The Recycling Process after Collection

At the time the Oregon Recycling Opportunity Act was passed in the 1983 legislature (ORS 459a), it was hailed as the most comprehensive statewide solid waste & recycling management system. Effective in 1986, the law resulted in most cities over 4,000 population offering curbside recycling of glass, tin, cardboard, newspaper, aluminum, scrap metal, and motor oil to residents. In addition to curbside programs, "self hauling" to public landfills, transfer stations, and drop-off centers became another option, especially in rural areas where curbside programs are not economically viable.

Ever wonder what happens to your materials once they have been picked up or dropped off? Because recyclables are often placed onto garbage trucks or dropped off at the landfill, people sometimes doubt that they are really getting reprocessed rather than buried. However, the recycling industry has grown and advanced a great deal since its early roots in the 1970s. This means that the specific route for reprocessing depends on the material in question, but there are some common threads. The common factors have to do with words like collector and hauler, virgin material costs, resale markets, market distance, transportation and energy costs.

After reading about how materials are processed and recycled, hopefully you will have a better understanding of how recycling conserves natural resources, saves energy and water, reduces pollution. Moreover, you may come to see that your role as a recycler is critical in keeping unnecessary materials out of the landfill so they remain in the markets of usable products that contribute to our economy. The process of collecting and re-manufacturing recyclable materials, outlined here, is only part of recycling, however. Buying and using a recycled product completes the circle. Look for the recycled label on the products you buy, and ask your store manager to stock recycled products and products made of recycled materials.

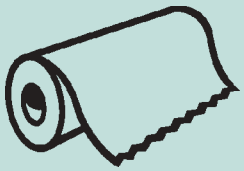
Newspaper

What's black and white and read over and over? Recycled newspaper.

Paper that is collected for recycling is usually sold in large quantities to a paper dealer, who, because of the volume of material purchased, often operates out of a storage warehouse. The dealer then sells quantities of paper to an end user. An end user is the business where the actual recycling--manufacturing one product into a new product--takes place. To make recycled paper, mills must be concerned about both quality (cleanliness, type of paper) and quantity of the supply, therefore, they usually issue purchasing contracts to dealers rather than buying small amounts of paper from the public. This also explains why your local collector asks that paper be sorted a certain way and free from contamination such as food or paint, for example.

At the paper mill, de-inking facilities separate ink from the newspaper fibers through a chemical washing process. A slusher turns the old paper

into pulp, and detergent dissolves and carries the ink away. Next, screens remove contaminants like bits of tape or dirt. The remaining pulp is mixed with additional pulp from wood chips to strengthen it and may be bleached depending on its intended use. The watery mixture is poured onto a wire, a continuously moving belt screen that allows excess moisture to drain through. By the time the mixtures gets to the end of the belt, it's solid enough to be lifted off and fed through steam-heated rollers which further dry and flatten it into a continuous sheet of paper. This paper machine produces finished newsprint at the rate of 3,000 feet per minute.



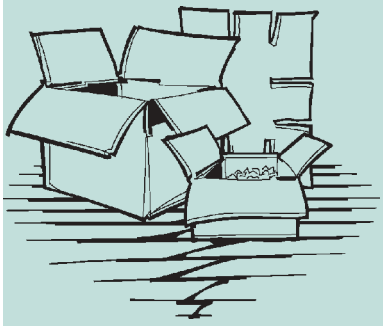
Finally the newsprint is trimmed, rolled, and sent to printing plants to be imprinted with tomorrow's news. Recycling paper requires less energy to break down the paper fibers than manufacturing wood into paper fibers. It also creates 95% less air pollution because there is less energy and chemicals needed to produce the final product.

The SP Newsprint (Newberg) and Blue Heron (Oregon City) mills are the major end-users of old newspaper in Oregon. Together they process close to 900 tons every day. This is equivalent to a stack of newspaper 9.5 miles high, and nearly 2.5 times the amount of newsprint printed and sold in this state each day. Even though Oregonians recycle nearly twice as much newspaper compared to other states (close to 70%), the mills must depend on old newspaper shipped to them from other states as well, in order to maintain their inventory. This is because Oregon produces about 5% of the nation's paper.

Some Oregon companies use old newspapers to make other products, too. For example, Western Pulp located in Albany, uses old newsprint for manufacturing molded flowerpots and Armstrong in St. Helens makes ceiling tiles. Additionally, Greenstone of Portland manufactures cellulose insulation, and Smurfit mills in Philomath and Sweethome make a building product called Cladwood. Paper brokers may also sell old newspaper to overseas markets. In this case, the paper sometimes is reused (rather than remanufactured) as wrapping paper.

Cardboard

What is cardboard? If you answered a brown box, you're only partly correct. There are actually two types of packaging materials made from paper. The first type is brown boxes or corrugated cardboard, also known as just corrugated. Look closely at a box and you will see that it is composed of a sandwich of linerboard (the two outer layers) and the medium (the ribbed inner layer).



The second type is the stiff gray colored packaging that your cereal and shoeboxes come in which is called "boxboard" or "grayboard". The gray color is from left over ink during the recycling process. Grayboard is not manufactured in Oregon. Grayboard should not be recycled with cardboard boxes because it contaminates the process. However, it may be included in mixed scrap paper collection, if your program collects these materials.

Notice that residents generate grayboard after the product has been used, but generally do not have large quantities of cardboard. On the other hand, businesses generate most of the cardboard waste because it used to ship and receive the products they sell. Like homeowners, stores usually have their garbage hauler or recycling service collect their cardboard 1) because it accrues in large quantities, 2) because it is a valuable material, and 3) because it would cost a lot to pay for its disposal. Once collected, it is sold to a dealer or broker, who collects and guarantees quantities of a material to end-users. In most cases, the end user is a paper mill.

At the mill, the corrugated is pulped and blended with additional pulp from wood chips. Every time old fibers are recycled, they get shorter and weaker, so they are often blended with the new pulp depending on what the final use of the paper will be. For strong boxes, the fibers need to be longer. Mills will manufacture both the linerboard and the medium, then the medium and the linerboard rolls are shipped to a box plant, where the manufacturing process is finished. The medium is corrugated or fluted by specially geared machines, the linerboards are glued on, and the resulting flat pieces, called mats, are trimmed to size and creased along a pattern of folds. The mats are shipped flat to customers who set them up into boxes.

Oregon has four major cardboard recycling plants: Weyerhaeuser in North Bend makes medium, and their Springfield plant makes linerboard; Willamette Industries in Albany makes just the linerboard. Georgia-Pacific in Toledo makes both medium and linerboard. The latter two plants also make recycled paper for brown grocery bags, also called Kraft paper.

Glass

The most commonly recycled types of glass are bottles and jars. Other types of glass such as Pyrex bowls, window glass, mirrors and light bulbs are made using special processes and have special physical properties. These items should not be mixed with other glass recyclables. Also, each on-route collector has a limited amount of space on the vehicle, so it isn't feasible to pick up every type of glass at the curb.

Glass bottles and jars that are empty and rinsed clean should be placed at curbside. Most recycling collectors ask people not to break the containers for safety purposes, although an on-route collector may break them with a machine to make more room in the vehicle. Likewise, at collection depots, it is generally preferred to keep glass in tact for safety reasons.

Clear glass has a higher market value than other colors, therefore, some collectors ask that you sort the glass into green, brown and clear colors. Others allow mixing of all colors and accept the lower market resale value for the materials. After the collector accumulates a quantity of a particular color or mix, they may sell it to a dealer or broker or directly to a glass plant.

At the plant, a mechanical processing system breaks the glass into small pieces called "cullet". Magnets, screens and vacuum systems separate out metals, labels, bits of plastic, metal rings and caps. The cullet then is blended in measured amounts with silica sand, soda ash, and limestone, and placed in a furnace which melts it into molten glass at a temperature of around 2,500 degrees Fahrenheit. Because manufacturing virgin glass requires a temperature of about 2,700 degrees, recycling glass is slightly less energy intensive.

Separated colored glass is purchased by Owens-Brockway in Portland, where it is remade into clear, green and amber bottles. A small amount of container glass also goes to Bullseye Glass, Portland, for manufacturing stained glass. Colored glass that has been mixed together goes to Strategic Materials in Portland where it is sold to out of state buyers for containers, fiberglass and road aggregate.

The Oregon Bottle Bill was enacted in 1971, making Oregon first in the nation with a statewide beverage deposit system for glass and aluminum containers. The consumer pays a deposit when the container is purchased. When it is empty, the consumer may return it to any store that carries that product, exchanging the container for a refund. This creates an incentive for people to keep deposit containers out of the trash and from littering the roadways. In fact, 90% of the Bottle Bill containers are returned for recycling.

In the past, companies offered refillable bottles that were used as much as eight or ten times before being recycled, which is a far more energy efficient method of dealing with this material than recycling alone. Unfortunately, the majority of the bottles collected today are no longer refilled before being recycled.

Tin cans

Tin is an excellent example of quality vs. quantity. Even though it's used in minute amounts, tin is essential in producing a variety of everyday items, including "tin" cans. While the cans originally were called "tinned" cans, the term was shortened to "tin" over the years. The term "tinned" is more accurate, because the cans aren't made of tin. At least not much. One ton of tin cans contain about 1,995 pounds of steel and only five pounds of tin. Yet that thin coating of tin on a steel can is essential: it helps solder the sideseam; keeps the can from rusting; and protects its contents.

Your local collector may ask you to remove the ends and flatten the cans. This allows more to be loaded into the truck, thus saving the time and fuel (and air pollution) it would take to drive the truck to the storage facility, unload it and resume collection. And since costs of shipping the cans to detinning plants also are determined by truckload, loads of compacted, flattened cans are more economical to ship.

Once collected the cans may now go through a metal dealer or directly to a detinning plant. The majority of processors in the U.S. are located in the

Midwest or in the Northeast. Once at the detinning plant, detinning solution flows around the cans (and cans with the ends removed allow more contact of the solution, which results in better recovery of the tin during the reclaiming process). In the batch process of detinning, the cans first are loaded into large perforated steel drums and dipped into a caustic chemical solution that dissolves the tin from the steel. The now detinned steel cans are drained, rinsed, and baled into 400-lb. squares. Now they are ready to be sold to steel mills and made into new products.

Meanwhile, the liquid with the tin, a salt solution called sodium stannate, is filtered to remove scraps of paper and garbage. Next, electricity is applied which makes tin form onto a plate in the solution. Finally, the tin is melted off and cast into ingots. The ingots are at least 99.98% pure tin and are used in the chemical and pharmaceutical industries. Pure tin also is alloyed with other metals to make solder, babbitt, pewter, and bronze products. Currently, tin is made of about 30% recycled material.

Aluminum

Did you know there are no North American sources of aluminum (bauxite) ore? The ore comes from tropical or subtropical countries such as Australia, Jamaica, and Indonesia. However, forty percent of U.S. primary aluminum production (smelting) takes place in Oregon, Washington and Montana. (Smelting turns the bauxite into the usable metal). Production and use of aluminum is higher in the U.S. than any other country.

Aluminum takes many forms because it has many uses. For example, everything from beverage cans to TV dinner trays to door frames can be molded from this flexible, lightweight metal. It's also rolled and made into foil (often inaccurately called "tinfoil"). It's all aluminum, and it's all recyclable through the process known as secondary aluminum smelting. Beverage cans alone make up 50% of all the aluminum scrap that is collected for recycling (64 billion cans were collected in 1998 in the United States). And by recycling aluminum, we save more energy over virgin production (95%), than by recycling any other type of material. And like glass, aluminum can be made from aluminum over and over again, skipping the natural resource step, which reduces pollution and helps preserve natural habitat.

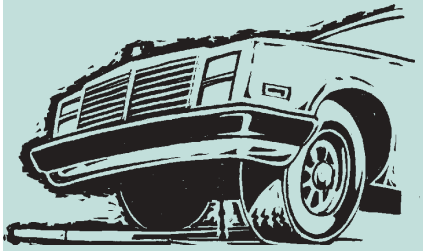
In Oregon, aluminum beer and soft drink cans are included in the Bottle Bill, and may be exchanged for deposit at the store. In fact, 90% of the Bottle Bill containers are returned for recycling. Once collected, the cans follow the same route to re-manufacturing as cans collected at curbside or swing sets collected from depots. Before being recycled, aluminum may be bought and sold several times by various recyclers or metal brokers. Its route, and whether it is sold domestically or abroad, depends on such business conditions such as cost of transportation, supply, and demand.

But eventually all aluminum reaches a producer or smelter, where it may be shredded or ground into small chips before being melted and cast into

ingots. The ingots are sent on to manufacturing plants where they are rolled into sheets of aluminum and used to manufacture end products ranging from cans to castings to car bodies. The major markets for shredded aluminum are overseas end users and domestic smelters.

Nearly every large city in Oregon has several companies that collect and sell scrap metal to Schnitzer Steel Products, Acme Trading & Supply, Metro metals and Calbag Metals, the major scrap metal dealers who are located in Portland. They in turn, ship aluminum to Alcoa-Reynolds, the world's largest aluminum smelter or other secondary smelters located around the U.S.

Scrap Metal



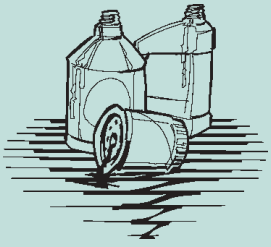
Did you know that scrap metal has the highest recycling rate of all materials currently being recycled in the U.S.?

Scrap metal collection includes, steel or "tin" cans, appliances, cars, and construction materials. Although consumers have nothing to do with it, almost every car ends up being recycled eventually, as do many old appliances left at junkyards, landfills or recycling depots. Most local collection programs will accept small pieces of metal (less than 2 feet long), so don't forget to include your wire, hangars, aerosol cans, old pipes or other metals from around your house.

Because steel is by far, the most common metal that people come in contact with besides aluminum, its recycling process is highlighted in this section. Like aluminum, steel is made from iron ore, so recycling steel saves a lot of energy and conserves natural resources. However, unlike aluminum, iron ore is mined domestically in Pennsylvania, Michigan, Minnesota, and Canada, as well as globally. There are two processes for making steel. The Basic Oxygen Furnace process, which is used to produce the steel needed for packaging, car bodies, appliances and steel framing, uses a minimum of 25% recycled steel. The Electric Arc Furnace process, which is used to produce steel shapes such as railroad ties and bridge spans, uses virtually 100% recycled steel.

As with aluminum, scrap metal is purchased by a variety of brokers or recycling companies and ultimately delivered to a smelter where it is melted into ingots and cast into new metal products. There are two large smelters in Oregon, Cascade Steel Rolling Mill in McMinnville and Oregon Steel in Portland.

Motor Oil



Did you know that Oregon has the most comprehensive curbside collection program for used motor oil of any state? And putting your used motor oil at curbside or leaving it at a recycling drop-off depot makes sense, environmentally and economically. Recycling motor oil keeps it out of storm sewers, where it can pollute our waterways, and unlike virgin crude oil, re-

refined oil is a renewable resource! The process of re-refining oil uses less energy to produce a gallon of oil than the traditional method of refining crude oil. In fact, it only takes 1/3 the amount of energy to re-refine oil as compared to refining virgin oil. Recycling also ensures that it's readily available, even in times of international political crises.

Collectors ask that you place the motor oil at curbside or the depot in a clean, non-breakable bottle with a lid. That way the bottle can be transported safely and easily. After it's picked up, the collector usually takes the oil back to the shop and pours it into one of a number of tanks or drums for storage. When the drums are full of oil, an independent hauler pumps them out into a special collection truck and delivers the load to an oil processor.

The five major processors in Oregon are: Harbor Oil and Sunwest Energy, located in Portland; Industrial Oils in Klamath Falls; and Inman Oil in Vancouver, Washington. The processor must first test the oil, using standards established by the federal Environmental Protection Agency (EPA) to detect contaminates such as hazardous waste and lead. Then any water that may be mixed with the oil is eliminated, either through a settling process or by being heated and boiled off. After it is tested once again, the used oil is blended with other grades of oil. Used oil that meets EPA testing standards for flashpoint and heavy metals is called specification fuel. This type of oil is considered environmentally safe to burn in any boiler, but because of the high ash-forming components of used oil, boilers designed for easy ash removal are recommended.

One role for used oil today is to help lighten bunker fuel, the heavy residue left from virgin oil refining. Bunker fuel often is used in ships' boilers, even though it becomes thick enough to be walked on when cold. Without the lighter-weight used motor oil, bunker fuel would hardly flow through the pipes when temperatures drop. Used oil is also burned for energy in asphalt plants, cement kilns, large mills and other industrial users.

As recently as two decades ago, most used oil was re-refined into new lubricating oil for cars and trucks. Unfortunately, only a tiny fraction of the oil recycled in Oregon is resold as automotive oil, and only five percent of the oil is re-refined into oil for lubricating chain saws and machinery. However, there are some big customers helping build the demand for re-refined oil, including: Coca-Cola, UPS, US Postal Service, Frito-Lay, Cal Trans, the City of San Francisco. Mercedes Benz now puts re-refined oil in every new passenger vehicle they manufacture!

Increasing the demand seems to be working. Today, Unocal, Chevron, ARCO, Texaco and Safety-Kleen have all become involved in re-refining. Look for Unocal and Safety-Kleen's re-refined oil available in automotive stores.