigh
Free Carbonates (CO_3)	Rating	~	3	V High
Volatile Organic Acids	ppm	1139	600	M Low
Organic Matter	%	61.1	32.2	644 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	3.8	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	15.3	15.3	M. Low
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	76	Slight Phytotoxicity
Lepedium sativum Weight	%	~	20	V. Poor
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	2.151	1.134	22.7

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: svyx Project: 610
Date Received : 08/10/2001
Date Reported : 09/20/2001
Lab ID Number : 5054.1
Quality Checked : WD 9/20/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 21 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	56.8	1136 lbs/ton
Moisture	%	0.0	43.2	104 gals/ton
est. water holding capacity	%	216	68	164 gals/ton
Inert and Oversize Matter	%	~	7.8	156.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.70	MedHigh
Free Carbonates (CO_3)	Rating	~	3	V High
Volatile Organic Acids	ppm	1144	650	M Low
Organic Matter	%	69.3	39.4	788 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	4.6	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	17.0	17.0	M. Low
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	63	Phytotoxic
Lepedium sativum Weight	%	~	18	V. Poor
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	2.208	1.254	25.1

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccvdyx Project: 610
Date Received : 09/11/2001
Date Reported : 10/11/2001
Lab ID Number : 5086.0
Quality Checked : WD 10/11/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 53 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs{\cdot}ft^3$	-	31	826 lbs/yd^3
Solids	%	100.0	51.2	1024 lbs/ton
Moisture	%	0.0	48.8	117 gals/ton
est. water holding capacity	%	198	66	159 gals/ton
Inert and Oversize Matter	%	~→	11.1	222.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~→	8.05	MedHigh
Free Carbonates (CO_3)	Rating	~→	1	None
Volatile Organic Acids	ppm	1173	601	M Low
Organic Matter	%	63.0	32.3	645 lbs/ton
Conductivity	$mmhos{\cdot}cm^{-1}$	~→	6.5	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	11.6	11.6	M. Low
Respiration Rate/day	C% of Total-C	1.08	1.08	-
Carbon loss per day	% of total weight	0.37	0.19	3.8 lbs/ton
Dewar Self-Heating	°C rise	~→	1	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~→	95	No Phytotoxicity
Lepedium sativum Weight	%	~→	69	Fair
Solvita CO_2 Rate	(see chart)	~→	6	Med-Low
Solvita NH_3 Rate	(see chart)	~→	5	Absent
Maturity Index	(see chart)	~→	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccvdyx–Project: 610
Date Received : 09/11/2001
Date Reported : 10/11/2001
Lab ID Number : 5086.0

MINERALS ANALYSIS

Sample Identification: NML Day 53 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.930	1.500	30.0
Organic-Nitrogen	%	2.892	1.481	29.6
Phosphorus (P)	%	0.677	0.347	6.9
Potassium (K)	%	0.389	0.199	4.0
Sodium (Na)	%	0.601	0.308	6.2
Calcium (Ca)	%	3.146	1.611	32.2
Magnesium (Mg)	%	0.281	0.144	2.9
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	378	194	0.4
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	6456	3306	6.61
Sulfate (SO_4–S)	ppm	1070	548	1.10

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccvdyx–Project: 610

Date Received : 09/11/2001
Date Reported : 10/11/2001
Lab ID Number : 5086.0

METALS ANALYSIS

Sample Identification: NML Day 53 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	120.2	61.5	0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	1010.0	517.1	1.0
Iron (Fe)	$mg{\cdot}kg^{-1}$	8016.0	4104.2	8.2
Zinc (Zn)	$mg{\cdot}kg^{-1}$	352.7	180.6	0.4
Lead (Pb)	$mg{\cdot}kg^{-1}$	121.4	62.2	0.1
Chromium (Cr)	$mg{\cdot}kg^{-1}$	46.5	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	4.4	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	60.5	31.0	0.1

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccvdyx Project: 610
Date Received : 09/11/2001
Date Reported : 10/11/2001
Lab ID Number : 5086.1
Quality Checked : WD 10/11/01

COMPOSITION ANALYSIS

Sample Identification: NML Day 53 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	31	842 lbs/yd^3
Solids	%	100.0	52.3	1046 lbs/ton
Moisture	%	0.0	47.7	114 gals/ton
est. water holding capacity	%	211	68	163 gals/ton
Inert and Oversize Matter	%	~	12.1	242.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.83	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1147	600	M Low
Organic Matter	%	67.7	35.4	708 lbs/ton
Conductivity	mmhos·cm^{-1}	~	4.7	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	14.5	14.5	M. Low
Respiration Rate/day	C% of Total-C	1.18	1.18	-
Carbon loss per day	% of total weight	0.43	0.23	4.5 lbs/ton
Dewar Self-Heating	°C rise	~	1	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	103	No Phytotoxicity
Lepedium sativum Weight	%	~	50	Fair
Solvita CO_2 Rate	(see chart)	~	5	Medium
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	5	Late-Active

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 | Code: Ccvdyx–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 09/11/2001
Date Reported : 10/11/2001
Lab ID Number : 5086.1

MINERALS ANALYSIS

Sample Identification: NML Day 53 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.523	1.320	26.4
Organic-Nitrogen	%	2.514	1.315	26.3
Phosphorus (P)	%	0.624	0.326	6.5
Potassium (K)	%	0.357	0.187	3.7
Sodium (Na)	%	0.568	0.297	5.9
Calcium (Ca)	%	3.174	1.660	33.2
Magnesium (Mg)	%	0.254	0.133	2.7
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	85	44	0.1
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	6585	3444	6.89
Sulfate (SO_4–S)	ppm	1113	582	1.16

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 | Code: Ccvdyx–Project: 610

attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date Received : 09/11/2001
Date Reported : 10/11/2001
Lab ID Number : 5086.1

METALS ANALYSIS

Sample Identification: NML Day 53 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	135.1	70.7	0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	1072.5	560.9	1.1
Iron (Fe)	$mg{\cdot}kg^{-1}$	7944.4	4154.9	8.3
Zinc (Zn)	$mg{\cdot}kg^{-1}$	349.6	182.8	0.4
Lead (Pb)	$mg{\cdot}kg^{-1}$	111.6	58.4	0.1
Chromium (Cr)	$mg{\cdot}kg^{-1}$	44.1	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	4.4	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	54.8	28.7	0.1

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

NML Day 21
Sample A & Sample B

Woods End Research Laboratory
INCORPORATED

Certificate of Analysis

PCB's Method EPA 8082

		Analyte	Result	Units	PQL
Sample:	5022.1	PCB 1242	ND	mg/kg	0.2
Collect Date:	7/26/2001	PCB 1254	ND	mg/kg	0.2
Date Received:	7/27/2001	PCB 1232	ND	mg/kg	0.2
Lab Sample #	01X0872-01	PCB 1260	ND	mg/kg	0.2
Date Analyzed	8/16/2001	PCB 1248	ND	mg/kg	0.2
Date Extracted	8/2/2001	PCB 1016	ND	mg/kg	0.2
Surrogate(DCB) % Recovery	90 AR 30-150	PCB 1221	ND	mg/kg	0.2
g Sample Extracted	Percent Solids 47.8				
Wt Basis	Dry wt Basis				

		Analyte	Result	Units	PQL
Sample:	5022.2	PCB 1242	ND	mg/kg	0.2
Collect Date:	7/26/2001	PCB 1254	ND	mg/kg	0.2
Date Received:	7/27/2001	PCB 1232	ND	mg/kg	0.2
Lab Sample #	01X0872-02	PCB 1260	ND	mg/kg	0.2
Date Analyzed	8/16/2001	PCB 1248	ND	mg/kg	0.2
Date Extracted	8/2/2001	PCB 1016	ND	mg/kg	0.2
Surrogate(DCB) % Recovery	80 AR 30-150	PCB 1221	ND	mg/kg	0.2
g Sample Extracted	Percent Solids 41.8				
Wt Basis	Dry wt Basis				

Wayne Davis

Laboratory Supervisor 8/30/01

PQL Practical Quantitation Limit ND Not Detected (<PQL)

PCB Report Page 1 of 1

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *7-Sep-01*
Project: 610
Acct# 556
Initials EE
Ref:

Lab No: **5084.0** **Description:** NML Final Off-Site Blend (<3/8")

Weight In, g: 1068

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.1	0.1	0.01%	3.3%
Plastic-Film	0.1	0.1	0.01%	3.3%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	3.6	2.8	0.33%	93.4%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	3.8	3.0	0.4%	100.0%

Total Man-made Inerts Matter = 6.6%

Weight In, g: 1067.80

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	3.7	3.7	0.44%	0.4%
Plastic-Hard	0.8	0.8	0.09%	0.1%
Plastic-Film	0.3	0.3	0.04%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.4	0.3	0.04%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	19.8	15.6	1.84%	1.8%
Stones	23.0	23.0	2.71%	2.7%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost + Fines	1016.0	802.6	94.49%	94.8%
TOTAL WEIGHT	1064.0	846.4	99.6%	100.0%

> 4mm

Total Man-made Inerts Matter = 0.6%

Printed: 10-19-01

Woods End Research Laboratory, Inc.

20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date:	*5-Oct-01*
Project:	610
Acct#	556
Initials	LEE
Ref:	

Lab No: **5022.2** **Description:** NML Day 21, Sample B

Weight In, g: 785

FRACTION: **Over 10mm**	**LAB SORT**	**percent of whole**	**relative percent**
Glass	2.4	0.31%	24.5%
Plastic-Hard	1.1	0.14%	11.2%
Plastic-Film	0.2	0.03%	2.0%
Metal	0.0	0.00%	0.0%
Textile, fibers	0.8	0.10%	8.2%
Paper	1.5	0.19%	15.3%
Wood	0.0	0.00%	0.0%
Stones	3.8	0.48%	38.8%
Bone, shell	0.0	0.00%	0.0%
Compost	0.0	0.00%	0.0%
TOTAL WEIGHT	9.8	1.2%	100.0%

Weight In, g: 784.90

> 4mm

FRACTION: **Under 10mm**	**LAB SORT**	**percent of whole**	**relative percent**
Glass	4.4	0.56%	0.6%
Plastic-Hard	3.1	0.39%	0.4%
Plastic-Film	1.4	0.18%	0.2%
Metal	0.0	0.00%	0.0%
Textile, fibers	5.2	0.66%	0.7%
Paper	27.0	3.44%	3.5%
Wood	2.1	0.27%	0.3%
Stones	1.9	0.24%	0.2%
Bone, shell	0.0	0.00%	0.0%
Compost + Fines	730.0	93.01%	94.2%
TOTAL WEIGHT	775.1	98.8%	100.0%
GRAND TOTAL		100.0%	

Notes * inerts > 4mm

Printed: 10-05-01

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.0
Quality Checked : WD 6/27/01

COMPOSITION ANALYSIS

Sample Identification: NQB Primary Screen Unders (<1"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	31	842 lbs/yd^3
Solids	%	100.0	54.6	1092 lbs/ton
Moisture	%	0.0	45.4	109 gals/ton
est. water holding capacity	%	217	68	164 gals/ton
Inert and Oversize Matter	%	~	2.2	44.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.87	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	2655	1450	Medium
Organic Matter	%	69.8	38.1	763 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	4.2	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	39.4	39.4	High
Dewar Self-Heating	°C rise	~	19	Grade IV
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	2	Very Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 | Code: x–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling | Date Received : 05/16/2001
· 44 Beaver Street-8th floor | Date Reported : 06/27/2001
· New York NY 10004 | Lab ID Number : 4953.0

MINERALS ANALYSIS

Sample Identification: NQB Primary Screen Unders (<1"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	0.957	0.523	10.5
Organic-Nitrogen	%	0.893	0.488	9.8
Phosphorus (P)	%	0.140	0.076	1.5
Potassium (K)	%	0.232	0.127	2.5
Sodium (Na)	%	0.232	0.127	2.5
Calcium (Ca)	%	2.440	1.332	26.6
Magnesium (Mg)	%	0.180	0.098	2.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	637	348	0.7
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4083	2229	4.46
Sulfate (SO_4–S)	ppm	3728	2036	4.07

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
Code: x–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.0

METALS ANALYSIS

Sample Identification: NQB Primary Screen Unders (<1"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	65.2	35.6	<0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	160.0	87.4	0.2
Iron (Fe)	$mg{\cdot}kg^{-1}$	5440.0	2970.2	5.9
Zinc (Zn)	$mg{\cdot}kg^{-1}$	404.0	220.6	0.4
Lead (Pb)	$mg{\cdot}kg^{-1}$	90.0	-	-
Chromium (Cr)	$mg{\cdot}kg^{-1}$	31.6	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	2.0	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	24.0	-	-

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.1
Quality Checked : WD 6/27/01

COMPOSITION ANALYSIS

Sample Identification: NQB Primary Screen Unders (<1"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	33	893 lbs/yd^3
Solids	%	100.0	53.2	1064 lbs/ton
Moisture	%	0.0	46.8	112 gals/ton
est. water holding capacity	%	224	69	166 gals/ton
Inert and Oversize Matter	%	~→	2.8	56.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~→	7.39	Med-Ideal
Free Carbonates (CO_3)	Rating	~→	1	None
Volatile Organic Acids	ppm	3666	1950	Medium
Organic Matter	%	72.2	38.4	769 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~→	5.2	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	44.9	44.9	High
Dewar Self-Heating	°C rise	~→	6	Grade V
Solvita CO_2 Rate	(see chart)	~→	3	High
Solvita NH_3 Rate	(see chart)	~→	5	Absent
Maturity Index	(see chart)	~→	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x–Project: 610

Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.1

MINERALS ANALYSIS

Sample Identification: NQB Primary Screen Unders (<1"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	0.868	0.462	9.2
Organic-Nitrogen	%	0.794	0.422	8.4
Phosphorus (P)	%	0.124	0.066	1.3
Potassium (K)	%	0.256	0.136	2.7
Sodium (Na)	%	0.240	0.128	2.6
Calcium (Ca)	%	2.444	1.300	26.0
Magnesium (Mg)	%	0.192	0.102	2.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	738	393	0.8
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	4063	2162	4.32
Sulfate (SO_4–S)	ppm	3744	1992	3.98

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x-Project: 610

Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.1

METALS ANALYSIS

Sample Identification: NQB Primary Screen Unders (<1"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	76.0	40.4	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	164.0	87.2	0.2
Iron (Fe)	$mg \cdot kg^{-1}$	5840.0	3106.9	6.2
Zinc (Zn)	$mg \cdot kg^{-1}$	364.0	193.6	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	114.0	60.6	0.1
Chromium (Cr)	$mg \cdot kg^{-1}$	30.8	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.0	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	27.6	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556	Code: x Project: 610
· attn: Venetia Lannon	Date Received : 05/16/2001
· DOS Waste Prev. Reuse and Recycling	Date Reported : 06/27/2001
· 44 Beaver Street-8th floor	Lab ID Number : 4953.2
· New York NY 10004	Quality Checked : WD 6/27/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 7, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	26	691 lbs/yd^3
Solids	%	100.0	66.4	1328 lbs/ton
Moisture	%	0.0	33.6	81 gals/ton
est. water holding capacity	%	212	68	163 gals/ton
Inert and Oversize Matter	%	~	3.7	74.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.55	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	10091	6700	High
Organic Matter	%	67.9	45.1	901 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	4.9	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	38.9	38.9	High
Dewar Self-Heating	°C rise	~	37	Grade II
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	0.943	0.626	12.5

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.

Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.3
Quality Checked : WO 6/27/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 7, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs{\cdot}ft^3$	-	26	708 lbs/yd^3
Solids	%	100.0	68.5	1370 lbs/ton
Moisture	%	0.0	31.5	76 gals/ton
est. water holding capacity	%	208	68	162 gals/ton
Inert and Oversize Matter	%	~	4.1	82.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.76	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	9847	6745	High
Organic Matter	%	66.5	45.5	911 lbs/ton
Conductivity	$mmhos{\cdot}cm^{-1}$	~	5.0	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	34.5	34.5	Med-High
Dewar Self-Heating	°C rise	~	46	Grade I
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	4	Med-Active
Total Mineral Nutrients				
Total Nitrogen	%	1.040	0.712	14.2

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.4
Quality Checked : WD 6/27/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 14, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	24	640 lbs/yd^3
Solids	%	100.0	66.4	1328 lbs/ton
Moisture	%	0.0	33.6	81 gals/ton
est. water holding capacity	%	201	67	160 gals/ton
Inert and Oversize Matter	%	~	1.8	36.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.58	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	5947	3949	M High
Organic Matter	%	64.0	42.5	849 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	3.8	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	33.2	33.2	Med-High
Dewar Self-Heating	°C rise	~	40	Grade II
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.041	0.691	13.8

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.5
Quality Checked : WD 6/27/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 14, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	25	674 lbs/yd^3
Solids	%	100.0	67.3	1346 lbs/ton
Moisture	%	0.0	32.7	78 gals/ton
est. water holding capacity	%	197	66	159 gals/ton
Inert and Oversize Matter	%	⤳	2.8	56.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	⤳	7.94	MedHigh
Free Carbonates (CO_3)	Rating	⤳	1	None
Volatile Organic Acids	ppm	7804	5252	High
Organic Matter	%	62.4	42.0	840 lbs/ton
Conductivity	*mmhos*·cm^{-1}	⤳	5.2	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	28.0	28.0	Med-High
Dewar Self-Heating	°C rise	⤳	47	Grade I
Solvita CO_2 Rate	(see chart)	⤳	3	High
Solvita NH_3 Rate	(see chart)	⤳	4	Slight
Maturity Index	(see chart)	⤳	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.202	0.809	16.2

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.6
Quality Checked : WD 6/27/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 21, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	24	657 lbs/yd^3
Solids	%	100.0	73.6	1472 lbs/ton
Moisture	%	0.0	26.4	63 gals/ton
est. water holding capacity	%	206	67	161 gals/ton
Inert and Oversize Matter	%	~	3.5	70.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.47	Med-Ideal
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	3331	2452	Medium
Organic Matter	%	65.7	48.4	967 lbs/ton
Conductivity	mmhos·cm^{-1}	~	5.6	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	36.4	36.4	High
Dewar Self-Heating	°C rise	~	32	Grade II
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	0.975	0.718	14.4

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: x Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.7
Quality Checked : WO 6/27/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 21, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	26	691 lbs/yd^3
Solids	%	100.0	73.0	1460 lbs/ton
Moisture	%	0.0	27.0	65 gals/ton
est. water holding capacity	%	198	66	159 gals/ton
Inert and Oversize Matter	%	~	4.6	92.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.84	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	5414	3952	M High
Organic Matter	%	62.8	45.8	917 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	6.3	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	30.8	30.8	Med-High
Dewar Self-Heating	°C rise	~	41	Grade I
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.101	0.804	16.1

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: xS Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.8
Quality Checked : WO 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NQB Final Screen Unders (<5mm), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	27	741 lbs/yd^3
Solids	%	100.0	79.2	1584 lbs/ton
Moisture	%	0.0	20.8	50 gals/ton
est. water holding capacity	%	213	68	163 gals/ton
pH (paste, H_2O)	$-logH^+$	~	7.95	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	821	650	M Low
Organic Matter	%	68.3	54.1	1082 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	6.3	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	33.5	33.5	Med-High
Dewar Self-Heating	°C rise	~	26	Grade III
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	88	No Phytotoxicity
Lepedium sativum Weight	%	~	33	Low
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: xS-Project: 610

Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.8

MINERALS ANALYSIS

Sample Identification: NQB Final Screen Unders (<5mm), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.101	0.872	17.4
Organic-Nitrogen	%	1.081	0.856	17.1
Phosphorus (P)	%	0.216	0.171	3.4
Potassium (K)	%	0.392	0.310	6.2
Sodium (Na)	%	0.300	0.238	4.8
Calcium (Ca)	%	3.500	2.772	55.4
Magnesium (Mg)	%	0.220	0.174	3.5
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	195	154	0.3
Nitrate-N	ppm	<2	< 2	nd
Nitrite-N	ppm	<2	< 2	nd
Chloride (Cl)	ppm	4479	3548	7.10
Sulfate (SO_4-S)	ppm	5496	4353	8.71

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 — Code: xS–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling — Date Received : 05/16/2001
· 44 Beaver Street-8th floor — Date Reported : 06/27/2001
· New York NY 10004 — Lab ID Number : 4953.8

METALS ANALYSIS

Sample Identification: NQB Final Screen Unders (<5mm), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	84.4	66.8	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	288.0	228.1	0.5
Iron (Fe)	$mg \cdot kg^{-1}$	8920.0	7064.6	14.1
Zinc (Zn)	$mg \cdot kg^{-1}$	524.0	415.0	0.8
Lead (Pb)	$mg \cdot kg^{-1}$	193.6	153.3	0.3
Chromium (Cr)	$mg \cdot kg^{-1}$	274.0	217.0	0.4
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	38.0	30.1	0.1
Arsenic (As)	$mg \cdot kg^{-1}$	9.5	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	0.57	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	13	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	< 5.3	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	380	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.0	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: xS Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.9
Quality Checked : WO 6/27/01

COMPOSITION ANALYSIS

Sample Identification: NQB Final Screen Unders (<5mm), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	26	691 lbs/yd^3
Solids	%	100.0	77.3	1546 lbs/ton
Moisture	%	0.0	22.7	54 gals/ton
est. water holding capacity	%	223	69	166 gals/ton
pH (paste, H_2O)	-logH$^+$	~→	7.99	MedHigh
Free Carbonates (CO_3)	Rating	~→	1	None
Volatile Organic Acids	ppm	582	450	M Low
Organic Matter	%	71.9	55.6	1112 lbs/ton
Conductivity	mmhos·cm^{-1}	~→	5.8	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	33.4	33.4	Med-High
Dewar Self-Heating	°C rise	~→	27	Grade III
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~→	95	No Phytotoxicity
Lepedium sativum Weight	%	~→	36	Low
Solvita CO_2 Rate	(see chart)	~→	3	High
Solvita NH_3 Rate	(see chart)	~→	5	Absent
Maturity Index	(see chart)	~→	3	Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Page 2 of 3

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: xS–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.9

MINERALS ANALYSIS

Sample Identification: NQB Final Screen Unders (<5mm), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.164	0.900	18.0
Organic-Nitrogen	%	1.144	0.884	17.7
Phosphorus (P)	%	0.192	0.148	3.0
Potassium (K)	%	0.400	0.309	6.2
Sodium (Na)	%	0.304	0.235	4.7
Calcium (Ca)	%	3.400	2.628	52.6
Magnesium (Mg)	%	0.226	0.175	3.5
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	201	155	0.3
Nitrate-N	ppm	<2	< 2	nd
Nitrite-N	ppm	<2	< 2	nd
Chloride (Cl)	ppm	4694	3629	7.26
Sulfate (SO_4–S)	ppm	5854	4525	9.05

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 · attn: Venetia Lannon · DOS Waste Prev. Reuse and Recycling · 44 Beaver Street-8th floor · New York NY 10004

Code: xS-Project: 610
Date Received : 05/16/2001
Date Reported : 06/27/2001
Lab ID Number : 4953.9

METALS ANALYSIS

Sample Identification: NQB Final Screen Unders (<5mm), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	90.4	69.9	0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	280.0	216.4	0.4
Iron (Fe)	$mg \cdot kg^{-1}$	7400.0	5720.2	11.4
Zinc (Zn)	$mg \cdot kg^{-1}$	440.0	340.1	0.7
Lead (Pb)	$mg \cdot kg^{-1}$	195.6	151.2	0.3
Chromium (Cr)	$mg \cdot kg^{-1}$	40.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.8	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	36.0	27.8	0.1
Arsenic (As)	$mg \cdot kg^{-1}$	9.5	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	0.59	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	11	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	< 5.6	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	39	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.1	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 06/12/2001
Date Reported : 07/17/2001
Lab ID Number : 4984.0
Quality Checked : WD 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 7 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	51.2	1024 lbs/ton
Moisture	%	0.0	48.8	117 gals/ton
est. water holding capacity	%	208	68	162 gals/ton
Inert and Oversize Matter	%	~	3.5	70.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.77	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1269	650	M Low
Organic Matter	%	66.6	34.1	682 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	2.7	Med-Low
Carbon:Nitrogen (C:N) Ratio	w:w	35.7	35.7	High
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.008	0.516	10.3

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 06/12/2001
Date Reported : 07/17/2001
Lab ID Number : 4984.1
Quality Checked : WP 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 7 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	53.0	1060 lbs/ton
Moisture	%	0.0	47.0	113 gals/ton
est. water holding capacity	%	210	68	162 gals/ton
Inert and Oversize Matter	%	~	3.8	76.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.71	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1131	599	M Low
Organic Matter	%	67.3	35.7	714 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~	3.4	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	34.2	34.2	Med-High
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.064	0.564	11.3

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Code: sv Project: 610
Date Received : 06/04/2001
Date Reported : 07/10/2001
Lab ID Number : 4971.0
Quality Checked : WO 7/10/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 14 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	52.8	1056 lbs/ton
Moisture	%	0.0	47.2	113 gals/ton
est. water holding capacity	%	213	68	163 gals/ton
Inert and Oversize Matter	%	~	17.4	348.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	8.07	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	3981	2102	Medium
Organic Matter	%	68.2	36.0	721 lbs/ton
Conductivity	$mmhos\cdot cm^{-1}$	~	3.3	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	35.0	35.0	Med-High
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.052	0.555	11.1

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 06/04/2001
Date Reported : 07/10/2001
Lab ID Number : 4971.1
Quality Checked : WD 7/10/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 14 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	55.5	1110 lbs/ton
Moisture	%	0.0	44.5	107 gals/ton
est. water holding capacity	%	208	68	162 gals/ton
Inert and Oversize Matter	%	~	15.0	300.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.97	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	5315	2950	M High
Organic Matter	%	66.5	36.9	738 lbs/ton
Conductivity	$mmhos{\cdot}cm^{-1}$	~	4.0	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	31.9	31.9	Med-High
Solvita CO_2 Rate	(see chart)	~	3	High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	3	Immature
Total Mineral Nutrients				
Total Nitrogen	%	1.126	0.625	12.5

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 06/12/2001
Date Reported : 07/17/2001
Lab ID Number : 4984.2
Quality Checked : WO 8/3/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 21 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	51.2	1024 lbs/ton
Moisture	%	0.0	48.8	117 gals/ton
est. water holding capacity	%	190	66	157 gals/ton
Inert and Oversize Matter	%	~	4.1	82.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.89	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	684	350	M Low
Organic Matter	%	60.2	30.8	616 lbs/ton
Conductivity	$mmhos{\cdot}cm^{-1}$	~	3.7	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	26.6	26.6	Med-High
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	85	Slight Phytotoxicity
Lepedium sativum Weight	%	~	40	Low
Solvita CO_2 Rate	(see chart)	~	5	Medium
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	5	Late-Active
Total Mineral Nutrients				
Total Nitrogen	%	1.221	0.625	12.5

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 06/12/2001
Date Reported : 07/17/2001
Lab ID Number : 4984.3
Quality Checked : WD 8/3/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 21 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	52.5	1050 lbs/ton
Moisture	%	0.0	47.5	114 gals/ton
est. water holding capacity	%	192	66	158 gals/ton
Inert and Oversize Matter	%	~	4.1	82.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.88	MedHigh
Free Carbonates (CO_3)	Rating	~	3	V High
Volatile Organic Acids	ppm	667	350	M Low
Organic Matter	%	60.9	32.0	639 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	3.5	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	53.8	53.8	High
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	68	Phytotoxic
Lepedium sativum Weight	%	~	34	Low
Solvita CO_2 Rate	(see chart)	~	5	Medium
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	5	Late-Active
Total Mineral Nutrients				
Total Nitrogen	%	0.611	0.321	6.4

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556	Code: Ccyvdx Project: 610
attn: Venetia Lannon	Date Received : 07/10/2001
DOS Waste Prev. Reuse and Recycling	Date Reported : 08/07/2001
44 Beaver Street-8th floor	Lab ID Number : 5009.0
New York NY 10004	Quality Checked : WD 8/7/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 50 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs-ft^3	-	35	944 lbs/yd^3
Solids	%	100.0	50.5	1010 lbs/ton
Moisture	%	0.0	49.5	119 gals/ton
est. water holding capacity	%	194	66	158 gals/ton
Inert and Oversize Matter	%	~	2.3	46.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.79	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	396	200	V Low
Organic Matter	%	61.6	31.1	622 lbs/ton
Conductivity	mmhos·cm^{-1}	~	4.9	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	24.9	24.9	Med-High
Respiration Rate/day	C% of Total-C	0.49	0.49	-
Carbon loss per day	% of total weight	0.16	0.08	1.6 lbs/ton
Dewar Self-Heating	°C rise	~	6	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	24	Ex. Phytotoxic
Lepedium sativum Weight	%	~	47	Low
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx–Project: 610

Date Received : 07/10/2001
Date Reported : 08/07/2001
Lab ID Number : 5009.0

MINERALS ANALYSIS

Sample Identification: NQB Day 50 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.336	0.675	13.5
Organic-Nitrogen	%	1.334	0.674	13.5
Phosphorus (P)	%	0.176	0.089	1.8
Potassium (K)	%	0.360	0.182	3.6
Sodium (Na)	%	0.412	0.208	4.2
Calcium (Ca)	%	3.120	1.576	31.5
Magnesium (Mg)	%	0.304	0.154	3.1
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	13	7	0.0
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5292	2672	5.34
Sulfate (SO_4–S)	ppm	<4	< 2	

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx–Project: 610

Date Received : 07/10/2001
Date Reported : 08/07/2001
Lab ID Number : 5009.0

METALS ANALYSIS

Sample Identification: NQB Day 50 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	87.6	44.2	<0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	244.0	123.2	0.2
Iron (Fe)	$mg{\cdot}kg^{-1}$	17200.0	8686.0	17.4
Zinc (Zn)	$mg{\cdot}kg^{-1}$	476.0	240.4	0.5
Lead (Pb)	$mg{\cdot}kg^{-1}$	104.0	52.5	0.1
Chromium (Cr)	$mg{\cdot}kg^{-1}$	44.0	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	3.2	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	36.4	-	-

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx Project: 610
Date Received : 07/10/2001
Date Reported : 08/07/2001
Lab ID Number : 5009.1
Quality Checked : WO 8/7/01

COMPOSITION ANALYSIS

Sample Identification: NQB Day 50 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	35	944 lbs/yd^3
Solids	%	100.0	48.3	966 lbs/ton
Moisture	%	0.0	51.7	124 gals/ton
est. water holding capacity	%	192	66	158 gals/ton
Inert and Oversize Matter	%	~	1.2	24.0 lbs/ton
pH (paste, H_2O)	-logH^+	~	7.81	MedHigh
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	621	300	M Low
Organic Matter	%	60.6	29.3	585 lbs/ton
Conductivity	mmhos·cm^{-1}	~	4.3	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	24.5	24.5	Med-High
Respiration Rate/day	C% of Total-C	0.55	0.55	-
Carbon loss per day	% of total weight	0.18	0.09	1.7 lbs/ton
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	32	Very Phytotoxic
Lepedium sativum Weight	%	~	49	Low
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Page 2 of 3

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 | Code: Ccyvdx–Project: 610

· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Date Received : 07/10/2001
Date Reported : 08/07/2001
Lab ID Number : 5009.1

MINERALS ANALYSIS

Sample Identification: NQB Day 50 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	1.337	0.646	12.9
Organic-Nitrogen	%	1.336	0.645	12.9
Phosphorus (P)	%	0.176	0.085	1.7
Potassium (K)	%	0.372	0.180	3.6
Sodium (Na)	%	0.400	0.193	3.9
Calcium (Ca)	%	3.276	1.582	31.6
Magnesium (Mg)	%	0.316	0.153	3.1
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	< 2	< 1	-
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5587	2698	5.40
Sulfate (SO_4–S)	ppm	3599	1738	3.48

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccyvdx–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 07/10/2001
· 44 Beaver Street-8th floor Date Reported : 08/07/2001
· New York NY 10004 Lab ID Number : 5009.1

METALS ANALYSIS

Sample Identification: NQB Day 50 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	90.0	43.5	<0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	220.0	106.3	0.2
Iron (Fe)	$mg{\cdot}kg^{-1}$	8400.0	4057.2	8.1
Zinc (Zn)	$mg{\cdot}kg^{-1}$	436.0	210.6	0.4
Lead (Pb)	$mg{\cdot}kg^{-1}$	105.6	51.0	0.1
Chromium (Cr)	$mg{\cdot}kg^{-1}$	40.0	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	4.8	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	34.4	-	-

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

NQB Final Screen Unders (<5mm)
Sample A

WOODS END®
RESEARCH
LABORATORY INC.

Old Rome Road, P.O. Box 297, Mt. Vernon, Maine 04352-0297
Phone (207) 293-2457 Fax: (207) 293-2488
email: info@woodsend.org

Project: NYC DOS

Certificate of Analysis

EPA Method 8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name: 4953.8
Sample Location: COMPOST
Sampling Date: 5/21/2001
Sampling Time: 14:00
Date Received: 6/5/2001

Lab #: 01X0541-01
Matrix: SOIL
Analyst: HY
Extract Date: 5/24/2001
Analysis Date: 5/29/2001

Analyte	Result	Units	PQL
alpha-BHC:	ND	mg/Kg	0.02
gamma-BHC (Lindane):	ND	mg/Kg	0.02
Heptachlor:	ND	mg/Kg	0.02
Aldrin:	ND	mg/Kg	0.02
beta-BHC:	ND	mg/Kg	0.02
delta-BHC:	ND	mg/Kg	0.02
Heptachlor Epoxide:	ND	mg/Kg	0.02
Endosulfan I:	ND	mg/Kg	0.02
4,4'-DDE:	ND	mg/Kg	0.02
Dieldrin:	ND	mg/Kg	0.02
Endrin:	ND	mg/Kg	0.02
Endosulfan II:	ND	mg/Kg	0.02
4,4'-DDD:	ND	mg/Kg	0.02
4,4'-DDT:	ND	mg/Kg	0.02
Endrin Aldehyde:	ND	mg/Kg	0.02
Endosulfan Sulfate:	ND	mg/Kg	0.02
Methoxychlor:	ND	mg/Kg	0.10
Endrin Ketone:	ND	mg/Kg	0.02
Chlordane:	ND	mg/Kg	0.2
Toxaphene:	ND	mg/Kg	0.2
Arochlor 1016:	ND	mg/Kg	0.2
Arochlor 1221:	ND	mg/Kg	0.2
Arochlor 1232:	ND	mg/Kg	0.2
Arochlor 1242:	ND	mg/Kg	0.2
Arochlor 1248:	ND	mg/Kg	0.2
Arochlor 1254:	ND	mg/Kg	0.2
Arochlor 1260:	ND	mg/Kg	0.2

Surrogate Standard	% Recovery
TCX %R	36.2

ND Not Detected   PQL Practical Quantitation Limit

NQB Final Screen Unders (<5mm)
Sample B

WOODS END® RESEARCH LABORATORY INC.

Old Rome Road, P.O. Box 297, Mt. Vernon, Maine 04352-0297
Phone (207) 293-2457 Fax: (207) 293-2488
email: info @ woodsend.org

Certificate of Analysis

EPA Method 8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name: 4953.9
Sample Location: COMPOST
Sampling Date: 5/21/2001
Sampling Time: 14:00
Date Received: 6/5/2001

Lab #: 01X0541-02
Matrix: SOIL
Analyst: HY
Extract Date: 5/24/2001
Analysis Date: 5/29/2001

Analyte	Result	Units	PQL
alpha-BHC:	ND	mg/Kg	0.02
gamma-BHC (Lindane):	ND	mg/Kg	0.02
Heptachlor:	ND	mg/Kg	0.02
Aldrin:	ND	mg/Kg	0.02
beta-BHC:	ND	mg/Kg	0.02
delta-BHC:	ND	mg/Kg	0.02
Heptachlor Epoxide:	ND	mg/Kg	0.02
Endosulfan I:	ND	mg/Kg	0.02
4,4'-DDE:	ND	mg/Kg	0.02
Dieldrin:	ND	mg/Kg	0.02
Endrin:	ND	mg/Kg	0.02
Endosulfan II:	ND	mg/Kg	0.02
4,4'-DDD:	ND	mg/Kg	0.02
4,4'-DDT:	ND	mg/Kg	0.02
Endrin Aldehyde:	ND	mg/Kg	0.02
Endosulfan Sulfate:	ND	mg/Kg	0.02
Methoxychlor:	ND	mg/Kg	0.10
Endrin Ketone:	ND	mg/Kg	0.02
Chlordane:	ND	mg/Kg	0.2
Toxaphene:	ND	mg/Kg	0.2
Arochlor 1016:	ND	mg/Kg	0.2
Arochlor 1221:	ND	mg/Kg	0.2
Arochlor 1232:	ND	mg/Kg	0.2
Arochlor 1242:	ND	mg/Kg	0.2
Arochlor 1248:	ND	mg/Kg	0.2
Arochlor 1254:	ND	mg/Kg	0.2
Arochlor 1260:	ND	mg/Kg	0.2

Surrogate Standard	% Recovery
TCX %R	35.1

Lab Supervisor: John W. Cobb

Report Date: 07-Jun-01

ND Not Detected **PQL** Practical Quantitation Limit

EPA 8081 Report Page 2 of 2

Woods End Research Laboratory, Inc.

20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *16-May-01*
Project: 610
Acct# 556

Initials [illegible]
Ref:

Lab No: **4953.8** **Description:** NQB facility final < 5 mm, A

Weight In, g: 182

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.0	0.0	0.00%	0.0%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	0.0	0.0	0.00%	0.0%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	0.0	0.0	0.0%	0.0%

Total Man-made Inerts Matter = 0.0%

Weight In, g: 181.70

> 4mm

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.2	0.2	0.14%	0.1%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	0.0	0.0	0.00%	0.0%
Stones	0.5	0.5	0.35%	0.3%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost + Fines	181.0	143.0	99.51%	99.5%
TOTAL WEIGHT	181.70	143.7	100.0%	100.0%

Total Man-made Inerts Matter = 0.1%

Notes * inerts > 4mm

Printed: 10-19-01

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *16-May-01*
Project: 610
Acct# 556

Initials EE
Ref:

Lab No: 4953.9 Description: NQB facility final < 5 mm, B

237 Weight In, g: 237

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	0.0	0.0	0.00%	0.0%
Plastic-Film	0.0	0.0	0.00%	0.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	0.0	0.0	0.00%	0.0%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	0.0	0.0	0.0%	0.0%

Total Man-made Inerts Matter = 0.0%

Weight In, g: 236.70

> 4mm

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	0.3	0.3	0.16%	0.2%
Plastic-Hard	0.1	0.1	0.05%	0.1%
Plastic-Film	0.1	0.1	0.05%	0.1%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	0.0	0.0	0.00%	0.0%
Paper	0.0	0.0	0.00%	0.0%
Wood	0.0	0.0	0.00%	0.0%
Stones	1.2	1.2	0.64%	0.6%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost + Fines	235.0	185.7	99.09%	99.1%
TOTAL WEIGHT	236.70	187.4	100.0%	100.0%

Total Man-made Inerts Matter = 0.3%

GRAND TOTAL 100.0%

Notes * inerts > 4mm

Printed: 10-19-01

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *16-May-01*
Project: 610
Acct# 556
Initials CE
Ref:

Lab No: **4954.0** **Description:** NQB Final Facility Overs (>5mm), Sample A

Weight In, g: 174

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	1.0	1.0	0.71%	6.6%
Plastic-Hard	0.2	0.2	0.14%	1.3%
Plastic-Film	0.6	0.6	0.43%	4.0%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	7.2	5.7	4.03%	37.5%
Paper	8.0	6.3	4.48%	41.7%
Wood	1.7	1.3	0.95%	8.9%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	18.7	15.2	10.7%	100.0%

Total Man-made Inerts Matter = 49.4%

Weight In, g: 164.48

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	0.7	0.7	0.53%	0.6%
Plastic-Hard	4.5	4.5	3.41%	3.8%
Plastic-Film	3.2	3.2	2.43%	2.7%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	12.0	9.5	7.19%	8.1%
Paper	55.1	43.5	33.00%	37.0%
Wood	9.1	7.2	5.45%	6.1%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost + Fines	62.2	49.1	37.25%	41.7%
TOTAL WEIGHT	146.80	117.7	89.3%	100.0%

> 4mm

Total Man-made Inerts Matter = 15.2%

Printed: 10-19-01

Woods End Research Laboratory, Inc.
20 Old Rome Road - Mt Vernon ME 04352

INERTS CHARACTERIZATION

Client:
attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date: *16-May-01*
Project: 610
Acct# 556

Initials ETE
Ref:

Lab No: 4954.1 Description: NQB Final Facility Overs (>5mm), Sample B

Weight In, g: 161

FRACTION: **Over 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of over-10 mm, dry basis
Glass	0.0	0.0	0.00%	0.0%
Plastic-Hard	1.4	1.4	1.07%	8.2%
Plastic-Film	1.0	1.0	0.76%	5.8%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	8.6	6.8	5.18%	39.6%
Paper	6.8	5.4	4.10%	31.3%
Wood	3.3	2.6	1.99%	15.2%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.0	0.0	0.00%	0.0%
Compost	0.0	0.0	0.00%	0.0%
TOTAL WEIGHT	21.1	17.2	13.1%	100.0%

Total Man-made Inerts Matter = 53.5%

Weight In, g: 153.86

FRACTION: **Under 10mm**	LAB SORT	dry weight, grams	percent of whole, dry basis	percent of under-10 mm dry basis
Glass	0.9	0.9	0.73%	0.8%
Plastic-Hard	1.4	1.4	1.14%	1.3%
Plastic-Film	3.0	3.0	2.44%	2.8%
Metal	0.0	0.0	0.00%	0.0%
Textile, fibers	16.5	13.0	10.61%	12.2%
Paper	54.0	42.7	34.73%	40.0%
Wood	12.0	9.5	7.72%	8.9%
Stones	0.0	0.0	0.00%	0.0%
Bone, shell	0.8	0.6	0.51%	0.6%
Compost + Fines	45.1	35.6	29.01%	33.4%
TOTAL WEIGHT	133.70	106.7	86.9%	100.0%

> 4mm

Total Man-made Inerts Matter = 17.2%

GRAND TOTAL 100.0%

Printed: 10-19-01

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx Project: 610
Date Received : 06/06/2001
Date Reported : 07/17/2001
Lab ID Number : 4973.0
Quality Checked : WD 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NRC Primary Screen Unders (<1 3/4"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	30	809 lbs/yd^3
Solids	%	100.0	51.1	1022 lbs/ton
Moisture	%	0.0	48.9	117 gals/ton
est. water holding capacity	%	236	70	168 gals/ton
Inert and Oversize Matter	%	~	25.7	514.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.00	Med Low
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	11942	6102	High
Organic Matter	%	76.7	39.2	784 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	2.9	Med-Low
Carbon:Nitrogen (C:N) Ratio	w:w	51.0	51.0	High
Respiration Rate/day	C% of Total-C	1.44	1.44	-
Carbon loss per day	% of total weight	0.60	0.31	6.1 lbs/ton
Dewar Self-Heating	°C rise	~	43	Grade I
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	33	Very Phytotoxic
Lepedium sativum Weight	%	~	30	V. Poor
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	2	Very Immature

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx-Project: 610
Date Received : 06/06/2001
Date Reported : 07/17/2001
Lab ID Number : 4973.0

MINERALS ANALYSIS

Sample Identification: NRC Primary Screen Unders (<1 3/4"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	0.812	0.415	8.3
Organic-Nitrogen	%	0.775	0.396	7.9
Phosphorus (P)	%	0.132	0.067	1.3
Potassium (K)	%	0.268	0.137	2.7
Sodium (Na)	%	0.400	0.204	4.1
Calcium (Ca)	%	1.980	1.012	20.2
Magnesium (Mg)	%	0.164	0.084	1.7
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	371	190	0.4
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5118	2616	5.23
Sulfate (SO_4–S)	ppm	2284	1167	2.33

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccyvdx-Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 06/06/2001
· 44 Beaver Street-8th floor Date Reported : 07/17/2001
· New York NY 10004 Lab ID Number : 4973.0

METALS ANALYSIS

Sample Identification: NRC Primary Screen Unders (1 3/4"), Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg{\cdot}kg^{-1}$	34.8	17.8	<0.1
Manganese (Mn)	$mg{\cdot}kg^{-1}$	98.4	50.3	0.1
Iron (Fe)	$mg{\cdot}kg^{-1}$	9880.0	5048.7	10.1
Zinc (Zn)	$mg{\cdot}kg^{-1}$	240.0	122.6	0.2
Lead (Pb)	$mg{\cdot}kg^{-1}$	76.0	-	-
Chromium (Cr)	$mg{\cdot}kg^{-1}$	18.4	-	-
Cadmium (Cd)	$mg{\cdot}kg^{-1}$	2.4	-	-
Nickel (Ni)	$mg{\cdot}kg^{-1}$	26.0	-	-
Arsenic (As)	$mg{\cdot}kg^{-1}$	< 4.0	-	-
Mercury (Hg)	$mg{\cdot}kg^{-1}$	0.92	-	-
Molybdenum (Mo)	$mg{\cdot}kg^{-1}$	< 9.9	-	-
Selenium (Se)	$mg{\cdot}kg^{-1}$	< 8.4	-	-

BACTERIOLOGIC ANALYSIS

Fecal coliform EPA503	MPN per g	58000	-
Total *Salmonella* EPA503	MPN per 4g	< 1.5	-

Notes: $mg{\cdot}kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only.

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx Project: 610
Date Received : 06/06/2001
Date Reported : 07/17/2001
Lab ID Number : 4973.1
Quality Checked : WD 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NRC Primary Screen Unders (<1 3/4"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	28	758 lbs/yd^3
Solids	%	100.0	53.1	1062 lbs/ton
Moisture	%	0.0	46.9	112 gals/ton
est. water holding capacity	%	228	70	167 gals/ton
Inert and Oversize Matter	%	~	16.4	328.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.08	Med-Ideal
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	7155	3799	M High
Organic Matter	%	73.9	39.2	785 lbs/ton
Conductivity	mmhos·cm^{-1}	~	3.0	Med-Low
Carbon:Nitrogen (C:N) Ratio	w:w	45.0	45.0	High
Respiration Rate/day	C% of Total-C	1.47	1.47	-
Carbon loss per day	% of total weight	0.59	0.31	6.2 lbs/ton
Dewar Self-Heating	°C rise	~	42	Grade I
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	40	Very Phytotoxic
Lepedium sativum Weight	%	~	34	Low
Solvita CO_2 Rate	(see chart)	~	1	Ex. High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	1	Raw Waste!

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccyvdx–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 06/06/2001
· 44 Beaver Street-8th floor Date Reported : 07/17/2001
· New York NY 10004 Lab ID Number : 4973.1

MINERALS ANALYSIS

Sample Identification: NRC Primary Screen Unders (<1 3/4"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	0.887	0.471	9.4
Organic-Nitrogen	%	0.874	0.464	9.3
Phosphorus (P)	%	0.104	0.055	1.1
Potassium (K)	%	0.264	0.140	2.8
Sodium (Na)	%	0.388	0.206	4.1
Calcium (Ca)	%	2.048	1.087	21.7
Magnesium (Mg)	%	0.164	0.087	1.7
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	126	67	0.1
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	5114	2716	5.43
Sulfate (SO_4–S)	ppm	2084	1107	2.21

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 — Code: Ccyvdx–Project: 610

attn: Venetia Lannon
DOS Waste Prev. Reuse and Recycling
44 Beaver Street-8th floor
New York NY 10004

Date Received : 06/06/2001
Date Reported : 07/17/2001
Lab ID Number : 4973.1

METALS ANALYSIS

Sample Identification: NRC Primary Screen Unders (<1 3/4"), Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	42.0	22.3	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	75.2	39.9	<0.1
Iron (Fe)	$mg \cdot kg^{-1}$	3880.0	2060.3	4.1
Zinc (Zn)	$mg \cdot kg^{-1}$	196.8	104.5	0.2
Lead (Pb)	$mg \cdot kg^{-1}$	52.0	-	-
Chromium (Cr)	$mg \cdot kg^{-1}$	16.0	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	2.0	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	23.6	-	-
Arsenic (As)	$mg \cdot kg^{-1}$	< 3.9	-	-
Mercury (Hg)	$mg \cdot kg^{-1}$	2.5	-	-
Molybdenum (Mo)	$mg \cdot kg^{-1}$	< 9.7	-	-
Selenium (Se)	$mg \cdot kg^{-1}$	< 8.2	-	-
BACTERIOLOGIC ANALYSIS				
Fecal coliform EPA503	MPN per g	17,000,000	-	
Total *Salmonella* EPA503	MPN per 4g	< 1.5	-	

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 — Code: sv Project: 605
· attn: Venetia Lannon — Date Received : 06/15/2001
· DOS Waste Prev. Reuse and Recycling — Date Reported : 07/17/2001
· 44 Beaver Street-8th floor — Lab ID Number : 4986.0
· New York NY 10004 — Quality Checked : WD 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NRC Day 7 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	49.8	996 lbs/ton
Moisture	%	0.0	50.2	120 gals/ton
est. water holding capacity	%	241	71	170 gals/ton
Inert and Oversize Matter	%	~	15.0	300.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.27	Med-Ideal
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	19294	9608	High
Organic Matter	%	78.7	39.2	784 lbs/ton
Conductivity	$mmhos\text{-}cm^{-1}$	~	4.2	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	51.7	51.7	High
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	0.821	0.409	8.2

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 605
Date Received : 06/15/2001
Date Reported : 07/17/2001
Lab ID Number : 4986.1
Quality Checked : WD 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NRC Day 7 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	51.4	1028 lbs/ton
Moisture	%	0.0	48.6	117 gals/ton
est. water holding capacity	%	238	70	169 gals/ton
Inert and Oversize Matter	%	~	10.7	214.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.78	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	13900	7145	High
Organic Matter	%	77.3	39.7	794 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	3.4	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	50.9	50.9	High
Solvita CO_2 Rate	(see chart)	~	2	V. High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	2	Very Immature
Total Mineral Nutrients				
Total Nitrogen	%	0.821	0.422	8.4

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 06/22/2001
Date Reported : 07/17/2001
Lab ID Number : 4992.0
Quality Checked : WO 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NRC Day 14 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	27	725 lbs/yd^3
Solids	%	100.0	49.4	988 lbs/ton
Moisture	%	0.0	50.6	121 gals/ton
est. water holding capacity	%	228	70	167 gals/ton
Inert and Oversize Matter	%	~	16.4	328.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~	7.95	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	2735	1351	Medium
Organic Matter	%	73.9	36.5	730 lbs/ton
Conductivity	mmhos·cm^{-1}	~	4.2	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	33.9	33.9	Med-High
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	4	Med-Active
Total Mineral Nutrients				
Total Nitrogen	%	1.179	0.582	11.6

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 06/22/2001
Date Reported : 07/17/2001
Lab ID Number : 4992.1
Quality Checked : WO 7/17/01

COMPOSITION ANALYSIS

Sample Identification: NRC Day 14 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs\cdot ft^3$	-	30	809 lbs/yd^3
Solids	%	100.0	49.8	996 lbs/ton
Moisture	%	0.0	50.2	120 gals/ton
est. water holding capacity	%	227	69	166 gals/ton
Inert and Oversize Matter	%	~	12.1	242.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.94	MedHigh
Free Carbonates (CO_3)	Rating	~	1	None
Volatile Organic Acids	ppm	1407	701	M Low
Organic Matter	%	73.5	36.6	732 lbs/ton
Conductivity	$mmhos\cdot cm^{-1}$	~	4.5	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	34.9	34.9	Med-High
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	4	Slight
Maturity Index	(see chart)	~	4	Med-Active
Total Mineral Nutrients				
Total Nitrogen	%	1.135	0.565	11.3

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 06/28/2001
Date Reported : 08/03/2001
Lab ID Number : 5000.0
Quality Checked : WD 8/3/01

COMPOSITION ANALYSIS

Sample Identification: NRC Day 21 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	58.2	1164 lbs/ton
Moisture	%	0.0	41.8	100 gals/ton
est. water holding capacity	%	206	67	161 gals/ton
Inert and Oversize Matter	%	~	19.5	390.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.37	Med-Ideal
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	773	450	M Low
Organic Matter	%	65.6	38.2	764 lbs/ton
Conductivity	$mmhos{\cdot}cm^{-1}$	~	3.4	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	28.1	28.1	Med-High
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	80	Slight Phytotoxicity
Lepedium sativum Weight	%	~	36	Low
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	4	Med-Active
Total Mineral Nutrients				
Total Nitrogen	%	1.260	0.733	14.7

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: sv Project: 610
Date Received : 06/28/2001
Date Reported : 08/03/2001
Lab ID Number : 5000.0
Quality Checked : WD 8/3/01

COMPOSITION ANALYSIS

Sample Identification: NRC Day 21 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
Solids	%	100.0	58.2	1164 lbs/ton
Moisture	%	0.0	41.8	100 gals/ton
est. water holding capacity	%	206	67	161 gals/ton
Inert and Oversize Matter	%	~	19.5	390.0 lbs/ton
pH (paste, H_2O)	$-\log H^+$	~	7.37	Med-Ideal
Free Carbonates (CO_3)	Rating	~	2	Med-High
Volatile Organic Acids	ppm	773	450	M Low
Organic Matter	%	65.6	38.2	764 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	3.4	Medium
Carbon:Nitrogen (C:N) Ratio	w:w	28.1	28.1	Med-High
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	80	Slight Phytotoxicity
Lepedium sativum Weight	%	~	36	Low
Solvita CO_2 Rate	(see chart)	~	4	Med-High
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	4	Med-Active
Total Mineral Nutrients				
Total Nitrogen	%	1.260	0.733	14.7

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx Project: 610
Date Received : 07/30/2001
Date Reported : 09/19/2001
Lab ID Number : 5036.0
Quality Checked : WO 9/19/01

COMPOSITION ANALYSIS

Sample Identification: NRC Day 52 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	$lbs \cdot ft^3$	-	28	758 lbs/yd^3
Solids	%	100.0	51.4	1028 lbs/ton
Moisture	%	0.0	48.6	117 gals/ton
est. water holding capacity	%	149	60	143 gals/ton
Inert and Oversize Matter	%	~	27.8	556.0 lbs/ton
pH (paste, H_2O)	$-logH^+$	~	7.94	MedHigh
Free Carbonates (CO_3)	Rating	~	3	V High
Volatile Organic Acids	ppm	389	200	V Low
Organic Matter	%	44.9	23.1	462 lbs/ton
Conductivity	$mmhos \cdot cm^{-1}$	~	7.7	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	8.4	8.4	V. Low
Respiration Rate/day	C% of Total-C	0.63	0.63	-
Carbon loss per day	% of total weight	0.15	0.08	1.6 lbs/ton
Dewar Self-Heating	°C rise	~	5	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~	95	No Phytotoxicity
Lepedium sativum Weight	%	~	69	Fair
Solvita CO_2 Rate	(see chart)	~	6	Med-Low
Solvita NH_3 Rate	(see chart)	~	5	Absent
Maturity Index	(see chart)	~	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Appendix H

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556 Code: Ccyvdx–Project: 610
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling Date Received : 07/30/2001
· 44 Beaver Street-8th floor Date Reported : 09/19/2001
· New York NY 10004 Lab ID Number : 5036.0

MINERALS ANALYSIS

Sample Identification: NRC Day 52 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	2.891	1.486	29.7
Organic-Nitrogen	%	2.873	1.477	29.5
Phosphorus (P)	%	0.184	0.095	1.9
Potassium (K)	%	0.384	0.197	3.9
Sodium (Na)	%	0.740	0.380	7.6
Calcium (Ca)	%	3.520	1.809	36.2
Magnesium (Mg)	%	0.296	0.152	3.0
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	176	90	0.2
Nitrate-N	ppm	<2	< 1	nd
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	9496	4881	9.76
Sulfate (SO_4–S)	ppm	3015	1550	3.10

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx-Project: 610

Date Received : 07/30/2001
Date Reported : 09/19/2001
Lab ID Number : 5036.0

METALS ANALYSIS

Sample Identification: NRC Day 52 Bench-Scale, Sample A

VARIABLE MEASURED	Unit	dry basis	as is basis‡	pounds/ton *as is*
Copper (Cu)	$mg \cdot kg^{-1}$	77.6	39.9	<0.1
Manganese (Mn)	$mg \cdot kg^{-1}$	156.0	80.2	0.2
Iron (Fe)	$mg \cdot kg^{-1}$	5400.0	2775.6	5.6
Zinc (Zn)	$mg \cdot kg^{-1}$	356.0	183.0	0.4
Lead (Pb)	$mg \cdot kg^{-1}$	152.0	78.1	0.2
Chromium (Cr)	$mg \cdot kg^{-1}$	26.8	-	-
Cadmium (Cd)	$mg \cdot kg^{-1}$	3.6	-	-
Nickel (Ni)	$mg \cdot kg^{-1}$	25.2	-	-

Notes: $mg \cdot kg^{-1}$ = ppm (parts per million); MPN = most probable number
< signifies *less than MLD* (minimum level of detection) for the particular factor tested
‡ = EPA reporting requires dry basis only

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx Project: 610
Date Received : 07/30/2001
Date Reported : 09/19/2001
Lab ID Number : 5036.1
Quality Checked : WO 9/19/01

COMPOSITION ANALYSIS

Sample Identification: NRC Day 52 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	Notations †
DENSITY	lbs·ft^3	-	32	876 lbs/yd^3
Solids	%	100.0	43.3	866 lbs/ton
Moisture	%	0.0	56.7	136 gals/ton
est. water holding capacity	%	176	64	153 gals/ton
Inert and Oversize Matter	%	~→	21.4	428.0 lbs/ton
pH (paste, H_2O)	-logH$^+$	~→	8.17	MedHigh
Free Carbonates (CO_3)	Rating	~→	3	V High
Volatile Organic Acids	ppm	692	300	M Low
Organic Matter	%	54.9	23.8	476 lbs/ton
Conductivity	*mmhos*·cm^{-1}	~→	6.4	Med-High
Carbon:Nitrogen (C:N) Ratio	w:w	8.0	8.0	V. Low
Respiration Rate/day	C% of Total-C	0.47	0.47	-
Carbon loss per day	% of total weight	0.14	0.06	1.2 lbs/ton
Dewar Self-Heating	°C rise	~→	5	Grade V
Seedling Response Assay, Percent of Control				
Lepedium sativum Germination	%	~→	93	No Phytotoxicity
Lepedium sativum Weight	%	~→	42	Low
Solvita CO_2 Rate	(see chart)	~→	6	Med-Low
Solvita NH_3 Rate	(see chart)	~→	5	Absent
Maturity Index	(see chart)	~→	6	Active-Curing

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

†For explanation of data, see Woods End Laboratory Interpretation Sheet

Page 2 of 3

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx–Project: 610

Date Received : 07/30/2001
Date Reported : 09/19/2001
Lab ID Number : 5036.1

MINERALS ANALYSIS

Sample Identification: NRC Day 52 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	3.694	1.600	32.0
Organic-Nitrogen	%	3.679	1.593	31.9
Phosphorus (P)	%	0.184	0.080	1.6
Potassium (K)	%	0.480	0.208	4.2
Sodium (Na)	%	0.772	0.334	6.7
Calcium (Ca)	%	4.000	1.732	34.6
Magnesium (Mg)	%	0.308	0.133	2.7
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	85	37	0.1
Nitrate-N	ppm	67	29	0.1
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	9856	4268	8.54
Sulfate (SO_4–S)	ppm	3469	1502	3.00

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

Woods End Research Laboratory, Inc.
Old Rome Road, P.O. Box 297
Mount Vernon, ME 04352/USA
207-293-2457 FAX: 207-293-2488 www.woodsend.org

Account: 556
· attn: Venetia Lannon
· DOS Waste Prev. Reuse and Recycling
· 44 Beaver Street-8th floor
· New York NY 10004

Code: Ccyvdx–Project: 610
Date Received : 07/30/2001
Date Reported : 09/19/2001
Lab ID Number : 5036.1

MINERALS ANALYSIS

Sample Identification: NRC Day 52 Bench-Scale, Sample B

VARIABLE MEASURED	Unit	dry basis	as is basis	pounds/ton *as is*
Total Mineral Nutrients				
Total Nitrogen	%	3.694	1.600	32.0
Organic-Nitrogen	%	3.679	1.593	31.9
Phosphorus (P)	%	0.184	0.080	1.6
Potassium (K)	%	0.480	0.208	4.2
Sodium (Na)	%	0.772	0.334	6.7
Calcium (Ca)	%	4.000	1.732	34.6
Magnesium (Mg)	%	0.308	0.133	2.7
Soluble Nutrients				
Ammonium-N (NH_4-N)	ppm	85	37	0.1
Nitrate-N	ppm	67	29	0.1
Nitrite-N	ppm	<2	< 1	nd
Chloride (Cl)	ppm	9856	4268	8.54
Sulfate (SO_4-S)	ppm	3469	1502	3.00

Notes: ppm = mg/kg < = less than MLD (minimum level of detection); nd = none detected

NRC Primary Screen Unders (<1 3/4")
Sample A

Woods End®
Research Laboratory
INCORPORATED

Date : Thursday, July 12, 2001

Certificate of Analysis

EPA Method 8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name:	4973.0
Sample Location:	COMPOST
Sampling Date:	6/19/2001
Sampling Time:	14:00
Date Received:	6/21/2001
Lab #:	01X0682-01
Matrix:	SOIL
Analyst:	HY
Extract Date:	6/25/2001
Analysis Date:	6/27/2001

Analyte	Result	Units	PQL
alpha-BHC:	ND	mg/Kg	0.02
gamma-BHC (Lindane):	ND	mg/Kg	0.02
Heptachlor:	ND	mg/Kg	0.02
Aldrin:	ND	mg/Kg	0.02
beta-BHC:	ND	mg/Kg	0.02
delta-BHC:	ND	mg/Kg	0.02
Heptachlor Epoxide:	ND	mg/Kg	0.02
Endosulfan I:	ND	mg/Kg	0.02
4,4'-DDE:	ND	mg/Kg	0.02
Dieldrin:	ND	mg/Kg	0.02
Endrin:	ND	mg/Kg	0.02
Endosulfan II:	ND	mg/Kg	0.02
4,4'-DDD:	ND	mg/Kg	0.02
4,4'-DDT:	ND	mg/Kg	0.02
Endrin Aldehyde:	ND	mg/Kg	0.02
Endosulfan Sulfate:	ND	mg/Kg	0.02
Methoxychlor:	ND	mg/Kg	0.10
Endrin Ketone:	ND	mg/Kg	0.02
Chlordane:	ND	mg/Kg	0.2
Toxaphene:	ND	mg/Kg	0.2
Arochlor 1016:	ND	mg/Kg	0.2
Arochlor 1221:	ND	mg/Kg	0.2
Arochlor 1232:	ND	mg/Kg	0.2
Arochlor 1242:	ND	mg/Kg	0.2
Arochlor 1248:	ND	mg/Kg	0.2
Arochlor 1254:	ND	mg/Kg	0.2
Arochlor 1260:	ND	mg/Kg	0.2

Surrogate Standard	% Recovery
TCX %R	53.7

Page 1 of 1

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

NRC Primary Screen Unders (<1 3/4")
Sample B

Woods End® Research Laboratory INCORPORATED

Date : Thursday, July 12, 2001

Certificate of Analysis

EPA Method 8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name:	4973.1
Sample Location:	COMPOST
Sampling Date:	6/19/2001
Sampling Time:	14:00
Date Received:	6/21/2001
Lab #:	01X0682-02
Matrix:	SOIL
Analyst:	HY
Extract Date:	6/25/2001
Analysis Date:	6/27/2001

Analyte	Result	Units	PQL
alpha-BHC:	ND	mg/Kg	0.02
gamma-BHC (Lindane):	ND	mg/Kg	0.02
Heptachlor:	ND	mg/Kg	0.02
Aldrin:	ND	mg/Kg	0.02
beta-BHC:	ND	mg/Kg	0.02
delta-BHC:	ND	mg/Kg	0.02
Heptachlor Epoxide:	ND	mg/Kg	0.02
Endosulfan I:	ND	mg/Kg	0.02
4,4'-DDE:	ND	mg/Kg	0.02
Dieldrin:	ND	mg/Kg	0.02
Endrin:	ND	mg/Kg	0.02
Endosulfan II:	ND	mg/Kg	0.02
4,4'-DDD:	ND	mg/Kg	0.02
4,4'-DDT:	ND	mg/Kg	0.02
Endrin Aldehyde:	ND	mg/Kg	0.02
Endosulfan Sulfate:	ND	mg/Kg	0.02
Methoxychlor:	ND	mg/Kg	0.10
Endrin Ketone:	ND	mg/Kg	0.02
Chlordane:	ND	mg/Kg	0.2
Toxaphene:	ND	mg/Kg	0.2
Arochlor 1016:	ND	mg/Kg	0.2
Arochlor 1221:	ND	mg/Kg	0.2
Arochlor 1232:	ND	mg/Kg	0.2
Arochlor 1242:	ND	mg/Kg	0.2
Arochlor 1248:	ND	mg/Kg	0.2
Arochlor 1254:	ND	mg/Kg	0.2
Arochlor 1260:	ND	mg/Kg	0.2

Surrogate Standard	% Recovery
TCX %R	61.5

Lab Supervisor:

Report Date: 11-Jul-01

Page 1 of 1

7850 Old Rome Road • P.O. Box 297 • Mt. Vernon, Maine 04352
(207) 293-2457 • (207) 293-2488 FAX • info@woodsend.org

New York City MSW Composting Report

Appendix I
Revised Preliminary Design and Cost Estimate for Material Recovery Facility Front End for Co-Composting[1] Pilot Facility

Proposal by Hertlein Industries, Inc.[2]

1. "Co-Composting" is another term for the composting of municipal solid waste and biosolids.

2. The Reference Drawings (blue prints) that were orignially attached with this proposal have been redrawn for viewing convenience and are presented in Chapter 5.

3. The equipment listed here is based on a preliminary design and is provided to support the cost estimates in this report. The list in no way constitutes an endorsement or a commitment on the part of the City to purchase any of this equipment.

Hertlein Industries, Inc

Cost Estimate - 14-Aug-2002

For: New York City Department of Sanitation - Bureau of Waste Prevention, Reuse & Recycling

Material Recovery Facility for Co-Composting System

Revision 1 - Revised Preliminary Design Cost Estimate

Item	Description	Cost	HP	Type
1A	Pedestal Mounted Grapple Crane - Cost includes Installation	310000	75	Feeder
1	72" Wide Double Beaded Chain Belt Conv.	45465	7.5	Variable
2	72" Wide Standard Chain Belt Conveyor	78897	15	Variable
3	72" Wide x 64'-5" PreSort Conveyor w/ Catwalks	101802	20	Variable
4	60" x 88' Troughing Idler Conveyor w/ Supports	68740	15	Fixed
5	36" x 34'-9" Sliderbed Bag Opener Xfer Conveyor	40309	5	Fixed
6A	36" x 29' Sliderbed Bag Opener Feed Conveyor	28428	5	Fixed
6B	36" x 29' Sliderbed Bag Opener Feed Conveyor	28424	5	Fixed
6C	Bifurcated Chute - with Air Gate & Supports	26547	NA	N/A
7A	Bag Breaker - BHS Model BB-72	72006	17	Mixed
7B	Bag Breaker - BHS Model BB-72	72006	17	Mixed
8A	36" x 29' Sliderbed Bag Opener Disch Conveyor	28428	5	Fixed
8B	36" x 29' Sliderbed Bag Opener Disch Conveyor	28428	5	Fixed
9A	60" Wide Standard Chain Belt Infeed Conveyor	79317	10	Variable
9A-1	Pedestal Mounted Grapple Crane - Cost includes Installation	310000	75	Feeder
9B	60" Wide Standard Chain Belt Infeed Conveyor	79317	10	Variable
9B-1	Pedestal Mounted Grapple Crane - Cost includes Installation	310000	75	Feeder
10A	60" X 28' Catenary Sliderbed Plastic Bag Picking Conv. w/Platform	61345	7.5	Variable
10B	60" X 28' Catenary Sliderbed Plastic Bag Picking Conv. w/Platform	61345	7.5	Variable
11A	Primary Fines Vibrating Screen - Minus 2-1/2" Openings	83370	20	Fixed
11B	Primary Fines Vibrating Screen - Minus 2-1/2" Openings	83370	20	Fixed
11C	Extra Screen Decks (Plate, 3" & 4")	36176	N/A	N/A
12A	30" x 60' Troughing Idler Primary Fines Discharge Conv. W/Supports	31435	10	Fixed
12B	30" x 32' Troughing Idler Primary Fines Discharge Conv. W/Supports	24955	7.5	Fixed

Item	Description	Cost	HP	Type
12C	Dings Model 66 Overhead Magnet w/Supports	36832	15	Fixed
12D	30 x 22'-5" Troughing Idler Primary Fines Xfer Conv.	17546	5	Fixed
13A	60" x 24' Primary Fines Screen "Overs" Disch. Convneyor	22110	5	Fixed
13B	60" x 24' Primary Fines Screen "Overs" Disch. Convneyor	22110	5	Fixed
15A	60" x 65' Main Sorting Sliderbed Conveyor w/Supports	92095	20	Variable
15A-1	Dings Model 66 Overhead Magnet w/Supports	36832	15	Fixed
15B	60" x 54' Main Sorting Sliderbed Conveyor w/Supports	92095	20	Variable
15B-1	Dings Model 66 Overhead Magnet w/Supports	36832	15	Fixed
16A	Final Fines Screen - BHS Debris Roll Screen	72020	6	Fixed
16B	Final Fines Screen - BHS Debris Roll Screen	72020	6	Fixed
17A	60" x 30' Final Fines Screen - Product Stacker Conveyor	30528	10	Fixed
17B	60" x 30' Final Fines Screen - Product Stacker Conveyor	30528	10	Fixed
18A	24" x 31' Troughing Idler Conveyor/w Supports	22865	7.5	Fixed
18B	24" x 31' Troughing Idler Conveyor/w Supports	22865	7.5	Fixed
19	60" x 116' Troughing Idler Conveyor w/ Supports	85774	15	Fixed
21	Electrical Controls & Start-Up	210301		
20	Expanded Metal Cages & Roll Off Boxes (See Schedule)	200800	N/A	N/A
22	Mechanical Erection	295900		
23	Electrical Field Installation	181160		
24	Engineering	185500		
	Sub Totals	$3,856,823		
	Freight	$138,500		
	Contingency - 5% of Sub Total	$192,841		
	Project Total Estimate	$4,188,164	596	

Note: For Optional Environmental Housings on Sort Platforms see separate Schedule.
Note that the Pedestal Cranes were not included in Revision 0 of this estimate.

Hertlein Industries, Inc

Cost Estimate - 14-Aug-2002

For: New York City Department of Sanitation - Bureau of Waste Prevention, Reuse & Recycling

Material Recovery Facility for Co-Composting System

Revision 1 - Revised Preliminary Design Cost Estimate

Roll Off Boxes & Expanded Metal Cages Schedule

	Qty	Cost	Unit	Ext
Pre Sort Area				
40 YD Roll Off Boxes	4	5000	EA	$ 20,000.00
Secondary Sort Area				
Ferrous Metal Boxes 4.6 YD	6	2000		$ 12,000.00
DeStoner "Heavies" Boxes 8.8 YD	0	2800		$ -
Film Plastic Cages 14.5 YD	12	3150		$ 37,800.00
Main Sort Area				
A & B Main Sort Lines Cages 18 YD	18	3750		$ 67,500.00
A & B Main Sort Lines Cages 16 YD	6	3650		$ 21,900.00
Minus 4" Sort Line Cages 8.5 YD	12	2800		$ 33,600.00
Minus 1" Fines Boxes 5.5 YD	4	2000		$ 8,000.00
Total for all Roll Off, Cage & Box Requirements				**$ 200,800.00**

Note: Ferrous Metal Boxes and Minus 1" Fines Boxes are solid Steel Construction and designed for use with a Forklift with a rotator.

All other Cages are Tube Steel Framing with Expanded Metal walls. They will have a door in the lower section of one side. They are also designed to be used by a forklift with a rotator. The door eliminates the necessity of turning a cage completely over with the forklift. This greatly improves the life of the Cage.

The quantity of each box allows for reasonable change out on each process line.

These boxes would be locally fabricated to our design drawings.

Hertlein Industries, Inc.

New York City Co-Composting MRF
Revised Energy Useage Calculations
14-Aug-02

Power Source - 480V Three Phase 60Hz

Total Plant Connected Horsepower	596
Total Plant Connected Amperes	715
Total Plant Connected kW	475.5
Plant Kwh based on connected load for each 8 hour shift - assuming actual operation of equipment at 6.5Hrs.	3091
Based on actual experience in many of these types of facilities the nominal useage is typically not more than 60% of connected load. This is what I would project as nominal useage for an 8 hour shift.	1854.6

Note that these numbers do not include a baler or other general utility load.

Hertlein Industries, Inc

Cost Estimate - 14-Aug-2002

For: New York City Department of Sanitation - Bureau of Waste Prevention, Reuse & Recycling

Material Recovery Facility for Co-Composting System

Revision 1 - Revised Preliminary Design Cost Estimate

Environmental Housings for Sort Lines

	Qty	Cost	Unit	Ext
Pre Sort Area				
49' x 17' x 8' Insulated Housing with Climate Control (833 Sq Ft)	1	35069	EA	$ 35,069.00
Secondary Sort Area				
Film Plastic Sort Platform Insulated Housing 17' x 22' x 8' (374 Sq Ft)	2	17980		$ 35,960.00
Main Sort Area				
A & B Main Sort Lines Insulated Housing 57' x 16'-8" x 8' (954 Sq Ft)	2	40762		$ 81,524.00
Total for all Sort Line Environmental Enclosures				**$ 117,484.00**

Each Insulated Housing will have a Heat Pump style all Elecric Climate Conditioning Unit mounted at one end or on top. Each Unit will have appropriate Flourescent Lighting inside.

Hertlein Industries, Inc.

New York City Department of Sanitation
Bureau of Waste Prevention, Reuse & Recycling
Revised Preliminary Design - MRF for Co-Composting Facility
Planned Processing Equipment Descriptions Revision 1 – Dated 14-Aug-2002
Reference Drawings – 023006-NYD-0111 thru 0113

Item #1A – Northshore Manufacturing - Pedestal Mounted Grapple Crane with 35 Foot reach. The crane is Electric/Hydraulic powered with a 75 HP Hydraulic Pump.

Item #1 – 72” x 15’-9”, 9” Pitch double beaded steel pan with 36” skirting and powered by a 7.5 HP Energy Efficient Electric Motor with planetary gearbox. Variable Speed via a Variable Frequency Drive from 3 – 18 FPM.

Item #2 – 72” skid mounted standard chain belt conveyor w/ WEAR-LOC 600 belting with a 9’ lower flat section, a 29’-0” 30 Degree incline section to a 3’-0” upper flat section with a head shaft height of 16’-0”. The Conveyor has 42” skirting and is powered by a 15 HP Energy Efficient Electric Motor with planetary gearbox. Variable speed via a Variable Frequency Drive from 10 – 40 FPM.

Item #3 – 72” x 64’-5” Fully Skirted Sliderbed conveyor with WEAR-LOC 600 belting and is powered by a 20 HP Energy Efficient Electric Motor with planetary gearbox. Variable speed via a Variable Frequency Drive from 40 – 120 FPM. The Conveyor is permanently mounted to a Skid Frame with support towers bolt-flanged for shipping. Unit is equipped with Fold Down Catwalks.

Item #4 – 60” x 88’ Troughing Idler Conveyor powered by a 15 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed Reversible at 120 FPM. Complete with tower support structure.

Item #5 - 36” x 34’-9”’ Sliderbed Conveyor powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with supports.

Item #6A - 36” x 29’ Cleated Sliderbed Conveyor powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hopper and supports.

Item #6B - 36” x 29’ Cleated Sliderbed Conveyor powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hopper and supports.

Item #6C - Bifurcated Chute complete with Electric/Air operated Diverter gate to feed either Conveyor 6A or B or Both.

New York City Department of Sanitation
Bureau of Waste Prevention, Reuse & Recycling
Preliminary Design - MRF for Co-Composting Facility
Planned Processing Equipment Descriptions Revision 0 – Dated 7-Jul-2002
Reference Drawings – 023006-NYD-0111 thru 0113

Item #7A - BHS Model BB-72 Bag Breaker with 66" x 48" Inlet opening. The Bag Breaker® is sized for processing up to 15 tons per hour of incoming waste. The incoming material will be bagged. The processing rate is based on 10-33 gallon bags at least 70% full. For the standard bag rating the processing efficiency is 90%. This efficiency rating means 90% of the bags will be open and will have 90% percent of the material released from the bag. The empty bags leave the machine with the released material. The Bag Breaker® has been designed to minimize shredding of the bags. The majority of the bags remain in one piece with a small percentage of the bags coming out in two to four pieces. The Bag Breaker has 17 total connected HP. Bag Breaker controls and software will be part of the complete Plant Control System Package.

Item #7B - BHS Model BB-72 Bag Breaker with 66" x 48" Inlet opening. The Bag Breaker® is sized for processing up to 15 tons per hour of incoming waste. The incoming material will be bagged. The processing rate is based on 10-33 gallon bags at least 70% full. For the standard bag rating the processing efficiency is 90%. This efficiency rating means 90% of the bags will be open and will have 90% percent of the material released from the bag. The empty bags leave the machine with the released material. The Bag Breaker® has been designed to minimize shredding of the bags. The majority of the bags remain in one piece with a small percentage of the bags coming out in two to four pieces. The Bag Breaker has 17 total connected HP. Bag Breaker controls and software will be part of the complete Plant Control System Package

Item #8A - 36" x 29' Cleated Sliderbed Conveyor powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hopper and supports.

Item #8B - 36" x 29' Cleated Sliderbed Conveyor powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hopper and supports.

Item #9A - 60" skid mounted standard chain belt conveyor Scandura 330 belting with a 16' lower flat section, a 24'-2" 30 Degree incline section to a 3'-0" upper flat section with a head shaft height of 15'-0". The Conveyor is powered by a 10 HP Energy Efficient Electric Motor with planetary gearbox. Variable speed via a Variable Frequency Drive from 10 – 40 FPM. The conveyor is complete with a Splayed push ramp with end and back wall extensions.

New York City Department of Sanitation
Bureau of Waste Prevention, Reuse & Recycling
Preliminary Design - MRF for Co-Composting Facility
Planned Processing Equipment Descriptions Revision 0 – Dated 7-Jul-2002
Reference Drawings – 023006-NYD-0111 thru 0113

Item #9A 1– Northshore Manufacturing - Pedestal Mounted Grapple Crane with 35 Foot reach. The crane is Electric/Hydraulic powered with a 75 HP Hydraulic Pump.

Item #9B - 60" skid mounted standard chain belt conveyor Scandura 330 belting with a 16' lower flat section, a 24'-2" 30 Degree incline section to a 3'-0" upper flat section with a head shaft height of 15'-0". The Conveyor is powered by a 10 HP Energy Efficient Electric Motor with planetary gearbox. Variable speed via a Variable Frequency Drive from 10 – 40 FPM. The conveyor is complete with a Splayed push ramp with end and back wall extensions.

Item #9B 1– Northshore Manufacturing - Pedestal Mounted Grapple Crane with 35 Foot reach. The crane is Electric/Hydraulic powered with a 75 HP Hydraulic Pump.

Item #10A – 60" x 28'-0" Catenary Style Sliderbed Conveyor. The Conveyor is powered by a 7.5 HP Energy Efficient Electric Motor with planetary gearbox. Variable speed via a Variable Frequency Drive from 40 – 100 FPM. The Conveyor is permanently mounted to a Skid Frame with support towers bolt-flanged for shipping. Unit is equipped with Bolt on Catwalks.

Item #10B – 60" x 28'-0" Catenary Style Sliderbed Conveyor. The Conveyor is powered by a 7.5 HP Energy Efficient Electric Motor with planetary gearbox. Variable speed via a Variable Frequency Drive from 40 – 100 FPM. The Conveyor is permanently mounted to a Skid Frame with support towers bolt-flanged for shipping. Unit is equipped with Bolt on Catwalks.

Item #11A– Primary Fines Vibrating Screen—General Kinematics (GK) Vibrating Finger Screen designed for processing presorted municipal solid waste. The screens will be designed to remove 4" minus (nominal) material. Screen is powered by a 20 HP Energy Efficient Electric Motor at a fixed speed.

Item #11B – Primary Fines Vibrating Screen—General Kinematics (GK) Vibrating Finger Screen designed for processing presorted municipal solid waste. The screens will be designed to remove 4" minus (nominal) material. Screen is powered by a 20 HP Energy Efficient Electric Motor at a fixed speed.

Item #11C–Vibrating Screen additional screening deck plates. One set of 2ea decks – solid plate, 3" Openings & 4" Openings.

Item #12A - 30" x 60' Troughing Idler Primary Fines Discharge Conveyor – The conveyor is powered by a 10 HP Energy Efficient Electric Motor with

New York City Department of Sanitation
Bureau of Waste Prevention, Reuse & Recycling
Preliminary Design - MRF for Co-Composting Facility
Planned Processing Equipment Descriptions Revision 0 – Dated 7-Jul-2002
Reference Drawings – 023006-NYD-0111 thru 0113

planetary gearbox. Fixed speed at 100 FPM. Complete with transition hoppers and supports.

Item #12B - 30" x 32' Troughing Idler Primary Fines Discharge Conveyor – The conveyor is powered by a 7.5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hoppers and supports.

Item #12C – Dings Model 66 self cleaning Overhead Magnet complete with stainless steel clad belt and 10kW Rectifier unit. The conveyor is powered by a 5 HP Energy Efficient Electric Motor and shaft mounted gearbox at a fixed speed of 400 FPM. The Magnet is complete with all supports and guarding.

Item #12D - 30" x 22'-5" Troughing Idler Primary Fines Discharge Conveyor – The conveyor is powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hoppers and supports.

Item #13A – 60" x 24' Primary Fines Screen "Overs" Discharge Conveyor. The conveyor is a Cleated Sliderbed Conveyor powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hopper and supports.

Item #13B – 60" x 24' Primary Fines Screen "Overs" Discharge Conveyor. The conveyor is a Cleated Sliderbed Conveyor powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hopper and supports.

Item #15A – 60" x 54' Fully Skirted Main Sorting Sliderbed conveyor with Scandura 330 belting and is powered by a 15 HP Energy Efficient Electric Motor with planetary gearbox. Variable speed via a Variable Frequency Drive from 40 – 120 FPM. The Conveyor is permanently mounted to a Skid Frame with support towers bolt-flanged for shipping. Unit is equipped with Fold Down Catwalks.

Item #15A1 – Dings Model 66 self cleaning Overhead Magnet complete with stainless steel clad belt and 10kW Rectifier unit. The conveyor is powered by a 5 HP Energy Efficient Electric Motor and shaft mounted gearbox at a fixed speed of 400 FPM. The Magnet is complete with all supports and guarding.

Item #15B – 60" x 54' Fully Skirted Main Sorting Sliderbed conveyor with Scandura 330 belting and is powered by a 15 HP Energy Efficient Electric Motor with

New York City Department of Sanitation
Bureau of Waste Prevention, Reuse & Recycling
Preliminary Design - MRF for Co-Composting Facility
Planned Processing Equipment Descriptions Revision 0 – Dated 7-Jul-2002
Reference Drawings – 023006-NYD-0111 thru 0113

planetary gearbox. Variable speed via a Variable Frequency Drive from 40 – 120 FPM. The Conveyor is permanently mounted to a Skid Frame with support towers bolt-flanged for shipping. Unit is equipped with Fold Down Catwalks.

Item #15B1 – Dings Model 66 self cleaning Overhead Magnet complete with stainless steel clad belt and 10kW Rectifier unit. The conveyor is powered by a 5 HP Energy Efficient Electric Motor and shaft mounted gearbox at a fixed speed of 400 FPM. The Magnet is complete with all supports and guarding.

Item #16A– BHS Model 70-28 Debris Roll Screen® -- Final Fines Screen units are designed for processing secondary sorted municipal solid waste. The screens will be designed to remove 1-1/2" minus (nominal) material. Screen is powered by 2ea 3 HP Energy Efficient Electric Motors. Screen is complete with supports and hopper.

Item #16B– BHS Model 70-28 Debris Roll Screen® -- Final Fines Screen units designed for processing secondary sorted municipal solid waste. The screens will be designed to remove 1-1/2" minus (nominal) material. Screen is powered by 2ea 3 HP Energy Efficient Electric Motors. Screen is complete with supports and hopper.

Item #17A – 60" x 30' Final Fines Screen "Overs" Discharge Conveyor. The conveyor is a Cleated Sliderbed Conveyor powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hopper and supports.

Item #17B – 60" x 30' Final Fines Screen "Overs" Discharge Conveyor. The conveyor is a Cleated Sliderbed Conveyor powered by a 5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hopper and supports.

Item #18A - 24" x 31' Troughing Idler Final Fines Discharge Conveyor – The conveyor is powered by a 7.5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hoppers and supports.

Item #18B - 24" x 31' Troughing Idler Final Fines Discharge Conveyor – The conveyor is powered by a 7.5 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 100 FPM. Complete with transition hoppers and supports.

New York City Department of Sanitation
Bureau of Waste Prevention, Reuse & Recycling
Preliminary Design - MRF for Co-Composting Facility
Planned Processing Equipment Descriptions Revision 0 – Dated 7-Jul-2002
Reference Drawings – 023006-NYD-0111 thru 0113

Item #19 - 60" x 116' Troughing Idler Sorted MSW Transfer to Digester Infeed Area – The conveyor is powered by a 15 HP Energy Efficient Electric Motor with planetary gearbox. Fixed speed at 150 FPM. Complete with transition hoppers and supports.

Item #20 - Expanded Metal Material Cages & Boxes. Roll Off Containers, etc for sorted mate4rials. See Spreadsheet schedule for details

Item #21 – **Electrical Control System** – The MRF System is provided with an "Automated Control System" that will include 2ea Color Flat Panel Display Operator Terminals, one for each of the processing areas. The Terminals will incorporate controls for the operator to select a mode of operation, change direction of reversing conveyors, select the speed for the Variable Speed equipment and Start or Stop the plant areas. The system will have an alarm system which will annunciate plant alarms on the operator terminals such as "Conveyor Safety Pull Cord C4", which will allow the operator to quickly locate the fault condition and fix it. All equipment described as variable speed above will have an Adjustable Frequency Drive with the proper current limiting fusing and circuit breaker. All fixed speed equipment will have a Full Voltage Non-Reversing motor starter unit complete with short circuit and overload protection. The control system will have a Programmable Logic Controller (PLC) which will contain all of the plant operating logic. The main Motor Control Panel will be housed in a Nema Type 12 Oil & Dust tight enclosure with a Main Circuit Breaker interlocked with the door. The Control Panels will carry Underwriters Laboratories (U.L.) certifications for compliance with all regulatory agencies requirements.

Item #22 – **Mechanical Field Erection** – This item covers the compete field erection of all equipment. It includes all of the required labor and miscellaneous materials to provide a mechanically complete and ready to start-up system. It also includes all required erection equipment such as cranes, forklifts, etc.

Item #23 – **Electrical Field Installation** – This item covers the compete field Installation of all Electrical Devices, Conduit & Wire. It includes all of the required labor and miscellaneous materials to provide an electrically complete and ready to start-up system.

Item #24 – **Engineering** – This item covers all of the required Engineering & Design including a complete Drawing Package for all Equipment and Structural Steel required for a complete operating plant. All Drawings will be done with AutoCad and Electronic Files will be submitted to the City at the end of the

New York City Department of Sanitation
Bureau of Waste Prevention, Reuse & Recycling
Preliminary Design - MRF for Co-Composting Facility
Planned Processing Equipment Descriptions Revision 0 -- Dated 7-Jul-2002
Reference Drawings – 023006-NYD-0111 thru 0113

project. All Structural drawings will be Stamped by a Registered Professional Engineer in the State of New York.

New York City MSW Composting Report

Appendix J
Life Cycle Financial Analysis for New York City MSW Composting Facility

Report by R.S. Lynch and Company, Inc.

NA = Not Applicable to a publicly financed facility.

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

ASSUMPTIONS:		Development Equity: First 6 Months of Project Development	Second 6 Months of Project Development	Upon Project Finish (000)	Deprecation Per (Years)
Capital Costs:					
Design & Engineering Cost			$1,000,000		28
Permitting & Project Development			$2,000,000		28
Project Financing & Construction: ($000):					
Equipment				$20,000	10
Digester Drums				included	10
Biofilter				$1,000	10
249,200 Sqare Feet of Buildings @	$115 per SF			$28,658	28
Fire & Electrical Systems & Other				included	10
15 Acre Site @	$250,000 per Acre			NA	
Performance Guarantee				NA	28
Interest During Construction				NA	28
Borrower's Counsel				NA	28
Contingency & Spare Parts @ 10%				$4,966	28
Debt Reserve Fund				NA	
Financing:					
Underwriting Fee @ 1% assumes General Obligation debt				$586	28
Underwriter's Counsel				$50	28
Issuer's fee @ 1%, if required				NA	28
Bond Counsel				$50	28
Feasibility Opinion				NA	28
Trustee				$25	28
Cusip, Printing & Other				$25	28
Financial Advisor				$25	28
Miscellaneous		$0	$0	$250	28
SUB TOTAL		$0	$3,000,000	$55,635	
TOTAL				$58,635	
Financing Assumptions:					
Debt (%/Amt)		100%	100%	100%	$58,635
Equity (%/Amt)		0%	0%	0%	$0
Total Capital					$58,635
Average % Equity				0.00%	
Debt Term				20	years
Debt Rate				4.72%	

Depreciation Summary:

10 Year	NA	Total	
28 Year	NA		$0

Operating Costs (000):			Annual Escalation Rate	Per ton of MSW
Salaries & Benefits		$3,799	2.00%	$41.93
OTPS		$825	2.00%	$9.11
Repair & Replace		$1,000	2.00%	$11.04
8000000 kwh/yr	$0.08	$640	2.00%	$7.06
Residue Disposal		$1,977	2.00%	$21.83
(29.1% of MSW @ $75/ton)				
TOTAL		$8,241		$91

Throughput:	Tons per Day	Days per Year	Tons per Year
MSW	300.00	302	90600
Biosolids	200.00	302	60400
Total	500		151000

Fees per ton:		
MSW Tip Fee (w/ Residue Disposal)	see below	2.00%
Biosolids Tip Fee	$100.00	2.00%
Aluminum Revenue (.75% MSW)	$0	2.00%
Ferrous Metal Revenue (2.3% MSW)	$0	2.00%
Sold Compost Revenue (FOB Plant)	$0.00	2.00%
Unsold Compost Cost (FOB Plant)	$0.00	2.00%

Financial Results:

Cost per MSW Ton:	
Year 1	$75.00
10 Year IRR	NA
20 Year IRR	NA

Debt Coverage Ratio:	
Year 1	NA
Avg. Yr. 1-10	NA
Avg. Yr. 1-20	NA

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

Year	1	2	3	4	5	6	7	8	9	10
Revenues:										
MSW Tons	90600	90600	90600	90600	90600	90600	90600	90600	90600	90600
MSW Tip Fee	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
MSW Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sludge Tons	60400	60400	60400	60400	60400	60400	60400	60400	60400	60400
Sludge Tip Fee	$100.00	$102.00	$104.04	$106.12	$108.24	$110.41	$112.62	$114.87	$117.17	$119.51
Sludge Revenue	$6,040,000	$6,160,800	$6,284,016	$6,409,696	$6,537,890	$6,668,648	$6,802,021	$6,938,061	$7,076,823	$7,218,359
Compost Tons (50%MSW)	45300	45300	45300	45300	45300	45300	45300	45300	45300	45300
% Sold	25.00%	50.00%	75.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
% Unsold	75.00%	50.00%	25.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Cost/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Compost Net Rev per Ton	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Compost Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Al Rev/T	$0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fe Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Recyclable Rev	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue	$6,040,000	$6,160,800	$6,284,016	$6,409,696	$6,537,890	$6,668,648	$6,802,021	$6,938,061	$7,076,823	$7,218,359

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : **Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF**
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 3

Year	11	12	13	14	15	16	17	18	19	20
Revenues:										
MSW Tons	90600	90600	90600	90600	90600	90600	90600	90600	90600	90600
MSW Tip Fee	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
MSW Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sludge Tons	60400	60400	60400	60400	60400	60400	60400	60400	60400	60400
Sludge Tip Fee	$121.90	$124.34	$126.82	$129.36	$131.95	$134.59	$137.28	$140.02	$142.82	$145.68
Sludge Revenue	$7,362,726	$7,509,981	$7,660,180	$7,813,384	$7,969,652	$8,129,045	$8,291,626	$8,457,458	$8,626,607	$8,799,139
Compost Tons	45300	45300	45300	45300	45300	45300	45300	45300	45300	45300
% Sold	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
% Unsold	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Cost/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Compost Net Rev per Ton	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Compost Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Al Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fe Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Recyclable Rev	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue	$7,362,726	$7,509,981	$7,660,180	$7,813,384	$7,969,652	$8,129,045	$8,291,626	$8,457,458	$8,626,607	$8,799,139

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

Year	21	22	23	24	25	26	27	28	29	30
Revenues:										
MSW Tons	90600	90600	90600	90600	90600	90600	90600	90600	90600	90600
MSW Tip Fee	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
MSW Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Sludge Tons	60400	60400	60400	60400	60400	60400	60400	60400	60400	60400
Sludge Tip Fee	$148.59	$151.57	$154.60	$157.69	$160.84	$164.06	$167.34	$170.69	$174.10	$177.58
Sludge Revenue	$8,975,122	$9,154,625	$9,337,717	$9,524,472	$9,714,961	$9,909,260	$10,107,445	$10,309,594	$10,515,786	$10,726,102
Compost Tons	45300	45300	45300	45300	45300	45300	45300	45300	45300	45300
% Sold	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
% Unsold	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Cost/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Compost Net Rev per Ton	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Compost Revenue	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Al Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fe Rev/T	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Recyclable Rev	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue	$8,975,122	$9,154,625	$9,337,717	$9,524,472	$9,714,961	$9,909,260	$10,107,445	$10,309,594	$10,515,786	$10,726,102

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

Debt Service:

Beginning Principal	$58,635	
Term	20	Years
Rate	4.72%	

Year	Principal	Interest	Total	Outs. Balance
				$58,635
1	$1,826	$2,768	$4,594	$56,809
2	$1,913	$2,681	$4,594	$54,896
3	$2,003	$2,591	$4,594	$52,893
4	$2,097	$2,497	$4,594	$50,796
5	$2,196	$2,398	$4,594	$48,599
6	$2,300	$2,294	$4,594	$46,299
7	$2,409	$2,185	$4,594	$43,891
8	$2,522	$2,072	$4,594	$41,368
9	$2,641	$1,953	$4,594	$38,727
10	$2,766	$1,828	$4,594	$35,961
11	$2,897	$1,697	$4,594	$33,064
12	$3,033	$1,561	$4,594	$30,031
13	$3,177	$1,417	$4,594	$26,854
14	$3,326	$1,268	$4,594	$23,528
15	$3,483	$1,111	$4,594	$20,044
16	$3,648	$946	$4,594	$16,397
17	$3,820	$774	$4,594	$12,576
18	$4,000	$594	$4,594	$8,576
19	$4,189	$405	$4,594	$4,387
20	$4,387	$207	$4,594	($0)
21	$0	($0)	$0	($0)
22	$0	($0)	$0	($0)
23	$0	($0)	$0	($0)
24	$0	($0)	$0	($0)
25	$0	($0)	$0	($0)
Total	$58,635	$33,244	$91,880	

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

Depreciation & Operating Costs:

Year			1	2	3	4	5	6	7	8	9	10
Salaries & Benefits			$3,799	$3,875	$3,952	$4,032	$4,112	$4,194	$4,278	$4,364	$4,451	$4,540
Other O&M			$825	$842	$858	$875	$893	$911	$929	$948	$967	$986
R&R			$1,000	$1,020	$1,040	$1,061	$1,082	$1,104	$1,126	$1,149	$1,172	$1,195
Off Site Curing			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Electric			$640	$653	$666	$679	$693	$707	$721	$735	$750	$765
Reside T&D			$1,977	$2,017	$2,057	$2,098	$2,140	$2,183	$2,227	$2,271	$2,317	$2,363
DSRF			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Costs			$8,241	$8,406	$8,574	$8,746	$8,921	$9,099	$9,281	$9,467	$9,656	$9,849
Depreciation:												
10 Year	NA		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
28 Year	NA		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20 Year		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

Depreciation & Operating Costs:

Year	11	12	13	14	15	16	17	18	19	20
Salaries & Benefits	$4,631	$4,724	$4,818	$4,914	$5,013	$5,113	$5,215	$5,320	$5,426	$5,534
Other O&M	$1,006	$1,026	$1,046	$1,067	$1,089	$1,110	$1,133	$1,155	$1,178	$1,202
R&R	$1,219	$1,243	$1,268	$1,294	$1,319	$1,346	$1,373	$1,400	$1,428	$1,457
Off Site Curing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Electric	$780	$796	$812	$828	$844	$861	$879	$896	$914	$932
Reside T&D	$2,410	$2,459	$2,508	$2,558	$2,609	$2,661	$2,714	$2,769	$2,824	$2,881
DSRF	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Costs	$10,046	$10,247	$10,452	$10,661	$10,874	$11,092	$11,314	$11,540	$11,771	$12,006
Depreciation:										
10 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
28 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest Exp	$1,697	$1,561	$1,417	$1,268	$1,111	$946	$774	$594	$405	$207

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 8

Depreciation & Operating Costs:

Year	21	22	23	24	25	26	27	28	29	30
Salaries & Benefits	$5,645	$5,758	$5,873	$5,991	$6,110	$6,233	$6,357	$6,484	$6,614	$6,746
Other O&M	$1,226	$1,250	$1,275	$1,301	$1,327	$1,353	$1,381	$1,408	$1,436	$1,465
R&R	$1,486	$1,516	$1,546	$1,577	$1,608	$1,641	$1,673	$1,707	$1,741	$1,776
Off Site Curing	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Electric	$951	$970	$989	$1,009	$1,029	$1,050	$1,071	$1,092	$1,114	$1,137
Reside T&D	$2,938	$2,997	$3,057	$3,118	$3,180	$3,244	$3,309	$3,375	$3,443	$3,511
DSRF	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Costs	$12,246	$12,491	$12,741	$12,996	$13,256	$13,521	$13,791	$14,067	$14,348	$14,635
Depreciation:										
10 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
28 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20 Year	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 9

Financial Results:

Year	1	2	3	4	5	6	7	8	9	10
Revenues (w/o MSW)	$6,040,000	$6,160,800	$6,284,016	$6,409,696	$6,537,890	$6,668,648	$6,802,021	$6,938,061	$7,076,823	$7,218,359
Operating Exp	$8,241,345	$8,406,172	$8,574,295	$8,745,781	$8,920,697	$9,099,111	$9,281,093	$9,466,715	$9,656,049	$9,849,170
Debt Service	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982
Net Cost	($6,795,327)	($6,839,354)	($6,884,262)	($6,930,067)	($6,976,789)	($7,024,445)	($7,073,054)	($7,122,636)	($7,173,209)	($7,224,793)
MSW Ton	90600	90600	90600	90600	90600	90600	90600	90600	90600	90600
Cost per Ton	($75)	($75)	($76)	($76)	($77)	($78)	($78)	($79)	($79)	($80)

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 10

Financial Results:

Year	11	12	13	14	15	16	17	18	19	20
Revenues (w/o MSW)	$7,362,726	$7,509,981	$7,660,180	$7,813,384	$7,969,652	$8,129,045	$8,291,626	$8,457,458	$8,626,607	$8,799,139
Operating Exp	$10,046,154	$10,247,077	$10,452,018	$10,661,059	$10,874,280	$11,091,765	$11,313,601	$11,539,873	$11,770,670	$12,006,083
Debt Service	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982
Net Cost	($7,277,410)	($7,331,078)	($7,385,820)	($7,441,657)	($7,498,610)	($7,556,703)	($7,615,957)	($7,676,397)	($7,738,045)	($7,800,926)
MSW Ton	90600	90600	90600	90600	90600	90600	90600	90600	90600	90600
Cost per Ton	($80)	($81)	($82)	($82)	($83)	($83)	($84)	($85)	($85)	($86)

NYC DRUM PRELIMINARY
LIFE-CYCLE FINANCIAL ANALYSIS
RUN : Public Ownership - MSW300/SLUDGE150 - 9-02 assumptions w/ MRF
PREPARED BY: R. S. Lynch & Company, Inc.

PAGE 11

Financial Results:

Year	21	22	23	24	25	26	27	28	29	30
Revenues (w/o MSW)	$8,975,122	$9,154,625	$9,337,717	$9,524,472	$9,714,961	$9,909,260	$10,107,445	$10,309,594	$10,515,786	$10,726,102
Operating Exp	$12,246,205	$12,491,129	$12,740,952	$12,995,771	$13,255,686	$13,520,800	$13,791,216	$14,067,040	$14,348,381	$14,635,349
Debt Service	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982	$4,593,982
Net Cost	($7,865,065)	($7,930,487)	($7,997,217)	($8,065,282)	($8,134,708)	($8,205,522)	($8,277,753)	($8,351,428)	($8,426,577)	($8,503,229)
MSW Ton	90600	90600	90600	90600	90600	90600	90600	90600	90600	90600
Cost per Ton	($87)	($88)	($88)	($89)	($90)	($91)	($91)	($92)	($93)	($94)