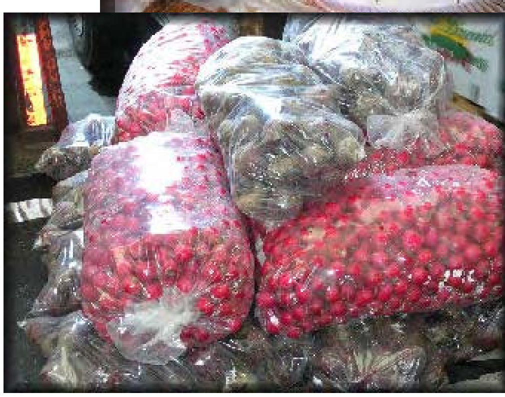
Hunts Point Food Distribution Center

Organics Recovery Feasibility Study

Final Report
December 30, 2005



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DSM takes full responsibility for the information provided and the conclusions reached.

LIST OF ABBREVIATIONS USED IN THE REPORT

Abbreviation	Term
Action Carting	Action Carting, Inc.
AD	Anaerobic Digestion
Circle Rubbish	Circle Rubbish, Inc.
City	New York City
DSM	DSM Environmental Services, Inc.
DSNY	New York City Department of Sanitation
DWR	DWR Associates, Inc.
EDC	New York City Economic Development Corporation
Fish Market	Fulton Fish Market
Food Center	Hunts Point Food Distribution Center
IDA	New York City Industrial Development Authority
Markets	Produce and Fish Markets
MTS	Marine Transfer Station Site
MSW	Municipal Solid Waste
NYISO	New York Independent System Operator
NYSERDA	New York State Energy Development Authority
OCC	Old Corrugated Cardboard
ORRS	Organic Resource Recovery System
PRE	Pathogen Reduction Effect
Produce Market	NYC Terminal Market
ROI	Return on Investment
Royal Waste	Royal Waste Services, Inc.

EXECUTIVE SUMMARY

The New York City Economic Development Corporation (EDC) contracted with DSM Environmental Services, Inc. (DSM) to assess the feasibility of siting an organics recovery facility at the Hunts Point Food Distribution Center (Food Center) in the Bronx, New York. The Food Center is located on land owned by the City of New York (City), and represents parcels leased to over twenty tenants, including the New York City Terminal Market (Produce Market) and the Fulton Fish Market[1] (Fish Market).

The feasibility study had four principle tasks:

1. Conduct a waste characterization analysis to determine the quantity and composition of material in the waste stream at the Food Center.
2. Conduct a technology evaluation to determine which technologies would be best suited to recover organics from the Food Center from a technical and community perspective.
3. Conduct a financial assessment of the most promising technologies, and compare estimated costs to current disposal costs, or other off-site alternatives for composting waste.
4. Evaluate potential sites for locating a facility.

Principle Results

The Produce Market and Fish Market generate approximately 27,400 tons of waste per year (111 tons per day), roughly three-quarters of which is biodegradable. While this material is a valuable feedstock for organics recovery operations, the tonnage is at the low end of the range for a facility to be economically feasible.

DSM sent a request for information to 86 firms from around the world that were identified as being involved in commercial organics recovery activities. Firms responding represented three major technologies: in-vessel composting, anaerobic digestion (AD), and fertilizer producers. The respondent that fared best on both the technological and economic analyses represented an AD technology, which turns organic matter into biogas (which is converted to electricity or other fuel sources) and compost.

The advantages of the AD technology approach over the other two were that they have smaller footprints, generate less odor, create marketable energy and compost products, and are eligible for financial assistance as producers of alternative energy. The specific AD firm rated highest in DSM's evaluation had the most reference facilities in current operation, and stated a willingness to provide a significant equity contribution. Projected capital and operating costs for the highest ranked AD firm would allow it to operate profitably while charging a waste disposal fee to tenants of the Food Center that is no higher than what they are being charged today.

However, to be sustainable economically, the AD firm would need to operate at the low end of cost estimates, and the high end of grant and revenue estimates, that DSM developed. In particular, the developer and operator must secure multi-year guarantees for waste generated at the Produce and Fish Markets, receive favorable financing terms, receive grants from public entities, and have low or no land lease and land clean-up costs to absorb.

DSM evaluated four sites in or adjacent to the Food Center based on size, distance from commercial neighbors, and development costs, and determined that all four sites were suitable to host an AD facility. Three of the four sites could possibly also accommodate an in-vessel compost facility, which requires a larger footprint. Of the four sites, the South Bronx Marine Transfer Station site was the smallest, yet had

[1] The Fish Market was located at the lower end of Manhattan at the start of this project and moved to the Food Center in 2005.

benefits of significant buffers on two sides. In addition, the other three sites had remediation requirements that pose additional potential site development and operational costs.

In conclusion, the study finds that it is feasible to site an AD facility at the Food Center without significant impacts to neighbors while providing a reasonably priced organics recovery option that creates jobs for the Hunts Point community, generates a renewable energy source and a marketable compost product, reduces exports of waste to out-of-state disposal facilities and the associated truck emissions.

However, it is clear that for such a facility to be developed, New York City and State agencies and authorities, the facility developer, and the Food Center tenants would need to demonstrate a commitment to its success. The City and State would need to use resources within their authority, such as providing land at low or no cost, providing assistance with facility permitting, and providing capital or operating grants and loans under existing funding assistance programs for innovative recycling and renewable energy projects. The facility developer would need to demonstrate commitment by providing the necessary financial equity and backing, justified by the realization that developing an organics recovery facility in a high visibility location in a major US city can open the door to potential development of additional facilities down the road.

Finally, Food Center tenants would need to commit to delivering their organic waste to the facility by entering into a longer term disposal contract, essentially sharing in a portion of the financial risk with the facility developer and the various public authorities. The upside of taking on this risk for the tenants would be helping to facilitate the development of a convenient waste disposal option that has the potential to save them money if the costs of conventional disposal options continue to rise. The downside of taking on this risk is if a new, less expensive disposal option becomes available, or the costs of conventional disposal do not outpace the costs of the AD facility over time. This is a risk that the Food Center tenants will have to weigh carefully in consultation with the public authorities and the local community.

The cost models developed in this report, while thorough, are at the feasibility level. To derive more exact costs of a potential organics recovery facility at the Food Center, which all the stakeholders would require prior to making a commitment to the facility, the City would need to issue a more formal Request for Proposals. This Request for Proposals could target the short list of firms identified in this feasibility analysis, and / or set specific operational and economic parameters for a facility, based on the results of this analysis.

INTRODUCTION

The New York City Economic Development Corporation (EDC) contracted with DSM Environmental Services, Inc. (DSM) to assess the feasibility of an organics recovery facility located at the Hunts Point Food Distribution Center (Food Center) in the Bronx, New York. The Food Center is located on land owned by the City of New York (City), and represents parcels leased by the EDC to over twenty tenants, including the New York City Terminal Market (Produce Market) and the Fulton Fish Market (Fish Market).[2]

The purpose of the study was to determine whether it would be feasible from a financial, technical and environmental perspective to site a facility at the Food Center to process organic waste generated by the tenants. Given New York City's lack of waste disposal capacity, and potential increases in waste disposal costs, as well as the environmental impacts associated with transporting waste out of the City, there has been considerable interest in the potential to recover organics from the waste stream.[3] The Food Center has long been considered an attractive location for an organics recovery facility, because it generates large quantities of organic wastes, the Hunts Point community faces traffic congestion and air quality challenges, and residents could benefit from new job creation.

This feasibility study is essentially an evaluation of the relative benefits and costs to the various stakeholders. Potential benefits include reduced and predictable waste disposal costs for tenants, development of local jobs, and a viable economic enterprise for the organics recovery facility owner and operator. These potential benefits need to be measured against potential impacts of the facility on the residential and business character of the community, including real or perceived issues relating to aesthetics, odor, noise and vermin.

To determine the feasibility of such a facility, DSM undertook the following tasks:

Task 1: Waste Characterization: Determine the quantity and composition of organic wastes generated at the Food Center that could be made available for an organics recovery facility.

Task 2: Technology Assessment: Identify and evaluate potential aerobic and anaerobic technologies for recovering organics from the Food Center.

Task 3: Economic Evaluation: Estimate development, construction, and operating costs and revenues of the facility, to determine a likely per-ton tipping fee that would have to be charged to generators. Compare that estimated tipping fee to existing and future costs for exporting this waste to out-of-City landfills or recovery facilities.

Task 4: Site Analysis: Evaluate and rank four parcels in or adjacent to the Food Center, identified by the EDC, in terms of preference for siting an organic recovery facility. Size, configuration, proximity to tenants at the Food Center and site development costs were factors considered in the evaluation. In addition, DSM conducted an odor assessment based on an air dispersion model, and assumed emission coefficients, to predict a worst-case scenario should an organics recovery facility be sited.

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[2] The Fish Market was located at the lower end of Manhattan at the start of the project and moved to the Food Center in 2005.

[3] See: *New York City MSW Composting Report: Summary of Research Project and Conceptual Pilot Facility Design*, Prepared by New York City Department of Sanitation, Bureau of Waste Prevention, Reuse and Recycling, January 2004 (http://www.nyc.gov/html/records/html/govpub/sanit23.shtml).

Task 5: Meetings with Stakeholders: DSM met with various stakeholder groups, including current vendors and managers of the Produce and Fish Markets, current and past waste haulers for the markets, other businesses in the Food Center, the Hunts Point Vision Plan Task Force, City agencies (DSNY and EDC) and other entities that will have an impact on any decisions related to recovering organics at the Food Center.

This report presents the methodology used and findings of Tasks 1-4, with the addition of a Conclusions Chapter, and Executive Summary. Numerous appendices are also included as data sources and references for further study.

DSM has made every effort to gather the most accurate and current data available and to objectively evaluate it with respect to the feasibility of an on-site organics recovery facility. Because this is a feasibility-level analysis, the data and analysis need to be considered as initial estimates requiring further refinement if the project moves forward.

This feasibility study required a significant amount of input by the vendors of potential organic recovery facilities. Some of the data provided to DSM is considered proprietary. As such, the final analysis represents DSM's aggregation of the data and should not necessarily be considered representative of any single vendor's final proposal should a decision be made to move forward with formal solicitations.

The City will make a determination regarding next steps, based on the results of this study and other issues of importance to the stakeholders mentioned in this report and others whom they identify.

TASK 1 – WASTE CHARACTERIZATION

Introduction

The purpose of Task 1 was to assemble feasibility-level waste characterization (generation and composition) data at the Food Center and the Fulton Fish Market. Task 1 was divided into three sub-tasks:

1. Tenant Site Visits and Annual Waste Generation Data Collection
2. Waste Sort and Characterization
3. Comparative Data Research with Other Food Markets

Tenant Site Visits and Annual Waste Generation Data Collection

DSM held initial meetings with EDC and managers of the Produce and Fish Markets (Markets) in July 2004. In October 2004, detailed site visits were conducted at the Produce Market and the Fish Market (at that time still located in lower Manhattan). The site visits involved meetings with managers, vendors, and the waste haulers servicing the Markets in order to better understand current waste handling procedures, pricing structures, and waste generation volumes and characterization. Data were collected during the site visits and subsequently through follow-up communication regarding waste disposal tonnages, characteristics and charges.

DSM also met with managers at three large companies located in the Food Distribution Center to determine if there was interest in delivering organics to the facility, and with a representative of the Food Bank for New York City regarding the amount of produce recovered for use by food banks. Other entities at the Food Distribution Center were contacted but did not express an interest in being interviewed.

DSM also contacted the waste hauling company that had serviced the Produce Market in the past who provided historical data on waste tonnages and charges. Further, DSM contacted two separate composting companies that have taken organic waste from the Produce Market in the past to discuss the type and quantity of compostable material previously generated.

Fish Market Waste Generation

The Fulton Fish Market is the oldest fish market in the nation. It had been located on Manhattan's southeastern waterfront for nearly 200 years, and moved to a new location at the Food Center in 2005. There are roughly 45 vendors of varying size at the Fish Market, collectively selling 250 million pounds, or 125,000 tons, of seafood a year.[4]

The sales representative for Action Carting, Inc. (Action Carting)[5], which has collected most of the waste from the Fish Market for a number of years, estimates that the daily average of waste generated at the market is 19 tons. The manager of the Fish Market indicated that the market is open approximately 250 days per year, resulting in a total waste generation of roughly 4,750 tons per year, or 3.8 percent of the Fish Market's total annual tons of product sold.

[4] Interview with George Maroulis, General Manager of the Fulton Fish Market on October 6, 2004 and follow-up phone and email correspondence.
[5] Phone interview with Dan Romando, Action Carting, November 2004.

Variations in Generation

There are considerable variations in tonnage of waste generated, corresponding with variations in sales on a seasonal, as well as a daily, basis. According to vendors and the Fish Market manager, waste is greatest during the summer months and winter holidays. During the week, waste volumes on the busiest day (Thursday) are a third more than on the slowest day (Tuesday). In addition, weather patterns at sea directly affect the quantity of fish caught and sold and, thus, waste generated. Therefore, the waste volumes are likely to vary by 20 percent, plus or minus, in any given week.

It should be noted that there are also significant variations in waste generated by different vendors. Some vendors at the Fish Market unpack and process fish, while others resell fish to customers in essentially the same containers in which they are received. Vendors that simply resell fish tend to generate much less waste on a per-sales-unit basis than those that process fish. For example, one vendor that sells both full and partial boxes of fish mentioned that more waste is generated from the 15,000 pounds of fish which is filleted each day, than the 35,000 pounds which is not. Vendors indicated that fish that is processed (filleted) generally yield 40 to 60 percent of weight, with the remainder as waste, although different types of fish have different yields (e.g., yield for cod is 50 percent, hake is 70 percent and flounder is 38-45 percent). Much of the fish waste from filleting is subsequently sold to fishermen for bait.

A considerable amount of packaging materials is reused. For example, one large vendor indicated that "99 percent of cardboard boxes" are reused to package fish for sale to customers. Wooden baskets, buckets and pallets are also reused where possible.

DSM did not attempt to include street waste collected by the DSNY street sweepers along the market street each day, because it was not anticipated to be a significant quantity. In addition, DSM did not evaluate the tonnage of whole, unbroken pallets that were collected for reuse because they do not end up in the organic waste stream.

New Fulton Fish Market

Waste Handling

Most vendors at the Fish Market would bring their waste via forklift to a central area on South Street at the close of business every morning where a packer truck was parked. The driver of the truck would estimate the number of yards of waste brought in and write a ticket for the vendor, forming the basis of monthly bills to vendors. Some larger vendors had small dumpsters that they used for their own waste. These dumpsters were also mechanically unloaded into the back of the packer truck.

Impact of Moving to Food Center

The move to the Food Center will bring certain changes to the waste handling procedures and costs. The Fish Market will now be totally enclosed in a large building, which should reduce wastes associated with hot summer days and cold, rainy or snowy days. Better cooling and waste handling systems may also reduce waste generation. However, it is anticipated that the move may also result in increased sales, which would also increase waste generation amounts. DSM has therefore assumed that waste generation and composition will remain relatively unchanged for purposes of this feasibility-level study.

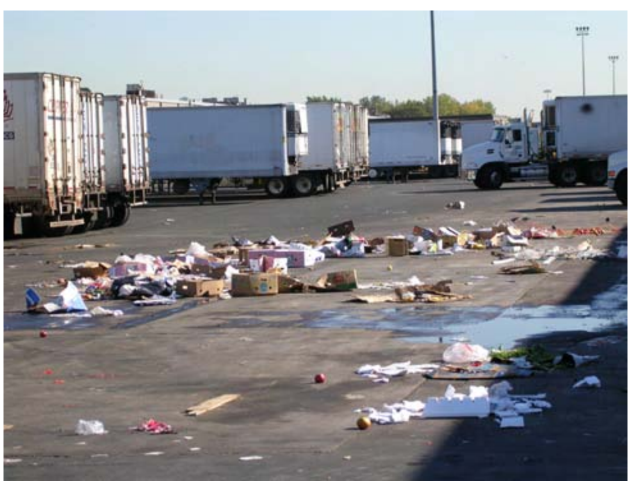
Produce Market Waste Generation

The Produce Market at Hunts Point is the largest produce market in the nation. The market has approximately 60 vendors, each of whom operates out of anywhere from one to a dozen bays. In total, there are 270 bays, which are lined up along four parallel docks that each extend a quarter mile in length. The Produce Market provides fruits and vegetables to distributors and retailers in and around New York City. Most of the vendors resell whole boxes of produce, although some unpack the produce and repackage it in boxes or bags for resale.

Royal Waste Services, Inc. (Royal Waste) is currently the principle hauler contracted by the Produce Market and most individual vendors since June 2004. Between 2001 and 2004, Circle Rubbish, Inc. (Circle Rubbish) was the principle hauler. DWR Associates (DWR) provided solid waste consulting services to Circle Rubbish during that time. DSM obtained information from both Royal Waste and DWR for this study.

There are two principle streams of waste at the Produce Market, *Common Area Waste* and *Dock Waste*.

Common Area Waste is generated from material that falls off, or is pushed off, the docks when produce is delivered or taken away. Common Area Waste includes a mixture of spoiled produce, broken wooden pallets, cardboard, shrink-wrap, plastic straps and miscellaneous materials. On a daily basis, the waste hauler crushes and mixes the Common Area Waste with a front-end loader and transports it to 40-cubic-yard roll-off containers. The roll-offs are taken to a nearby transfer station, where the waste is unloaded and weighed. The DSNY pays for the disposal of the Common Area Waste, and maintains records of monthly disposal quantities and charges (see Appendix A, DSNY Waste Records). The Produce Market pays the collection costs for the Common Area Waste.



Like the Fish Market, waste volumes at the Produce Market vary considerably, primarily as a function of sales, but also due to weather conditions at both the point of production and at the market, and to spoilage resulting from refrigeration problems in transport vehicles. According to DSNY records, there was a total of 13,007 tons of Common Area Waste disposed in 2004, with a monthly average of 1,084 tons. The highest tonnage month was July, with 1,579 tons, nearly twice that of October, the lowest tonnage month, in which 821 tons were disposed. The Produce Market is open 245 days per year, meaning the average Common Area Waste generation is 53 tons per day.

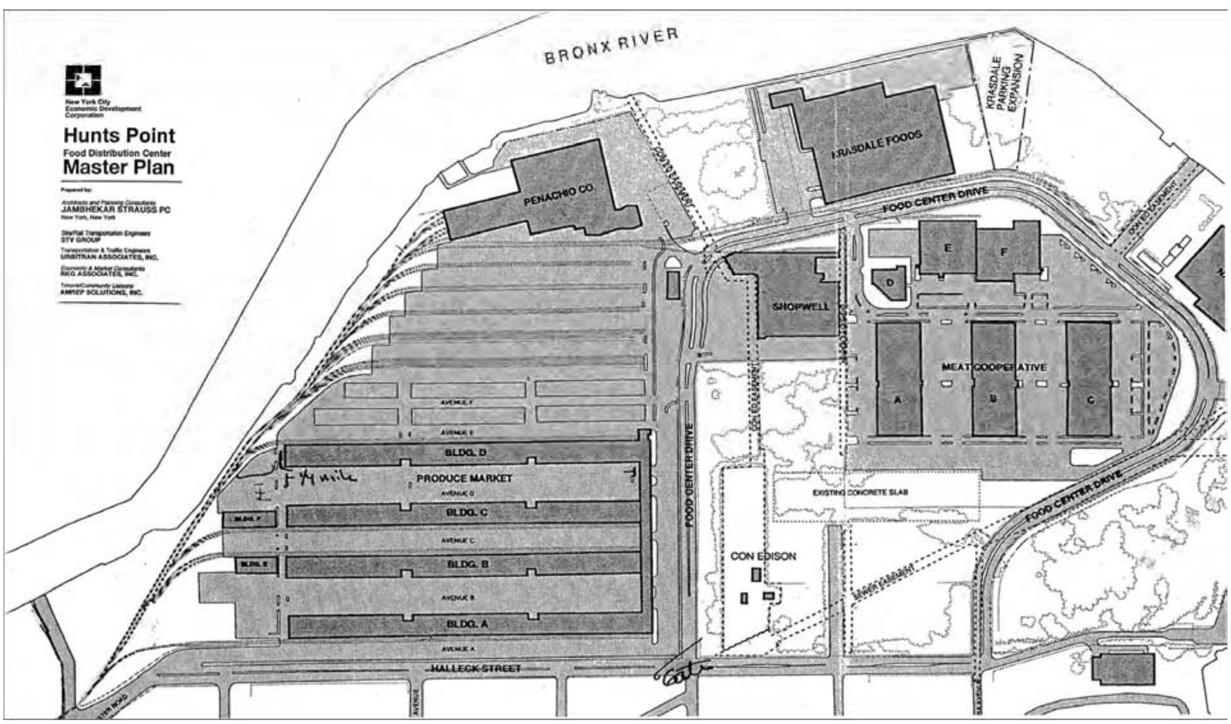
Dock Waste is waste cleaned up by the individual vendors and typically stored at the front of the dock. This waste is collected by a waste hauler and charged directly to the individual vendors at the Produce Market. The majority of Dock Waste is "wet" or heavy, spoiled produce that is packaged in cardboard boxes, with varying amounts of other paper or plastic packaging, depending on the particular product, point of packaging and producer. Most of this material is collected on-call by the waste hauler who tips pallet loads of spoiled produce into a packer truck, and writes a ticket indicating the estimated number of cubic yards in the load. Unless broken, the driver does not discard the wooden pallets themselves. This waste is crushed by the packer truck, with liquid waste discharged to the common area, and ultimately to the storm water drains, reducing tonnage of material sent for disposal.

Most vendors also have 1.5-cubic-yard containers at the back of their bay for use by their employees. These containers are used primarily for "dry" materials, such as cardboard, film wrap, broken wood, and some spoiled produce. However, some vendors use these containers for larger quantities of spoiled produce, particularly if they unpack produce for sale.

DSM was not able to obtain data for the Dock Waste generated at the Produce Market from Royal Waste for the second half of 2004. However, DWR records for Dock Waste collected and disposed of between June 2002 and May 2004 indicate an average of 9,635 tons of Dock Waste was generated per year. Of this, 45 percent was spoiled full pallet loads of produce loaded directly onto trailers and brought to compost facilities in Albany, New York or Wrightstown, New Jersey. Packer trucks picked up the remainder.

In addition, some produce that is not appropriate for resale is either donated to food reuse programs, such as the Food Bank for New York City or sold to buyers interested in lower quality produce for which they negotiate reduced prices. Food diverted to these sources is not accounted for in the calculations of waste generated at the Produce Market.

Some cardboard from vendors that repackage their product is baled and sent to recycling facilities. This cardboard is not included in the assessment of waste. Finally, pallets that are set aside for reuse are also not included in these numbers.



Buildings A, B, C and D, depicted in the lower left of this map, represent the rows of docks at the Produce Market. The Common Areas are directly above and below the rows of docks. Most Common Area waste is generated in the areas between Buildings A and B, and between Buildings C and D.

Other Tenants at the Food Center

There are roughly twenty other tenants at the Food Center who are involved in some aspect of the food distribution industry. There is a large Meat Cooperative, distributors of dry goods, and some food processing and packaging companies. DSM met with representatives of three firms to discuss current waste handling practices, and opportunities and interest in diverting food to a potential organics recovery operation.

The three firms interviewed tended to generate a large quantity of cardboard, some of which is already separated for recycling. While this cardboard could potentially be diverted to an organics recovery operation, the facility would have to meet or beat the price that these firms are currently receiving for the cardboard. Therefore, DSM did not include this cardboard in the summary of waste readily available for an organics facility, although it is important to note that there is a local supply of cardboard available if the organics facility needed it as a bulking agent.[6] There was general agreement that the types of wastes generated by the three firms interviewed were not particularly amenable to organics recovery.

The Meat Cooperative, which currently sends organic by-products to a rendering company that derives a valuable product, did not participate in the organics recovery facility evaluation. However, the EDC may wish to further explore waste generated at the Meat Cooperative, as well as other Food Center vendors, if further steps are taken to site an organics recovery facility at the Food Center.

Table 1 provides a summary of the waste estimated to be readily available for an organics recovery facility at the Food Center.[7]

Table 1 Estimated Daily and Annual Waste Tonnages Potentially Available For Organics Recovery

Source of Waste	Daily Tonnage	Days of Operation	Annual Tonnage*
Fish Market	19	250	4,800
Produce Market - Common Area	53	245	13,000
Produce Market - Dock Waste	39	245	9,600
Total	111	NA	27,400

* Rounded

Waste Sort and Characterization

DSM sorted waste at the Fish Market on Wednesday October 20th and the Produce Market on Thursday October 21st (2004) to estimate the percent of waste represented by different material streams. In both sorts, a team of six sorters separated the material into five categories: food (fish or produce), cardboard, wood, plastic, and other. At the Fish Market, a category for ice was also noted. Food wrapped in plastic was identified separately at the Produce Market. Weights of each material were obtained with portable scales and results were calculated on a percentage basis to be applied to total tons generated.[8]

[6] Recent prices for clean dry unwaxed cardboard delivered to a paper packer in New York City at the time of this study were in the range of $30 per ton.

[7] As noted in Sections 2 and 3, the estimated volume of waste generated at the Food Center was revised upward after the initial request for information was sent to vendors. The estimate in Table 1 represents DSM's best estimate of the tonnage of waste currently generated at the Food Center.

[8] It should be noted that as the waste sorting took place on only one day at each market, it could not be considered statistically significant.

Fish Market Waste Characterization

Types of waste generated at the Fish Market include fish waste, ice, cardboard, waxed cardboard, plastic film wrap, polystyrene (for packing salmon), plastic strapping, burlap or plastic woven bags for shell fish, wood from crates, baskets and broken pallets, paper and other materials.

The sort at the Fish Market was conducted on a Wednesday, as it is a lower volume day, to allow for a greater sample percentage to be sorted and less interference with vendors in the limited space available. Random loads delivered to the Action Carting packer truck on forklifts by vendors were diverted to the sort area. In all, 16 loads were diverted, including a representative number of small containers and pallets of boxes filled with waste. The total amount of material sorted weighed 4,045 pounds, and after sorting, it completely filled a 30-cubic-yard dumpster.

This waste (two tons) represents about 10 percent of an average day's volume at the Fish Market. The two tons is probably closer to 20 percent of waste generated on this particular day, which was a slower day of the week and lighter volume month of the year.

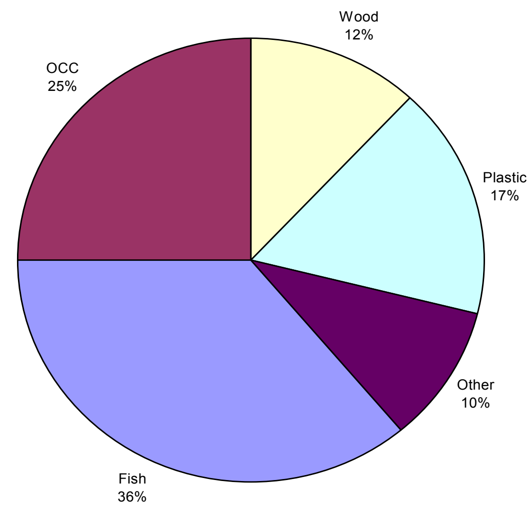
There was considerable variation in the 16 samples that were analyzed. For example, one load had an extremely large amount of fish waste. Other loads were largely cardboard or plastic. DSM included all of the loads sorted, assuming that the variation in loads was representative of waste characterization of the market as a whole.

In addition to the materials noted in Figure 1 below, roughly 315 pounds of ice were sorted. The ice was excluded from the characterization, but noted in information provided to vendors in Task 2. Of the plastic fraction, roughly one-third by weight was polystyrene packaging used to package salmon. This is notable in that this material may be acceptable to some organics recovery technologies.

The "other" category includes material that was swept up after the sort and was a mix of organic and plastic waste, as well as some old clothing and miscellaneous items.

As illustrated in Figure 1, the fish waste and old corrugated cardboard (OCC), which are both easily biodegraded, represent 61 percent of the total material sampled by weight. Adding in wood waste, which is degradable if processed by wood chipping machinery, brings the organic fraction to 73 percent.

FIGURE 1 FISH MARKET WASTE COMPOSITION (PERCENT BY WEIGHT)



Produce Market Waste Characterization

Common Area Waste

The Common Area Waste characterization was based on a sample that was selected in the afternoon of October 20th, after business activity at the market had slowed and the majority of waste had been deposited in the Common Area. One large bucket-load of material was taken from each of the four rows between docks at the market to get a representative sample of material from the full range of vendors. Two of the loads were crushed by the bucket-loader before being picked up, and two of the loads were not crushed.[9]

One of the uncrushed loads was almost exclusively spoiled produce (lettuce) that was wrapped in plastic bags and boxed in cardboard. This load was sorted, although the results were not incorporated in the calculations for the Common Area Waste characterization. Instead, they were used in the Dock Waste characterization as noted below. This load seemed to be an anomaly for Common Area Waste, but potentially predictive of the characterization of spoiled pallets of produce.

Based on the site inspection and visual inspection of material in the Common Area, DSM considered the three remaining samples of waste from the Produce Market to be a fair representation of Common Area Waste. However, it should be noted that waste at the Produce Market could vary considerably from day to day based on the number of loads of spoiled produce caused by the variables noted above.

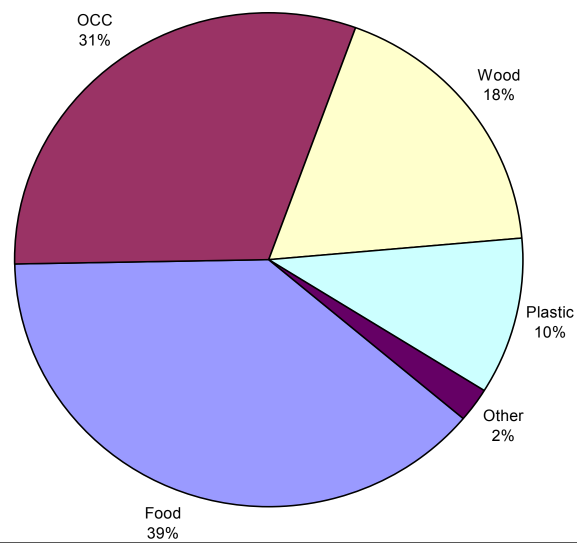
In total, 3,621 pounds of material was sorted from the three remaining samples. These samples were similar in terms of percentages of materials, as noted in Table 2. Degradable materials, as noted in Figure 2, represent 88 percent of Common Area Waste.

[9] DSM requested that the bucket-loader driver not crush the last two loads to enable the sorting procedure to be more efficient.

Table 2 Common Area Waste Composition

MATERIAL	Row 1 (Pounds)	Row 1 (%)	Row 2 (Pounds)	Row 2 (%)	Row 3 (Pounds)	Row 3 (%)	Total (Pounds)	Average %
Food	419.5	35%	555	38%	423.9	43%	1,398.4	**39%**
OCC	302.5	26%	469	32%	350	36%	1,121.5	**31%**
Wood	251	21%	244.5	17%	157	16%	652.5	**18%**
Plastic	148	12%	163.5	11%	55	6%	366.5	**10%**
Other	64.5	5%	18.5	1%		0%	83	**2%**
Total	1185.5	100.00%	1450.5	100.00%	985.9	100.00%	3621.9	**100.00%**

FIGURE 2 COMMON AREA WASTE COMPOSITION (PERCENT BY WEIGHT)



Degradable materials represent 88% of waste stream

Dock Waste

Dock Waste, as noted above, is waste generated by the vendors who are responsible for having it collected and disposed. Dock Waste can be divided into two categories. The first consists primarily of a "wet" stream collected at the front of the dock, of spoiled produce and the cardboard boxes and plastic it is packaged in. Dock Waste also includes a smaller portion, or "dry" stream, which contains office paper, cardboard boxes, plastic strapping and other materials. This dry waste is collected for disposal from dumpsters located at the rear of the dock. While DSM visually inspected the dry stream in the small dumpsters at the back of the vendors' docks, the waste characterization figures below are based on wet stream analysis only. For purposes of the feasibility-level analysis, the small fraction of Dock Waste that is dry was not included. However, DSM did inform vendors in the technology questionnaire (Task 2) that additional cardboard from this stream might be available for their processes.

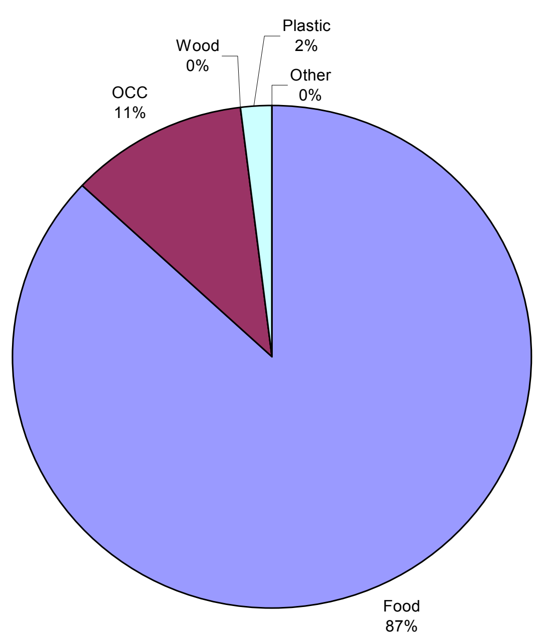
To obtain a reasonable sample for estimating composition of wet Dock Waste, DSM evaluated material from two sources. First, the Common Area Waste row sample that was not included in the Common Area data (see above) contained pallet loads of spoiled produce typical of wet dock waste and was therefore one source analyzed. In addition, DSM picked up ten boxes of spoiled produce from vendors before they were disposed of in the packer truck and analyzed those materials. The results are shown in Table 3 and Figure 3 below.

Table 3 Dock Waste Composition

Material	Row 4 Pounds	Row 4 %	Boxes Pounds	Boxes %	Total	Weighted Average % (1)	Average % (2)
Food	837.2	84%	311.5	92%	1,148.7	86%	88%
OCC	153.5	15%	20	6%	173.5	13%	11%
Wood	0	0%		0%	0	0%	0%
Plastic	8	1%	8	2%	16	1%	2%
Other	0	0%		0%	0	0%	0%
Total	998.7	100%	339.5	100%	1,338.2	100%	100%

(1) The "Weighted Average %" is based on total weights of both sources of material.
(2) The "Average %" is the average of the averages, and is the number used in Figure 3 and in further analysis.

FIGURE 3 DOCK WASTE CHARACTERIZATION (PERCENT BY WEIGHT)



Degradable materials represent 98% of waste

Comparative Data Research

As a means of providing context for this study, DSM conducted limited comparative data research regarding organics recovery efforts at other food markets, including: Pike Place Market in Seattle, Washington; Haymarket in Boston, Massachusetts; and Foodshare and the Hartford Regional Produce Market in Hartford, Connecticut. In all cases, the volume of waste material generated is significantly less, and the waste related activities are somewhat different, from those at the Food Center, and thus the comparison of data and systems in place is somewhat limited. However, it is useful to note for the purpose of the waste characterization analysis, that there is a high percentage of organic waste at all three markets, including food waste, cardboard and wood. Further, for each of these markets, it has been economically advantageous to divert the organic fraction through composting, recycling or other means. (A brief description of these efforts is provided in Appendix B.)

Conclusion

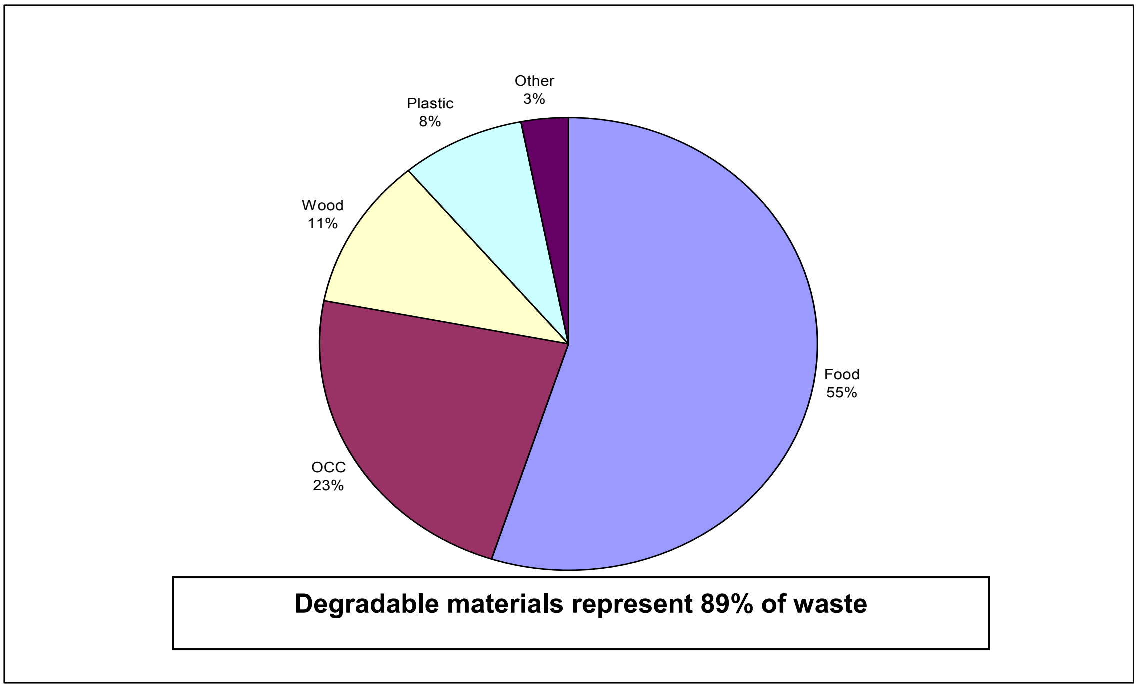
Based on the site visits, historical data and the waste composition analysis, Table 4 and Figure 4 present DSM's best estimate of tonnage and composition of waste at the Food Center.

Table 4 Summary of Daily Waste Generation at the Markets

Source	Food Tons	OCC Tons	Wood Tons	Plastic Tons	Other Tons	Total Tons	Percent of Total
Fish Market	7	5	2	3	2	19	17%
Produce Market Common Area	21	16	10	5	1	53	47%
Produce Market Dock	35	4	0	0	0	39	35%
Total Daily	**62**	**25**	**12**	**9**	**3**	**111**	**100.00%**
Total Annual (1)	**15,200**	**6,256**	**2,899**	**2,268**	**769**	**27,392**	
Percent	**55%**	**23%**	**11%**	**8%**	**3%**	**100%**	

(1) Based on 245 days a year at the Produce Market and 250 days per year at the Fish Market.

FIGURE 4 FISH AND PRODUCE MARKETS WASTE CHARACTERIZATION (PERCENT BY WEIGHT)



In summary:

- It is estimated that, on average 111 total tons of wastes are generated per day from the Fish and Produce markets.
- The Produce Market represents 83 percent of this total.
- Annual generation is estimated to be 27,400 tons, 24,350 of which is organic.
- There is considerable seasonal and daily variation in waste generation.
- Fifty-five percent of the waste is food, and another 23 percent is discarded cardboard, which is easily degradable.
- Eleven percent is wood that would need to be shredded or chipped to be rapidly biodegraded.
- Eleven percent of the waste is non-degradable plastic and other materials.

TASK 2 - TECHNOLOGY ASSESSMENT

Task 1 provided a basis for understanding the volume and characterization of the waste stream, and the material handling operations in practice, at the Markets. The purpose of Task 2 was to assess the technical merit of various approaches for processing the organic fraction of the Food Center's waste stream. This task was divided into four aspects:

1. Determine feasibility of source separated versus commingled collection of waste.
2. Gather information from vendors of organics waste processing technologies.
3. Evaluate and discuss the organics recovery approaches submitted.
4. Rank the organic waste processing technologies and select technologies to proceed to economic analysis (Task 3).

Source Separated Collection vs. Commingled Collection

Given difficulties associated with handling non-degradable waste in an organics recovery facility, it was important to ask whether it would be possible for tenants to separate organic from inorganic waste at the point of generation before being diverted to waste management facilities. The answer to this question had bearing on the types of facilities that would be most appropriate and feasible for operation at the Food Center.

Source separation at the Food Center could have different implications for different recovery approaches. For example, some technologies are designed to process commingled food waste, cardboard and wood. Other technologies can only process food waste with no other organic materials in the mix. The presumption is that most technologies would function better if plastic and non-degradable materials are separated out. However, different technologies have different thresholds for acceptable levels of these various ingredients.

While source separated waste streams are "cleaner" and easier to process, the critical question was whether it would be feasible to establish systems at the Food Center to keep separate streams of waste. As noted in the Waste Characterization analysis, some tenants keep cardboard separate already. Others, primarily tenants that re-package, or somehow further prepare fish or produce before resale, keep food waste separate. Wooden pallets, and some other materials, are also kept separate for reuse or recycling by various vendors.

However, these examples are more the exception than the rule. Cardboard and plastic are intermingled throughout the waste stream. Pallets are delivered with shrink-wrap on top of cardboard boxes that contain products, some of which are individually wrapped in other types of plastic. It would be very labor intensive to have staff remove plastic from spoiled food. Further, the logistics of storing and arranging for collection of separate streams of waste would be complex and costly, as compared to collecting a single stream of waste. A majority of tenants interviewed at the Produce Market felt it would not be feasible to separate all the plastic from the produce prior to disposal.

Also, as tenants use a shared disposal system, an enforcement mechanism would need to be established to ensure that all vendors abide by the rules of source separation. The experience at Pike's Peak Market in Seattle, Washington (summarized in Appendix B) has some relevance for this discussion. At Pike's Peak, staff hired by the market must continually train new employees of the market tenants regarding the source separation rules, monitor waste for compliance, and then establish fee schedules for waste that contained non-acceptable materials. This is a time-consuming and costly aspect of their operation.

Finally, based on the prevalence of individually wrapped produce and the cooperative configuration of the tenants, it is not likely that tenants would be able to remove enough plastics from the waste stream through source separation to negate the need for a front-end separation and/or back-end screening system at the organics recovery facility. Therefore, establishing and enforcing a costly source separation system would be duplicative. For these reasons, DSM did not seek approaches that would seek separate streams, although some firms responding to the questionnaire (described below) did suggest source separated collection schemes.

Gather Information from Vendors

Identify Vendors

DSM developed a list of organics recovery technology firms based on DSM's prior knowledge, as well as information gathered from trade magazines, web sites, consultation with experts in the field and officials from various government agencies. In total 86 firms were identified (see Appendix C). In some cases the firms were technology design and engineering firms, others were facility vendors, and others were facility operators. Some firms typically provide whole systems, and others only provide one technological or operational feature.

Develop and Distribute Questionnaire

DSM developed and distributed a letter and questionnaire (Appendix D) on November 12, 2004 to each of the 86 firms that it identified. The letter communicated the intent of the feasibility study, and background on the waste characteristics at the Food Center.[10] The questionnaire included detailed questions about the technology and system configuration the company would provide to maximize recovery of end-products for beneficial use while minimizing potential impacts to neighboring businesses and residential communities. In addition, there were numerous questions about reference facilities that the company had designed or operated in the past. Responses were due on December 10, 2004.

Evaluation / Description of Organics Recovery Approaches

DSM received 18 responses to the questionnaire. Some of these responses were submitted by teams of multiple parties. DSM developed and applied exclusionary and preferential criteria to the respondents.

Exclusionary Criteria

Exclusionary criteria were established as minimum thresholds that firms were required to meet to be further considered and ranked in the preferential criteria phase. The exclusionary criteria (Appendix E) focused on the following issues:

- *Full-scale application:* Does the firm have any reference facilities that have operated at the scale that would be required at Hunts Point (i.e., between 50 and 200 tons per day)?
- *Operating experience:* Does the firm have any full-scale reference facilities that have been in continuous operation, except for scheduled maintenance shutdowns, for at least three years?
- *Enclosed operation:* Is the processing operation of the proposed system fully enclosed (in a building, bags, or some other barrier to the outside environment)?
- *Self-sustainability:* Are any of the reference facilities operating without ongoing financial subsidies from outside sources?
- *Appropriate footprint:* Can the proposed system function on a site with a footprint that is between three and ten acres?

[10] It should be noted that the waste characterization summary distributed to vendors indicated that waste from the Markets averaged 101 tons a day, and 24,880 tons a year. This is ten percent lower than the final waste characterization numbers presented in Task 1 of this report (111 tons per day, 27,400 tons per year). The change is based on annual generation information that became available after the initial waste characterization was completed, and the questionnaire to vendors was distributed. Because vendors were told that waste could vary considerably on various days, all responses were based on the ability to handle this additional throughput. For consistency in evaluation, DSM used the lower annual tonnage estimate for its evaluation. In some circumstances, for example the economic analysis in Task 3, the implications of higher throughputs were considered.

- *Variable waste steam:* Has the proposed system been successfully operated, on at least a trial basis, processing a waste stream that includes at least 50 percent food and fish waste, and that includes at least 10 percent contamination (non-organic and non-hazardous material)?

- *North American representation:* Do the firms involved in the proposed system have a North American presence, either in terms of operating facilities in North America, or North American representatives available for ongoing assistance with operations, maintenance, parts or repair?

- *Ability to transfer product for beneficial use:* Do the firms involved in the proposed system have experience marketing, or transferring for beneficial use, their end-product, as opposed to storing it on location for extended periods, or disposing of it at a negative value?

- *Performance guarantee:* Do the reference facilities include operating performance guarantees or performance bonds, and are the firms involved in the proposed system prepared to offer a performance guarantee equivalent to at least the annual value of the project revenues?

- *Demonstrated odor mitigation approach:* Does the proposed system have a defined odor control technology, and demonstrated experience using that technology?

Of the 18 initial questionnaire respondents, eleven met the exclusionary criteria. Table 5 provides a listing of the firms meeting the exclusionary criteria and a summary of their technology and system configuration. The most common criteria used to exclude other respondents were inability to demonstrate operation of a full-scale facility, and/or lack of adequate operating experience.

Table 5 Respondents Meeting Exclusionary Criteria

Respondent	Principle Project Partners	Technology	Primary Products
Arrow Ecology		ArrowBio Process Anaerobic Digestion	Bio Gas Compost
California Liquid Fertilizer		High temperature liquid composting	Fertilizer
Canada Composting		BTA Process Anaerobic Digestion	Bio Gas Compost
EcoCorp	Linde	Linde Technology Anaerobic Digestion	Bio Gas, Liquid Fertilizer and Carbon Dioxide
Engineered Compost Systems	Bulk Handling Systems Ambio Biofiltration	In-vessel Composting	Compost
Environmental Design Group	Waste Options	In-vessel Composting	Compost
Mining Organics	International Bio Recovery Corp/ Weston Solutions, Inc.	Enhanced autogenous thermophilic aerobic digestion	Fertilizer
Orga World		Dry Anaerobic Batch Digestion	Bio Gas Compost
Organic Waste Solutions	Dranco/ City Green	Anaerobic Digestion	Bio Gas Compost
Waste Recovery Solutions Inc.	Valorga	Anaerobic Digestion	Bio Gas Compost
Wright Environmental	SHAW Group – Stone and Webster	In-vessel Composting	Fuel Pellet

Technology Descriptions

Of the eleven responses that met the exclusionary criteria and proceeded to the preferential ranking, six involved anaerobic digesters, three were in-vessel composting technologies, and two were companies that produce liquid or solid fertilizers. Following are brief descriptions of these technologies or approaches to recovering organics from the waste stream.

Anaerobic Digestion

Anaerobic digestion (AD) is the biological process of bacteria growing in the absence of oxygen to break down organic carbon compounds, with methane and carbon dioxide created as by-products. In this application, the AD process will likely occur in the mesophilic temperature range (95° F), which destroys pathogens. For example, a simple mesophilic digester can achieve a 99.9 percent Pathogen Reduction Effect (PRE), which is virtually free of all common pathogens except for some viruses and helminths. If required, the materials can also be treated for one hour at a temperature of 140°F to achieve a PRE of 99.99 percent.[11]

When AD takes place in nature, or in a solid waste landfill, the methane generated is a significant source of greenhouse gas emissions, 21 times more potent than carbon dioxide. However, when AD takes place in the controlled environment of an AD facility, the methane is captured and used to create fuel.

Most of the AD respondents to the DSM questionnaire indicated that they would use methane generated in their processes to fuel turbines that would create electricity, a portion of which could be used in the facility itself with

[11] H. Bendixon (1996). "Hygiene and Sanitation Requirements in Danish Biogas Plants." *Ninth European Bioenergy Conference; June 24-27, 1996, Copenhagen, Denmark.* UK: Pergamon Press; pp. 296-301.

the remainder to be sold to the electric utility, or grid. Some of the respondents indicated that the methane could also be used to create vehicular fuel.

Europe has had extensive experience with AD technology for municipal solid waste (MSW), with over 87 plants in operation,[12] close to half of which were represented as reference facilities by respondents to DSM's questionnaire. To date, AD has been used in the US to process agricultural waste, but none of the respondents to the questionnaire referenced facilities processing MSW in the US, although there are a few facilities operating in Canada.

Types of AD Processes

There are several different AD approaches, including a batch process, a one-stage process and a two-stage process. In addition, there are dry fermentation (or high solids concentration) and wet fermentation (or low solids concentration) approaches, distinguished by the fact that water is added to the latter. It was beyond the scope of this study to evaluate all of the potential AD processes for applicability at Hunts Point.[13] Instead, DSM evaluated the contemplated processes submitted in response to the questionnaire. The AD approaches that ranked highest on the evaluation were one-stage dry fermentation (high solids) processes, and it is this approach that is referred to as the AD process from here out.

AD Process Train

There are some variations in proposed AD processes regarding how the material flows through the system, but most follow a similar general "process train". The basic components of the process for an AD facility are:

- Feedstock material is received in enclosed area with negative air pressure to contain odor releases associated with raw waste.
- Feedstock is preprocessed by separation of metals and non-compostable materials through some combination of hand sorting, mechanical sorting with magnets, and other equipment, and/or size reduction of the material through use of sheers, screens or other equipment.
- Material is mixed with older, digested materials, re-circulated water and heat.
- Material is pumped into digesters.
- Material is digested for 15 to 21 days, creating biogas and a slurry, called "digestate"[14].
- Biogas is directed into storage units, emergency flares, and/or end-product (turbines to create electricity, or other equipment to create pipeline quality fuel or vehicular fuel).
- The collected digestate will then be sent to a solids processing unit where mechanical separators partition the solid fiber and liquid filtrate fractions. The fiber fraction is then screened and transported to a secondary processing area for final aerobic composting and curing.
- Aerobic composting and curing takes place for seven to fourteen days in enclosed building with aerated static piles and biofilter to remove odors from air leaving building.
- The resulting compost is screened, and the finished material (if it meets NYS Department of Environmental Conservation Part 360 Regulations[15]) is marketed.

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[12] James Rollefson, Ph.D. and Bruce Holbein, Ph.D. "Anaerobic Digestion of Municipal Solid Waste: It's Role in Achieving Waste Diversion and Kyoto Targets for Canada", Solid *Waste and Recycling*, April/May 2005.
[13] A useful comparison of the various types of anaerobic digestion can be found in Chapter 4 of Biomethanization of OFMSW, edited by J. Mata Alvarez, 2002. The chapter Types of Anaerobic Digesters for Solid Wastes by P. Vandevivere, L. De Baere and W. Verstraete compares these various processes.
[14] The digestate consists of the undigested solids, cell-mass, soluble nutrients, other inert materials, and water.
[15] http://www.dec.state.ny.us/website/regs/subpart360_01.html

Model AD Material Flow[16]

The material flow is a comparison of the quantity of feedstock entering the facility to the quantity of material exiting the facility in various forms. Table 6 describes the model AD facility material flow.

Table 6 Model AD Material Flow

Material Entering Facility	**Tons**
Biowaste	24,880
Water (for cleaning)	1,980
Total	26,860
Material Exiting Facility	
Compost	6,113
Residue and Recyclables[17]	10,790
Wastewater	5,607
Water vapor	1,240
Biogas	3,110
Total	26,860

In-vessel Composting [18]

Composting is a biological process in which bacteria and other organisms break down organic matter in the presence of oxygen. The process produces heat, which destroys pathogens. The result is a stabilized compost product that can be used as mulch, soil conditioner, and topsoil additive. In-vessel systems can be used to compost yard waste, food, sewage sludge, mixed wastes, and paper to produce a marketable product. Under optimum conditions, materials degrade aerobically in a vessel. Considered advanced technology compared to other composting methods, in-vessel systems require precise temperature and oxygen control. In-vessel systems are used in applications where land space is limited, and work well for food waste (including animal products) and sewage; material that are often considered too messy or odoriferous for open composting.

Although carbon-to-nitrogen ratios and moisture content must be considered, the composition of feed materials is less critical for in-vessel systems than it is for windrow or aerated static pile systems. This flexibility allows different mixes to be composted, based on availability of feed materials. However, if in-vessel systems operate under less than ideal conditions, the length of time required to create a stable product will increase, affecting design parameters and ultimately capital and operating costs.

Non-biodegradable materials must be screened or hand-picked either before or after composting. Biodegradable materials must then be chipped, ground, or shredded into uniform particles that will decompose quickly. Feedstock materials are mixed using a pugmill, front-end loader, conveyor or paddle-blade mixer to distribute the carbon and nitrogen evenly.

Oxygen and temperature regulation is critical to maintain optimum conditions for microbial action. The temperature must be high enough to kill pathogens and weed seeds but not so high as to kill the

[16] DSM requested "mass balance" information from vendors, including inputs and outputs of energy, water and materials. DSM is presenting "material flow" data, which is the subset of the mass balance reflecting the weight of material entering and exiting the system.

[17] The AD facility in this scenario projected that 2,986 tons of cardboard and 1,061 tons of plastic would be recovered for sale as recyclable materials. In addition, the AD facility projected that 2,001 tons of wood would be recovered for sale or internal use as a bulking agent. For this analysis, DSM is assuming that all plastics will be disposed of in landfills, and cardboard and wood will be either digested or used as a bulking agent. DSM did not adjust estimated amount of compost that will be generated for sale resulting from this increase in throughput.

[18] Overview of In-vessel composting from the Joint Service Pollution Prevention Opportunity Handbook, revised 10-03: http://p2library.nfesc.navy.mil/P2_Opportunity_Handbook/7_II_A_3.html

microorganisms. The method of ensuring the maintenance of an air supply to the compost mix depends on the particular in-vessel system selected. Generally, air is supplied by blowers, and flows up through the compost. Air can be supplied via piping networks or through damper arrangements beneath the compost. Blowers can operate automatically based on measured temperature set points or can be set at regular intervals. Pile temperature is controlled by cycling the aeration system on and off. Good odor control for this system is achieved by collecting and treating the process air and building air.

Types of In-vessel Composting Approaches

There are various types of in-vessel composting systems, and modifications or combinations to systems, that are in use in both the US and elsewhere. Again, while a full discussion of these approaches is beyond the scope of this report, a short summary of alternatives follows.

- **Tunnels/containers:** Material can either be "batch" fed or continuously fed, with either a single end, or dual end opening for loading and unloading material.
- **Vertical tower/ silo**: Material is loaded from the top and unloaded after composted from the bottom.
- **Agitated bay/ bed:** Material is fed continuously into long concrete-walled bays or extended beds. Material is turned by mechanical equipment, such as rotating tines or augers which can be mounted above the beds or driven through the beds.
- **Rotating drums**: A continuous feed processing system where material is fed into a large, rotating drum, with the material agitated and aerated as it passes along the drum.
- **Housed windrows**: Employ traditional windrows or extended bed of material housed in a building

In-Vessel Process Train

There are some variations in proposed in-vessel composting systems, but most follow a similar process train. The basic components of the process for a compost facility are similar to those of the AD facility, except that material does not go into an anaerobic digester, but rather an in-vessel system where it is composted aerobically. Compost then needs to be cured for a set period of time.

Model In-Vessel Material Flow

The material flow for composting facilities would vary according to the degree of pre- and post-processing activity employed, and end-products derived. For use of this analysis, the following in-vessel material flow (shown in Table 7) was used.

Table 7 In-vessel Material Flow Amount Used

Material Entering Facility	**Tons**
Biowaste	24,880
Water	4,269
Total	29,149
Material Exiting Facility	
Residue and Recyclables[19]	6,202
Water Vapor	13,586
Compost	9,360
Total	29,149

[19] Based on information submitted by vendors, all material will be diverted for disposal as opposed to recycling.

Fertilizer Manufacturers

There were two firms that recommended making fertilizer products from the organic material in the waste stream. As a point of reference, one of the firms referred to their technology as a high temperature liquid composting, which is an in-vessel biological system that rapidly converts organic waste materials into liquid organic fertilizer product. While similar in principle to solids composting (described above), a main difference is that liquid composting has no temperature gradient in the medium, and continually mixes all material, resulting in a process time of five to six days, start to finish.

Fertilizer Manufacturer Process Train

Input materials are visually inspected and wood, cardboard and non-digestible materials are manually or mechanically picked out for recycling or disposal. Organic feedstock is loaded into the receiving tank where it is macerated to obtain a homogenous liquid mixture, and then transferred into large storage vessels.

The raw organic feedstock is pumped into the digesters where the reaction is monitored. Once the material reaches pre-determined temperature, it is transferred to the third stage where the product is triple-filtered prior to loading for bulk delivery for use in drip-irrigation applications as an agricultural fertilizer. Roughly ten percent of the organic input material ends up as a solid which is sold as a soil amendment.

Table 8 Model Fertilizer Manufacturer Material flow

Material Entering Facility	**Tons**
Biowaste	24, 880
Material Exiting Facility	
Liquid Fertilizer	11,920
Solid Soil Amendment	1,244
Residuals/Recycling[20]	11,716
Total	24,880

Preferential Criteria

Preferential criteria were used to rank the respondents who met the exclusionary criteria. For each criterion, a respondent could receive a maximum score of 5 points, with standards established to warrant a 1, 3 or 5 points. In some cases, scores of 2 or 4 were given to provide further differentiation between respondents.

A team of experts in organics recovery technologies was assembled by DSM to review and score the responses. In most instances, the experts had similar scores for respondents. Where experts disagreed on scores, the project manager brought the experts together to discuss their different perspectives or interpretations of the data. In some cases, follow-up questions were asked of the respondents to provide additional information or clarifications. In rare cases where experts still had differing opinions on a score, the scores were averaged.

Weighting of the Scores

In consultation with the EDC, the DSM evaluation team weighted criteria with a 1, 2 or 3. In other words, criteria that were deemed more important were given a higher weight, which was multiplied by the respondents' raw score for those criteria. Appendix G provides an explanation for all of the weights that were applied to the scores. Appendix H provides a summary of all the raw and weighted scores for the 11 respondents. Table 9 provides a ranking of the 11 respondents by weighted score and includes raw score as well.

[20] Vendors indicated that some cardboard, wood and other materials would be source separated for recycling prior to arriving at the facility, or removed from the material stream prior to processing in fertilizer manufacturing system.

Table 9 Ranking of Respondents by Weighted Score

Company	Facility Type	Weighted Score	Raw Score
Organic Waste Solutions/Dranco	AD	82	53
Waste Recovery Solutions/Valorga	AD	80	53
Eco Corp	AD	77	51
Canada Composting	AD	70	46
Orga World	AD	70	46
Arrow Bio	AD	68	45
Waste Options--EDG	Compost	66	41
Wright Environmental	Compost	64	41
Engineered Compost Systems	Compost	62	39
California Liquid Fertilizer	Fertilizer	58	39
Mining Organics	Fertilizer	57	38

Key
AD: Anaerobic digestion technology
Compost: In-vessel compost technology
Fertilizer: Facility creates a fertilizer product

Conclusions

It is interesting to note that the AD technologies performed better than the in-vessel composting technologies in terms of total scores and weighted scores, and that the in-vessel composting technologies performed better than did the fertilizer facilities.

Principle differences include:

- AD firms that responded to the questionnaire have more operating experience than the in-vessel composting firms that responded. The six AD respondents combined listed more than 30 operating plants as reference facilities, most of which are in Europe and Canada. These AD facilities also require a smaller footprint, generate fewer odors[21] and produce power that is highly marketable.

- The in-vessel composting firms providing responses to the request for information had less operating experience, require bigger footprints, and have more odor release points due to larger curing areas, than the AD firms that responded.

- Fertilizer firms that responded have a potentially higher value end-product, although experience marketing that product in the East Coast is at a pilot stage at best. Also, the fertilizer facilities only process about half of the input material, as they do not utilize cardboard or wood. This means more residuals are generated that need to be transported out of the Food Center and disposed at a high-cost, or be further processed to obtain a positive value.

[21] See more detailed discussion of odor analysis in Task 4.

Financial Analysis

DSM, in consultation with EDC, elected to evaluate six firms in the economic and financial analysis, including the top three scoring AD technologies and three in-vessel composting technologies. As noted in Table 9, the scores were relatively close on technological basis. Thus, it was deemed important to have a better understanding of the economic implications to make a determination on which facility(s) to use in the final financial model(s).

TASK 3 - FINANCIAL EVALUATION

Introduction

The purpose of Task 3 was to conduct an evaluation of potential cost savings to tenants of the Food Center if an on-site organics recovery facility were developed, and to develop a financial feasibility analysis of an organics recovery facility from the perspective of the potential developer/operator.

Task 3 included six sub-tasks:

1. Economic Analysis on Technology Assessment Finalists
2. End-product Valuation
3. Potential Facility Funding Sources
4. Facility Financial Analysis (Pro Forma) on Model Facility
5. Collection Cost Analysis
6. Economic Implications for Food Center Tenants

Economic Analysis on Technology Assessment Finalists

DSM developed and sent an economic questionnaire (Appendix I) to the six firms ranked highest on the Technology Assessment in Task 2, three in-vessel compost systems, and three AD systems. The questionnaire asked for feasibility-level cost estimates on their contemplated facility, including a list of interested parties, development and construction costs, facility financing options, annual operating costs and annual revenues. In addition, firms were asked to submit any updated information regarding their projected facility mass balance in order to evaluate the costs and revenues associated with materials entering and exiting their processes.

The questionnaire responses were reviewed by a team of experts in composting and AD facility design and operation. Wherever possible, standard pricing units were applied by DSM to the data submitted by the firms to ensure that responses were being evaluated on an equal basis. The data for each facility were used to create an economic analysis that estimated capital and operating costs for the facilities as well as revenues, and estimated a tipping fee that the facility would need to charge to cover annual costs, including debt service and profit.

These individual cost estimates were then refined to develop economic pro formas for two model facilities, based on the most economically feasible responses submitted to DSM: an AD system and an in-vessel compost system. For each facility, two costing scenarios were developed. The "low-cost" scenario incorporated favorable assumptions about financing and land lease costs, and the "high-cost" scenario incorporated less favorable financing assumptions (noted below).

Table 10 summarizes the pro formas that DSM created for the model AD and in-vessel compost systems, under low-cost and high-cost scenarios. The high-cost scenarios only depict the elements of the pro forma that differ from the low-cost or base scenario. These changes are all related to financing variables. Other development and annual operating costs are considered to represent DSM's best estimate based on submissions of facility information, knowledge of the industry, and standardized costs for the New York City area, as noted in the assumptions below. As illustrated by Table 10, the AD system appears to be the less expensive facility to construct and operate. Capital costs for the building, odor control equipment and other fixed costs were considerably less. Also, the AD firms responding to the economic questionnaire indicated a greater likelihood of contributing equity. On the operating costs side, the in-vessel composting facility had higher waste disposal and electricity consumption costs.[22] The AD system also generates more revenue, as it produces marketable electricity and compost, as opposed to only compost.

[22] It should be noted that estimated waste disposal tonnages for the AD and in-vessel systems are based on reported information from the vendors, with some adjustments as noted in material flow for AD facility in Task 2.

Table 10 Estimated Development and Operating Costs

	AD Low	AD High	In-Vessel Compost Low	In-Vessel Compost High
Developmental Costs				
Design, Engineering and Permitting	$ 696,900		$492,000	
Financing Costs (closing, legal)	$1,000,000	$1,500,000	$1,000,000	$1,500,000
Site Development	$814,700		$814,700	
Building	$2,030,000		$5,467,000	
Odor Control Equipment	$100,000		$653,000	
Fixed Equipment (excl. odor control)	$3,330,000		$4,255,000	
Mobile Equipment	$140,000		$325,000	
Start-up and Testing	$1,294,900		$897,000	
Total Development Costs	**$9,406,500**	**$9,906,500**	**$13,903,700**	**$14,403,700**
Development Cost Contributions				
Equity Contribution	$1,000,000			
Grants	$500,000		$350,000	
Net Requiring Debt Financing	**$7,906,500**	**$8,406,500**	**$13,553,700**	**$14,053,700**
Annual Costs and Revenues				
Finance Costs				
Debt Service	$702,130	$794,360	$1,250,500	$1,543,000
Return on Equity	$171,000			
Operating Costs				
Payroll	$560,000		$522,500	
Operations and Maintenance	$343,500		$449,900	
Electricity			$209,000	
Water and sewer	$9,900		$5,700	
Land lease		$450,000		$450,000
Insurance	$137,500		$137,500	
Waste disposal	$310,950		$458,950	
Capital Reserve	$20,000		$32,500	
Total Operating Costs	**$1,381,850**	**$1,831,850**	**$1,816,050**	**$2,266,050**
Profit	**$69,090**	**$183,190**	**$90,800**	**$226,610**
Total All In Annual Costs	**$2,324,070**	**$2,980,400**	**$3,157,350**	**$4,035,660**
Revenue				
Compost	$229,200		$315,000	
Electricity Sales	$ 248,000			
Total Annual Revenue	**$477,200**	**$477,200**	**$315,000**	**$315,000**
Net Annual Cost	**$1,846,870**	**$2,503,200**	**$2,842,350**	**$3,720,660**

Note: Shaded cells without data in AD High and In-vessel Compost High columns indicate no change from Low scenario for that technology.

Assumptions for Table 10

Development Cost Assumptions

All Facilities

- Site development costs ($814,675) represent an average of listed site development costs provided by respondents.
- Site remediation costs were assumed to be reimbursed by other parties.
- Facilities would qualify for New York City Industrial Development Authority (IDA) triple tax exempt bonds as a recycling facility.
- Facilities will be financed for 15 years in equal monthly payments of principle and interest for full term of loan.
- AD vendor indicated equity contribution of $1 million with 15 percent return on investment (ROI).
- Fixed and mobile costs include all equipment needed to operate facility and prepare end-products for market.

Low-cost Scenarios

- Interest rate of 4 percent on IDA-issued bonds, based on low-end of recent IDA tax-exempt bond rates for recycling facilities.
- Upfront financing costs of $1 million reflecting less extensive legal work related to closing on the loan.
- Contractual agreements with Produce Market and Fish Market tenants to ensure their waste would be directed to the organics recovery facility for at least first five years of facility operation. (See discussion under Waste Contract Issues, below.)

High-cost Scenarios

- Financing rate of 7 percent based on the high-end of recent IDA tax-exempt bond rates for recycling facilities.
- Financing costs of $1.5 million reflecting more extensive legal work related to closing on the loan.
- No or limited contractual agreements with Produce Market and Fish Market tenants to ensure their waste would be directed to the organics recovery facility during the life of the long-term debt.

Operating Cost Assumptions

All Facilities

- Administrative personnel salary is $85,000 per year.
- Marketing personnel salary is $75,000 per year.
- Operating labor wages amount to $50,000 per year.
- All facilities listed one administrator, one marketing specialist and seven or eight laborers.
- Fixed equipment operation and maintenance costs equal one-tenth of fixed equipment capital cost (including replacement cost).
- Mobile equipment operation and maintenance costs equal one-seventh of mobile equipment capital cost (not including replacement costs).
- The cost of electricity delivered to the facility averages $0.16 per kWh based on quote from Con Edison for a commercial facility in the Bronx. (The AD system will produce all the electricity required for its operation, and will sell surplus power on the wholesale market, as noted in the revenue assumptions below.)
- Water and sewer costs equal $5,540 per million gallons of potable water used based on report of New York City Water Board, Public Information Regarding Water and Wastewater Rates, April 2005.
- Insurance costs are $137,500 annually, based on an average of estimates submitted by respondents.

- Waste disposal costs are set at $74 based on data provide by the DSNY for the Common Area waste (adjusted for City discount) and by Circle Rubbish for waste collected at Hunts Point in 2002-2004. Waste costs are assumed to increase with inflation, according to the EDC estimate.
- Capital reserve for mobile equipment is equal to one-seventh of capital costs, and for fixed equipment it is equal to one-tenth of capital costs.

Low-cost Scenarios

- No land lease cost.
- Profit equals 5 percent of operating costs.

High-cost Scenarios

- Land lease of $2.60 per square foot, based on EDC estimate of current rates at the Food Center.
- Profit equals 10 percent of operating costs.

Revenue Assumptions[23]

All Facilities

- Price of compost is $15 per cubic yard. (Note that this is the price for compost delivered. If the compost was picked up at the Food Center, the price would be $8 per cubic yard).[24]
- Electricity produced for sale is valued at 8 cents per kilowatt-hour.
- AD facility would receive $500,000 in New York State Energy Development Authority (NYSERDA) or other grants under various funding programs.
- AD facility would potentially qualify for renewable energy credits for energy produced from biomass.
- In-vessel compost facility would receive $350,000 in Empire State Development grants.

Tonnage Scenarios

For each of the four scenarios, three additional scenarios were developed with different tonnage throughputs. Table 11 provides a summary of the tip fees that would need to be charged under each of those scenarios for the AD facility and the in-vessel compost facility to be economically sustainable. The range of tip fees varies from a low of $55 per ton (for the AD, low-cost scenario, with high throughput), to a high of $150 per ton (for the compost facility with high-costs and low throughput).

DSM is using as a base case the scenario with low costs and low throughput, resulting in an estimate of $75 per ton for the AD facility and $111 per ton for the in-vessel compost facility. This is because without beneficial costing scenarios it is unlikely that a facility would be built, and yet it is important to be conservative with regard to the amount of waste expected to be delivered to the facility.

[23] Additional discussion on revenue projections in section on end-product valuation below.

[24] The value of compost generated by an in-vessel compost system and the compost or digestate generated by an anaerobic digester with similar feedstock is presumed to be identical based on discussions with experts in compost and anaerobic digestion fields. Clearly, the ultimate quality of the end-product will be based on a number of factors, including pre- and post-processing to remove contaminants, and monitor for stability, moisture and other characteristics. The value of the end-product will be dependent on these quality concerns as well as the marketing skill of the facility operator, and current market values.

Table 11 Estimated Tip Fees for Anaerobic Digestion and In-Vessel Compost Facilities

	ANAEROBIC DIGESTION			IN-VESSEL COMPOST		
Throughput (Tons per Day)	*101*	*111*	*122*	*101*	*111*	*122*
Low-cost Scenario ($/Ton)	$75	$61	$55	$111	$106	$97
High-cost Scenario ($/ Ton)	$99	$83	$75	$150	$142	$130

Base Case is shaded.

Tonnage Assumptions

- 101 tons per day (24,880 tons per year) is derived from the waste characterization summary distributed to vendors, and from which the vendors based their responses to questionnaires for Tasks 2 and 3.
- 111 tons per day (27,400 tons per year) is the revised number of tons estimated to be generated by the Produce Market and the Fish Market (as noted in Task 1).
- 122 tons per day (30,000 tons per year) is a high-end estimate of tons available at the Food Center, and includes waste that was not quantified, but is likely available from other entities at the Food Center.
- In estimating the required tipping fees for the two higher tonnage throughput scenarios (27,400 and 30,000 tons), waste disposal costs and revenues were adjusted based on the per-ton factors that were calculated for those line items in the lower tonnage (24,880 tons) estimate.
- Capital and operating costs (other than those noted above) are assumed to remain constant within the range of tonnage analyzed given the level of estimating error inherent in feasibility-level costs.

Waste Contract Issues

This tonnage analysis raises an important point about the facility owner/operator's ability to secure contracts for the waste identified in the waste characterization analysis. A predictable quantity of waste, and thus of revenue in the form of tipping fees, is an important consideration for potential financiers who want assurance that the facility they are backing will be able to repay their dept.

For example, in the past, some municipal waste combustion facilities have required "put or pay" contracts with waste suppliers as a necessary component of securing long-term debt financing. These contracts required waste generators to pay for a set amount of waste, regardless of whether or not they produced it. However, tenants at the Food Center will likely not want to be restricted to obtaining waste management services exclusively from one entity, or may want some assurance that their costs will not exceed market prices for services that would otherwise be available to them.

A more plausible alternative to a put-or-pay contract would be for the facility owner/operator to guarantee debt service payments through its own financial resources (which are more likely with larger firms, such as the AD firms responding to the questionnaire), and to secure contracts for waste delivery from the Produce and Fish Markets for a limited period, of say, five years. The debt service guarantee and this intermediate term contract, together with an independent engineering report assessing long-term export costs might be sufficient for financing.[25]

[25] It should be noted that there are a number of financing instruments, with variations related to each, including length of term, size of loan, proportion of loan amount to total development costs, etc. For this feasibility-level analysis, it is not possible to identify a specific financing arrangement that would be most attractive to a developer, as many other variables are as yet undetermined.

End-Product Valuation

End-products from the vendors that ranked highest on the technology and economic evaluations were compost and electricity. Following are the values of the end-products that DSM estimates are most appropriate for the feasibility analysis.

Compost: Compost is currently sold in the New York City metropolitan area, on a wholesale basis, at $10 to $20 per cubic yard. For example, compost is being sold to La Guardia airport for $15.50 per yard including trucking. Compost retails (at nurseries for example) for $20 to $30 per yard. Based on these figures, DSM estimates that a reasonable estimate of compost produced at the Food Center would be $15 per cubic yard delivered, including sales tax.

Electricity: The value of electricity sold to the grid in New York City ranges considerably based on the demand at time of sale. Prices for each zone in New York are available at the New York Independent System Operator (NYISO) website http://www.nyiso.org/public/market_data/reports.jsp . While NYISO does not have historical averages for the price of electricity over a year's time, a NYISO representative indicated that the range of prices in 2004 for the Bronx area was 6 cents to 20 cents, depending on time of year, and time of day. For purposes of this analysis, it was assumed that a blended rate of 8 cents per kilowatt-hour represented a conservative estimate of sales.

If an electricity producing facility was able to store biogas and generate electricity during peak-periods when power demand is high, revenues for electricity sales could increase significantly. While DSM confirmed that such an approach is technically feasible, and that revenue would be significantly enhanced, it was outside the scope of this feasibility-level project to evaluate the full costs involved in configuring a facility to follow that approach.

A number of other possible end-products were listed in responses to DSM's questionnaires to vendors, including mulch, fuel pellets, pipeline quality gas, and a cleaner motor vehicle fuel. Some of these products could potentially generate higher revenue values, and help to reduce environmental impacts in other ways. However, it was outside of the scope of this study to investigate options other than those proposed by the vendors producing the highest ranking responses. The end-products used in the economic pro formas were those that the vendors proposed in their responses to the economic questionnaire, and for which the model systems were configured to produce.

Potential Funding Options

The following entities have been identified as potential financial assistance providers:

- New York State Empire State Development "Environmental Investment Program" provides capital grants for fixed equipment with a cap of $500,000. Proposals are reviewed monthly on a rolling basis throughout the year. Commercial organics recovery is a current priority for this funding program. Only non-energy producing related equipment is eligible for grants, meaning that the equipment in an AD facility related to energy production would not be eligible, but other capital items could be.

- The New York State Energy Research and Development Authority (NYSERDA) has several grant programs that an AD facility producing energy could apply for, including:
  - Environmental Products and Process Solicitation, which has a cap of $250,000.
  - Industrial Product and Process Solicitation, which also has a cap of $250,000.
  - Combined Heat and Power, which has a higher cap.

  One or more of the NYSERDA grants could be applied for to support one or more of the following aspects of an AD facility:

  - Construction of the digester as a technology to produce a gas

- Technology to remove contaminants from biogas to enable it to be used as pipeline quality gas or vehicle fuel
- Converting gas to electricity
- Environmental controls on the digester
- Creating pipeline quality gas
- Storing gas, so that it could be sold during peak hours

- New York City Industrial Development Agency (IDA) offers a Tax Exempt Facilities Bond Program for companies developing solid waste recycling facilities. Reductions in mortgage recording and sales taxes may also be available. Interest rates ranging from four to seven percent have recently been reported for firms depending on credit ratings and other financial criteria.

Model AD Facility Pro Forma

Table 12 provides an economic pro forma for the Base Case AD facility for year one and years two – fifteen, which for the purposes of this feasibility study are the same, as noted in assumptions below. (Appendix J provides a 15-year economic proforma for the Base Case AD facility.)

This pro forma is based on the following assumptions:

- All costs and revenues are reported in constant (2005) dollars. With the exception of export disposal costs, DSM does not believe that any one category of costs will behave differently than another with respect to inflation, making it unnecessary to adjust for inflation over time.
- Currently the commercial rate at the nearby transfer station is approximately $74 per ton. To be conservative, the assumption has been made that export waste disposal rates at Hunts Point will not increase faster than inflation over the life of this analysis.
- It is assumed that the owner/operator would seek a 15 percent return on equity and a 5 percent profit on gross revenues associated with this facility.
- Income taxes have not been included in the costs because of the wide range in taxes that could be paid depending on ownership and tax strategies.
- Low tonnage estimates have been used to be conservative with the assumption that there would not be a long term put-or-pay contract, but that there would be shorter term (e.g., five-year) contractual commitments by the Markets to deliver most organic waste to the facility.[26]
- The impacts of increasing and reducing throughput by 10 percent have been estimated to illustrate the sensitivity of changes in throughput on overall facility viability.
- It is assumed that throughput in the first year would be reduced, as would revenues, but that the increased cost would be absorbed by the owner/operator, either through increased debt service or reduced cash flow, or through lower returns on equity and profits.
- Capital reserves have been established for all mobile and fixed equipment to account for replacement over the life of the analysis.
- Financing of debt service is assumed to be carried out with tax-exempt revenue bonds with equal annual principal and interest payments.
- Cash flow during start up and testing is assumed to be financed as part of the long term debt.
- It is assumed that EDC will not charge a land lease to the facility, and that any site remediation costs will be borne by responsible parties and not the facility owner/operator. It should be noted however that if facility throughput were increased by 10 percent, the potential would exist for paying a land lease to EDC – this could be a negotiated component of the EDC/facility operator agreement.
- The annual tipping fee is calculated based on subtracting revenues from all-in costs for the facility, including return on equity and profit.

[26] A five-year term is identified here as a plausible time period, consistent with longer term contracts for commercial refuse collection service contracts. A term of less than five years might not be adequate for a facility to demonstrate that it can function profitably when operated at capacity.

Table 12: Economic Pro Forma for AD Base Case

CATEGORY	Units	Initial Cost	Year 1	Years 2-15
COSTS				
Capital				
Soft Costs (design, engineering, legal, financial)		$1,696,879		
Site Development (assumes no brownsfield cleanup)		$814,675		
Building Construction (includes odor control)		$2,030,072		
Fixed Equipment (10 year life)		$3,330,000		
Mobile Equipment (7 year life)		$140,000		
Start-up and Testing (including working capital)		$1,294,921		
Total All In Capital Costs		$9,306,547		
Less Equity Contribution		$1,000,000		
Less Grants		$500,000		
Total Debt Financing		$7,806,547		
Annual Debt Service (@4%)			$702,129	$702,129
Return on Equity (@15%)			$171,017	$171,017
Operating				
Administrative personnel (FTE)	1.00	$85,000	$85,000	$85,000
Marketing personnel (FTE)	1.00	$75,000	$75,000	$75,000
Operating labor (FTE)	8.00	$400,000	$400,000	$400,000
Fixed equipment O&M (includes capital reserve)		$333,000	$333,000	$333,000
Mobile Equipment O&M (includes capital reserve)		$30,500	$30,500	$30,500
Electricity (assumes internal generation)		$0	$0	$0
Water and sewer (million gallons)	1.79	$9,894	$9,894	$9,894
Land lease (assumed to be zero)		$0	$0	$0
Insurance		$137,500	$137,500	$137,500
Waste disposal ($/Ton)		$74	$74	$74
Waste disposal (percent of throughput)	0.17			
Waste disposal cost	4,229.60	$312,990	$312,990	$312,990
Total Annual Operating Cost		$1,381,842	$1,383,885	$1,383,885
Profit (assume 5% of operating costs)			$69,194	$69,194
Total, All In Costs			$2,326,226	$2,326,226
REVENUES				
Compost (cubic yards)	15,283	$229,238	$114,619	$229,238
Electricity (KWH's)	3,100,000	$248,000	$179,421	$248,000
Revenue / Ton of Throughput	$19.18			
Other materials	0	$0	$0	$0
Total, All In Revenues		**$477,238**	**$294,040**	**$477,238**
Net Cost			**$2,032,186**	**$1,848,988**
Throughput (tons)	**24,880**		**18,000**	**24,880**
Required Tipping Fee Per Ton			**$113**	**$74**
IMPACT OF CHANGES IN THROUGHPUT				
Increase throughput by 10% (annual tons)	**27,368**			
Change in capital cost	0			$873,146
Increase in operating cost	0.05			$1,122,295
Increase in waste disposal cost	0.1			$344,289
Increase in revenue	0.1			$524,961
Estimated Tipping Fee				**$66**
Net Impact on Tipping Fee				**-$8**
Reduce throughput by 10% (annual tons)	**22,392**			
Change in capital cost	0			$873,146
Reduction in operating cost	-0.05			$1,015,409
Reduction in waste disposal cost	-0.1			$281,691
Reduction in revenue	-0.1			$429,514
Estimated Tipping Fee				**$78**
Net impact on Tipping Fee				**$3**

Collection Cost Analysis

One advantage of an on-site organics recovery facility is the short distance between the point of waste generation and the end processing point, resulting in low transportation costs and related environmental impacts. However, in this case the benefits of low transport costs are reduced by the location of a transfer facility close to the Food Center.

After evaluating the Produce Market's current collection procedures, it has been assumed that there would not be significant changes if an organics recovery facility was sited at the Food Center. Common Area Waste would continue to be collected by a bucket loader and then loaded into an open top container, which would then be hauled to the new organics facility instead of the current transfer station. Dock Waste would continue to be picked up by packer trucks that would then be driven to the facility. Given that the transfer station that Produce Market waste is currently transported to is located only 1.5 miles from the Produce Market, no significant changes in transportation cost of waste would be expected.

The manager of the Fish Market indicated that there will be no dock encircling the new Fish Market facility, and thus tenants will move all their garbage to one of two locations where it will be emptied into rear-loading trucks or compactors. In reality, this is quite similar to the previous situation in lower Manhattan. It is possible that the transportation costs at the new market will be reduced compared to costs from lower Manhattan. However, because waste from the Fish Market represents only 17 percent of waste under consideration, this potential variance should have a minor impact on total costs. The assumption for the study, therefore, is that there will be no change in Fish Market collection costs.

Collection costs are not currently charged to tenants separately from disposal costs. Rather, tenants are charged by an estimate of cubic yards of waste generated. To estimate current costs, DSM used actual internal cost data provided by DWR Associates[27] for collection and disposal of Dock Waste from the Produce Market from 2002 through 2004. DSM used the actual number of cubic yards charged to tenants and the actual number of tons of waste Circle Rubbish paid to dispose of to extrapolate a charge to tenants of $98 per ton. DWR Associates' analysis showed the tip fee paid to the transfer station of $72 per ton. Collection costs of $26 per ton were derived as the difference.

Economic Implications for Food Center Tenants

Table 13 provides a comparison of projected waste disposal costs for various scenarios. Current costs are compared to costs under the model AD low-cost scenario with the three tonnage variations, as well as two alternative offsite composting options. One site is an outdoor windrow composting operation in New Jersey, which is only permitted and capable of processing vegetative waste, and not fish or other meat waste. This facility, located 85 miles away, has taken spoiled pallet loads from the Produce Market in the past. The other site is a mixed-waste in-vessel composting operation in Massachusetts, located 235 miles away, and could take all waste generated at the Markets.

[27] DWR Associates provided solid waste consultation services to Circle Rubbish during the period that Circle Rubbish provided collection services at the Produce Market.

Table 13 Comparison of Waste Disposal Prices for Food Center Vendors

Disposal Scenario	Tip Fee per Ton	Haul Fee per Ton	Collection Cost per Ton	Total Tip Fee per Ton
Current Costs	$74		$26	$100
Anaerobic Digestion / 24,880 tons	$75		$26	$101
Anaerobic Digestion / 27,400 tons	$61		$26	$87
Anaerobic Digestion / 30,000 tons	$55		$26	$81
NJ Windrow Composting Site (accepts clean produce only)	$35	$40		$75
MA In-vessel Composting site (accepts all material identified in study)	$70	$50	$26	$146

Table 13 Assumptions

Current costs are based on internal cost data provided by DWR Associates for collection and disposal of Dock Waste from the Produce Market from 2002 through 2004. Circle Rubbish charged tenants $16.50 per cubic yard, which is similar to what Royal Waste is currently charging. The average density of waste collected from tenants during this period was 338 pounds per yard.[28] This equates to 5 cents per pound, or $97.63 per ton. DWR Associates' analysis showed the tip fee paid to the transfer station of $72 per ton. Collection costs of $26 per ton were derived as the difference. The current tip fee (as noted in Table 12) was increased to $74 per ton to account for inflation since that data were generated.

Tip fees for the three AD scenarios are the low finance cost scenarios presented in Table 11. The collection/haul fees are based on current costs as discussed above.

The New Jersey windrow composting facility is not currently permitted to process fish waste, and does not have the ability to screen excessive contaminants. Thus, they would likely only be able to take the Produce Market's spoiled pallet loads, which represents roughly one-third of the material identified in the Food Center waste characterization. It is assumed that the other two-thirds would need to be handled under the current contract.

The New Jersey facility provided a tip fee range of $25 to $45 per ton, based on the quantity of material delivered and the level of non-biodegradable materials in it. For example, a truckload of spoiled grapes packaged in plastic bags would be charged $45 per ton, whereas a load of onions that are loose in boxes would be charged $30 per ton. Larger loads (e.g., 100 ton trailers) of mixed spoiled produce would be charged $25 per ton. DSM used an average of $35 per ton for the tip fee at this facility.

The operator of the Massachusetts mixed-waste in-vessel composting facility provided estimated prices for tip fees and hauls. Factors considered by the Massachusetts facility related to their tipping fee include the percent of inorganic materials in the waste and the duration of the contract. Factors impacting the hauling costs include bulk density of the loads, such that greater density per unit of volume mean that greater tons can be received from one truckload and transportation costs per ton decrease.

[28] Based on total tons disposed divided by cubic yards charged. It should be noted that the collection truck driver estimates the number of cubic yards at the time of pickup.

Collection Costs if Facility Operator Owns and Operates Collection Vehicles

One alternative to potentially reduce collection costs would be for the facility operator to own and operate their own collection vehicles. DSM conducted a limited analysis of the costs involved in owning and operating two packer trucks, one new and one used (as a backup) that serviced the vendors at the Food Center. As noted in Table 14 below, DSM estimates that it would cost less than $300,000 a year to own and operate the vehicles, which would equate to a $12 per ton (assuming 25,000 tons of waste per year was collected) collection cost. This represents more than a 50 percent decrease in costs currently assumed to be charged and could provide a significant benefit to vendors at the Food Center.

The economic pro formas and estimated required tipping fees do not reflect this potential reduction in collection costs. However, it is an important consideration, and a potentially viable option for reducing costs, should facility development ensue.

Table 14 Estimated Costs of Owning and Operating Collection Vehicles to Service Food Center Tenants

Annual Costs	
Annual Payment on Two Trucks ($180,000 purchase price)	$33,405
Laborer 1 - Full Time	$75,000
Laborer 2 - 50% time (as back up)	$37,500
Administrative Overhead, including supervisory and billing	$75,000
Equipment O&M @ 7.5% of initial purchase price	$13,500
Fuel, at $50/day	$12,500
Taxes, Licenses, Insurance	$10,000
Sub total - Annual Costs	$256,905
Profit (15% of Annual Costs)	$38,536
Total Annual Costs	$295,441
Tons	25,000
COST PER TON	$11.82

Conclusion

DSM estimates that the most economically feasible approach to organics recovery at the Food Center would be to develop an AD facility that turned waste into biogas to be converted to marketable electricity. Under favorable economic circumstances, assuming: tonnage commitments by Market tenants; issuance of tax exempt bonds at low interest rates; grant funding for eligible equipment; and, zero or reduced land-lease costs, the facility could operate at a tip fee of $75 per ton (rounded). This is nearly identical to the $74 per ton tip fee that is currently being charged to tenants for waste transfer and disposal, and thus represents neither a savings nor added expense to tenants.

If ten percent more waste were received by the AD facility (which disposal data appear to support), the tip fee could be reduced to roughly $66 per ton which would significantly improve facility viability. However, failure to attract at least 24,800 tons of waste would significantly reduce facility viability. This illustrates that the facility is at the low end of the size necessary for economic viability given today’s commercial tipping fees in the Bronx.

It appears that exporting all the organic waste identified in the waste characterization to an in-vessel composting facility in Massachusetts would be more expensive than developing a facility on site. It may be possible to export a subset of the waste, the spoiled pallet loads of produce, to a compost facility in New Jersey for lower costs than the current situation. However, the other two-thirds of waste identified in the study would need to be handled otherwise.

It is further noted that revenue could be significantly increased by timing sales of electricity to coincide with peak demand load periods, and that collection costs could be reduced if the facility owner/operator provided collection themselves. These options warrant further consideration should facility development planning proceed.

TASK 4 – SITE ANALYSIS

Introduction

The purpose of Task 4 was to evaluate four sites identified by EDC in terms of relative preference for a location of an organics recovery facility, including an evaluation of the potential odor impacts of the four sites on the surrounding community. The four sites are depicted on Figure 5, and described in Table 15.

FIGURE 5 AERIAL PHOTOS OF POTENTIAL ORGANIC RECOVERY SITES

This photo was provided by the EDC, and was taken before the new Fulton Fish Market was built on the land directly northwest (to the left) of the MTS.

Table 15 Descriptions of Potential Sites (Alphabetical Order)

Site	Acres	Location / Neighbors	Other Issues
A OU-2	7.5	Located on the NW corner of Halleck Street and Food Center Drive/Ryawa Ave, adjacent to Meat Cooperative and site A OU-1 (recently leased to Meat Cooperative).	Former Con Edison property requiring remediation. Across the street from existing private waste transfer station.
D	7.25	Located on Food Center Drive, on W side of Krasdale Foods and E side of Fruit Auction Building (contains three food companies).	Former Con Edison property requiring remediation. A 30-foot greenway is included in future plans for Site D along N side (along Bronx River)
E OU-3	6.3	Located on NE corner of Halleck Street and Food Center Drive/East Bay Ave, adjacent to Meat Cooperative and site A OU-1 (recently leased to Meat Cooperative).	Former Con Edison property requiring remediation.
South Bronx Marine Transfer Station	3.93	Located next to 600 Food Center Drive, which operate two food businesses.	Land owned by DSNY. Would require salt pile and special waste drop off site to be dismantled and removed from site. A 30-foot greenway is included in future plans for MTS (along Long Island Sound).

Siting Criteria

Exclusionary Criteria

Exclusionary criteria by which the sites were evaluated included their total size and configuration. The minimum size was assumed to be three acres for the exclusionary evaluation. Based on responses from technology vendors, all four sites are large enough to allow for sizing of an AD facility that requires about three acres. All but the South Bronx Marine Transfer Station site (MTS) are large enough for an in-vessel compost facility that requires seven acres. In addition, all four sites are configured to allow adequate space within boundaries for a facility to be located on them.

Preferential Criteria

Preferential criteria include the potential impacts to neighbors and the costs related to site remediation. All sites were assumed to be similar in terms of the distance to available power, water and sewer hookups.

Potential Impacts on Neighbors

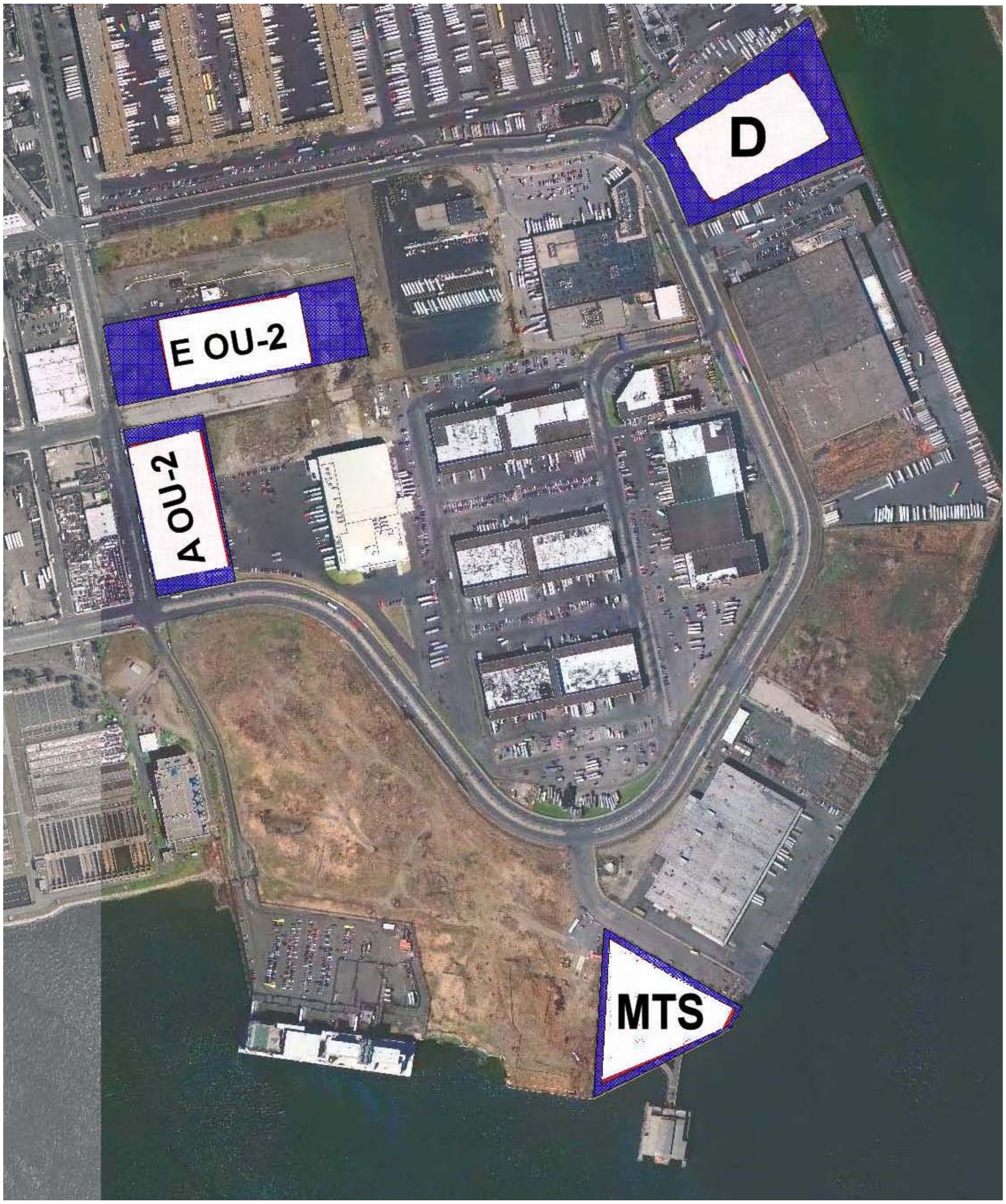
Potential impacts on neighbors from an organics recovery facility are a principle issue for evaluation of the sites under consideration. These impacts include noise, dust, truck traffic and visual impacts, as well as potential impacts of odor and vermin. In addition, some stakeholders in the food distribution industry noted a potential impact to their image. In other words, if their customers knew that a waste processing facility was located in close proximity to their business it could negatively affect their image.

All of the sites have neighboring businesses and thus have potential concerns. DSM made a judgment that the best means of determining relative impacts on neighbors of various sites was to evaluate the sites in terms of distance from nearest neighbors, the number and size of neighbors, and the types of uses they have.

Proximity to Neighbors

Figure 6 depicts a hypothetical 3-acre footprint of an AD facility located within borders of each site. Appendix K presents an aerial photo of each site and notes the distance from the border of the hypothetical facility to the nearest food related businesses.

FIGURE 6 THREE-ACRE FACILITY FOOTPRINTS ON FOOD CENTER SITES



Following is a summary description of the neighbors to each site, ranked in ascending order of distance to nearest neighbor.

- The MTS is located 185 feet southwest from 600 Food Center Drive which houses two food companies, and the access road adjacent to the MTS is opposite land leased by the Meat Cooperative to the north. The Long Island Sound is on the south side of the MTS, and the new Fulton Fish Market is to the west (not depicted in Figure 6).

- Site D is located 205 feet from Krasdale Corporation to the south, and 285 feet from the Fruit Auction Building to the north. Across the Food Center Drive is Shopwell and on the east is the Bronx River.

- Site E OU-3 is located 335 feet from Produce Market on the north side. To the south is the vacant parcel, A OU-2, and to the east is land leased by Shopwell and the Meat Cooperative. To the west lie commercial businesses in the Hunts Point community, including a private waste transfer station.

- Site A OU-2 is located 365 feet west of the Meat Cooperative. On the south side is the new Fulton Fish Market, and to the north is the vacant parcel E OU-3. To the west lie commercial and light industry businesses in the Hunts Point community, including a private waste transfer station.

Based on the various issues listed above, DSM does not believe that there is a clear-cut advantage of any of the sites over the others, in terms of proximity to neighbors. While the MTS has the closest neighbor, it has significant buffers on three other sides. Site D has the next closest neighbors, and only one side with a natural buffer. Sites E OU-3 and A OU-2 have the greatest distance to neighbors and a vacant parcel on one side. However, if that land, which is leased to the Meat Market, were developed, it would have a much closer sensitive neighbor.

Size of Site

All of the sites under consideration are large enough to house the model AD facility, which has an estimated footprint of 2.5 to 3 acres. The three sites within the Food Center are also just large enough to house an in-vessel composting facility, which would require up to 7 acres. Given the results of the financial analysis in Task 3, indicating that an AD facility is more financially feasible, any of the four sites would be adequate from a size perspective, although a larger plot has some inherent advantages in terms of providing more options where a facility could be positioned on the site.

Cost of Cleanup

A consultant to EDC is preparing a report on the remediation costs at the three sites within the Food Center (Sites: A OU-3, D, and E OU-3). The MTS is not presumed to require remediation; however, subsurface conditions are not known and there are structures on the site that would need to be removed. Based on preliminary findings, it is assumed by the EDC consultant that the remediation costs would be greatest at Site D, with lesser amounts at the other two sites. The cost to prepare the MTS for use is presumed to be less than the clean-up costs at any of the other three sites.

For the purpose of this analysis, it is assumed that an organics recovery facility located on at the Food Center would not be required to pay costs associated with remediating the sites. However, it is possible that a facility developer or operator would be responsible for building a cap over certain portions of the site and/or installing and maintaining a venting system beneath any pavement or buildings. Therefore, the MTS facility is presumed to have less site-development related costs.

Odor Assessment

Odor is a common issue of concern for neighbors of potential waste management facilities, especially organics recovery technologies such as composting and AD. These concerns stem from direct or indirect experience with facilities that have been significant odor sources in the past. Modern organics recovery approaches and odor mitigation technologies reduce chances of odor episodes to a significant extent.

However, given the close proximity of neighbors within the Food Center, DSM made odor analysis and control a priority issue in this feasibility report. Specifically, DSM:

- Excluded technology responses that did not describe an odor control technology that would be used at the Food Center, or did not demonstrate experience using that technology;
- Required all proposed waste processing activities to be conducted in enclosed areas with negative air pressure to capture potential odor releases;
- Weighted facility odor mitigation approaches heavily in preferential criteria evaluation;
- Hired an odor analysis expert to develop an odor-screening model to estimate the potential maximum odor impact for model AD and in-vessel composting facilities at the four potential sites; and
- Interviewed individuals not affiliated with facilities under consideration in this study who have visited reference facilities to verify statements about odor related issues by vendors.

Dilution to Threshold Odor Standard

One standard measure of odor is called the dilution-to-threshold ratio or D/T. The D/T represents the number of dilutions of fresh air that are required to ensure that the air being sampled (air sample) is below the threshold of what can be detected by an odor panel (or group of people selected to smell and comment on odors). An odor panel is considered to be a more sensitive evaluation than field air analysis using equipment. For example, a D/T of 1,000 requires 1,000 dilutions of fresh air to reach a threshold value of 1.0, or to be not detected. In short, the lower the D/T, the less odorous the air.

Odor Results

- *Anaerobic digestion versus in-vessel composting:* The AD system evaluated for this study has a much lower odor impact than the in-vessel system evaluated, because the AD facility releases a much smaller volume of biofilter exhaust (17,000 cubic feet per minute (CFM) for AD versus 72,000 CFM for in-vessel composting). Further, the composting operation used as the basis for modeling includes outdoor curing piles that contribute to the overall odor emission. The AD technology used for modeling has no such outdoor emission source.

Photo above depicts an anaerobic digester operating next to a fast food restaurant. There has been no record of odor complaints at this facility.

- *Anaerobic digestion odor impacts:* Odor impacts for an AD facility are not predicted to be greater than 1 D/T. The highest odor impact predicted by the model is less than 0.5 D/T immediately adjacent to the biofilter stack. In practical terms, the AD facility did not generate detectable odors in the odor modeling analysis.[29]

- *In-vessel composting odor impacts:* Odor impacts of 5 D/T are predicted to occur at least once per year out to a distance of approximately 450 to 700 feet from the biofilter stacks (5 D/T is a standard regulatory guideline adopted by some states). Odor impacts of 1 D/T are predicted to occur outward to a distance of approximately 1,400 to 2,200 feet from the biofilter stacks.

Conclusions Related to Odor

The odor-screening model indicates that there would not be detectable odors emitting from an AD facility at any of the proposed sites located at the Food Center.

Recommendation for Site Selection

All four of the sites are large enough to house an AD facility, which is considered the most feasible from an economic and technical perspective.

While all four of the sites have business neighbors, the MTS has a significant buffers, with Long Island Sound on two sides, and a vegetative buffer between it and the Fish Market.

Most importantly, the MTS also would likely have the lowest site-development related costs. The MTS is not known to require remediation, whereas the other three sites are, reducing the potential that the site would need to be capped, and/or need an air venting system installed or maintained. Table 16 provides a summary of the factors that DSM considered in evaluating the sites:

Table 16 Comparisons of Potential Sites

Site	Buffers	Distance to Closest Neighbor (Feet)	Close Business Neighbors/Buffers
A OU-2	Vacant parcel on north, land leased to Meat Market on east	365	• Meat Cooperative • Transfer Station
D	Bronx River on east	285	• Krasdale Corporation • Fruit Auction Building
E OU-3	Vacant parcel on south, land leased to Meat Market on east	335	• Meat Cooperative • Transfer Station
MTS	Long Island Sound on south and east, vegetative buffer to west.	185	• 600 Food Center Drive • Fish Market

[29] It should be noted that many AD facilities that digest sewage have odors associated with them. However, in most cases these odors are produced by holding ponds that contain sewage rather than the digesters themselves. Of anaerobic digesters handling municipal solid waste that have had odor episodes, one possible cause has been leaks in metal tanks holding the biogas. The system modeled for this analysis proposes using all concrete tanks, greatly reducing the chance of any leakage of gas. The firm modeled for this analysis has had only one incidence of odor in sixteen years of experience with over eleven operating facilities. That problem was caused by the installation of a pressure regulator upside down. One independent source who has visited plants designed and built by this AD firm has not detected odors outside the buildings, and notes that a restaurant was built next to an existing AD plant built by this firm (depicted in photo above), and would not likely have done so if they had any concerns about odor.

Based on this evaluation, the recommended order of preference for the four sites is as follows:

1. Marine Transfer Station
2. Site AO-2
3. Site D
4. Site E OU 3

CONCLUSIONS

The Hunts Point Food Distribution Center Organics Recovery Feasibility Study conducted by DSM provides the EDC with a framework for evaluating their next steps regarding efforts to support development of an organics recovery facility at the Food Center. Significant findings of the study are as follows.

Waste Characterization

There are an estimated 27,400 tons of waste generated at the Fish and Produce Markets each year (111 tons per day). This quantity of waste is considered adequate, although at the low end of the range that facility developers seek in order to realize economies of scale for enclosed organics recovery operations.

Seventeen percent of this waste is generated at the Fish Market, with the remainder at the Produce Market. More than half (55 percent) of the material is food waste, and another 23 percent is cardboard, meaning that 78 percent is readily degradable, providing valuable feedstock for an organics recovery facility.

There is also a significant amount of waste wood (11 percent) that would require chipping or shredding before being acceptable to most organics recovery technologies. In addition, there is considerable plastic packaging and other materials (11 percent) that are found throughout the waste stream and would require processing to remove at one or more points in a facility's process.

Limitations to DSM's waste characterization include the fact that the waste volumes and characteristics at the Markets fluctuate on a daily and seasonal basis due to a number of variables, including weather, market conditions, and operations. DSM's waste characterization represents a limited picture of the waste based on samples taken on one day. Further, annual tonnage figures for the Markets are based on various sources, including hauler estimates, which could not be fully verified. While the estimates are appropriate for feasibility-level analysis, the limitations need to be recognized.

Technology Assessment

DSM based its technology assessment on responses to a solicitation for information that was distributed widely. Responses indicated that there are a number of technologies that could recover organics from the waste stream at the Food Center, including anaerobic digestion (AD), in-vessel composting, and fertilizer manufacturers. Each of these technology types has multiple vendors with interest in processing material at the Food Center. In addition, each of these technologies can generate a variety of end-products that have been marketed successfully in the past, although not all end products have been marketed in the US or in the Northeast.

DSM's evaluation of the responses submitted involved a team of experts in organics recovery technologies, and included a wide array of exclusionary and preferential criteria and rankings. Anaerobic digestion approaches evaluated had the greatest potential to succeed in the challenging environment of the Food Center, where space is limited, sensitive businesses are located near by, and the community has heightened awareness around odor and other environmental issues.

In addition, the AD systems had a greater record of accomplishment in terms of the number of existing operating facilities, and the number of years of operating experience. In addition, with AD, a smaller footprint is required, less odor impacts are generated, and more varied and marketable end-products are produced.

The in-vessel composting systems represented by respondents would also reclaim a high percentage of the waste stream and create a marketable end-product. However, they are hampered in that they require a larger footprint on which to operate, are relatively energy-intensive and have less operating experience to draw from. Fertilizer companies evaluated have the advantage of small footprints and high value end-products, but have limited experience operating in the East Coast, and would only reclaim half of the waste materials generated at the Food Center.

Financial Assessment

Development and construction costs for the most feasible AD system at the Food Center would be in the range of $9 to $10 million, and annual operating costs for the AD would range from $2.3 million to $3 million. The ranges represented are largely due to varying financing assumptions. An estimated $475 thousand would be generated from the sale of compost and electricity, with the remainder of the revenue to be obtained from tipping fees for waste received at the facility. An AD facility would create nine fulltime jobs.

DSM presumes that financing variables are largely dependent on the confidence of lenders in the ability of the facility operator to repay loans. To provide confidence to the lender, the facility will need to be able to provide construction, operating and waste delivery guarantees. In addition, a developer that is willing and able to contribute equity, will increase lender confidence and presumably decrease financing costs.

One strategy for providing waste delivery guarantees is to issue "put or pay" contracts, which require customers to pay for a set amount of waste, whether or not it is generated and disposed of. These strategies work to the advantage of waste facility operators, but to the disadvantage to generators. Another approach would be for the facility to tie its prices to an index of market prices for waste services, or to provide the facility with the right of first refusal in the event of a bidding war for waste management services.

One economic consideration for a facility developer or operator would be to provide hauling services to the tenants, which DSM estimates could be provided at costs well below current market prices for similar services. This would also help ensure necessary deliveries of waste to the facility. Another consideration would be to time the sale of electricity to the grid to coincide with higher priced peak load periods, increasing revenue per kilowatt hour of electricity produced. These considerations were not included in the economic model, but warrant further analysis should plans for facility development proceed.

DSM's base case is that an AD facility would need to charge $75 per ton, which is very similar to the current price paid by vendors at the markets today. This is based on a through-put of 24,880 tons per year, which was the smallest of the three through-puts evaluated. Depending on actual tonnage received by the facility, this tip fee would increase or decrease. Alternatively, it would be possible to divert about one-third of the waste, the spoiled pallet loads of produce, to a New Jersey facility permitted to take produce waste for a lower price. However the other two-thirds of the waste identified in the study would need to be disposed of at local market prices.

In the final analysis, DSM believes that an AD facility that secures lower financing costs and obtains capital grants, both of which are available for such a facility in the City, could be profitable while offering prices competitive with other waste disposal options at Hunts Point. In fact, it is possible that the AD facility operator could optimize energy payments, lower collection costs, and increase tonnage throughputs, such that it would be able to provide waste disposal services for the tenants in the Food Market at rates below their current pricing. This would be even more likely if waste disposal prices increased faster than inflation, the conservative assumption used in this analysis.

Site Analysis

All four sites at the Food Center identified by the EDC are large enough to host an AD facility, and three are also large enough for an in-vessel compost facility. While all the sites have close business neighbors, and have certain site-development requirements, DSM believes that of the four, the most preferable site is the South Bronx Marine Transfer Station site (MTS). The MTS has better buffers between it and sensitive business neighbors and is presumed to have lower costs for site development. Based on odor modeling analysis, it is unlikely that neighbors would notice any odors, particularly with an AD facility. These facilities generate limited odors because of the biofilter technologies employed and use of negative air pressure around odor source points.

Summary

The study results indicate that an anaerobic digestion facility sited on the Marine Transfer Station site at the Food Center could be feasible from a technological and economical standpoint. It is clear that for such a facility to be developed, New York City and State agencies and authorities, the Hunts Point Food Terminal Market tenants, and the facility developer would need to demonstrate a commitment to its success. The City and State can do this by using resources within their authority, such as providing land at low or no cost, providing assistance with facility permitting, and providing capital or operating grants and loans under existing funding assistance programs. In return the City and State would help to model an environmentally and economically prudent solution to the City's solid waste disposal challenges. The Market tenants can demonstrate a commitment to the project by entering into contracts to deliver their organic waste to the facility with the intent of assuring a long-term cost-effective and convenient waste disposal option. Lastly, the facility developer can demonstrate commitment by providing the necessary financial equity and backing, justified by the realization that developing an organics recovery facility in a highly visibility location in a major US city can open the door to potential development of additional facilities down the road.

If these conditions are met, the Food Center and Hunts Point in general would benefit from a reasonably priced waste disposal option, that creates jobs, generates a renewable energy source, reduces exports of waste to out of state disposal facilities, and reduces the related environmental impacts.

APPENDICES

APPENDIX A: **HUNTS POINT MARKET-- COMMON AREA WASTE DATA FOR 2004**

CIRCLE RUBBISH - 01/01/04THRU 05/31/04

ROYAL WASTE SERVICE - 06/01/04 THRU 12/31/04

MONTH	NUMBER OF LOADS DUMPED	CUBIC YARDS DUMPED	TOTAL TONNAGE DUMPED	HAULER
JANUARY	47	4653	974.99	CIRCLE
FEBRUARY	50	4950	1026.89	CIRCLE
MARCH	56	5544	1074.92	CIRCLE
APRIL	57	5643	1070.58	CIRCLE
MAY	56	5544	1238.14	CIRCLE
JUNE	88	3960	1152.39	CIRCLE
JULY	106	4770	1578.63	ROYAL
AUGUST	92	4140	1236.26	ROYAL
SEPTEMBER	80	3600	1032.4	ROYAL
OCTOBER	70	3150	821.09	ROYAL
NOVEMBER	77	3465	844.26	ROYAL
DECEMBER	83	3735	956.86	ROYAL
TOTAL	862	53,154	13,007.41	

APPENDIX B: COMPARATIVE DATA RESEARCH ON OTHER FOOD MARKET COMPOST EFFORTS

Introduction

DSM conducted comparative data research on other food market compost efforts in the US. Following is a summary of findings from efforts at Pike Place Market in Seattle, Washington; Haymarket in Boston, Massachusetts; and Foodshare and the Hartford Regional Produce Market in Hartford, Connecticut.

Pike Place Market: Seattle, Washington

The Pike Place Market is a 9-acre site comprised of more than 200 small businesses (bars, restaurants, food vendors and mercantile), about 300 seasonal farmers and craftspeople, and 500 tenants in six residential buildings. [1]

Waste Generation and Composition

Over 3200 tons of waste is generated per year (about three percent of the waste generated at the Food Center).[2] Over the last ten years or so, an aggressive recycling program has been implemented, such that today nearly 1,235 tons of material are recycled per year, including:

- 1,070-cubic-yards of compostables from seasonal farmers
- 1,650-cubic-yards of mixed produce and waxed cardboard from permanent (non-seasonal) vegetable vendors.
- 248 tons of corrugated cardboard
- 208 tons of glass bottles
- 211 tons of mixed recycling (paper, and non-glass food containers)
- 24 tons of wood pallets(all shippers are technically required to haul their pallets and shrink wrap away with them, and while most do so, some are left behind)
- 605 gallons of used cooking oil every week

Compost

All of the compostable materials from the market go to Cedar Grove Compost, which also takes all the yard waste from the city of Seattle. Waxed and wet cardboard is blended with other materials to help regulate the heat of the overall mix. Cardboard that is reasonably clean is baled and recycled separately. Cardboard that contains fish or meat goes into the garbage, as Cedar Grove is not permitted to take it.

Compostable waste (produce and cardboard) is gathered in eight "compost only" dumpsters sited along the street. These dumpsters range from 2-cubic-yards to 6-cubic-yards, and they are emptied four times a week year-round. There are also forty 90-gallon toters that are strictly for food waste generated by seasonal farmers. These toters are emptied four times a week. In addition, there are fifteen 90-gallon toters in place all year for waste greenhouse flowers and dried flowers.

[1] http://www.pikeplacemarket.org
[2] Information on waste management at Pikes Peak provided by Jeff Jarvis, Director of Operations

Waste Costs

The market pays the trash and recycling bill, $135 per ton for trash and $85 per ton for compostable materials. If vendors put non-compostable materials in compost-only containers, garbage truck drivers pull those materials out and the vendor is charged.

Staffing

The market has 22 full time staff. In addition to many other roles, the staff helps to keep non-compostables out of the organics stream by inspecting dumpsters and toters and training vendors and their employees. Since these are businesses that have very high employee turnover, there is a lot of training involved.

Boston Haymarket

Haymarket is a one-hundred-year-old market located in downtown Boston, comprised of 60 individual fruit and vegetable vendors who operate on Friday nights and Saturdays.

Waste Generation and Composition

A waste sort and collection analysis conducted in 1995 indicated that the average weekly generation of waste at Haymarket is 33.9 tons, roughly one-third of the *daily* tonnage of waste generated at the Hunt's Point Food Center. Of this, 37 percent is food waste, 18 percent is cardboard, 4 percent is reusable wood or plastic containers, 14 percent is wooden pallets (half broken, half whole) and the remaining 27 percent was considered trash. [3]

As vendors generate waste, they pile it along the curb of a local street near the produce stands. The Haymarket Association employs a regular crew of 2-3 people whose sole job is to load waste into packer trucks. Most waste is generated on Saturdays between 5:00 and 8:00 pm, as vendors are shutting down their stands.

Collection Pilot

In 1995, a pilot project to collect source-separated organics (produce and cardboard) was conducted using a designated packer truck operated by the City of Boston. Separated organics were brought to a compost operation at a farm in Boston. The project was deemed only partially successful, as the high levels of cardboard and non-degradable materials made it difficult to capture organics in an economically feasible manner.

The 1995 analysis was originally intended to evaluate four collection options for recovering organics from the waste stream over a five-week period. These options focused on separate collection of cardboard, produce and other waste, and utilized different staffing configurations, types of equipment and schedules for collection. There were obstacles to implementing the analysis that related to labor cooperation, availability of equipment, and congestion in the market. These obstacles have some relevance for the Food Center, if an effort to collect source-separated materials is ever tried.

In the end, the study did utilize two types of containers, including 90-gallon toters with lids and wheels for food waste, and 2-cubic-yard rolling tilt trucks for cardboard. The 90-gallon toters were deemed problematic because they filled up too quickly and were too heavy to lift into the packer truck. The tilt trucks were considered useful in that they were easy to maneuver in tight conditions, and yet were wide enough for several workers to load cardboard into at once. The study authors indicated that the tilt truck

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[3] DRAFT Final Report, Haymarket Waste Sort and Collection Plan, Submitted to Commonwealth of Massachusetts Executive Office of Environmental Affairs, Prepared by Greenleaf Composting Company, Inc., June 30, 1995.

could be lifted by the packer truck to unload, although they did not discuss using a packer truck with a lifting arm to unload the toters.

Foodshare and the Hartford Regional Produce Market; Hartford, Connecticut

The Hartford Regional Produce Market houses 20 produce and fruit wholesalers. Foodshare is a regional food donation organization that is located at the Regional Market. Food donations more than doubled to 850 tons in 2001, and along with increased donations, there was an increased disposal of spoiled produce.

Foodshare received a grant from the Connecticut DEP to develop an organics recovery program that involved an Organic Resource Recovery System (ORRS). The ORRS is a hammer mill that pulverizes the produce into a slurry (liquefied vegetable waste), and discharges it into a 6,000-gallon holding tank for storage. Periodically, the slurry is collected using vacuum trucks and transported to permitted organic waste recycling facilities. Wholesale vendors at the Regional Market pay for their own recycling through the ORRS on a weight/volume based system. In other words, the more they throw out, the more they will pay. Therefore, it is in the best interest for the vendors to move surplus produce to Foodshare before it has a chance to spoil.

Based on two years of records, from December 2002 to January 2005, a total of 195 tons were diverted, or slightly less than 100 tons per year. The tank has been emptied every two months or so, when it contains about 4,000 gallons. The tip fee at local farms is about $32 per ton. [4]

[4] Information on the DEP sponsored project available at http://dep.state.ct.us/wst/compost/compilots.htm, recent information on tonnages provided by Steve Slipschinsky at Foodshare.

APPENDIX C: VENDORS CONTACTED FOR TECHNOLOGY ASSESSMENT

(R) = Responded
(E) = Met Exclusionary Criteria

Vendors Contacted	R/E	Vendors Contacted	R/E	Vendors Contacted	R/E
AAT GmbH Kelhofstrabe 12 A-6922 Wolfurt Austria		Arge Biogas Blindergabe 4/10-11 A-1080 Vienna, Austria		Biosystem Solutions, Inc. 3350 Scott Blvd #20 Santa Clara, CA 95054-3104	
A-C Equipment Services 6737 W. Washington St. Suite 1400 Milwaukee, WI 53214		Arrow Ecology 105 Carmel Road Wheeling, WV 26003	R/E	Biothane Corporation 2500 Broadway Camden, NJ 08104	R
ACE Compost LLC 10639 Co. Road 30 Yuma, CO 80759		Augspurger Engineering Ste. C14 Scottsdale, AZ 85260-1609		BKS Nordic AB PO Box 6035 Fabriksgaten S-781 06 Borlange Sweden	
AD Technology, Ltd. Windover Farm Longstock Stockbridge, Hampshire UK		Backhus Kompost-Technologie PO Box 193 Allamuchy, NJ 07820		BRV Technologie Ststeme Bmbh Westfalenstrabe 208 D-48165 Munster	
ADI Systems, Inc. Suite 300, 1133 Regent Street Fredricton, New Brunswick, Canada		Bedminster, Inc. 2301 NW Thurman Ste. #N Portland, OR 97210		BTA-Biotechnische Abfallvertung GmbH & Co. Kgnstrasse 18 Munchen, Germany	
AG Bag International 2320 SE Ag-Bag Lane Warrenton, Oregon 97146		Biocel/Heidemij Realisatie BV Postbox 139 NL-6800 AC Amhem, NL		Burlington County Resource Recovery Complex PO Box 429 Columbus, NJ 08022	
American Bio Tech 280 Business Park Circle Suite 411 St. Augustine, FL 32095		Bioplan A/S Livorvej 21 DK-8800 Viborg, Denmark		BW Organics Rt. 8, Box 729 Sulphur Springs, TX 75482	R
ANM, AN Machinebau und Unwelttschutzanlagen Waterbergstrabe 11 D-28237 Bremen, Germany		BioRecycling Technologies, Inc. 6101 Cherry Avenue Fontana, CA 92336		BWSC Gydevang 35, Box 235 DK-3450, Allerod, Denmark	R
Arcadis Heidemij Realistate bv PO Box 139 NL 6800 Arnhem		Bioscan A/S Orbaekvej 101 PO Box 426 SO, Denmark		California Liquid Fertilizer PO Box 949 Gonzales, CA 93926	R/E

(R) = Responded
(E) = Met Exclusionary Criteria

Vendors Contacted	R/E	Vendors Contacted	R/E	Vendors Contacted	R/E
California Liquid Fertilizer PO Box 949 Gonzales, CA 93926	R/E	Earth Tech 300 Atrium VII 340 Midpark Way SE Calgary, Alberta Canada		GHD, Inc. PO Box 69 Chilton, WI 53014	
Canada Composting, Inc. 390 Davis Drive Suite 301 Newmarket, Ontario, Canada	R/E	Eastern Organics Resources LLC 2469 Saylors Pond Road PO Box 297 Wrightstown, NJ 08562	R	Green Mountain Technologies 51 Stimpson Hill Road Box 560 Whitingham, VT 05361	
Carl Bro Environmental A/S Granskoven 8 DK-2600 Glostrop, Denmark		EcoCorp, Inc. (no address available-sent email)	R/E	Group Conporec, Inc. 3125 Joseph-Simard Street Tracy, Quebec Canada	
CCI US Corporation (no address available)		Engineered Compost Systems 4211 24th Avenue West Seattle, WA 98199	R/E	Haase Energietechnik GmbH Oliver Martens Gadelanderstraße 172 D-22531 Neumünster GERMANY	
CiTec International Ltd Oy PO Box 109 SF-65101 Vaasa, Finland		Engineering, Separation & Recycling LLC 519 West Dejean Street Washington, LA 70589	R	HGC Hamburg Gas Consult Guido Gummert Heidenkampsweg 101 D-20097 Hamburg	
City Green 151 1st Ave, #3 New York, NY 10003		Entech Umwelttechnik GmbH Peter Stepany Shilfweg 1 A-6972 Fussach AUSTRIA		IMK BEG Bioenergie GmbH Konrad Adenauerstraße 9-13 D-45699 Herning GERMANY	
Dobbie & Co Ltd John Winders 42 The Green, Ewell Surrey KT17 3JJ UNITED KINGDOM		Enviro-Control Ltd Paul Stafford 26 Forsythia Drive, Greenways, Cyncoed Cardiff CF2 71 1P UK		ISKA GmbH Am Erlengragen 5 D-76725 Ettingen Germany	
Dranco Organic Waste Systems Winfried Six Dok Noord 4 B-9000 Gent BELGIUM		EPM, Inc. PO Box 1295 Cottage Grove, OR 97424		Jysk Biogas A/S Kjeld Johansen Haals Bygade 15 DK-9260 Gistrup DENMARK	
DSD Gas und Tankanlagenbau GmbH Lars Klinkmüller Pablo Picasso Straße 45 D-13057 Berlin GERMANY		Ferm Tech, Inc. Dirk Quartemont Gretelweg 2 D-53819 Neunkirchen GERMANY		Kompogas W. Schmid AG Rohrstraße 36 CH-8152 Glattbrugg SWITZERLAND	R
Duke Engineering & Services Harold Backman PO Box 1004 Charlotte, NC 28201-1004		Galli Engineering, P.C. 734 Walt Whitman Road Suite 402A Melville, NY 11747	R	Krüger A/S Karsten Buchhave Klamsagervej 2-4 DK-8230 Åbyhøj	

(R) = Responded
(E) = Met Exclusionary Criteria

Vendors Contacted	R/E	Vendors Contacted	R/E	Vendors Contacted	R/E
Larsen Engineers S. Ram Shrivastava 700 West Metro Park Rochester, New York 14623-2678		Orgaworld Ward Janssens Loopkantstraat 39 PO box 96 5400 AB Uden NL	R/E	SPI Srl Societa Produzione Idrosanitari Via per Borgomanero - Reg. Pulice I-28060 Comignago ITALY	
Maltin Pollution Control Systems Ltd Chris Maltin Gould's House, Horsington Somerset BA8 0EW UNITED KINGDOM		Paques Solid Waste Systems BV Marten Bennen Postbox 52 NL-8560 AB Balk NL		Steinmüller Valorga Sarl 1300 avenue Albert Einstein Immeuble Stratégie Concept Parc du Millénaire - BP 51 F-34935 Montpellier Cedex 09 FRANCE	
Mining Organics One Wall Street, Suite 201 Manchester, NH 03101	R/E	Prikom/HKV Poul Lyhne Enghavevej 10 DK-7400 Herning DK		US Filter 441 Main Street, PO Box 36 Sturbridge, MA 01566	
Motherwell Bridge Envirotech Ltd PO Box 4, Logans Road Motherwell ML1 3NP UNITED KINGDOM		Projektrör AB Gunnar Örn PO Box 7256 S-183 07 Täby SWEDEN		Waste Options One State Street Providence, RI	R/E
Nature Tech, Renewable Carbon Mnagement, LLC 44 28th Avenue North, Suite J Saint Cloud, MN 56303-4259		Purac AB Daniel Ling PO Box 1146 S-22 105 Lund SWEDEN		Waste Recovery Systems 3581 Laguna Ct. Gulf Breeze, FL 32563	
New England Organics 5 Fundy Road Falmouth, ME		R.O.M. Recycling Organischer Materialien AG Mattstraße CH-8502 Frauenfeld SWITZERLAND		Waste Recovery Systems 33655 Marlinspike Drive Monarch Beach, CA 92629	R/E
NIRAS Aboulevarden 80, Postboks 615 DK-8100 Arhus Denmark		RPA Risanamento Protezione Ambiente, SpA Str. Del Colle 1A/1 - Loc. Fontana I-06074 Perugia ITALY		Wehrle Werke AG Bismarchstrasse 1-11 D-79312 Emmendinge GERMANY	
NSR Nordvästra Skånes Renhållnings AB Dag Lewis-Jonsson S-251 89 Helsingborg		RT Solutions 12 Northview Drive Geneseo, NY 14454	R	WMC Resource Recovery Ltd Peter Cumberlidge 2, Eaton Crescent, Clifton Bristol BS8 2EJ UNITED KINGDOM	
O.W.S., Inc. 3155 Research Blvd. Ste. #104 Dayton, OH 45420	R/E	Schwarting-UHDE GmbH Lise Meitnerstraße 2 D-24941 Flensburg GERMANY		Wright Environmental Management 9051 Yonge Street, Suite #300 Richmond Hill, Ontario CA	R/E
Onsite Power Systems (no address available)		Snamprogetti SpA Mr. Bassetti Via Toniolo 1 I-61032 Fano ITALY		YIT Corporation PO Box 36 Panuntie 11 SF-00621 Helsinki FINLAND	

DSM ENVIRONMENTAL SERVICES, INC.
Economists, Environmental Scientists, Planners

Request for Responses

Date: November 12, 2004
To: Vendors of Organics Recovery Options
From: Peter Allison and Michael Simpson, DSM Environmental Services, Inc.
Subject: **Request for Responses RE: Organics Recovery Systems for Hunts Point, NYC**

DSM Environmental Services, Inc. (DSM) has been hired by the New York City Economic Development Corporation (EDC) to assess the feasibility of establishing an on-site system for recovering the organic components of the waste streams of the Hunts Point Produce Market and the Fulton Fish Market. Both markets will be tenants of EDC at Hunts Point in the Bronx, NYC as of 2005.

The feasibility study has a number of components. The first task involved a waste characterization analysis of the two waste streams (see attached **Waste Characterization Summary**). The second task is to evaluate existing compost, anaerobic digestion or other appropriate technologies, and vendors, for potential application at Hunts Point.

This letter is a formal request for information on how your company could provide the technology and system configuration to maximize the recovery of end-products for beneficial use, while minimizing potential impacts to neighboring businesses and residential communities. The information provided will be held in confidence and will establish the basis for further consideration of your technical approach to addressing EDC's objectives. The third task will be to conduct an economic analysis of technologies that are ranked highest in the evaluation of existing technologies (second task).

Pending results of this feasibility study, EDC will determine whether and under what conditions to issue a bid for facility development and operation. Several possible sites owned by EDC at Hunts Point are under consideration for a prospective organics recovery facility. Any ensuing contracts would be held between EDC and the facility developer and/or operator.

RESPONSES TO THIS LETTER ARE DUE BY DECEMBER 10, 2004.

We ask that you respond specifically to each question, and not simply send generalized promotional or facility information. However, you may provide any additional information that you feel will inform DSM's evaluation of the potential of your company to meet EDC's objectives. Questions may be submitted in writing to: Peter Allison at: Peter@dsmenvironmental.com.

Responses may be submitted in writing by email (Microsoft Office or PDF) to: Peter@dsmenvironmental.com OR to the following postal address:

Peter Allison
DSM Environmental Services, Inc.
23 Thrasher Road
P.O. Box 466
Ascutney, VT 05030

23 Thrasher Road, P.O. Box 466, Ascutney, VT 05030
TEL (802) 674-2840 FAX (802) 674-6915
www.dsmenvironmental.com

ORGANICS RECOVERY SYSTEM QUESTIONAIRE

1) Please provide primary contact name, phone number, address and email for any clarification that may be required based on your response.

2) Briefly describe how your company would provide the technology and system configuration to maximize the recovery of end-products for beneficial use, while minimizing potential impacts to neighboring businesses and residential communities.

3) List the number of full-scale facilities that your company currently operates. <u>For each facility</u>, indicate the following:
   a) Location of facility
   b) Owner
   c) Contact name, email, address and phone number for municipality in which facility is located, and other appropriate references
   d) Years of operation to date
   e) Length of contract term
   f) Number of full time and part time employees
   g) Types and daily tonnages of input materials, and percentage of each input material
   h) Types and daily tonnages of output material(s) and primary use of output material(s)
   i) Retention time for material
   j) Recovery rate (percentage of material actually recovered for secondary beneficial use)
   k) Performance guarantees (e.g., regarding recovery rate, quality of end product, etc.)
   l) Record of complaints from adjacent neighbors or municipalities and how those complaints were addressed
   m) Regulatory permits (list agency that issued permit and agency contact person)
   n) Type and date of any permit or regulatory violations - indicate if violations resulted in suspension in the acceptance of materials
   o) On-site and off-site odor mitigation measures
   p) Longest period facility has been shut-down and the reason for such closure
   q) Specific measures for mitigation of off-site odor impacts

4) Describe the optimum feedstock and moisture range for your technology.

5) Provide draft definitions of "acceptable waste," "unacceptable waste," and "bypass waste" for the process.

6) Describe any mechanical separation systems that your technology would require or involve.

7) Based on the **Waste Characterization Summary for Hunts Point Produce Market and Fulton Fish Market** (attached), please provide a process flow diagram (PFD) for a facility that would remove non-degradable materials and maximize the recovery of the degradable fraction.

8) Indicate a projected mass balance that reflects the PFD described above. Include inputs of any PFD amendments and conditioners. The projected mass balance should also include all end-product(s) and materials destined for ultimate disposal. Please provide the estimated residence time for materials in each phase of the process flow.

9) Indicate how your proposed facility would provide maximum flexibility to include fluctuations in amounts and types of material. Also provide a description of how the facility will address the need for redundancy and the estimated impacts resulting from a temporary shut-down of operations.

10) Based on the incoming stream of materials and the estimated mass balance, please provide an estimated footprint of a facility utilizing your technology, including space for receiving and any pre- and/or post- processing of materials. Please note any supplemental infrastructure that may be needed, e.g., odor control.

11) Please provide a preliminary description of the requirements of your technology with respect to the water and electricity supply, and wastewater treatment.

ALL RESPONSES ARE DUE BY DECEMBER 10, 2004

Responses may be submitted in writing by email (Microsoft Office or PDF) to:
Peter@dsmenvironmental.com OR to the following postal address:

Peter Allison
DSM Environmental Services, Inc.
23 Thrasher Road
P.O. Box 466
Ascutney, VT 05030

Waste Characterization Summary
Hunts Point Produce Market and Fulton Fish Market

Introduction

This document provides an estimate of the tonnage and characterization of the waste streams at the Hunts Point Produce Market and the Fulton Fish Market, both of which will be located at Hunts Point in the Bronx (NYC) in early 2005. Annual tonnage data from both markets were applied to waste characterization coefficients derived from waste sampled in October 2004 (See Table 1). Both markets are open 5 days a week, with the exception of major holidays, for an average of 245 days per year. Terms used in this characterization include:

Food: spoiled produce (fruits and vegetables), or discarded fish or fish parts (not shellfish)
OCC: old corrugated cardboard, both waxed and not waxed
Wood: broken pallets and wooden crates, boxes and baskets (includes staples and wire)
Plastic: shrink-wrap, strapping, plastic bags, polystyrene
Other: small fractions of all of the above, car battery, oil filter, textiles, shell fish

Hunts Point Produce Market

The Hunts Point Produce Market represents 60 vendors who operate out of 270 bays which are divided into four parallel rows that each extend a quarter mile. The market is located in the Hunts Point section of the Bronx, NYC. The market provides fruits and vegetables to distributors and retailers. Daily waste generation averages 82 tons. However, there is considerable seasonal fluctuation in volume of materials handled at the market and in tonnage of waste generated. Typically, waste tonnages may vary plus/minus 25% from the mean on a monthly basis, and even more on a daily basis. Waste volumes vary as a function of sales, and also due to unpredictable factors such as mechanical failure of refrigeration units, weather conditions in the growing region, and temperature and humidity at the produce market.

Hunts Point waste is commingled at various points. The cleanest source of organic materials is the "**pallet waste**", made up of cardboard boxes filled with spoiled produce, and sometimes plastic or paper liners or packaging on the produce within the cardboard boxes. There are very few "pallets" in the pallet waste as they are sold for reuse or repair, or pushed off the dock into the Common Area. Pallet waste is collected off the dock in packer trucks. Liquid wastes are expelled from the truck from a drain valve. At various times in the past, pallet waste was delivered to compost facilities in Albany, New York or Wrightstown, New Jersey, but is currently diverted to transfer stations and ultimately to landfills, along with the other waste from Hunts Point.
"**Common Area waste**" represents other materials that are discarded in the process of repacking or handling produce. This waste is pushed off docks into an area of the market where trucks load and unload produce. This waste is currently size-reduced by front-end loaders and loaded into open top dumpsters.

A third component of the waste stream is dry dock waste stored in 1.5 yd dumpsters. This material includes plastic wrap, strapping, and some cardboard and wood. Based on a visual inspection, DSM estimates that there is roughly 750 pounds per day of OCC and wood in the dry dock waste that could be source separated for diversion to an organics recovery system (but is not included in the totals below). Stores that generate large volumes of dry cardboard bale it for recycling, and that material is not expected to be available for an organics recovery system. Currently, all waste is delivered to transfer stations and ultimately to landfills.

Fulton Fish Market

The Fulton Fish Market is scheduled to relocate to Hunts Point in early 2005. At that time, it is expected that the quantity of both fish sold, and of waste generated in the fish market, will increase by 5-7%. The fish market sells to distributors, retailers and some restaurants. There are considerable seasonal fluctuations in tonnages of fish sold and waste generated at the fish market. There are also regular daily fluctuations, with volumes on the busiest day (Thursday) being a third more than volumes on the lightest day (Tuesday). Weather patterns at sea also directly affect the quantity of fish sold and waste generated.

Waste is currently brought to a central area by vendors in small dumpsters or on pallets, and loaded into a packer truck. The daily average of waste brought to the packer truck is 19 tons, according to the waste hauling company. Pallets are set aside and collected for reuse, repair or discard (and are not included in the waste characterization except for random broken pallets commingled with other waste). Roughly one-third of the plastic fraction of the fish market waste is polystyrene packaging. Ice represented an additional 7.8% of the waste stream, but is not included in the summary below. The current assumption is that waste handling practices will remain essentially the same, once the market is relocated to Hunts Point. However, that assumption could change as designs and systems for the new fish market are finalized.

Table 1: Waste Characterization Summary for Fulton Fish Market and Hunts Point Produce Market

	Estimated Weight in Tons – Based on Annualized Averages					
Source of Waste	**Food**	**OCC**	**Wood**	**Plastic**	**Other**	**TOTAL**
Fulton Fish Market	1,719	1,204	555	800	471	4,750
Hunts Point - Common Area	4,934	3,957	2,302	1,293	293	12,779
Hunts Point - Pallet Waste	6,511	810	0	29	0	7,350
TOTAL	13,164	5,971	2,858	2,122	764	24,879
TOTAL / DAY (245 DAYS)	53.73	24.37	11.66	8.66	3.12	101.55
PERCENT OF TOTAL	52.91%	24.00%	11.49%	8.53%	3.07%	100.00%

APPENDIX E: EXCLUSIONARY CRITERIA FOR HUNTS POINT ORGANICS RECOVERY METHODOLOGIES

Following are the exclusionary criteria that will be applied to organics recovery systems represented in responses to DSM's November 12, 2004, *Request for Responses Regarding Organics Recovery Systems for Hunts Point, NYC.*

In order for a respondent to be considered in the Preferential Ranking phase of the evaluation, the respondent must be ranked affirmatively on each of the following issues.

FULL SCALE APPLICATION: Does the firm have any reference facilities that have operated at the scale that would be required at Hunts Point (i.e., between 50 and 200 tons per day)

OPERATING EXPERIENCE: Does the firm have any full scale reference facilities that have been in continuous operation, except for scheduled maintenance shutdowns, for at least 3 years?

ENCLOSED OPERATION: Is the processing operation of the proposed system fully enclosed (in a building, bags, or some other barrier to the outside environment)?

SELF SUSTAINABILITY: Are any of the reference facilities operating without ongoing financial subsidies from outside sources?

APPROPRIATE FOOTPRINT: Can the proposed system function on a site with a footprint that is between 3 and 10 acres?

VARIABLE WASTE STEAM: Has the proposed system been successfully operated, on at least a trial basis, processing a waste stream that includes at least 50% food and fish waste, and that includes at least 10% contamination (non-organic and non-hazardous material)?

NORTH AMERICAN REPRESENTATION: Do the firms involved in the proposed system have a North American presence, either in terms of operating facilities in North America, or North American representatives available for ongoing assistance with operations, maintenance, parts or repair.

ABILITY TO TRANSFER PRODUCT FOR BENEFICIAL USE: Do the firms involved in the proposed system have experience marketing, or transferring for beneficial use, their end product, as opposed to storing it on location for extended periods, or disposing of it at a negative value?

PERFORMANCE GUARANTEE: Do the reference facilities include operating performance guarantees or performance bonds, and are the firms involved in the proposed system prepared to offer a performance guarantee equivalent to at least the annual value of the project revenues?

DEMONSTRATED ODOR MITIGATION APPROACH: Does the proposed system have a defined odor control technology, and demonstrated experience using that technology?

APPENDIX F: PREFERENTIAL SCORING DEFINITIONS

ISSUE	DEFINITION	HOW POINTS ARE AWARDED: OK = 1 POINT FAIR = 2 POINTS GOOD = 3 POINTS BETTER = 4 POINTS BEST = 5 POINTS
Operator's Experience	Number of full scale reference facilities proposed operator has operated	No proposed operator is OK; Proposed operator is identified but has no experience operating proposed technology is FAIR; Vendor has operated at least one of its facilities of type proposed OR proposed operator has operated numerous relevant facilities is GOOD; Vendor has operated at least one facility AND proposed operator has operated numerous relevant facilities is BEST
Vendor Experience	Number of full scale reference facilities using proposed technology that are currently operating	1-2 facilities is OK; 3-5 FAIR; 6-7 GOOD, 8-9 BETTER, 10+ BEST
Technology Shut Down	Number of full scale reference facilities using proposed technology that have been shut down for one year or more	>26% is OK; 1%-25% GOOD; <0% BEST
Years of Operation - Longest	Number of years that longest running facility has been operating	1 to <2 years OK; >2 but <5 FAIR, > 5 but <7 GOOD, >7 but <10 BETTER, >10 BEST
Years of Operation - Average	Average Years of Operation (Total operational years / number of reference facilities)	1-4 years is OK; >4-<10 GOOD; >10 BEST
Footprint required (acres)	Footprint required for all operations including processing, storage, curing and transfer	7 acres is OK; >3 to 7 is GOOD; 3 or less is BEST
Enclosed Operations	P=processing, S=pre-processing material storage, C=curing, T=materials transfer	P is OK; P&C GOOD; P,S,C&T BEST
Odor Mitigation	Proposed odor mitigation method	Minimal is OK; RACT GOOD; BACT BEST
Proximity to Neighbors	Based on proximity to residential and commercial neighbors, populations affected, number of facilities with close neighbors	Scores of OK, GOOD and BEST awarded based on review of all facilities
Acceptable fluctuations in tonnage of feedstock	% variation from typical loading	<10% is OK; 10%-50% GOOD; >50% BEST
Ability to handle contaminants	Scores based on number of systems in place to remove contaminants	1 system is OK; 2 systems is GOOD; 3 systems is BEST
Residual Rate	Percent of material that ends up as residuals going to landfill/ Percent of material that is recycled (other than as compost)	> 25% residual (or combined recycling and disposal of >40%) is OK; 15 to 25% is GOOD; <15% is BEST
Marketing	Experience moving product to end-use/markets and value of end product	Reference facilities produced material only for landfill cover or clean fill - OK; Reference facilities have been able to regularly sell product on the market - GOOD; Reference facility has highly value-added product (energy and fertilizer) - BEST Note: if product is highly valued, but history of marketing on east coast is limited score may be reduced

APPENDIX G: WEIGHTING PREFERENTIAL CRITERIA

Explanations for Weighting Scores

DSM worked with the EDC to develop weights to apply to the scores given by the DSM review team to organics recovery vendors as part of the Preferential Ranking phase of the Hunts Point Feasibility Study. The weights (1, 2 or 3), noted for each issue in parentheses below, were multiplied by the raw scores to provide a final score that reflects the relative importance of the different issues being evaluated.

Number of full scale facilities in operation (2)
DSM believes that the higher the number of full scale facilities in operation (defined as receiving more than 50 tons per day of waste) the greater the ability to evaluate a vendor's experience, and therefore potential to construct a facility at Hunts Point.

Number of plants shut down for one year or more (1)
Plants shut down for extended periods are a definite red flag in the evaluation process. However, the causes of shut downs could be due to factors not significant to potential success at Hunts Point (e.g., economics of local waste diversion conditions, operator skill and experience). As such, DSM does not want to over emphasize this issue in the scoring process.

Years in Operation - longest running facility (2)
Years in Operation - average of all facilities (1)
DSM believes that the years in operation of the longest running facility is more important than the average years of operation of all facilities. A reference facility with a long track record provides valuable data on long term viability of a technology. On the other hand, the average could be misleading if there are many new facilities that have been developed, or if a vendor has only one facility, which has been in operation for a long time.

Footprint required (1)
DSM included this issue in the ranking because in general, a smaller footprint is seen as an asset at the highly developed Hunts Point area. However, as a potential project goes through greater development, it is possible that footprint requirements could be expanded or decreased, based on regulatory or political issues that might require process changes. DSM does not want to overemphasize the footprints that vendors reported that their facility would require.

Enclosed Operations (2)
The extent of enclosed operations is related to odor issues, as well as other aesthetic considerations of a facility. As such, DSM places a high value on proposed facilities that have more operations enclosed. As odor mitigation is receiving a separate score, and as there may be some differences in the descriptions that vendors used related to enclosed operations, DSM feels a weight of 2 is appropriate.

Odor Mitigation Methods (3)
Clearly, odor mitigation methods are a critical issue for any proposed facility at Hunts Point and DSM believes that it deserves the highest level of importance.

Experience operating facilities in highly developed area (1)
Experience operating facilities in highly developed areas is important for determining whether the facility could function at Hunts Point. This issue is closely tied to odor mitigation and enclosed operations issues. However, facilities that have not operated in developed areas are not necessarily incapable of doing so. Therefore, DSM feels it is important to score this issue, but does not think additional weight should be added to the score.

Acceptable fluctuations in tonnage of feedstock (1)
DSM believes that a facility's ability to handle fluctuations in tonnage of feedstock is important, but that there will be opportunities to plan for those fluctuations in the design phase.

Ability to handle contaminants (3)
Ability to handle contaminants is a critical issue for any Hunts Point facility, given the high level of plastic in the waste stream and low likelihood of significant source separation at the markets. Ability to handle and process a large percentage of the stream will have important economic impacts, and as such will be a key determinant to sustainability of the project, and thus to the economic benefit to the market vendors.

Demonstrated experience moving product to end market (2)
Demonstrated experience moving product to end market is another key determinant of economic success of any proposed project. DSM has given a higher raw score to the vendors that produce higher value end products, and believes that further weighting is also warranted to provide adequate significance to this issue.

APPENDIX H: WEIGHTED SCORES

Issue	Weights	Engineered Compost Systems		Waste Options - EDG		Wright Environmental		California Liquid Fertilizer		Mining Organics		Aarow Bio		Canada Composting		Eco Corp		Organic Waste Solutions - Dranco		Orga World		Waste Recovery Solutions - Valorg	
		RS	WS	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS	RS	WS
Operator's Experience	1	1	1	3	3	1	1	3	3	2	2	3	3	3	3	3	3	3	3	1	1	3	3
Vendor Experience	1	3	3	3	3	1	1	1	1	1	1	1	1	5	5	4	4	3	3	1	1	5	5
Technology Shut Down	1	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Years of Operation - Longest	2	3	6	3	6	1	2	3	6	3	6	1	2	4	8	4	8	5	10	4	8	5	10
Years of Operation - Average	1	1	1	1	1	1	1	3	3	3	3	1	1	3	3	3	3	3	3	3	3	3	3
Footprint required (acres)	1	3	3	1	1	5	5	5	5	5	5	5	5	3	3	5	5	5	5	5	5	5	5
Enclosed Operations	2	5	10	3	6	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10	5	10
Odor Mitigation	3	3	9	3	9	3	9	3	9	3	9	3	9	3	9	3	9	3	9	3	9	3	9
Proximity to Neighbors	1	3	3	3	3	5	5	1	1	3	3	5	5	3	3	5	5	5	5	5	5	5	5
Acceptable fluctuations in tonnage of feedstock	1	3	3	3	3	3	3	5	5	3	3	5	5	3	3	3	3	3	3	5	5	3	3
Ability to Handle Contaminants	2	5	10	5	10	5	10	1	2	1	2	3	6	3	6	3	6	3	6	1	2	3	6
Residual Rate	2	3	6	5	10	5	10	1	2	1	2	3	6	1	2	3	6	5	10	3	6	3	6
Marketing End Product	2	1	2	3	6	1	2	3	6	3	6	5	10	5	10	5	10	5	10	5	10	5	10
TOTALS		**39**	**62**	**41**	**66**	**41**	**64**	**39**	**58**	**38**	**57**	**45**	**68**	**46**	**70**	**51**	**77**	**53**	**82**	**46**	**70**	**53**	**80**

KEY
Weights = Factor RS is multiplied by to achieve WS
RS = Raw Score
WS = Weighted Score

APPENDIX I: ECONOMIC QUESTIONNAIRE

To: NAME OF VENDOR
From: Peter Allison, DSM Environmental Services, Inc.
Cc: Venetia Lannon, EDC
Re: **Hunts Point Economic Evaluation**

Congratulations! Based on your response to DSM Environmental Services, Inc.'s (DSM's) request for information related to the *Hunts Point Organics Recovery Feasibility Study* being conducted for the New York City Economic Development Corporation (EDC), your firm is one of several that have been selected out of fifteen respondents to advance to the next round of investigation.

In this round, DSM will conduct an economic comparison of the short list of firms for EDC. To complete this evaluation, additional feasibility level cost information on your contemplated facility will be required. Therefore, we ask that you respond as fully as possible to the list of questions on the following pages concerning costs and revenues of your contemplated facility by **March 18, 2005**.

We understand that your responses will be estimates only, based on the level of data available to you. However, the more detailed you can be, including statements concerning critical assumptions you are making, the better we will be able to carefully compare the economics of the competing ideas.

Your responses will be considered along with other factors, regarding which we have already gathered information, to determine the feasibility of your conceptual facility at the Hunts Point location. After examination, DSM will rank each conceptual facility based on its merits. A presentation of this ranking will be included in the feasibility study report submitted to EDC.

The specific information that you provide to DSM will not be released in any reports or communications designed for public dissemination, but rather used by DSM to conduct our analysis, and by EDC for its own internal purposes. Any information regarding facility costs provided in public reports will not be assigned to a particular vendor, but rather aggregated and assigned to a generic entity. (Please see attached document from the EDC entitled, "Information on Respondents' Costs and City Obligations").

The NYC EDC will use the results of the feasibility study to inform the process of potentially developing an organics recovery facility within the Hunts Point Food Distribution Center.

Thank you for your timely response to this letter and questionnaire. Please feel free to contact me if you have any questions at either peter@dsmenvironmental.com or 802 674-2840.

Hunts Point Organics Recovery Feasibility Study
Development, Construction and Operational Cost Analysis
QUESTIONNAIRE

Please provide responses to the following questions by **3 Weeks from Mail Date**. Please provide all economic information in US Dollars.

Interested Parties

Please indicate the qualifications for, and anticipated roles of, all significant parties (both individuals and firms) in the development, construction, ownership, operation and financing of the proposed facility.

Development and Construction Costs

Please provide all related construction costs for the facility, divided into the following components:

- Design and engineering costs
- Site development costs
- Building costs (include the number of square feet of building)
- Fixed equipment costs (include estimated replacement lifetime)
- Odor control and air treatment costs (if part of fixed equipment cost, indicate breakout for these items)
- Mobile equipment costs (list equipment required and estimated replacement lifetime)
- Start-up and testing costs
- Working capital (specify how many months before facility is fully operational and first product is sold)

Incorporate the following assumptions into your facility development and construction cost analysis:

- The site will be owned by the New York City Economic Development Corporation, and will be leased to the owner/operator of the facility – assume a zero $ lease cost.
- The site will be flat, with utilities to the boundary of the site, sized between 3 and 10 acres (specify the acreage required for your facility, including incoming and finished material curing, processing and storage).

Facility Financing

Do you anticipate 100% loan and grant financing, or will there be an equity contribution? If there is equity contribution, what return on investment (ROI) is expected?

For any expected loans, what range of the interest rates and terms of repayment would you expect for your facility given today's (spring, 2005) market conditions?

Update Facility Mass Balance

As needed, please amend the mass balance that you submitted with your initial response to our November 12, 2004 request for information, to ensure that the mass balance for the proposed facility, includes <u>all inputs</u> (e.g., electricity, water, Hunts Point and Fulton Fish

Market waste inputs [as provided by DSM], any amendments, etc.), and **all outputs** (e.g., material for sale, energy for sale, liquid and solid waste products).

If facility generates **energy**, and some portion of energy produced by the facility will be used for operating the facility, be clear to distinguish:

- quantities generated that will be used internally,
- quantities that will be bought to augment internally generated quantities, and
- net quantities that will be sold on the market.

Annual Operating Costs

Provide feasibility level operating and maintenance costs as follows:

- Administrative and marketing labor (number and cost)
- Operating labor (number and cost)
- Fixed equipment operating and maintenance cost
- Moving equipment operating and maintenance cost
- All other costs (specify type) including license fees, insurances, debt service, supplies

Annual Revenues

Please itemize the anticipated annual revenues for all products (e.g., compost, electricity, gases, and fertilizer) generated at the facility and sold:

- Describe the type, characteristics and quality of all products that are expected to be produced by the facility that will be sold
- Identify the quantity of each product that will be sold
- Identify potential markets for these products (provide contact information where appropriate)
- Indicate expected market prices per unit of these products
- Indicate how long you expect it will take from the date of facility start up until receipt of revenues at projected levels for the various products that the facility will generate for sale.

Information on Respondents' Costs And City Obligations

Respondents acknowledge that the costs associated with any responses submitted by them to this Economic Questionnaire will be borne solely by them, and that NYCEDC will not bear any costs or obligations related to the preparation and submission of responses. NYCEDC is soliciting information only and does not commit, now or in the future, to any procurement or purchase, or contract regarding, any of technologies or approaches that are the subject of this solicitation. Each Respondent acknowledges and agrees that by submitting a response it thereby releases NYCEDC, The City of New York and their respective employees, officers, contractors, subcontractors and agents (collectively, the "Released Parties") from and any and all claims, losses, liabilities arising directly or indirectly from the use, reuse or dissemination by the Released Parties of any information submitted by such Respondent in connection with the Economic Questionnaire.

Respondents are encouraged to avoid the submission of trade secrets, proprietary information or confidential information. All proposals submitted in response to this Economic Questionnaire may be disclosed in accordance with the standards specified in the Freedom of Information Law, Article 6 of the Public Officers Law of the State of New York ("FOIL"). An entity submitting a proposal may provide in writing, at the time of its submission, a detailed description of the specific information contained in its submission which it has determined is a trade secret and/or proprietary and which, if disclosed, would substantially harm such entity's competitive position. This characterization shall not be determinative, but will be considered by NYCEDC when evaluating the applicability of any exemptions in response to a FOIL request.

APPENDIX J MODEL ANAEROBIC DIGESTER BASE CASE PROFORMA

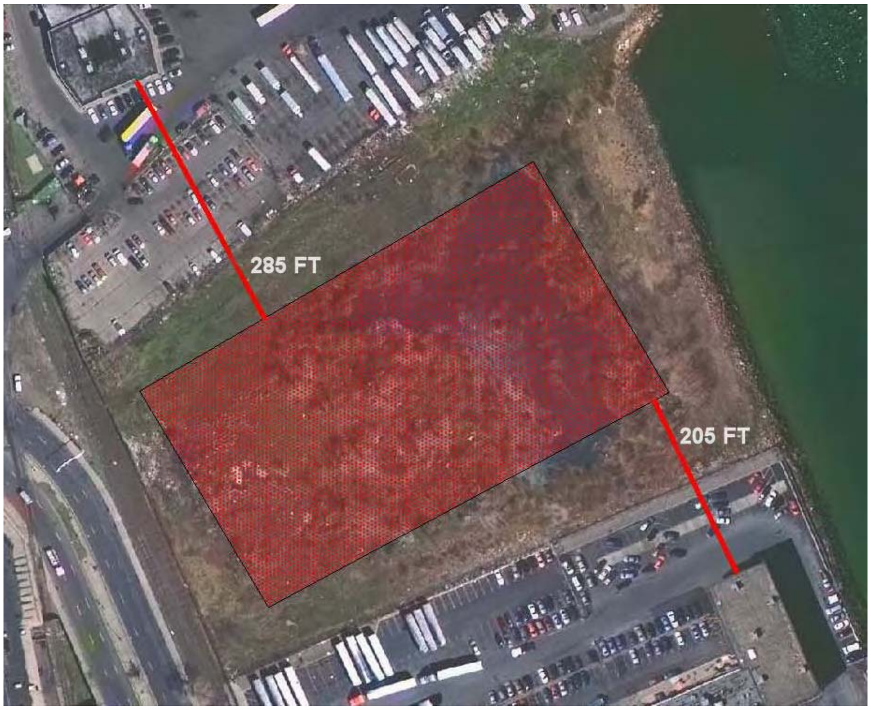
CATEGORY	Units	Initial Cost	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
COSTS																	
Capital																	
Soft Costs *(design, engineering, legal, financial)*		$1,696,879															
Site Development *(assumes no brownfield cleanup)*		$814,675															
Building Construction *(includes odor control)*		$2,030,072															
Fixed Equipment *(10 year life)*		$3,330,000															
Mobile Equipment *(7 year life)*		$140,000															
Start-up and Testing *(including working capital)*		$1,294,921															
Total All In Capital Costs		**$9,306,547**															
Less Equity Contribution		$1,000,000															
Less Grants		$500,000															
Total Debt Financing		**$7,806,547**															
Annual Debt Service *(@4%)*			$702,129	$702,129	$702,129	$702,129	$702,129	$702,129	$702,129	$702,129	$702,129	$702,129	$702,129	$702,129	$702,129	$702,129	$702,129
Return on Equity *(@15%)*			$171,017	$171,017	$171,017	$171,017	$171,017	$171,017	$171,017	$171,017	$171,017	$171,017	$171,017	$171,017	$171,017	$171,017	$171,017
Operating																	
Administrative personnel *(FTE)*	1	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000	$85,000
Marketing personnel *(FTE)*	1	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000
Operating labor *(FTE)*	8	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000	$400,000
Fixed equipment O&M *(includes capital reserve)*		$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000	$333,000
Mobile Equipment O&M *(includes capital reserve)*		$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500	$30,500
Electricity *(assumes internal generation)*		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Water and sewer *(million gallons)*	1.786	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894	$9,894
Land lease *(assumed to be zero)*		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Insurance		$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500	$137,500
Waste disposal $/Ton	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*	*$74*
Waste disposal (percent of throughput)	17%																
Waste disposal cost	4230	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990	$312,990
Total Annual Operating Cost		**$1,381,842**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**	**$1,383,885**
Profit *(assume 5% of operating costs)*			$69,194	$69,194	$69,194	$69,194	$69,194	$69,194	$69,194	$69,194	$69,194	$69,194	$69,194	$69,194	$69,194	$69,194	$69,194
Total, All In Costs			**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**	**$2,326,226**
REVENUES																	
Compost *(cubic yards)*	15,283	$229,238	$114,619	$229,238	$229,238	$229,238	$229,238	$229,238	$229,238	$229,238	$229,238	$229,238	$229,238	$229,238	$229,238	$229,238	$229,238
Electricity *(KWH's)*	3,100,000	$248,000	$179,421	$248,000	$248,000	$248,000	$248,000	$248,000	$248,000	$248,000	$248,000	$248,000	$248,000	$248,000	$248,000	$248,000	$248,000
Revenue / Ton of Throughput	*19*																
Other materials	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total, All In Revenues		**$477,238**	**$294,040**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**	**$477,238**
Net Cost			**$2,032,186**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**	**$1,848,988**
Throughput (tons)	24,880		**$18,000**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**	**$24,880**
Required Tipping Fee Per Ton			**$113**	**$74**	**$74**	**$74**	**$74**	**$74**	**$74**	**$74**	**$74**	**$74**	**$74**	**$74**	**$74**	**$74**	**$74**

Impact of Changes in Throughput		
Increase throughput by 10% *(annual tons)*	27,368	
Change in capital cost	0	$873,146
Increase in operating cost	5%	$1,122,295
Increase in waste disposal cost	10%	$344,289
Increase in revenue	10%	$524,961
Estimated Tipping Fee		**$66**
Net Impact on Tipping Fee		($8)
Reduce throughput by 10% *(annual tons)*	22,392	
Change in capital cost	0	$873,146
Reduction in operating cost	-5%	$1,015,409
Reduction in waste disposal cost	-10%	$281,691
Reduction in revenue	-10%	$429,514
Estimated Tipping Fee		**$78**
Net impact on Tipping Fee		$3

A OU-3

E OU-2

SITE D



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