

Recycling 101 – Important Terms

Important Recycling Terms – The bulk of this list was adopted from Kentucky DEP Division of Waste Management's *Community Recycling Guide* found at www.waste.ky.gov/recycling

Coding – In the context of solid waste, coding refers to a system to identify recyclable materials. For example, the coding system for plastic packaging utilizes the “three chasing arrows” with a number in the center and letters underneath. The numbers and letters indicate the resin from which each container is made:

- 1 = PETE (polyethylene terephthalate)
- 2 = HDPE (high density polyethylene)
- 3 = V (vinyl)
- 4 = LDPE (low density polyethylene)
- 5 = PP (polypropylene)
- 6 = PS (polystyrene)
- 7 = Other/mixed plastics

This code is designed to help sort for recycling.

Collection – The act of obtaining used materials from residential and business sources and hauling them to a facility for processing.

Composite Packaging – In the simplest sense, any type of packaging constructed of more than one material. Also may include some packages composed of multi-layered material.

Contaminant – Any substance that causes other substances to be unfit for use by the introduction of unwholesome or undesired elements. For example, ceramic is a contaminant to be avoided when recycling glass.

Cullet – Furnace-ready, crushed glass, usually added to new raw material to facilitate melting when making glass.

Densify – To reduce recyclables' volume, by compacting, crushing, baling, or other means. This allows for more efficient storage and transportation.

Detinning – The process of removing the thin coating of tin on steel food cans. This process can be done optionally prior to steel can scrap being recycled.

End User – Mills and other industrial facilities where secondary materials are converted into new materials. Examples include paper mills, steel mills, detinners, and glass manufacturing plants.

Flake – When plastic bottles are collected for recycling they are sorted, ground into small flakes of material, and washed.

Feedstock – A processed material used in manufacturing, which is also called “furnish” for paper mills.

Ferrous Metal – Metal containing iron. Ferrous metals, such as steel, will stick to a magnet.

Generator – An individual, company, organization, or activity that produces wastes or secondary materials.

Market – (1) A firm or operation purchasing secondary materials. (2) The available supply of or demand for goods containing recycled materials. **Intermediary Market** – Scrap dealer, recycling operation, and /or processor that purchase secondary materials from collectors for sale to an end user.

Materials Recovery – A mechanical or labor-intensive process that separates out reusable and recyclable materials such as plastics, metals, glass, and certain grades of paper for the purpose of beneficial reuse.

Mill Scrap – Material generated during primary material manufacturing that is often reused at the point of generation. Also called “Post-industrial Waste”.

Non-Ferrous Metal – Metal that does not contain iron, such as aluminum, copper, zinc.

OCC – Old Corrugated Cardboard – The official term given to cardboard in the recycling process.

ONP – Old Newsprint – The official term given to newspaper in the recycling process.

Office Paper – Used paper generated by offices, including stationery and copy paper.

Pellet – After recovered plastic bottles are ground into flake and washed, the flakes are often melted into pellets for use by manufactures in creating new goods.

Post-consumer Waste – Materials generated by the final consumer (residential or non-residential) after it has served its intended use and has been collected for reuse or recycling. The term does not include those materials and by-products generated from and commonly used within an original manufacturing process.

Primary Material – Virgin or new material used for manufacturing basic products.

Processor – A part of the recycling business cycle where operators store, grade, clean, densify, or package secondary materials for sale to an end user.

Raw Material - An unprocessed natural resource, a processed secondary material, or a product used in manufacturing.

Reclamation – The process of restoring material found in the waste stream to usefulness or productivity. Reclaimed materials may be used for purposes different from their original use.

Reduction – see “**Waste Reduction.**”

Recyclable – The technical ability of a material to be reused in manufacture.

Recycled Content – Percentage of recycled material used to manufacture a product.

Recycling – The diversion of materials from the solid waste stream and the beneficial reuse of such materials. Recycling is further defined as the result of a series of activities by which materials that would become or otherwise remain waste are diverted from the waste stream for collection, separation, and processing. These materials are used as raw materials or feedstock in lieu of or in addition to virgin materials in the manufacture of goods sold or distributed in commerce or the reuse of such materials as substitute for goods made from virgin materials.

Roll-off – A bulk container for holding waste materials. Small roll-offs are picked up and emptied into a waste disposal truck; large ones are mechanically pulled into a roll-off bin truck, trailer, or transfer trailer.

Secondary Materials – All types of materials handled by dealers and brokers that have fulfilled their original function and usually cannot be reused in their present form or at their present location. Also includes materials that occur as waste from manufacturing or conversion of products.

Separation – Sorting material by its physical properties, including color, luster, size, shape, or other surface characteristics.

Shred – To cut or tear into long narrow strips. Cans and paper are often shredded.

Solid Waste Stream – The total flow of solid waste from homes, businesses, institutions, and manufacturing plants.

UBC – Used beverage containers.

Virgin Materials – Any basic materials for industrial processing or manufacturing that have not been previously used.

Waste Reduction – Products or policies that reduce the amount of waste that must be disposed in landfills, incinerators, or waste-to-energy facilities.

Recycling 102: Material collection specifics by commodity

Effectively and responsibly managing a recycling program is greater than buying a baler and tossing in materials. Many communities decide to partner with a commingled collection-based MRF to avoid in-house processing of recyclables. Other communities feel their programs function most efficiently when they can market sorted material directly to a recycler. This material handling guide will help you determine how best to manage your materials. Much of this information is reprinted from Mississippi's material handling guides found online. www.recyclenet.net can be another valuable resource.

Aluminum

Used beverage containers (UBCs) are typically flattened, then baled or compressed into bales, densified into biscuits, or blown into trailers for loose shipment. It is very important that aluminum cans be free of contaminants before further processing. Contaminants to aluminum cans include iron, lead, foil, other metals, paper, plastic, glass, and dirt. Non-container aluminum such as pie pans and frozen food trays should not be processed with aluminum cans. They are considered a contaminant.

Curbside Value Partnership's Steve Thompson reports that the Southeast is fortunate to be home to nearly all of the melting facilities in the U.S. for UBC. This helps Alabama recyclers because these plants want to purchase UBCs from as close to home as possible. Prices move in a fairly constant relationship to virgin prices and are always higher than any other recyclable commodity, sometimes fetching more than \$1.00 per pound.

Possible equipment needs for managing aluminum:

Can Sorter - Aluminum cans should be run through a can sorter to remove debris and ferrous metals. The cans are fed into a hopper and carried up a conveyor belt. Cans are carried past a magnetic device that efficiently removes any steel cans in the material and sorts them into a separate container from the aluminum cans.

Can Handler Basket - These are steel-framed units with nylon netting to contain the aluminum cans. They can generally be purchased with small wheels so they can be rolled from the can sorter to the scales and then to the can flattener/blower.

Can Flattener/Blower - This is a device that aluminum cans pass through in order to flatten the cans to save space. A blower attachment can also be used in order to blow the flattened cans into a tractor-trailer. They generally weigh several hundred pounds and have a footprint of about 5' X 10'.

Scales - Scales are a necessity if paying out money to individuals bringing cans in for sale. Scales that measure up to 1,000 lbs are the recommended minimum.

Densifier or Baler - Aluminum cans that are not blown into a tractor-trailer can be densified or baled using one of several types of equipment. Some densifiers can compress several hundred pounds to several thousand pounds per hour. Aluminum cans can be baled using a vertical or horizontal baler or specially manufactured can densifiers. Vertical balers can do the job, but look at the specifications extremely close. The stroke of the vertical baler must be of sufficient length to ensure proper compaction of the cans, otherwise the bale may fall apart when removed from the baler. A horizontal baler can produce a fine bale of aluminum cans and would be preferable over that of a vertical baler. The specially designed can densifiers produce a 35-45 lbs./cubic foot brick that allows efficient loading of a tractor trailer or railcar.

Trailer - Forty-five or forty-eight foot van type trailer. Trailer should be in clean and in good condition with swing out type doors.

Can Conveyor - Aluminum cans should run over a conveyor so that personnel can remove debris and contaminants. The cans are then fed into a hopper and carried up a conveyor belt. Cans move across a magnetic head pulley that efficiently removes any steel cans and diverts them into a separate container from the aluminum cans.

Glass

Glass containers are 100% recyclable. The grades of glass include the following:

- Clear (flint)
- Brown (amber)
- Green (emerald)
- Mixed Colors

The contamination issues for glass are straight forward. If colors are not kept separated, there may not be as strong a market for the materials. In addition, other contaminants that can cause problems marketing glass include ceramics, mirrors, rocks, cement, metals, window or plate glass, light bulbs or tubes, cookware, drinking glasses, automotive glass, and medical waste glass. Glass must also be kept away from paper and corrugated boxes because broken glass can get imbedded into the paper and cause quality control problems at the paper mill.

Glass is best handled as a bulk material, hauled in the largest loads possible. Typically that means storing glass in large outdoor bunkers (on a concrete pad) until at least 20 or so tons are accumulated. The most efficient transport is then with an aggregate dump trailer, most often used for handling rock and gravel.

A bunker system is a good investment for any community that handles its own glass. A front end loader is usually also necessary for the loading of glass over the high tops of the dump trailers.

Paper

Paper products including old newsprint (ONP), old corrugated cardboard (OCC), sorted office paper (SOP) and mixed office paper is most often baled. Each buyer of recovered fiber may have individual requirements for bale weights and dimensions or quantity accepted in a tractor-trailer.

Quality control is very important in processing most papers for recycling. Generally the buyer of paper fiber will be interested in the baled weight, moisture content, and contaminants.

Moisture content is generally limited to 10% or less. Special equipment is available to check moisture content, but the buyer will generally determine the need for such testing. Since paper is most often bought by the ton, high moisture content would mean that the buyer is paying too much for a load of wet paper.

Contamination is also a serious issue with paper processing. Contaminants to paper are known as outthrows and prohibitive materials. Outthrows are usually paper of a different type, a small percentage of which may be acceptable. It all depends on the grade of paper you are attempting to generate. Outthrows are limited to 2% contamination. Prohibitive materials are usually non-paper items such as metals, plastics, glass, and dirt. Prohibitive materials are often limited to .5% contamination. Sunlight and rain can degrade baled paper stored outside.

Plastic

When collecting and processing PETE and HDPE plastic bottles, several contamination issues need to be considered. These are incompatible resin types, dirt, pumps, hazardous products, and incompatible grades.

An example of incompatible types would be PVC in a PETE line. Although both containers are

similar in look, they are definitely not compatible. When PETE is being melted down for production of pellets or fiber, any PVC in the batch can cause major problems with equipment since PVC melts at a different temperature than PETE. Learn what comes in PVC containers and make sure they do not mix with PETE being baled. Examples of PVC containers may include translucent pharmaceutical bottles, imported mineral water bottles, salad dressing bottles, and cooking oil bottles. Check the code on the bottom of the container. PVC bottles are marked with a "3."

Contamination such as dirt and trash and caps, lids, and pumps are items that need to be monitored during the processing of plastics. Contact the buyer to see what contamination levels they can live with and work to keep it at or under that level. Often this is an educational process with the consumers who are recycling these products. They need to be taught what is acceptable and what needs to be thrown away. Depending on the facility, these contaminants will often be left behind on the conveyor after all other plastics are picked off. The exception would be when the caps, lids, and pumps are not removed from the container prior to recycling, which then requires the recycler to remove these items which slows down the process. Don't store baled plastics directly on the ground since dirt and rocks will lodge in the bales and become a contamination issue.

Contamination because of incompatible grades is generally limited to HDPE plastics. An example is HDPE milk jugs and HDPE ice cream containers. Both are marked HDPE on the bottom of the container, but are not compatible grades and should not be baled together.

The reason is HDPE can be both blow molded into bottles and injection molded into tubs. The two resins are different in their melt flow index. This can get complicated, so the easiest thing to remember is only accept plastic bottles and not plastic tubs. Incompatible grades can also apply to the color of the plastics depending on the end-use of the material. This color sorting can impact the price you'll receive for your plastic bales. PET is mostly clear, but there is more and more colored PETE coming on the market and the trend is for increasing amounts of colored PETE.

HDPE comes in numerous colors. The highest grade of HDPE is the non-pigmented (opaque) plastic. It also brings the highest dollar value of the HDPE plastics. HDPE that is white, blue, green, red, or any other color is considered pigmented HDPE and carries with it less value. Color sorting the materials will bring a higher value for the bale, while a mixed bale of sorted color is of least value. Check with the buyer before getting started.

PETE PLASTIC (#1) PROCESSING

PETE - Polyethylene Terephthalate PETE bottles consist of soda and custom plastic bottles including:

- clear and green soft drink bottles
- clear and green liquor bottles
- some cooking oil containers
- some coffee containers
- some small water containers

Approximately 25 cubic yards (16 Gaylord boxes) of PET bottles will equal an 800-pound bale of plastics.

Bales must be:

- clean and dry
- secured with 10 gauge galvanized baling wire
- stored out of the sunlight and weather
- loaded, shipped, handled, and stored maintaining integrity
- dense (at least 10 lbs. per cubic foot)
- a standard size

When loading tractor trailers for shipment remember:

- stack bales properly to facilitate unloading
- load 40,000 lbs., smaller loads with pre-approval
- note trailer number on Bill of Lading
- truck driver must sign the B.O.L.
- inform buyer of the approximate load weight to avoid freight chargebacks

Unacceptable Bales

All bales of material must not exceed 2% contamination. Contamination in this case includes all of the following:

- any PVC bottles
- any other type of plastic (HDPE, LDPE, PP, PS)
- other PET plastic that is not specified above, i.e. scoops, tubs, etc.
- material that has deteriorated due to sunlight
- dirt and mud
- stones, grease, and glass
- excessive paper
- free flowing moisture (i.e. motor oil, cooking oil, water, detergent, or any other liquid)
- any bales that cannot be processed
- bottles of hazardous material or residue
- bottles that contained pesticides or herbicides
- medical waste

HDPE PLASTIC (#2) - Natural Colored Bottle Processing

HDPE - High Density Polyethylene - Natural Colored Bottles

HDPE natural bottles consist of post-consumer, blow molded, translucent bottles with necks.

This grade of plastic consists of:

- milk containers (natural)
- some juice containers
- some water containers

Bottles should be rinsed with caps or closures removed.

Approximately 40 cubic yards (25 Gaylord boxes) of HDPE bottles will equal an 800-pound bale of plastics.

Bales must be:

- clean and dry
- secured with 10 gauge galvanized baling wire
- stored out of the sunlight and weather
- loaded, shipped, handled, and stored maintaining integrity
- dense (at least 10 lbs. per cubic foot)
- a standard size

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Unacceptable Bales

All bales of material must not exceed 2% contamination. Contamination in this case includes all of the following:

- any other type of plastic (PETE, PVC, LDPE, PP, PS)
- other HDPE plastic that is not specified above, i.e. detergent bottles, tubs, etc.
- material that has deteriorated due to sunlight
- dirt and mud
- stones, grease, and glass
- excessive paper
- free flowing moisture (i.e. motor oil, cooking oil, water, detergent, or any other liquid)

- any bales that cannot be processed
- bottles of hazardous material or residue
- bottles that contained pesticides or herbicides
- medical waste

HDPE PLASTIC (#2) - Mixed Colored Bottle Processing

HDPE - High Density Polyethylene - Mixed Colored Bottles

HDPE pigmented bottles consist of post-consumer, blow molded, bottles with necks.

This grade of plastic consists of:

- detergent bottles
- some juice containers
- pigmented milk containers (yellow or white)
- some shampoo bottles
- well-drained motor oil bottles

Bales must be:

- clean and dry
- secured with 10 gauge galvanized baling wire
- stored out of the sunlight and weather
- loaded, shipped, handled, and stored maintaining integrity
- dense (at least 10 lbs. per cubic foot)
- a standard size

When loading tractor trailers for shipment remember:

- stack bales properly to facilitate unloading
- load 40,000 lbs., smaller loads with pre-approval
- note trailer number on Bill of Lading
- truck driver must sign the B.O.L.

Unacceptable Bales

All bales of material must not exceed 2% contamination. Contamination in this case includes all of the following:

- any other type of plastic (PETE, PVC, LDPE, PP, PS)
- other HDPE plastic that is not specified above, i.e. tubs, etc.
- material that has deteriorated due to sunlight
- dirt and mud
- stones, grease, and glass

- excessive paper
- free flowing moisture (i.e. motor oil, cooking oil, water, detergent, or any other liquid)
- any bales that cannot be processed
- bottles of hazardous material or residue
- bottles that contained pesticides or herbicides
- medical waste

Equipment for Processing Plastics

Several pieces of equipment may be necessary for processing plastics:

- Plastic Perforator/Flattener - This piece of equipment will simultaneously perforate and flatten containers. This can be important since it will often reduce the time it takes to bale plastics and improves the integrity of the baled plastic. It improves the baled plastic because the bale no longer contains any appreciable amount of trapped air in the containers. This can be important on a hot day when those bottles that are not perforated begin to expand from the hot air trapped inside putting additional pressure on the bale wire. If sufficient size or quantity of bale wire is not used, the bottles can expand to the point that the bale breaks open.
- Baler - PETE and HDPE bottles should be baled in a horizontal baler if possible. Horizontal balers will do the best job and should be considered strongly if you can afford the cost. Vertical or downstroke balers can do the job, but you'll need to look at the specifications on the baler very carefully. The stroke of the vertical baler must be of sufficient length to ensure proper compaction of the plastic bottles in order to get a sufficient bale weight. If a vertical baler must be used for plastics, acquire one that has at least 90,000 psi platen pressure to ensure plastic bales of 650 pounds or greater. A horizontal baler can easily provide bales in excess of 700 pounds or larger, which is what brokers and end-users prefer.

Several things to keep in mind while baling plastics include how much plastic is needed to make a bale, how much bale wire is needed per bale, where can baled plastics be stored, and how much plastic is needed for a typical truck load.

It takes 15 cubic yards of plastics to make a 700-pound bale. Typically, 22 Gaylord boxes (3' X 3' X 4') of uncrushed plastic bottles will produce a 700-pound bale. These numbers will change some since PETE and HDPE are of a different weight.

It will take a minimum of 6 bale wires per bale of plastic. The bale wire should be 10-gauge to reduce the chances of the wire breaking. Double up on 12-gauge wire if 10-gauge is unavailable.

Plastic bottles will degrade while unprotected outside. The following is the maximum time to leave bales of plastics outside in the weather and sunlight:

- PETE - 6 months
- HDPE - 1 month

- PVC - 6 months
- LDPE - 1 month
- PP - 1 month
- PS - 6 months

The typical truck load of plastics will be around 40,000 pounds. It is important that the baler can produce bales of at least 600 pounds or greater due to the limited number of bales that can be placed on a tractor trailer. If additional capacity is needed, request a 53-foot trailer. Density of bales is very critical. The target is 10 to 15 pounds per cubic foot.

Steel

Steel containers and cans generally include food containers, aerosol containers, and paint cans. Steel containers and cans are typically flattened, then baled or compressed into biscuits. It is very important that steel containers and cans be free of any contaminants before further processing.

Steel mills are generally tolerant of small levels of foreign matter, but processors should guard against contaminants as much as possible. Contaminants to steel containers and cans include liquids (paint and other residues), dirt, mud, plastics, and other debris. Paper labels and plastic nozzles from aerosol containers are not much of a concern since they are burned off in the extreme high temperatures of the steel furnace. Paint cans that have a thin skin of dry paint on the sides and bottom is acceptable, as is the paper label. Processed steel containers and cans should be free of other ferrous scrap metal.

The processing of steel containers and cans for recycling will generally require the purchasing of some of the following equipment:

Can Sorter - Often times steel cans are collected commingled with aluminum cans and should therefore be run through a can sorter. The cans are fed into a hopper and carried up a conveyor belt. Cans are carried past a magnetic device that efficiently removes the steel cans from the aluminum cans and puts them into a separate container from the aluminum cans.

Can Handler Basket - These are generally round steel-framed units with nylon netting to contain the steel containers and cans. They can generally be purchased with small wheels so they can be rolled from the can sorter to the scales and then to the baler.

Scales - Scales are a necessity if the facility will be paying out money to individuals bringing cans in for sale. Scales that measure up to 1,000 lbs. is the recommended minimum.

Baler - Steel containers and cans should be baled in either a vertical or horizontal baler. Vertical

balers can do the job but the specification on the baler will need to be carefully reviewed. The stroke of the baler must be of sufficient length to ensure proper compaction of the containers and cans, otherwise the bale may fall apart when removed from the baler. A horizontal baler can produce a fine bale of steel containers and is the recommended equipment for this activity. Local markets for steel will general accept the material either whole, loose, flattened, or baled, so exact specifications are not required. Marketing steel materials directly to the steel industry is a different matter and may require specific bale sizes and weight.

Recycling 103: Equipment

The equipment needed for a recycling program varies greatly from one town to another. The information listed below overviews many of the more common pieces. The prices listed are provided for comparison only and should not be used for developing quotes or grant applications. Please contact vendors specifically for actual quotes.

Mississippi also maintains a directory of Recycling Container and Trailer Manufacturers: deq.state.ms.us/MDEQ.nsf/page/Recycling_RecyclingContainerTrailerManufacturersWebsites

Eighteen-gallon curbside recycle bins

- These bins average \$7.50 each.
- Weekly collection needed to prevent overflow and keep participation rate high.
- Will typically not hold a household's weekly recycling supply, so many times two bins per household are necessary.

Sixty-five-gallon capacity rolling carts

- These containers average \$45.00 each.
- Some, but not all, are designed for use in automated collection systems.
- Can be used in drop-off situations and collection of material from commercial or institutional sources, as well as residential.

Ninety-five-gallon carts

- These bins often cost \$65.00 each and are the largest size of roll carts.
- Some, but not all, are designed for use in automated collection systems.
- Can be used in drop-off situations and collection of material from commercial or institutional sources, as well as residential.

Six-yard-dumpsters

- Average about \$800.00 each.
- Need a front load compactor truck to empty.

Eight-yard-dumpsters

- These containers cost around \$1,000.00 each.
- Need a front load compactor truck to empty.
- Some programs choose to lease rather than buy this type of equipment.
- Communities often rely on open top or side open 8-yard collection dumpsters to collect sorted material.

- If these containers are used for collecting cardboard, boxes must be properly broken down to avoid overflow

Forty-yard roll-off containers

- These containers can often be compartmentalized to accept multiple types of materials.
- Many programs choose to lease rather than buy this type of equipment.

Forklifts

- Sell for the high \$20,000 range, but usually there is a good market for used forklifts that cost less.
- Programs that use Gaylord containers or other containers on pallets should have a forklift or a pallet jack.
- Forklifts can use different fuels or electric power depending where they are used. Typically, electric or propane driven forklifts are best for indoor uses.

Bobcat steer loaders

- These generally sell for something like \$38,000.
- Can be fitted with forklift blades and other front attachments that allow covering different material handling needs

Gaylords

- These boxes generally sell for \$5.00 to \$7.00.
- A Gaylord box is 48" x 40" x 36" and fits neatly on a standard pallet.
- In covered facilities, these large, reusable cardboard boxes can be an effective and inexpensive collection tool.

Trailers

- Trailers vary in price, often between \$5,000 and \$25,000 a piece.
- Recycling trailers are available in a variety of styles and sizes, including basic bin style, removable multiple bins, and hydraulic compaction trailers.
- Facilities who manage their own sorting floor often use compartmentalized trailers that can be hauled by a pick-up truck with a standard hitch.
- Trailers often work well for special event recycling.

Vertical balers

- These balers often sell in the \$11,000 - \$12,000 range. Look for good used models for less.
- Vertical balers are most often used for easily compactable materials such as cardboard.
- Sometimes, paper dealers will set balers at no cost at a recycling facility in exchange for the discounted cardboard or other materials. If you have no means to buy a baler, it is a good idea to check with local processors.

Horizontal balers

- These balers often sell in the \$30,000 - \$75,000 range.
- Programs that plan to bale plastics often need the compaction ability of a horizontal baler.
- More advanced versions, including auto-tie single-ram balers, often range from \$100,000 - \$200,000.

Feed conveyors for balers

- from \$18,000 - \$30,000

Simple single-stream systems without the baler

- This system often costs programs something in the range of \$1.8 million.
- Approved for low-volume rated equipment only.

Complete glass crushing systems

- The equipment for this process often costs near \$160,000. Smaller systems can be quite a bit cheaper, but will deliver a less-quality product.

Platform scale

- These small scales generally run \$1,500 to \$3,000.
- They are appropriate for weighing bales and Gaylord containers of materials.

Drive-over truck scales

- These scales often cost \$23,000 – \$29,000, not including installation.