

Report No. S5

Municipal Solid Waste National Totals

1. Definition of the Commodity Flow Data Gap

1.1. General Description

Municipal Solid Waste (MSW), as defined by the Environmental Protection Agency (EPA) and generally accepted within the industry, is defined as a subcategory of the Resource Conservation and Recovery Act (RCRA), Subtitle D wastes. Subtitle D wastes are typically disposed of in Subtitle D landfills. Hazardous wastes are covered under Subtitle C of RCRA and typically disposed of in Subtitle C landfills.

1.2. Commodities involved in the data gap

Subtitle D wastes included in MSW are:

- Containers and packaging, such as soft drink bottles and cardboard boxes;
- Durable goods, such as furniture and appliances;
- Nondurable goods, such as newspapers, trash bags, and clothing; and
- Other wastes, such as food scraps and yard trimmings.

Other Subtitle D wastes not included as MSW are:

- Municipal sludge;
- Agricultural wastes;
- Industrial non-hazardous wastes;
- Construction and demolition debris;
- Oil and gas wastes;
- Mining wastes;

This study focuses primarily on MSW. Some information is available and is reported on Construction and Demolition Debris (CDD). The remaining Subtitle D wastes are not covered here. At least some of these remaining categories are likely to be included in other SCTG categories included in the Commodity Flow Survey (CFS).

1.2.1. *SCTG codes*

MSW and CDD fall within SCTG Code 41, Waste and Scrap. More specifically, SCTG 41901 (Garbage) captures MSW and CDD.

1.2.2. *STCC codes*

Under the STCC system, MSW and CDD fall within STCC 40 (Waste, Scrap Recyclables). More specifically, STCC 40291 (Waste and Scrap) captures MSW and CDD.

1.3. Establishments involved in the data gap

1.3.1. *NAICS codes*

MSW is included at the two-digit level under NAICS Code 56 (Administrative and Support and Waste Management and Remediation Services.) At the three-digit level, MSW is Code 562 (Waste Management and Remediation Services). Code 562 includes several hazardous categories. Thus, this study (per value) is assessed at the 6-digit NAICS level: including 562111 (Solid Waste Collection), 562212 (Solid Waste Landfill), 562213 (Solid Waste Combustors & Incinerators), 562219 (Other non-hazardous Waste Treatment and Disposal), and 562920 (Materials Recovery Facilities). Note that two value estimates are given. The official assumption per this study is that the value of MSW is zero. Landfill, waste-to-energy, incineration, and resource recovery are all subsidized (see Curlee, and Curlee, et. al. 1994). Total sales for MSW industries are also reported.

1.3.2. *NAICS-SIC conversion issues*

Given that MSW and CDD were not included in previous FAF tabulations, this issue is not relevant to this study.

Nonetheless, for conversions from NAICS to SIC for the relevant codes, see;

<http://www.census.gov/epcd/naics02/def/ND562111.HTM>

<http://www.census.gov/epcd/naics02/def/ND562212.HTM>

<http://www.census.gov/epcd/naics02/def/ND562213.HTM>

<http://www.census.gov/epcd/naics02/def/ND562219.HTM>

<http://www.census.gov/epcd/naics02/def/ND562920.HTM>

2. Importance of the Data Gap

2.1. Value and tonnage as a share of national shipments

On the one hand, MSW has a negative value and must be subsidized with public funds. The official position of this study is that the value of MSW is zero.

On the other hand, MSW is relatively large in terms of tonnage and value (measured as sales of the industry). Although MSW is not thought of as a “commercial business” the industry does employ several thousand people and it creates billions of dollars in economic activity every year.

This study estimates total annual tonnage of MSW and CDD at 491 million tons. Total sales in the five 6-digit NAICS codes that comprise the MSW industry are \$35.6 billion annually. See below for further information:

http://www.census.gov/econ/census02/data/us/US000_56.HTM

2.2. Value and tonnage as a share for individual modes

MSW and CDD are moved by truck for the vast majority of within-zone movements and the majority of all movements. Rail is the second most used mode for longer distance moves. Barge plays a smaller role in longer distance moves. This study estimates total ton-miles for all modes at 32.5 billion ton miles.

See Table 1 (below) for details by mode and summary statistics for the study. The methodology by which the numbers are estimated is given in Section 4. Truck is the predominant mode, accounting for 97.8 percent by tons, 86.4 percent by ton miles, and (by assumption) 86.4 percent by industry sales.

Table 2 (below) provides value information for the selected NAICS codes and a disaggregation by mode.

Table 1: Summary Statistics for Municipal Solid Waste (MSW) and Construction and Demolition Debris (CDD) (SCTG 41 Waste and Scrap)

Mode	Tons (thousands)	Ton Miles Exports* (thousands)	Ton Miles Local (thousands)	Total Ton Miles (thousands)	Total Ton Miles (percent)	Value of Economic Activity (thousand dollars)
All modes	490,683.10	17,274,882.99	15,205,442	32,480,324.90	100.00%	\$35,596,536.00
Truck	479,911.70	12,866,816.62	15,205,442	28,072,258.53	86.43%	\$30,765,553.13
Rail				0	0.00%	\$0.00
Water				0	0.00%	\$0.00
Air (incl truck and air)				0	0.00%	\$0.00
Pipeline				0	0.00%	\$0.00
Parcel, U.S.P.S. or courier				0	0.00%	\$0.00
Truck and rail; truck portion		255,732.91		255,732.91	0.79%	\$280,268.31
Truck and rail; rail portion	8,071.40	3,804,649.10		3,804,649.10	11.71%	\$4,169,672.84
Truck and water: truck portion		85,546.36		85,546.36	0.26%	\$93,753.80
Truck and water; water portion	2,700.00	262,138.00		262,138.00	0.81%	\$287,287.91
Rail and water				0	0.00%	\$0.00
Other multiple modes				0	0.00%	\$0.00
Other and unknown modes				0	0.00%	\$0.00

* Interzonal movements.

Truck Rail Average Ton Mile	471.37
Truck Water Average Ton Mile	97.09
Truck Local Average Ton Mile	31.68
Truck Interstate Average Ton Mile	471.37

Table 2. Municipal Solid Waste (MSW) by Value and Mode

(Note: MSW as a commodity is valued at \$0 per this study. The table below gives industry sales for the collection and management of MSW.)

Mode	Value of Economic Activity (thousand dollars)	NAICS 562219				
		NAICS 562111 Solid Waste Collection	NAICS 562212 Solid Waste Landfill	NAICS 562213 Solid Waste Combustors and Incinerators	Other Nonhazardous Waste Treatment and Disposal	NAICS 562920 Materials Recovery Facilities
All modes	\$35,596,536.00	\$26,528,086.00	\$5,339,476.00	\$1,310,772.00	\$583,377.00	\$1,834,825.00
Truck	\$30,765,553.13					
Rail	\$0.00					
Water	\$0.00					
Air (incl truck and air)	\$0.00					
Pipeline	\$0.00					
Parcel, U.S.P.S. or courier	\$0.00					
Truck and rail; truck portion	\$280,268.31					
Truck and rail; rail portion	\$4,169,672.84					
Truck and water: truck portion	\$93,753.80					
Truck and water; water portion	\$287,287.91					
Rail and water	\$0.00					
Other multiple modes	\$0.00					
Other and unknown modes	\$0.00					

2.3. Geographic concentration: dispersed versus concentrated, local versus long distance

MSW and RCRA Subtitle D Wastes move both locally and over longer distances. High population areas often export their MSW to other states by truck, rail, or barge. Medium to low population states typically dispose (or recycle) their wastes locally or regionally.

This study estimates the interstate flow of MSW and CDD at 38.1 million tons. See below for methodology. The remaining tons are assumed to be managed locally.

2.4. Importance to international trade

Some waste is imported from Canada to the United States, but these movements are quite small. About one million tons moved from Toronto to Michigan in 2003. (McCarthy). In addition, small tonnages of recyclables are exported. This study did not attempt to measure these flows.

3. Data Sources

3.1. Coverage in CFS

This is an out-of-scope data gap of the CFS. None of this type of shipment is captured by the CFS. CFS does not cover NAICS Code 56 in the 2002 CFS.

3.2. Coverage in other data sources

There are two main sources of data on MSW in the United States. They include surveys by the journal, *BioCycle* (referred to as the State of Garbage in America) and periodic surveys conducted by Franklin Associates for the U.S. Environmental Protection Agency (EPA). A third survey was carried out in 1999 (published in 2001) by R.W. Beck and Chartwell Information. Beck/Chartwell surveyed 1,856 companies and 825 municipalities engaged in the collection and processing of MSW (including collection, transfer stations, waste-to-energy (WTE), and landfills). It presents a different viewpoint than the *BioCycle*/EEC survey. As discussed below, the Franklin Associates study is based on the relationship between MSW generation and economic activity and population (top-down). The *BioCycle* survey collects information from state waste management agencies. Both the *BioCycle* and Beck/Chartwell studies suggest that the Franklin Associates estimates are low.

See below Web sites for further information on *BioCycle* and Beck/Chartwell:

<http://www.jgpress.com/archives/free/000089.html>

and

<http://www.jgpress.com/archives/free/000138.html>

The Franklin/EPA study can be found at:

<http://www.epa.gov/epaoswer/non-hw/muncpl/pubs/msw2001.pdf>

In addition, some states collect detailed data on MSW production and flows (including imports and exports) -- for example, Pennsylvania. See:

<http://www.depweb.state.pa.us/landrecwaste/cwp/view.asp?A=1238&Q=464453>

Also see detailed information by state of origin for the State of Indiana:

http://www.in.gov/idem/programs/land/sw/qtrlyrpts/fars/03_profile.pdf

However, several other states do not have such detailed data, including for example, Tennessee, Ohio, Florida, West Virginia, and Illinois.

This work also includes Construction and Demolition Debris. One estimate by Franklin Associates puts CDD waste at 136 million tons per year in 1996. See:

<http://www.epa.gov/epaoswer/non-hw/debris-new/basic.htm>

Also see the summary report on CDD by Franklin Associates and sponsored by EPA:

<http://www.epa.gov/epaoswer/hazwaste/sqg/c&d-rpt.pdf>

Note that this study puts CDD waste at 113 million tons, per information in the most recent *BioCycle* survey. (See below for details.) One could argue that the number for CDD is somewhat higher than this, given the 1996 estimates of Franklin Associates. However, *BioCycle* number is adopted for purposes of consistency.

3.3. Data quality

Data for MSW and CDD are collected by a variety of government and non-government sources. As compared to a decade ago, the data are much improved. However, the data remain partial in some cases, and definitions of waste streams vary among sources. In most cases, there are at least two sources for each data element, which provides a reasonable degree of quality.

3.4. Other issues

No other issues at this time

4. Estimation Methods

4.1. General description of alternative methods

All viable alternative methods are covered below.

4.2. Method for estimating national totals

The methodology is derived from and based on the available data. The current methodology will be expanded and reformulated as additional information is gathered and we move toward estimates of specific origins and destinations.

As stated above, there are two primary sources of data on MSW tonnage: Franklin Associates and *BioCycle*. The most recent numbers available from Franklin Associates placed MSW at 232 million tons in 2000. The Franklin methodology is a top-down process based largely on economic activity and population. *BioCycle* has more recent numbers that are based on a bottom-up approach – i.e. surveys of state waste management agencies. *BioCycle* estimates MSW at 369 million tons in 2002. In addition to being more recent, *BioCycle*'s estimates also include Construction and Demolition Debris for some states. Their total estimate for MSW and CDD is 491 million tons in 2002. This study uses the 491 million ton estimate as the starting point of this analysis.

The Beck/Chartwell study reported 55 million more tons of solid waste generated than *BioCycle*. According to *BioCycle*, this difference is “likely explained by the fact that states’ data may not capture all the “commercial” wastes handled by private carters.” In addition, *BioCycle* reports that the

“Beck/Chartwell survey reported landfilling of 346 million tons, which includes all materials discarded in MSW-designated landfills, not only MSW. In their study, they reported another 22 million tons discarded in C&D-designated landfills. The only numbers that are consistent among the three studies are MSW tonnage to waste-to-energy plants. This reflects the fact that there are 98 WTEs in the U.S., all of which are highly controlled industrial plants.”

This study did not adopt the Beck/Chartwell estimates for two reasons: this is a one-time survey with less established credibility than the other two studies; and the *BioCycle* estimates are in between the Franklin Associates and Beck/Chartwell numbers – reflecting the study’s attempt to focus on “middle” estimates.

The second step addresses mode. MSW and CDD are processed via landfill, incinerator, heat recovery, or recycling both locally and regionally. The vast majority of waste is processed locally. As the second step and to estimate how much MSW and CDD are processed locally, we obtained information on interstate movements of MSW and CDD, for which there are two sources. *BioCycle* includes information for most, but not all, states per MSW imports and exports. A more complete sample is provided by James McCarthy in a 2004 report for the Congressional Research Service. McCarthy estimates state-to-state exports of MSW at 38 million tons in 2003 (or the most recent year for which he had data). McCarthy estimates MSW state-to-state imports at about 39 million tons, with the difference explained in part by

MSW imports from Canada to Michigan. This study adopts McCarthy's estimate of MSW state-to-state exports (which includes CDD for some states).

The third step draws upon data on rail and water movements of MSW and related waste to indirectly compute the quantity of waste that moves interstate by truck. It is assumed that water and rail are only used for long-distance hauls. Waterborne Commerce data from the Corps of Engineers is available for Commodity Code 80 (Waste Material, Garbage, Landfill, Sewage Sludge and Waste Water). The Corps places shipments of Code 80 for 2002 at 2.7 million tons (262 million ton miles). Similar information is available on MSW rail movements from the Waybill data at:

www.stb.dot.gov/stb/industry/econ_waybill.html

The Waybill estimates freight movements of STCC 40291 (Waste and Scrap, NEC) in 2002 at 8.1 million tons (3.8 billion ton miles.) This study assumes that the remainder of the 38 million tons of interstate MSW movement travels by truck. Note that in the case of rail and water transport, these are intermodal movements. Trucks are used to collect and carry the wastes to a transfer station where they are then reloaded and moved by rail, water, or large truck.

These data and assumptions allow us to disaggregate tons by mode as follows: truck (479.9 million tons); truck and rail (8.1 million tons); and truck and water (2.7 million tons).

The fourth step addresses total ton-miles. Ton-mile estimates are available from the Corps of Engineers and Waybill statistics for water and rail, respectively. FAF calculates that the average ton by water moves 97 miles. The average ton by rail moves 471 miles. For the purposes of this initial study, we assume that the average ton moved by truck for interstate disposal is equal to that for rail. Subsequent work will identify and tabulate the specific origin and destinations for interstate movements, which will provide more accurate ton-miles for interstate truck.

Next, ton-miles for local collection and transport of MSW and CDD must be estimated. Two sources of information were identified for this purpose. *MSW Magazine* estimated in a September/October 2000 article that the average ton of MSW moved 27 miles for landfill. Information also is available from VIUS on truck movements. Truck miles for Municipal Solid Waste were taken from the Average Annual Truck Miles for each state under North American Industry Classification System Code 56 provided in the Vehicle Inventory and Use Survey, 2002 Economic Census. The reported Average Annual Truck Mile figure was then reduced by 50 percent, to account for empty vehicle transport, resulting in an adjusted annual truck mileage. Ton-miles for MSW were then derived by taking the total tons transported by truck and multiplying by the adjusted annual truck mileage. Using this methodology, FAF estimated that the average ton of MSW travels 37 miles for disposal or delivery to the transfer station. For the purposes of this study, the average of the two numbers $((27 + 37)/2)$, or approximately 32 miles, is used. Studies, such

as *MSW Magazine* (2004) and *Waste Age* (2004) conclude that the average miles a ton travels for disposal is increasing over time as the number of landfills decreases sharply and interstate movements of waste from high-population centers becomes more common.

These data and assumptions lead to a national ton-mile estimate of 32.5 billion ton miles. This total is disaggregated by mode as follows: truck (28.1 billion ton miles); truck and rail (4.1 billion ton miles); and truck and water (0.3 billion ton miles).

The fifth step addresses total industry sales by mode, measured as the total annual sales of selected 6-digit NAICS codes as reported by the U.S. Census Bureau for 2002. See Section 1.3.1 and 1.3.2 of this report for details. The total value of MSW and MSW-related industries was \$35.6 billion in 2002 (due to economic activity created by the commodity). This total was disaggregated by mode (by assumption) according to the same percentages as ton-miles.

4.3. Proposed method for estimating regional flows

Please refer to Report No.R5.

4.4. Expected quality of the estimates

The quality of the estimates at the regional level will be of superior quality to the current national estimates. Regional estimates will result from data collected at the state and local levels, in addition to the national numbers reported and used in the current analysis.

5. Implications for the Scope and Content of the 2007 CFS

Unless the sample frame is changed to include MSW, this data gap will continue to be a missing component for the 2007 CFS. Alternative sources of information are available, and the quality of those data is improving. MSW should continue to remain out-of-scope per the CFS.

6. Other Issues

None.

7. References

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