MUNICIPAL SOLID WASTE

Municipal Solid Waste

Introduction

Municipal solid waste (MSW) includes household waste, municipal waste, food waste, and some industrial waste (U.S. EPA, 2006). Solid waste composition varies considerably with community size and with the activities conducted. Areas which experience population growth will often have increased amounts of construction materials, e.g. wood, insulation, and dirt in the waste stream. Communities which enjoy tourism as a primary industry will experience an increase in items such as food waste and paper waste.

Consumer buying habits and waste disposal habits continue to change due to increased awareness of packaging materials and landfill space concerns. The EPA encourages conservation, composting, and recycling. Solid waste generation and disposal habits are based on state and federal laws, deposits on items such as aluminum beverage cans, glass bottles, and tires, an increased environmental awareness, and market price and consumer's preferences.

In 2003, 236 million tons of MSW were produced in the United States, roughly 4.5 pounds of waste per person per day. Approximately 30% of MSW is recovered, recycled or composted, 14% is burned at combustion facilities, and the remaining 56 % is disposed of in landfills (U.S. EPA, 2006).

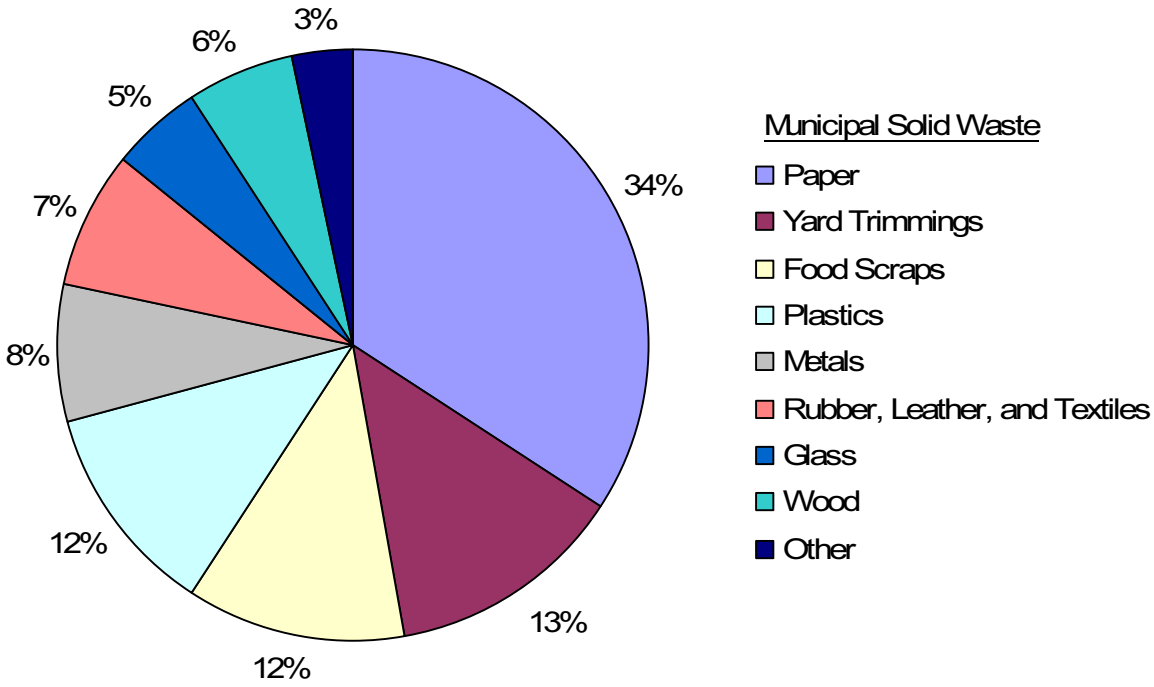

Figure VI-1. Total Municipal Solid Waste Generation for 2005 (U.S. EPA, 2006).

Basis for Estimating Solid Waste and Recyclables

Wyoming's municipal solid waste facilities include landfills, balefills, and transfer stations. For this report, our reference to "landfills" will include some balefills. The facility list from the Wyoming Department of Environmental Quality permitting municipal and industrial solid waste is available on-line at http://deq.state.wy.us/. Click on Solid and Hazardous Waste, and click on Databases Available.

Whenever possible, municipal solid waste generated per county per year was calculated based on the information obtained. For several counties, MSW was calculated using the 2005 county census information and the Wyoming Department of Environmental Quality's (DEQ) estimate of 6.3 pounds of waste generated per person, per day. This approach was taken when, for various reasons, no landfill information was obtained or based on the information received, the waste generation rates were substantially lower than the Wyoming DEQ's estimate.

In order to get an accurate estimate of the amount of MSW generated per county, recycling centers were also contacted. Recycling may occur at either the landfills or other public or private centers. Recycling rates ranged from 4% to 19%. The Wyoming Business Council has released the 2006-2007 Wyoming Recycling Center Directory available through the Wyoming Business Council and the Wyoming DEQ or on-line at www.wyomingbusiness.org/pdf/energy/Recycling_Directory1.pdf.

There are several concerns about the accuracy of the MSW data. First, although each landfill must estimate their daily waste for the operating permit, there are no requirements for tracking or reporting the amount of waste landfills receive or the amount that is recycled. Some of the counties keep very accurate records of the amount and type of waste received. Typically these were facilities that have scales.

However, many landfills do not have scales, and waste estimates are based on volume. Again, some of the facilities can report exactly how much space was used where others give estimates. Conversion factors for cubic yards to tons range from 800 to 1,000 pounds per cubic yard. The degree to which waste is compacted when it arrives at the landfill and the density of waste affect the conversion factor. The Wyoming Department of Environmental Quality most commonly suggests the use of 800 pounds per cubic yard. In a few cases, due to the information received by the landfill, a lower conversion rate was used.

For many of the communities, the municipal solid waste gets sent to a landfill outside of the county in which it was generated. For example, several of the smaller communities in Platte County have contracted with Torrington Disposal Service (TDS), and their MSW is deposited in TDS's landfill in Goshen County. Due to this, there is some error regarding the amount of waste generated per person, per day for several of the counties.

Industrial landfills are permitted by Wyoming Department of Environmental Quality, generally for a specific business with the intent of better managing their environmental liability. Only a few industrial facilities accept waste from more than one generator. As a result, municipal solid waste landfills in Wyoming may receive more business and industrial waste than landfills in other states.

In addition, Wyoming's landfills probably receive more construction and demolition (CD) waste than landfills in other states. Nine out of the twenty-three counties provided estimates on the amount of CD waste received, ranging from 16% to 56% of the total waste. The amounts

calculated for wood waste, and to some degree "other" waste included in Table IV-3 are lower than what are found in many of Wyoming's landfills.

Waste quantities included in this section should be considered estimates only. Waste volumes fluctuate with time of year, business activities, tourism, and population. Detailed information on the methods used for estimating the amount of MSW by county can be found in Appendix C: Methods for Estimating Municipal Solid Waste by County.

Table VI-1. Total Municipal Solid Waste per Year by County and the Amount Generated per Person, per Day.

County	Total MSW per Year (tons)	MSW per Person per Day (lbs)[A]
Albany	24,717	4.4
Big Horn	9,258	4.5
Campbell	44,477	6.5
Carbon	15,058	5.4
Converse	12,752	5.5
Crook	7,108	6.3
Fremont	36,354	5.5
Goshen	10,281	4.6
Hot Springs	5,200	6.3
Johnson	7,721	6.3
Laramie	101,024	6.5
Lincoln	11,679	4.0
Natrona	123,440	9.7
Niobrara	2,628	6.3
Park	20,000	4.1
Platte	8,095	6.3
Sheridan	37,986	7.6
Sublette	6,926	6.3
Sweetwater	53,433	7.7
Teton	27,070	7.8
Uinta	24,316	6.7
Washakie	8,679	6.0
Weston	6,674	5.5
State Total	**607,069**	**6.5**

A. Data based on Population Division, U.S. Census Bureau, Annual Estimates of the Population for Counties of Wyoming, 2005.

NOTE: The following breakdown of the municipal solid waste is based on the U.S. EPA's 2005 percentages by which different materials contribute to the total stream. In addition to the numerous concerns already listed, it is important to emphasize that these are estimates only, based on national numbers.

In addition, there is no regional information for the amount of moisture found in the paper, wood, yard trimmings, and food scraps portions of the MSW stream.

Paper

Paper contributes the largest amount of residential waste to landfills. This includes white paper, mixed colored paper, newspaper, magazines, and office pack.

Biomass Data Collection

Paper waste values were determined by using the total MSW stream for each county, including recycled material, and multiplying by the U.S. EPA's estimated percentage of paper waste, 34.2% (2006). The moisture content for paper is between three and seven percent, an average of five percent was used to determine tons dry biomass (Artic Paper, 2006; International Paper, 2006).

Tons Dry Biomass equals:

Total tons MSW*.342*.95

Table VI-2. Paper: Tons Dry Biomass Produced Annually

County	Dry Biomass (tons)	County	Dry Biomass (tons)
Albany	8,031	Natrona	40,106
Big Horn	3,008	Niobrara	854
Campbell	14,451	Park	6,498
Carbon	4,892	Platte	1,794
Converse	4,143	Sheridan	12,342
Crook	2,309	Sublette	2,587
Fremont	11,811	Sweetwater	17,360
Goshen	3,340	Teton	8,795
Hot Springs	1,689	Uinta	7,900
Johnson	2,884	Washakie	2,820
Laramie	32,823	Weston	2,127
Lincoln	3,795		
State Total	**196,360**		

Alternative Uses for Paper – The best alternative for decreasing the amount of paper added to the landfills is recycling. Most paper products can be made using a percentage of recycled material. In Lovell, WY, Georgia Pacific makes wallboard from recycled paper. The Wyoming Business Council has produced the 2006-2007 Wyoming Recycling Directory, which lists recycling programs by communities.

For communities in need of a recycling program, the Wyoming DEQ Solid Waste Management Program has produced the Solid Waste Guideline #9: A Guide to Wyoming Communities for Starting a Program to Collect and Market Recyclable Materials. This offers a variety of helpful suggestions for successfully implementing a recycling program, especially for small communities where the quantity of the materials and the transportation to a market may be hindering factors. For example it suggests backhauling to reduce transportation costs and cooperative marketing where more than one town works together. There are also grant programs available for establishing recycling programs through the State of Wyoming and the EPA.

Wood

Wood waste includes what is normally found in municipal solid waste, including green limbs from tree thinning and removal to construction and demolition waste. Many areas in Wyoming do not have a designated landfill for construction and demolition waste. As a result, there is probably more wood waste deposited in the landfills than reflected here. Also, many rural residents probably burn a significant amount of wood waste on site.

Biomass Data Collection

Wood waste values were determined by using the total MSW stream for each county, including recycled material, and multiplying by the U.S. EPA's estimated percentage of wood waste, 5.7% (2006). Twenty percent moisture content was used to determine tons dry biomass (Frear et al, 2005).

Tons Dry Biomass equals:

Total tons MSW*.057*.80

Table VI-3. Wood: Tons Dry Biomass Produced Annually

County	Dry Biomass (tons)	County	Dry Biomass (tons)
Albany	1,127	Natrona	5,629
Big Horn	422	Niobrara	120
Campbell	2,028	Park	912
Carbon	687	Platte	252
Converse	581	Sheridan	1,732
Crook	324	Sublette	363
Fremont	1,658	Sweetwater	2,437
Goshen	469	Teton	1,234
Hot Springs	237	Uinta	1,109
Johnson	405	Washakie	396
Laramie	4,607	Weston	299
Lincoln	533		
State Total	**27,559**		

Alternative Uses for Residue – The amount of wood waste found in MSW will fluctuate depending on the amount of construction occurring in the area and the amount of large trees removed. Due to this inconsistence, the wood component of the MSW stream from one community may not be able to provide a reliable continuous supply for energy or product use. However, there may be the potential to utilize this biomass if communities work in cooperation with each other or if woody biomass is received from other sources. For example, Biomass One in White City, Oregon is a 25 megawatt plant which uses 355,000 tons of wood waste per year. In addition to processing logging and land clearing debris, it also accepts CD waste and wood waste from the MSW stream. Biomass One produces enough electricity to provide power to 20,000 homes and results in a 500 to 1 reduction in particulate emissions compared to open burning. For more information on Biomass One visit the website at http://www.biomassone.com/index.php

Yard Trimmings

Yard trimmings include grass clippings, leaves, twigs, branches, and other garden refuse (US EPA, 2006). Yard waste in Wyoming is probably less than the amounts generated in states which receive more precipitation and have longer growing seasons.

Biomass Data Collection

Yard waste was determined by using the total MSW stream for each county, including recycled, reused, and composted material and multiplying by the U.S. EPA's estimated percentage of yard waste, 13.1% (2006). According to the city of Cheyenne's Sanitation Department, an average moisture content for yard waste in 40%.

Tons Dry Biomass equals:

Total tons MSW*.131*.60

Table VI-4. Yard Trimmings: Tons Produced Annually

County	Biomass (tons)	County	Biomass (tons)
Albany	1,943	Natrona	9,702
Big Horn	728	Niobrara	207
Campbell	3,496	Park	1,572
Carbon	1,184	Platte	434
Converse	1,002	Sheridan	2,986
Crook	559	Sublette	626
Fremont	2,857	Sweetwater	4,200
Goshen	808	Teton	2,128
Hot Springs	409	Uinta	1,911
Johnson	698	Washakie	682
Laramie	7,940	Weston	515
Lincoln	918		
State Total	**47,503**		

Alternative Uses for Residue – Many homeowners and private landscape firms do not remove grass clippings from yards when mowed. This retains the nutrients in the yard, reducing the amount of fertilizer needed.

Yard trimmings are also an excellent material for composting. Compost piles are located in several counties including Carbon, Converse, Laramie, Sheridan, Sweetwater, and Teton Counties. Compost piles are discussed in more detail on page 59.

Food Scraps

Biomass Data Collection

Food scrap waste was determined by using the total MSW stream for each county, including recycled, reused, and composted material and multiplying by the U.S. EPA's estimated percentage of food waste, 11.9% (2006). After reviewing the moisture content found in common foods listed in the USDA National Nutrient Database for Standard Reference, an average moisture content of 50% was used to determine tons dry biomass.

Tons Dry Biomass equals:

Total tons MSW*.119*.50

Table VI-5. Food Scraps: Tons Dry Biomass Produced Annually

County	Dry Biomass (tons)	County	Dry Biomass (tons)
Albany	1,471	Natrona	7,345
Big Horn	551	Niobrara	156
Campbell	2,646	Park	1,190
Carbon	896	Platte	329
Converse	759	Sheridan	2,260
Crook	423	Sublette	474
Fremont	2,163	Sweetwater	3,179
Goshen	612	Teton	1,611
Hot Springs	309	Uinta	1,447
Johnson	528	Washakie	516
Laramie	6,011	Weston	390
Lincoln	695		
State Total	**35,960**		

Alternative Uses for Residue – Like yard trimmings, food scraps can also be diverted from the landfill to a compost pile. Compost piles are discussed in further detail on page 59.

Other Municipal Solid Waste

Other municipal solid waste includes plastics, metals, rubber/textiles/leather, glass, and all other materials deposited in landfills, such as dead animals and manure.

Data Collection

Values were determined by using the total MSW stream for each county, including recycled material, and multiplying by the U.S. EPA's estimated percentage: plastics 11.8%, metals 7.6%, rubber/leather/textiles 7.3%, glass 5.2% and other 3.4%.

Table VI-6. Tons of Remaining Municipal Solid Waste Produced Annually by Commodity.

County	Plastics (tons)	Metals (tons)	Rubber, Leather, Textiles (tons)	Glass (tons)	Other (tons)
Albany	2,917	1,878	1,804	1,285	840
Big Horn	1,092	704	676	481	315
Campbell	5,248	3,380	3,247	2,313	1,512
Carbon	1,777	1,144	1,099	783	512
Converse	1,505	969	931	663	434
Crook	839	540	519	370	242
Fremont	4,290	2,763	2,654	1,890	1,236
Goshen	1,213	781	751	535	350
Hot Springs	614	395	380	270	177
Johnson	1,047	675	648	462	302
Laramie	11,921	7,678	7,375	5,253	3,435
Lincoln	1,378	888	853	607	397
Natrona	14,566	9,381	9,011	6,419	4,197
Niobrara	310	200	192	137	89
Park	2,360	1,520	1,460	1,040	680
Platte	955	615	591	421	275
Sheridan	4,482	2,887	2,773	1,975	1,292
Sublette	817	526	506	360	235
Sweetwater	6,305	4,061	3,901	2,779	1,817
Teton	3,194	2,057	1,976	1,408	920
Uinta	2,869	1,848	1,775	1,264	827
Washakie	1,024	660	634	451	295
Weston	788	507	487	347	227
State Total	**71,634**	**46,137**	**44,316**	**31,568**	**20,640**

White Goods, Junk Cars, and Scrap Metal - Throughout Wyoming, private firms collect white goods (appliances), junk cars, and scrap metal from several landfills. Markets for metal and many other recyclables have been depressed for some time, thus the value of metal has decreased. Some landfills have sufficient space to store scrap metal for several years, and some have done so anticipating that metal prices will increase. At this time, it does not appear likely that the value of metal will improve in the near future.

There are many scrap metal dealers throughout the state. As a result, a substantial volume of scrap metal is transported from the point of generation to the recycling facility by industries, businesses, and individuals and thus is not included in the waste totals described in this section. Many of the state's scrap metal dealers are included in the ***Wyoming Recycling Directory,*** which is available from the Wyoming Business Council.

Due in part to market factors such as volume of white goods or junk cars available, transportation costs, and end market value, the status of collection changes frequently. The most economical approach is for a collection firm to have several landfills on a route to reduce transportation costs.

Scrap metal, which is diverted from landfill disposal for recycling, has additional value based on landfill space saved and in the value of natural resources which are reused.

Glass – The most common alternative use for glass is to divert it from the landfill through intensive recycling programs. Glass takes over a million years to decompose. However it can be recycled an infinite number of times. With every ton of glass recycled, over a ton of raw materials are saved from the production of new products and an equivalent of ten gallons of oil in energy is saved. In addition, recycling glass produces 20% less air pollution and 50% less water pollution (SKS, 2006).

Recycled glass can be used in a number of ways. Construction applications for crushed glass include mixing it with cement, using it as a blasting abrasive or as a fill material for retaining walls. Recycled glass has been used in the manufacturing of fiberglass insulation, roof tiles, glassphalt for roadways, and composite materials. Using recycled glass can lower the cost of on-site waste water filters and can be used in slow rate filtration systems for treating drinking water. For ornamental purposes, recycled glass has been used in jewelry, stepping stones, landscaping, lawn ornaments, and pottery. Glass Aggregate Systems offers valuable information on these and many other uses for recycled glass, available on-line at http://glassagg.com/recycled_glass.html.

Rubber – The majority of wasted rubber comes from scrap tires. In 2003, of the 290 million tires generated, there was a market for 233 million scrap tires; just over 80% (Rubber Manufacturer's Association, 2004). Uses for scrap tires are numerous from civil engineering projects to rubber modified asphalt. Recycled rubber products are used in playgrounds, horse and dog training equipment, athletic facilities, and commercial flooring, as well as a number of miscellaneous uses.

Scrap tires have also been used to produce fuel. According to the EPA, tires consumed for fuel, either whole or in one to two inch or smaller tire derived fuel (TDF) chips, offer users a higher Btu value than coal or wood chips. An average twenty pound tire contains around 280,000 Btu, equal to 2.5 gallons of oil or twenty pounds of coal. In addition, if TDF is burned under proper conditions, little or no emissions are produced. In 2003, 130 million scrap tires were used for fuel (EPA), primarily by cement kilns, pulp, and paper plants and industrial boilers.

For more information on scrap tire management and TDF, visit the EPA's website, Management of Scrap Tires, available at http://www.epa.gov/garbage/tires/index.htm. Scrap tires are managed at the state level, and the Wyoming DEQ recommends either recycling (see the Wyoming Recycling Directory) or disposing of scrap tires in the landfill.

Plastic – The best alternative for plastic waste is recycling. Nationwide, in 2003, just over 26.7 million tons of plastic was in the MSW stream (EPA). However, only four percent of the plastic waste was recycled. There are a number of facilities in the state that collect plastic for recycling either through curbside collection or drop off locations. Recycled plastic can be used for a variety of commodities such as fencing, landscape timbers, plastic bottles, and even backpacks. As mentioned under *Alternative Uses for Wheat Straw*, there is a new plant in Torrington, WY (Heartland BioComposites) that utilizes wheat and recycled plastic to produce natural fiber composites as a wood substitute. Currently they use less than 10,000 lbs a month of HDPE #2 plastic from Wyoming. However, they are interested in additional plastic suppliers who can provide sorted baled HDPE #2 natural plastic. For more information, contact:

PrairiePicket by Heartland Biocomposites

Heartland Biocomposites
Ashley Harpstreith
1302 Industrial Park Avenue
Torrington, WY 82240
(307) 532-8700
http://www.heartlandbio.com/

Animal Manure - Although there is no central listing, some communities have multiple horse corrals within small areas. In some cases, manure is added to the compost piles within the local community or may be used as organic matter for landscaping. Manure is used as direct application on pastures and farm fields and, on a limited basis, yards. Odor can be an issue for neighbors. Direct use in highly populated areas may not be feasible. Consideration must be given to the carbon to nitrogen ratio and the other nutrient content of the manure before it is applied to ensure that it meets specific fertility requirements.

Composting

Some of Wyoming's communities operate compost facilities. Composting programs can be designed specifically for yard trimmings (leaves, grass, brush, and tree branches) or the entire compostable portion of the municipal solid waste stream (yard trimmings, food scraps, scrap paper, and all other decomposable organics). Through composting 30% or more of MSW can be diverted from the landfill. In addition to municipal solid waste, composting programs can be designed to handle sewage, agricultural residues, livestock manure, food processing by-products, and forest industry by-products (EPA, 94).

For the most part, compost is used as a soil amendment or mulch. Adding compost to the soil can benefit its physical, chemical, and biological properties and has been used for agricultural, landscaping, and gardening applications, as well as reforestation projects (EPA, 94). Some landfills use compost or other organic materials (such as yard waste) on their reclaimed landfill areas.

To ensure that markets and distribution systems are properly established, potential use of composted material should be investigated prior to creating a compost pile. Procedures for

composting operations and arrangements for dispersal of compost after treatment often change from year to year due to landfill permitting requirements, amount of material accepted, weather conditions, and demand for compost or related materials.

Compost piles can produce a number of environmental problems such as air and water pollution, odor, noise, vectors, fires, and litter. However, with proper design and management, these potential problems can be minimized. The U.S. EPA offers numerous publications on composting, available on-line at http://www.epa.gov/compost/pubs.htm.

The Wyoming DEQ also offers information specific to Wyoming on how to do both backyard composting and well as establishing community programs. For more information contact:

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