MassRecycle Presents

Recycling & Sustainable Materials Management Handbook

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Understanding Waste Management Systems & Options

If you are new to recycling and waste management, it is wise to take a few minutes to understand the system you are about to enter, as it can be confusing and has, like every system, its own jargon and acronyms. The topic of waste management can be approached from several contexts. This section will provide an overview of the types and generators of waste, and a basic understanding of waste collectors and haulers, recyclers, processors, and waste disposal facilities.

WASTE TYPES

Municipal Solid Waste (MSW) includes materials discarded from residential, commercial, and institutional sectors. MassDEP's regulations define MSW as "any residential or commercial solid waste," exclusive of medical wastes or waste from industrial processes. When forms of waste with value or those requiring special handling are not separated and recovered (or "diverted"), they often become part of the municipal solid waste stream.

See page 128 of this Handbook for more definitions.

Organics includes food waste and other organic wastes such as leaf and yard waste. End sites for organics include animal feed operations, anaerobic digesters, and commercial composting sites.

CONSTRUCTION AND DEMOLITION WASTE (C & D) is produced from both residential and commercial projects. MassDEP has implemented waste disposal bans on many of the materials generated during construction projects, including asphalt, brick and concrete, wood, metal, and clean gypsum wallboard.

HARD-TO-MANAGE WASTES are non-hazardous wastes that require special handling, such as white goods, bulky waste (e.g., mattresses), and tires.

HAZARDOUS WASTES are those wastes which, because of quantity, concentration, or characteristics may cause harm to humans or the environment. MassDEP defines hazardous waste in CMR 30.010 (see also the glossary at the end of this manual).

INDUSTRIAL WASTES are process wastes generated by industrial (manufacturing) activity. They are not managed in the MSW system.

MEDICAL/INFECTIOUS/RADIOACTIVE WASTES are those wastes from any source that are physically or biologically dangerous and require special handling.

UNIVERSAL WASTES are a class of hazardous wastes from large and small generators which accumulate in such quantity that special systems have been set up to deal with them. Currently they include non-alkaline batteries, some pesticides, and mercury-containing devices, such as thermostats and fluorescent lamps.

WASTE GENERATORS

Some of the wastes described above are generated from multiple sources. For example, food waste is produced in households, schools, restaurants, grocery stores, manufacturers, and more. Waste generators are typically grouped into four categories:

- Residential (single, multi-family, apartments, and condos)
- Commercial (offices, stores, restaurants, etc.)
- Institutional (churches, schools, colleges, municipal offices, and hospitals)
- Industrial, mining, and agricultural

Note: multi-family dwellings and apartments may be classified as commercial generators. Commercial, institutional, and industrial generators are subject to MassDEP's waste bans.

Wastes from various sources flow through a system of collectors and processors, and end up at a final disposal or processing site. Itemized below are the phases of the MSW management system. MSW can be minimized or prevented altogether through legislative efforts and behavior change (see the section Divert More with Waste Prevention and Reduction).

WASTE COLLECTION

Waste collection involves the consolidation of MSW that can be efficiently hauled for processing or disposal. This can be achieved via curbside collection using specially designed collection trucks, or through use of a single

collection point (transfer station) to which households and businesses bring their material. In addition, paper and container recycling can be collected as a single stream (combined) or a dual stream (separated).

VEHICULAR COLLECTION

Several forms of trucks facilitate MSW collection. Using a collection vehicle allows for the use of mechanical and technological solutions, which can be cost effective in large scale collection situations. When collection trucks are used, the accumulated material is usually driven (or "hauled") directly to the disposal or recycling processing facility, but in some cases it is taken to a large-scale commercial transfer station for sorting and diversion.

- Rear loading ("packer") trucks allow manual loading at the rear of the truck, and mechanical compactors compress the material.
- Front End Loaders or Front Load Trucks are typically employed to collect material from metal dumpsters, which are lifted over the front of the truck and emptied into the truck bed in the rear.
- Side loading trucks can be designed for manual dual or co-collection of two separate waste streams, so they can be collected with a single visit from a truck. A second type of side loading truck is outfitted with mechanical or hydraulic lifting systems that can clasp onto and empty special carts which have been wheeled to the curb. This automated collection method is popular because it facilitates collection of smaller amounts of material and eliminates the need for manual lifting, reducing the risk of injury.
- Roll-off trucks are used to move larger (20 – 40 cubic yard) open top containers or compactors of waste.
- Tractor trailer trucks ("18-wheelers") are used to haul larger and heavier loads over long distances to disposal facilities.

TRANSFER STATION COLLECTION

Vehicular collection can be challenging in some communities for many reasons. An alternative is to provide a collection point or "transfer station" for residents (and in some cases, businesses) to bring their discarded material, which is sorted into specific types as it is collected. The transfer station model allows for the collection of many different waste types in one convenient location. When a significant amount of a specific material has been collected, it is transported (or hauled) to a disposal or recycling processing facility.

The terms *aggregation* and *consolidation* refer to transfer stations that collect and consolidate waste from small-scale haulers and transfer it to disposal facilities. Consolidation operations range from small municipal facilities to large commercial ones that can process several hundred tons of waste a day.

RECYCLING COLLECTION

Collection of paper and mixed containers from households is done via both transfer station and vehicular collection, but there are two collection approaches.

DUAL STREAM RECYCLING COLLECTION requires residents to place commingled (or mixed) containers in a separate collection container from paper materials. In some cases, vehicular collections of the two streams occur on the same day, but more often haulers employ an alternating pickup schedule for each of the two streams. Although it is more resource intensive from the hauler perspective, this source-separated recycling collection model tends to ensure a high quality of recyclable material and generates a lower percentage of non-recyclable material (or contamination), which manufacturers and processing facilities appreciate. Some businesses choose to

participate in dual stream recycling for various reasons; in some instances, the hauler may financially incentivize them to do so. Additionally, separating materials at a business site often leads to cleaner streams of material.

SINGLE STREAM RECYCLING COLLECTION allows paper and household containers to be collected in a single container. It is currently the most popular form of curbside recycling in the U.S. Collecting recycling in a single stream streamlines the process, reducing collection and hauling costs. Household participation (pounds collected per household) tends to increase, but the amount of contamination also increases, which necessitates additional processing (and its associated costs) before recyclable material can be sold for reuse. Single stream recycling tends to be a popular choice for business recycling, as staff generate mixed containers at lunch and break times, waste paper is produced by office staff, and cardboard is accumulated from incoming deliveries.

WASTE PROCESSING

When valuable discarded material (such as sought-after recyclable material and food waste) is diverted from the MSW stream, additional processing is often required before it can be sold. Here is a list of some of the most common waste processing facilities:

- **Recycling facilities** accept recyclable materials, sort by material and remove contaminants from them (either by hand machine, or both), and then consolidate/bale them before marketing them to end users. Recycling facilities that process common household recycling (paper and mixed containers) are called materials recovery facilities or MRFs.
- **Construction & Demolition (C&D) facilities** process construction and demolition materials in a comparable manner that MRFs process recyclables: sorting, removing contaminants, and marketing/shipping to appropriate markets.
- **Traditional composting facilities** process organic materials such as leaves and yard waste, food waste, and other organic wastes and produce finished compost that can be sold for landscaping and gardening purposes.
- **Anaerobic digestion facilities** process organic materials like food waste and cow manure, turning their potential energy into electricity, heat, and fertilizer. Materials are placed in an enclosed anaerobic (without free oxygen) tank where naturally occurring microbes convert sugars, fats and other compounds into a biogas that contains methane that can be used as energy. The residual, relatively odor-free digestate can be used as an agricultural natural fertilizer.
- **Depackaging facilities** extract or separate food from its packaging. The extracted food forms a wet slurry that can be composted or anaerobically digested.

WASTE DISPOSAL

A disposal facility is a site where final treatment and/or disposal of solid waste occurs. Typically, disposal facilities are landfills or incineration facilities under public or private ownership. They are permitted by state and federal environment protection agencies, and must operate within specific parameters, including continual environmental monitoring and strict limits on the quantity of waste the site is allowed to accept or process daily or annually. Waste is accepted either by a formal contractual arrangement or via what is known as the “spot” market, which means that a truck just shows up and asks if the facility can take, or “tip”, the waste for a (typically higher) fee.

INCINERATORS/WASTE TO ENERGY FACILITIES burn waste at a very high temperature, and some can produce electricity from the waste. Exhaust stack emissions and other environmental impacts of their operations are closely monitored and regulated by state and federal agencies.

LANDFILLS employ an entombment model where waste is buried in the ground. Modern sanitary landfills are constructed with multi-layer liners, leak detection systems, and landfill gas management systems. After a landfill has reached capacity, a landfill gas (methane) management system is installed, and a "cap" made of synthetic and organic materials is installed to prevent rainwater from leeching contaminants into the surrounding groundwater table.

The best way to understand the complexity of the MSW management system is to observe the various components and processes first-hand. Virtual or in-person visits and tours of facilities and local hauling organizations will provide an invaluable perspective of the issues and complexities involved and offer an opportunity to improve communication between municipal employees and the vendors they hire.

GLOSSARY OF RECYCLING & WASTE TERMS

Please note: the footnotes/sources in this section are listed at the end of the section.

More definitions
https://swana.org/resources/solid-waste-glossary

Aggregation - Process used by transfer stations that collect and combine waste from multiple smaller haulers and transfer it in larger vehicles to disposal facilities. May range from small municipal facilities to large commercial ones that process several hundred tons of waste a day.

Aluminum – A lightweight, silver-white, metallic element, mined in the form of bauxite ore where it exists primarily in combination with oxygen as alumina. Used in a variety of ways, but perhaps most familiarly in the manufacture of soft drink cans.[3]

Aluminum Cans –single-use containers for packaging made primarily of aluminum, commonly used for food and beverages such as milk and soup but also for products such as oil, chemicals, and other liquids.

Anaerobic Digestion - a process in which microorganisms break down organic materials such as food scraps, manure and sewage sludge in the absence of free oxygen.[10]

Avoided Disposal Costs – The amount of money saved by not disposing of recyclables as trash. Waste service providers charge customers a disposal fee for each ton (or pound) of waste disposed.

Baler - equipment used to bind a compacted cube or block of recyclable material, such as cardboard. [10]

Biodegradable - The process of breaking down or decomposing rapidly under natural conditions and processes.[7]

Biogas - a renewable energy source that is produced throughout the anaerobic digestion process.[10]

Bond Paper - Commonly called white office paper. A high grade of paper usually used for forms, offset printing, copy paper, stationery, etc.[4]

Bottle Bill - A law requiring deposits on beverage containers.[7]

Capture Rate - A measurement to calculate the degree of success attained by a recycling program: the percentage of potentially recyclable material actually recycled.

Carbon Footprint - a measure of the impact human activities have on the environment based on carbon output.[10]

Cardboard - Commonly called OCC (old corrugated cardboard). Includes heavy boxes (like those used in packing appliances) and sheets of corrugated board of various qualities. OCC is clean cardboard made from unbleached, unwaxed paper with a fluted (corrugated) inner liner.[5] It does not include cereal boxes, and other non-corrugated 'pasteboard' known in the industry as chipboard.[4]

Close the Loop – The last, and highly important, step in the recycling process. It refers to the point when a consumer buys a recycled product after it has been put into a recycling program and reprocessed into a new item.[3]

Co-Collection - The collection of recyclables together with other municipal trash in the same truck, separated later for recycling or disposal.[7]

Collection of Waste - Refers to waste haulers moving materials from one point to another. They may use the typical rear-loading packer truck, a front-loading garbage truck that services dumpsters, a "roll-off truck" that hauls the bigger 20 – 40 cubic yard containers, or an 18-wheeler tractor trailer that hauls larger loads long distances to disposal facilities.

Collector - An individual or company that picks up trash for disposal or recyclable materials that have been set aside for recycling.[1]

Commercial Solid Waste - All types of solid waste generated by stores, offices, institutions, restaurants, warehouses, and other non-manufacturing activities, or similar types of solid waste generated by manufacturing operations. Excludes solid waste generated in a manufacturing or industrial process.[2]

Commingled containers- Glass, metal, bi-metal, and plastic containers mixed together.[1]

Compactor - Equipment that densifies and contains recyclable material or trash under pressure, not allowing it to expand until it is unloaded.[7] (Commonly used for cardboard).

Compost –A solid waste management technique that uses natural processes (Nature's way of recycling) to convert organic materials to humus through the action of microorganisms. Compost is a mixture that consists largely of decayed organic matter and is used for fertilizing and conditioning land. US EPA definition: The relatively stable humus material that is produced from a composting process in which bacteria in soil mixed with garbage and degradable trash break down the mixture into organic fertilizer.[3]

Compostable/Organic Wastes - Includes food wastes, leaves, brush, sticks, Christmas trees and yard waste. Waste materials capable of undergoing biological decomposition at a consistent rate within a compost site, eventually breaking down into carbon dioxide, water, inorganic compounds, and biomass[10]

Composting Facilities – Facilities that manage organic materials such as leaves and yard waste, food waste, or other organic wastes either in big compost piles or in composting vessels and/or buildings.

Computer Paper, commonly called CPO (computer print-out) – One of the highest grades of paper. Includes green-bar, gray/blue bar and white computer paper.[4]

Construction and Demolition Waste (C&D) - Debris generated during the construction, renovation or demolition of buildings, roads, and bridges. These waste materials are generally bulky, heavy and produced in large quantities.[10] Includes Waste from both homeowners' and contractors' projects. MassDEP's definition states that it includes "concrete, bricks, lumber, masonry, road paving materials, rebar, and plaster."