

INTEGRATED RECYCLING STRATEGY AT WASTE-TO-ENERGY FACILITIES

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ABSTRACT

In this paper, we summarize Massachusetts' new Class II Recycling Program regulations and present the preliminary results of Waste Characterization Studies being performed at three waste-to-energy (WTE) plants. We discuss how a Waste Characterization Study can help both the facility and the state to assess the success of existing recycling programs and develop strategies for future programs.

INTRODUCTION

In 2006, Massachusetts citizens, businesses, governments and institutions disposed of 6.5 million tons of solid waste in landfills and WTE plants located in Massachusetts and out of state.

As illustrated in Table 1 below, 79 percent of the solid waste generated in Massachusetts was disposed of at in-state facilities and 21 percent of the waste was shipped to disposal facilities located in other states in 2006. This was a decrease from 25 percent in 2000. States that received the largest amounts of Massachusetts waste included Maine, New Hampshire, New York, Ohio and South Carolina.

**Table 1 Solid Waste Disposal in Massachusetts,
2000 and 2006 (Tons)**

	2000	2006
Total Disposed	6,460,000	6,550,000
Landfilled in State	1,760,000	2,080,000
Combusted in State	3,070,000	3,100,000
Net Export out of State	1,630,000	1,370,000

Source: MADEP Website

To increase recycling initiatives, the Massachusetts Green Communities Act (enacted in 2008) provided provisions to allow WTE plants to be considered Class II renewable energy generating sources if the facility began commercial operation before December 31, 1997 and the facility operates or

contracts for recycling programs approved by the Massachusetts Department of Environmental Protection (MADEP). The facilities must also comply with new MADEP regulatory requirements. Facilities that meet these criteria will be allowed to obtain renewable energy credits which may be sold, provided that 50 percent of the revenue is allocated to recycling programs. The revenue will be allocated to the Sustainable Materials Recovery Program, from where facilities may deposit it in either (1) an Expendable Trust that will be established and administered by MADEP, or (2) a dedicated account that the facility has established to hold the funds until projects are awarded.

There are seven WTE plants in Massachusetts, of which six may currently qualify for the Class II renewable energy program based on the sale of electrical power. These six WTE plants are as follows:

- Wheelabrator – Saugus,
- Wheelabrator – Millbury,
- Wheelabrator – North Andover,
- Covanta – Haverhill,
- Covanta – Springfield, and
- Covanta – SEMASS (Rochester).

In 2007, these six facilities received approximately 3 million tons of solid waste for disposal, which represents approximately 44 percent of the total waste disposed of in the state of Massachusetts that year. An estimated 1.7 TeraWatt Hour (TWH) of electricity was produced.

One of MADEP's requirements for a Class II Recycling Program is that the facility must conduct a baseline Waste Characterization Study which will then be updated every three years. The Waste Characterization Studies that will be performed as part of this program represent the first opportunity for MADEP to examine statewide solid waste characterization data in detail. This data will be instrumental in guiding future solid waste management policy decisions in Massachusetts.

The second requirement is the installation and operation of an electronic tracking system to document all waste loads received at the facility to increase the level of compliance with the waste bans. This will enable the facility and MADEP to more easily monitor, track, and communicate with haulers and generators to allow for easy identification of repeat offenders and help MADEP target enforcement and technical assistance programs to improve compliance.

The third requirement is to contract with a third party to conduct ongoing waste ban inspections and monitoring (or an alternate approach with equivalent results).

WASTE CHARACTERIZATION STUDY

The Waste Characterization Study protocol is based on MADEP guidance and incorporates Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste (ASTM D 5231-92) revised in 2008. Sampling and data collection is implemented over two time periods to account for seasonal variation. The number of samples to be sorted is calculated based on statistical criteria to provide a 90 percent confidence level and 10 percent precision and was determined to be 26 samples per season for each facility.

MADEP has identified 60 waste categories for sorting as part of the Waste Characterization Study. A weekly sampling period of 6 days was used for each facility, with the number of vehicles sampled per day proportional to the number of vehicle types. Assigned vehicle types for sampling were selected at random during each day of the one-week sampling period to provide a representative cross-section of the incoming waste stream. It should be noted that transfer trailers

were not sampled because of the variability of the waste (e.g. residential, commercial, etc.) placed in the trailers at the transfer stations.

One sample, weighing a minimum of 225 pounds, was randomly selected and sorted from each collection vehicle that was identified for sampling. The sample was transferred to a designated sorting area away from other tipping floor operations and vehicle traffic. The sample was then manually separated into blue plastic bins, clearly labeled as to waste category. After the sample was sorted and the individual waste categories were weighed, the data was recorded and any recyclable materials were placed in roll-off bins for subsequent processing at an appropriate facility.

Table 2 lists the weighted distribution of samples based on 2009 data for vehicle type (commercial and residential waste) received at the facility.

RESULTS - SEASON 1

The first sampling season for the three Wheelabrator facilities was performed in February 2010. The preliminary results from this sampling event are presented in Table 3.

Figure 1 shows the sorting crew at the Wheelabrator Saugus facility and the sorting bins used for separating the solid waste sample into the various waste categories.

Table 2 Sample Distribution by Haul Type for each Facility for both seasons

Vehicle Type	Wheelabrator Millbury	Wheelabrator North Andover	Wheelabrator Saugus
Roll-off - open top	11	1	3
Roll-off - closed top	1	1	0
Roll-off - compactor	1	3	5
Rear loading packer	15	30	27
Front loading packer	24	17	17
Transfer Trailers & Tandem Trucks	NA	NA	NA
Total No. of Samples	52	52	52



Fig 1 Sorting Crew at Wheelabrator Saugus

Figure 2 shows the percentage of waste for each major category. The results may vary slightly by the end of the study due to various adjustments that may be required to validate the results

Table 3 Waste Composition Results - Season 1

WASTE CATEGORIES	Wheelabrator Saugus	Wheelabrator Millbury	Wheelabrator North Andover
1.0 PAPER			
1.1 Uncoated Corrugated Cardboard/Kraft Paper	9.05%	6.82%	8.76%
1.2 Waxed Cardboard	4.21%	3.41%	5.03%
1.3 High Grade Office Paper	1.52%	2.54%	1.97%
1.4 Magazines/Catalogs	2.40%	3.24%	2.87%
1.5 Newsprint	2.72%	2.65%	3.72%
1.6 Other Recyclable Paper	1.04%	1.52%	0.41%
1.7 Compostable Paper	9.11%	11.28%	15.34%
1.8 Remainder/Composite Paper	4.25%	2.84%	1.51%
2.0 PLASTICS			
2.1 PET Beverage Containers	0.71%	0.68%	0.75%
2.2 PET Containers other than Beverage Containers	0.37%	0.10%	0.18%
2.3 Plastic MA Deposit Beverage Containers	0.37%	0.22%	0.30%
2.4 HDPE Bottles, colored and natural	0.68%	1.35%	0.92%
2.5 Plastic Tubs and lids	0.94%	1.36%	1.51%
2.6 Plastic Containers Nos. 3, 4, 5, 6, 7	0.29%	0.24%	0.10%
2.7 Expanded Polystyrene Food Grade	0.63%	0.67%	0.93%
2.8 Expanded Polystyrene Non-food Grade	0.07%	0.32%	0.61%
2.9 Bulk Rigid Plastic Items	1.61%	1.86%	1.69%
2.10 Film (non-bag commercial and industrial packaging film)	1.99%	1.55%	1.22%
2.11 Grocery and other Merchandise Bags	3.28%	2.64%	1.84%
2.12 Other Film means plastic film	5.38%	8.01%	3.15%
2.13 Remainder/Composite Plastic	2.93%	3.04%	2.70%
3.0 METALS			
3.1 Aluminum Beverage Containers (non-MA deposit containers)	0.08%	0.03%	0.11%
3.2 Aluminum MA Deposit Beverage Containers	0.29%	0.23%	0.31%
3.3 Tin/Steel Containers	1.14%	0.75%	0.72%
3.4 Other Aluminum	0.68%	0.81%	0.78%
3.5 Other Ferrous and non-ferrous	6.19%	1.94%	1.06%
3.6 White Goods	0.18%	0.00%	0.00%
3.7 Remainder/Composite Metal	1.16%	0.88%	0.35%
4.0 GLASS			
4.1 Glass Beverage Containers (non-MA deposit containers)	1.11%	0.66%	1.26%
4.2 Other Glass Packaging Containers (non-MA deposit containers)	0.00%	0.41%	0.59%
4.3 Glass MA Deposit Beverage Containers	0.00%	0.29%	0.51%
4.4 Remainder/Composite Metal	1.67%	0.76%	0.56%
5.0 ORGANIC MATERIAL			
5.1 Food Waste	12.31%	12.58%	12.87%
5.2 Branches and Stumps	0.73%	0.22%	0.03%
5.3 Prunings, Trimmings, Leaves and Grass	0.52%	1.41%	0.80%
5.4 Manures	0.66%	0.99%	1.50%
5.5 Remainder/Composite Organic	0.76%	0.64%	0.48%
6.0 CONSTRUCTION AND DEMOLITION			
6.1 Asphalt/Pavement, Brick, and Concrete	0.27%	0.00%	0.41%
6.2 Aggregates, Stone, Rock	1.18%	4.13%	0.83%
6.3 Wood - Treated	2.61%	2.09%	4.55%
6.4 Wood - untreated	3.67%	1.07%	2.10%
6.5 Asphalt/Roofing	0.30%	0.42%	0.00%
6.6 Drywall/Gypsum Board	0.24%	0.43%	0.43%
6.7 Carpet and Carpet Padding	1.10%	0.71%	2.26%
6.8 Remainder/Composite Construction and Demolition	0.28%	0.54%	0.25%
7.0 HOUSEHOLD HAZARDOUS WASTE			
7.1 Ballasts, CFLs, and Other Fluorescents	0.01%	0.01%	0.00%
7.2 Batteries - Lead Acid	0.00%	0.00%	0.26%
7.3 Batteries - Other	0.04%	0.03%	0.03%
7.4 Paint	0.16%	0.07%	0.07%
7.5 Bio-Hazardous	2.03%	4.77%	5.05%
7.6 Vehicle and Equipment Fluids	0.08%	0.06%	0.32%
7.7 Empty Metal, Glass, and Plastic Containers (contained toxic materials)	0.12%	0.39%	0.12%
7.8 Pesticides and Fertilizers	0.00%	0.18%	0.00%
7.9 Other Hazardous or Household Hazardous Waste	0.00%	0.01%	0.00%
8.0 ELECTRONICS			
8.1 Computer-related Electronics	0.35%	0.29%	0.31%
8.2 Other "brown goods"	0.39%	0.40%	0.73%
8.3 Televisions and Computer Monitors	0.00%	0.44%	0.06%
9.0 OTHER MATERIALS			
9.1 Tires and other rubber	0.64%	0.44%	0.09%
9.2 Textiles	3.33%	4.24%	3.62%
9.3 Bulky materials	0.95%	0.38%	1.10%
9.4 Restaurant Fats, Oils and Grease	0.00%	0.00%	0.00%
10.0 OTHER MISCELLANEOUS			
	0.08%	0.33%	0.18%

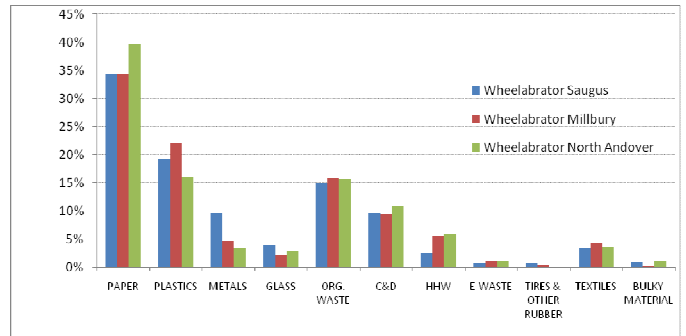


Fig. 2 Percent Distribution of Major Waste Categories for the three Wheelabrator Facilities.

FUTURE WORK

At the completion of the study, the mean waste composition values and standard deviation for each waste component will be calculated based on the composition of each of the sorting samples. The results will include the overall composition of waste, composition by substream, composition by vehicle type, and other observations and analyses.

A sensitivity study for the energy (Btu) value of the waste based on various recycling percentages will be evaluated for best management practices for each WTE facility.

REFERENCES

- [1] THE GREEN COMMUNITIES ACT (Chapter 169 of the Acts of 2008) M.G.L. 25A Section 11F(d)
- [2] Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste (ASTM D 5231-92) revised in 2008