Chapter 1: Overview

Why Focus on Solid Waste?

This course focuses on solid waste because what we throw away says a great deal about how we use the earth's resources. Looking at the impacts of our consumption and disposal of things allows us to consider the larger issues of environmental sustainability through the lens of everyday living.

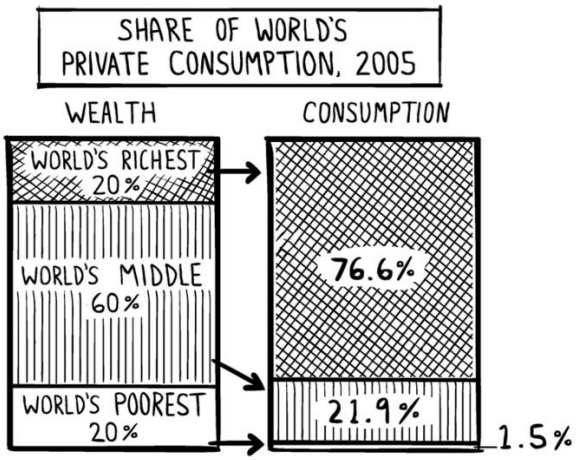
Solid waste is tangible, so we can use it to track our individual and societal progress of generating less solid waste, lessening our negative environmental impact, and using our resources more wisely. Oregon's Department of Environmental Quality (DEQ) measures how much solid waste is generated each year and where it comes from. The DEQ conducts periodic waste composition studies to determine exactly what we're throwing away—how much yard debris, food, plastic, glass, and other items are in our trash.

Solid waste gives us a visual way to think about resource use, garbage piles up, smells, and demands to be taken care of. It can't be ignored for long. And because solid waste is what is left after we've used up what we wanted, it can serve as a decent indicator of how much material we are going through. Looking at what is left over tells us something about what we have consumed. Tracking how much raw material is mined, cut, and drilled each year is difficult, particularly at the state or local level, but we can know how much material we put into our landfills, send to waste-to-energy plants, and recycle annually.

As we develop our understanding of waste management further, you will see that waste management is not simply "garbage," but much more. Current trends involve a different understanding of waste, such as "sustainable materials management" and "life-cycle thinking." Sustainable materials management involves using or reusing materials in the most productive and sustainable way across their entire life cycle. This approach reduces waste, conserves resources, and lessens the impact that materials have on the environment. Oregon has been in the foreground in this field, which you can read more about here[1]. Tillamook County's Comprehensive Materials and Solid Waste Management Plan, which was approved by the Board of County Commissioners in December 2012, set the stage for the Tillamook County Wasteshed to operate in this mindset as well.

Are you ready to dig in and get started? Let's begin by looking at where our things come from and where they go when we're finished using them. We'll look at how much solid waste we generate annually and the sources of the most common items in our waste stream. We'll take a brief look at the history of garbage and the birth of garbage dumps. Then our discussion will shift to the legal framework for waste management in Oregon, including how we currently manage residential and commercial waste, what our waste consists of, and where it is generated.

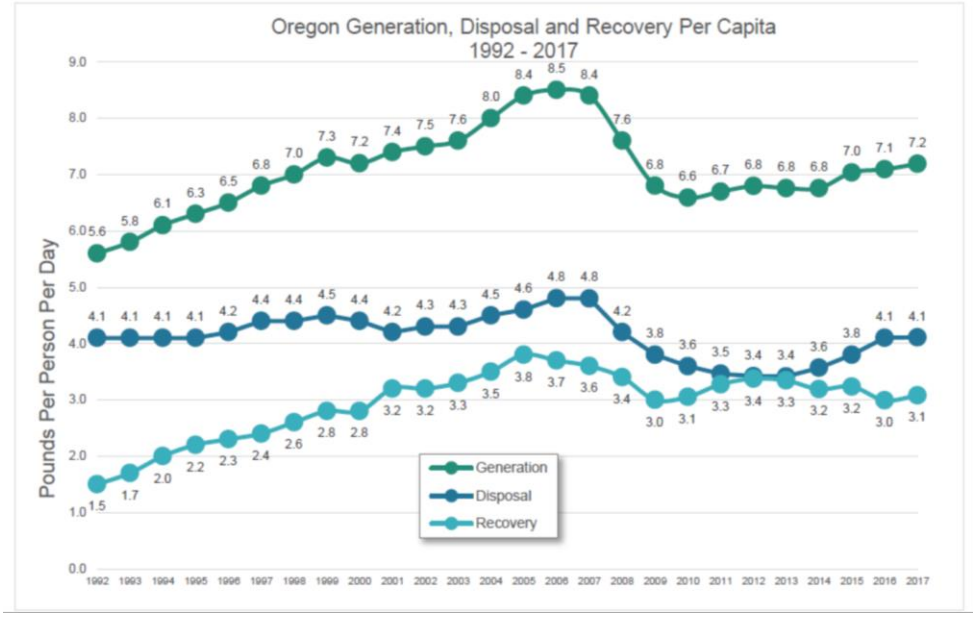
When it comes to trash, the United States is at the top of the heap[2]. According to data from the Organization for Economic Cooperation and Development, in 2010, Americans threw away 220,410 tons of garbage, for an average of nearly 4.5 pounds of waste per day. Oregonians generated 7.6 pounds of waste that same year, according to the Oregon Department of Environmental Quality (DEQ). This doesn't necessarily mean Oregonians are more wasteful; it largely represents a difference in the items included in the calculations. For example, the DEQ includes construction and demolition waste, which the EPA does not.



According to the Global Footprint Network[3], the average North American uses 70 percent more of the world's resources than the average world citizen. The ecological footprint measures the human demand on nature and compares consumption of natural resources with the earth's ecological capacity to regenerate them.

According to the DEQ, Oregonians generated 5,434,333 tons of waste in 2017. This number includes more than just the waste we throw away at home; construction and demolition waste as well as wastes generated by businesses are also included in this figure. In Tillamook County, we threw away 2,088 pounds per person in 2017.

Per Capita Recycling, Disposal & Generation



In 2017 Oregon generated 3,106,688 tons of municipal post-consumer waste, an increase of nearly three percent over 2016. This equates to per-capita generation of 2,625 pounds per person (7.2 pounds per day), a 1.4 percent increase from 2,589 pounds per person (7.1 pounds per day) in 2016.

The full Oregon Material Recovery and Waste Generation Rates Report is available here[4].

Factoids:

- In the United States we use enough office paper each year to build a 10- foot-high wall that's 6,815 miles long, or two and a half times the distance from New York to Los Angeles.
- In 2004 Americans wasted 55 billion aluminum cans. That's enough to fill the Empire State Building 22 times.
- It's estimated that the average man, woman and child in America uses 500 plastic shopping bags a year.
- If you put all of the fluorescent tubes that we collected in 2012 and put them from end to end, they would stretch 170,394 feet which is over 32 miles in length.
- In 2005, Americans used an average of six wireless products in their day- to-day lives (up from an average of 3 in 1999) with over 30% of Americans using 8 or more.
- Plastic generation increased tenfold from 1960 to 2000.
- Only 4% of the natural resources that we use come from renewable resources![5]
- Americans purchased nearly 3 billion dry-cell batteries (alkaline, button cell and rechargeable) every year to power radios, toys, cell phones, watches, laptop computers, and portable power tools. In Tillamook County we recycled 1500 lbs. of batteries in 2013!

2017 DEQ Material Recovery and Waste Generation Summary TILLAMOOK COUNTY

CALCULATED RECOVERY RATE: 28.2% **GOAL (2025): 37%**

In 2017, Tillamook disposed of 27,325 tons of waste and recovered 10,721 tons of waste.

Year	1996	2006	2007	2009	2012	2013	2014	2015	2016	**2017**
Calculated	25.6%	33.4%	30.6%	29.1%	33.0%	31.9%	29.6%	28.9%	26.1%	**28.2%**
Credits*	-	0.0%	0.0%	0.0%	2.0%	4.0%	4.0%	4.0%	-	-
Total	25.6%	33.4%	30.6%	29.1%	35.0%	35.9%	33.6%	32.9%	26.1%	**28.2%**

*Credits were only available between the years of 1997 and 2015

Per capita waste disposal for wasteshed (pounds per person):
The average per-capita waste disposed in Oregon during 2017 was 1,500 pounds. Tillamook's per-capita waste disposal was 2,088 pounds. As shown in the following table, per-capita waste disposal in Tillamook has *increased* 23% since 2012 (five year change) and *increased* 4% since 2007 (ten year change).

Per capita waste recovery for wasteshed (pounds per person):
The average per-capita waste recovered in Oregon during 2017 was 1,124 pounds. Tillamook's per-capita waste recovery was 819 pounds. As shown in the following table, per-capita waste recovery in Tillamook has *decreased* 2% since 2012 (five year change) and *decreased* 7% since 2007 (ten year change).

Per capita waste generation for wasteshed (pounds per person):
Waste generation is the sum of disposal and recovery. It is a rough measure of the total discards in a wasteshed. In 2001, the Oregon Legislature established waste generation goals for the State; revised by the Legislature in 2015. The waste generation goals require that the generation of solid waste in the years 2025 to 2049 shall be 15% below the amount of solid waste generated in 2012, and for 2050 and beyond, the generation goal is 40% less than the waste generated in 2012.

The average per-capita waste generation in Oregon during 2017 was 2,625 pounds. Tillamook's per-capita waste generation was 2,907 pounds. As shown in the following table, per-capita waste generation in Tillamook has *increased* 14% since 2012 (five year change) and *increased* 0% since 2007 (ten year change).

Year	1996	2006	2007	2009	2012	2013	2014	2015	2016	**2017**
PER-CAPITA DISPOSED*	1,271	1,958	2,008	1,730	1,704	1,632	1,695	1,801	2,037	**2,088**
PER-CAPITA RECOVERED*	438	983	885	710	838	764	713	734	720	**819**
PER-CAPITA GENERATED*	1,709	2,941	2,893	2,439	2,542	2,397	2,407	2,534	2,757	**2,907**

*Pounds per person per year.

Regional Technical Assistant Contact:
Contact Daniel Hough at 503-229-5529 for assistance in identifying ways to help reduce waste generation and disposal through waste prevention, reuse, recycling, and composting.

Survey Coordinator:
Contact Michelle Shepperd by email, shepperd.michelle@deq.state.or.us, or in Portland at 503-229-6724, or toll free in Oregon at 1-800-452-4011 x6724, for more information on the survey.

NOTE: DEQ routinely updates recovery rates for prior years as we receive new information. These are the current corrected figures for all years.

What's in Oregon's Garbage?
Waste Composition - 2016

Paper 15.30%

Plastic 11.79%

Food 14.92%

Other Organics 50.61%

Wood 15.29%

Glass 2.32%

Yard Debris 2.4%

Metals 5.16%

Other Inorganics 13.62%

Hazardous Materials 0.43%

Source: https://www.oregon.gov/deq/mm/Pages/Waste-Composition-Study.aspx

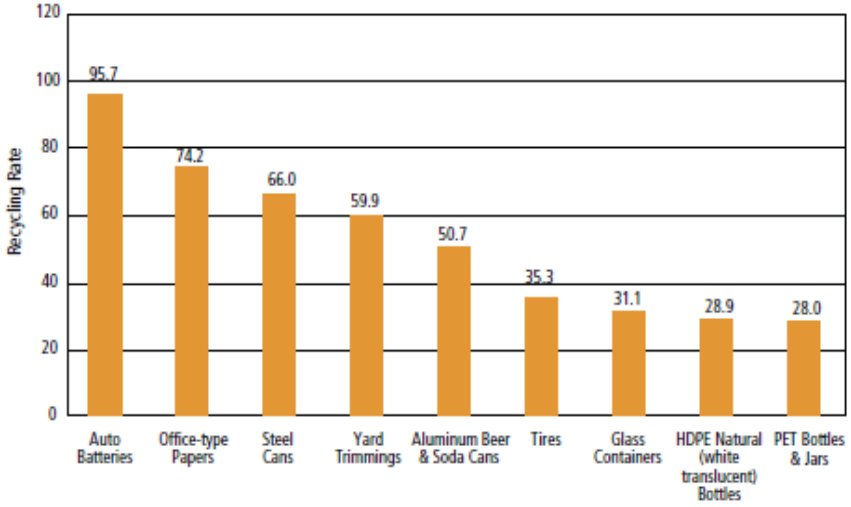
We don't need to be wasteful; we have an alternative. Households, businesses, community centers, places of worship, and the government can work together to better manage our natural resources by reducing, reusing, and recycling the materials we use every day. The choice is ours. We can preserve our resources or throw them away. And we make this choice every time we make a purchase, reuse or repair an item, and set things out for recycling and garbage collection.

When we use less and recycle more we help:

- Create jobs and increase U.S. competitiveness
- Ensure we have enough clean water
- Control pollution
- Protect nature for future generations
- Conserve forests, streams, and landscapes
- Save energy and reduce our dependence on foreign energy sources
- Reduce greenhouse gas emissions that fuel global warming
- Save money
- Feel good

The items we use every day do not just magically appear. They are made by processing raw materials into products. Even fresh, unprocessed food that is conventionally grown has chemical inputs. Let's look at where the biggest items in our waste stream come from and how their procurement impacts our natural systems.

Figure 3. Recycling Rates of Selected Products, 2009*



Food

In 2016, food was more than 14.92 percent of the waste going to Oregon's landfills—one of the largest components in our waste stream. Although food is plentiful and inexpensive in this country, it is not free of environmental costs. Two major trends have dominated the production of food in the past 40 years:

1. Food has become a globalized industry, and
2. There has been a shift from smaller family farms to corporate-run farms, with operations becoming bigger, more consolidated, and more mechanized each year.

These trends reflect a desire to lower the labor costs inherent in growing, harvesting, and processing our food. They also have increased the role of petrochemicals in the production of our food.

The Story of Stuff[6] project walks us through a product's lifecycle and shows the real impact each item we buy has on people and the environment. Watch an excerpt from one of their videos to learn more.

Large production-driven farms that use conventional farming practices consume enormous quantities of petrochemical-based fertilizers, as well as herbicides and pesticides, to keep pests and weeds at bay. Farm equipment requires fuel to plow, plant, and harvest crops. After harvest, crops are transported to facilities where they are sorted, graded, and processed. The finished products are then transported to wholesalers, retailers, and eventually to our homes.

Producing the chemicals and fossil fuels we use to grow, process, and transport our food generates air pollution and greenhouse gases. Water pollution is caused by the runoff of agricultural chemicals, and soil erosion often accompanies tilling the soil.

Growing large quantities of industrialized food crops impacts our natural systems. Approximately 20 percent of the land area of the United States is devoted to growing crops. Although cropland and pasture can support some wildlife, about one fourth of the threats to natural ecosystems and wildlife are related to agricultural use.

Growing food for humans uses approximately 30 percent of our water supply. Irrigating crops for animal feed takes another 18 percent. As the size of farming operations has grown, so have conflicts between water users. Large-scale irrigation projects have increased the amount of useable farmland in the American West, but recent court cases have pitted farmers against endangered species and recreational users.

Large meat and poultry operations also have a tremendous impact on the environment. Approximately 40 percent of U.S. land is used for grazing livestock. Another 60 million acres (about 3 percent more) are used to grow grain to feed food animals. In addition to habitat loss and water use, these operations create water pollution from their wastes and erosion from overgrazing. As they digest food, cattle and other ruminative animals produce methane, a very potent greenhouse gas. Animal manure also produces methane as it decomposes.

When we throw food away, it is more than just old lunchmeat and wilted lettuce going into the trash. In addition to the upstream impacts caused by producing food, there are also environmental impacts from transporting and depositing our food waste in landfills. Organic materials, such as food, can decay anaerobically in landfills. This process creates methane gas—and landfill operators cannot capture all of it. This decay also contributes to elevated levels of organic material in landfill leachate.

Although many think of hunger as a developing world problem, 6.6 percent of Oregon households were classified as hungry from 2006 to 2008. Only Mississippi had a higher hunger rate. Another 8 percent of Oregon households were considered food insecure—unable to provide enough food for active, healthy lives for all members at all times during the year. When 14.6 percent of Oregonians are unable to consistently access enough food for their families, it is unconscionable that 27 percent of the food produced for human consumption in the U.S. each year is thrown out. Recovering even just 5 percent of this would have fed 4 million people for one day.

Paper

According to the 2016 DEQ Waste Composition study, paper is another of the largest items in our waste stream at 15.3 percent. Paper is generally made from trees, although other fibers, such as cotton, linen, and hemp, may also be used. Logging disrupts natural systems and negatively affects wildlife habitat. Road building and logging operations cause water pollution from soil erosion and air pollution from the exhaust of vehicles and machinery. According to a 2001 report to Congress, there were more than 380,000 miles of logging and dirt roads on National Forest lands—enough to circle the globe nearly 15 times.

Trees take carbon dioxide from the air and release oxygen, helping fight global warming. According to ecology.com[7], 35 percent of the trees harvested worldwide are used for making paper.

Much of the wood used by paper companies in the U.S. comes from managed timberlands where forests are planted, groomed, and thinned for harvest in 20- to 35-year cycles, depending on the tree species. In the U.S., old-growth trees are usually used for high-end lumber. Although these supply much of the material for our paper, a new source has been developing in the last 20 years: pulpwood farms. These farms focus on fast-growing trees with high fiber content, such as poplars and cottonwoods. Trees are planted, grown, and harvested like other crops.

Until they are harvested, pulpwood tree farms help fight global warming by consuming carbon dioxide and releasing oxygen.

As with food crops, the faster and cheaper the plants can be grown, the higher the profit margin. Pulpwood farm trees are planted in rows and treated with chemical fertilizers to speed growth. These new tree farms are more efficient than old-style logging operations and less damaging to the environment because people and large machines don't go into relatively pristine areas to harvest the wood. But they also have the disadvantages of other monoculture farming: They require petrochemical inputs and irrigation.

After the trees are harvested, they are transported, cleaned, peeled, chipped, and processed into pulp. The pulp is sent to paper mills where it is bleached, combined with water, and turned into paper. Paper mills have worked hard to reduce the amount of dioxin and other hazardous chemicals in their production processes, but some toxins are still released into the air and water. Water quality is also affected by the release of nontoxic wastes. According to the U.S. Toxic Release Inventory[8] report published by the U.S. Environmental Protection Agency (EPA), pulp and paper mills are among the worst industrial polluters in the country.

Oregon became a leader in paper making because paper can be made from fiber left over from the timber industry. Today Pacific Northwest paper mills are leaders in using recycled content in their products.

Plastics

In 2016, plastics comprised 11.79 percent of our waste stream, with plastic packaging comprising almost half that amount. Plastics are polymers, meaning they are composed of essentially one molecule shape continuously repeated to form a chain of molecules with the same atomic structure. For the most part, the primary raw material for plastic is hydrocarbons, a byproduct of oil and natural gas production.

Plastic's versatility mean it is used for making everything from building materials to toys. They are lightweight, which cuts the energy required for transporting goods packaged in them.

Unfortunately, plastics also have some serious negative characteristics. When plastics break down, they just become smaller pieces of plastic. Plastic litter accumulates along roads, streams, and in oceans[9] where it can be consumed by wildlife and damage their digestive and hormone systems.

The chemical composition of plastics varies, and manufacturing some plastics is dangerous for the environment. Polyvinyl chloride (#3, PVC) is the third most-used plastic; unfortunately, manufacturing it creates the most toxic waste and air pollution. Vinyl chloride, a known carcinogen, is released into the air during production. Dioxin, a bio-accumulative carcinogen, is released during PVC's manufacturing and incineration. The EPA has listed dioxin in the top 10 percent of those substances most hazardous to human health. There are also concerns about toxic phthalate plasticizers leaching from the PVC used in children's toys, medical IV bags, and other items or through off-gassing.

Most plastics are made from petroleum and/or natural gas. Exploring and drilling for oil can be very hazardous and disruptive to our natural systems. Transporting oil via supertankers and pipelines is also risky. There have been several wide-scale accidents at sea that caused massive environmental damage, such as the 1989 Exxon Valdez disaster in Alaska or the Deepwater Horizon oil spill in 2010.

Hydraulic fracturing, or "fracking," is a process that forces pressurized fluid into rock fissures to extract natural gas and petroleum. The chemicals in the fluid used to open these fractures may be toxic to human and animal life when they enter groundwater or the air. This process may also pollute the air and water by forcing naturally occurring chemicals, including radioactive elements, from deep underground into streams or groundwater.

The refining and use of petrochemical products also causes air and water pollution, habitat disruption, and creates greenhouse gasses. Our dependence on oil for so much of our heating, manufacturing, and transportation needs also contributes to political instability around the world.

Bio-plastics

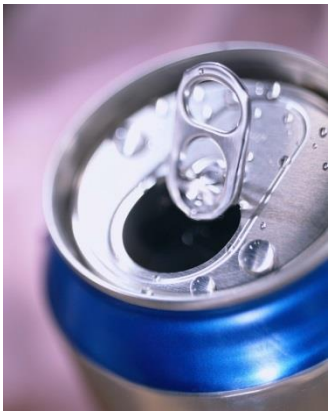
Bio-plastics are made from plants, not from petroleum, and producers hope they will replace traditional plastics. There are upstream impacts from them, too. Most modern methods of growing corn, sugarcane, and potatoes—materials generally used to make bio-plastics—are energy intensive. They often require petroleum-based pesticides or fertilizers and heavy equipment for planting and harvesting. Converting the plant materials to plastics can also involve energy-intensive and polluting processes. Using food crops as the basis for bio-plastics, biofuel, and ethanol, also removes land from food production and other uses. These crops are also water intensive, generally requiring irrigation. Bio-plastics will be discussed in more detail in the "Managing Organic Waste at Home and Work" module.

There is no standard labelling for bio-plastics, and hence bio-plastics can contaminate standard plastic recycling systems, as well as composting and anaerobic digesters.

Metals

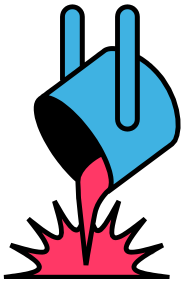
In 2016, metals comprised 5.16 percent of the Oregon waste stream. All metals require large amounts of energy to mine, refine, and turn into products. Some processes use toxic chemicals, such as mercury and cyanide. Other mining methods cut the tops off hills and mountains to access the metals and then deposit the dredged earth into the surrounding valleys.

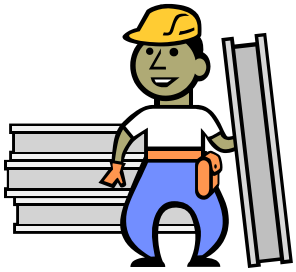
Mining exposes the land to erosion, sends toxic leachate from mining waste into water tables, and puts toxic and undesirable particulates into the air. Habitat disruption and damage to natural systems may be severe, and the roads built into these often-remote mining areas open them up to additional disruption.



In the United States, aluminum has traditionally been made from bauxite ore that has been converted to alumina. Most of the alumina and bauxite imported to the U.S. come from Australia, Jamaica, Guinea, and Suriname. Making aluminum is an expensive and energy-intensive process because the bauxite must be separated from other materials before it can be made into alumina. Because of this high demand for energy, bauxite ore is often shipped out of the United States to countries with access to cheap and abundant energy to refine it—especially those with less stringent environmental and human health safety laws.

To make aluminum, bauxite, an aluminum oxide, is dissolved in a molten mixture of sodium, calcium, and aluminum fluorides. Then an electric current[10] is passed through the hot liquid. Molten aluminum metal collects at the cathode[11] (negative electrode) in a process called electrolysis[12]. But producing aluminum can also be accomplished by using recycled aluminum. This process uses only 5 percent of the energy required to make it from bauxite. In fact, recycling aluminum saves so much energy that we could transport it by train almost as far as the moon and back before we used up the energy savings.





Steel is made from iron, which comes from the ground in the form of iron ore—rock that contains iron combined with oxygen. It is found around the world, but some of the best ore is located in Australia. After mining, the ore is subjected to very high temperatures to separate the iron from the rock. This process, called smelting, is done in a blast furnace, where coke and limestone are added to the iron ore and air is blown through it. The molten iron is drawn off.

To make steel, iron is mixed with carbon and other metals to give it extra hardness. Other forms of steel contain elements such as chromium and nickel to prevent rusting. Ordinary carbon steel rusts as easily as iron and must be protected with paint or other coatings. Steel may be melted and formed several times as it moves from raw material to finished product.

Iron and steel have been recycled for a long time, and recycling technology has been rapidly evolving. Older furnaces were able to incorporate only 28 to 50 percent recycled scrap. Most new steel mills, including those in Oregon and Washington, now use electric furnaces that can make steel out of 100 percent scrap while using 75 percent less energy! Steel is one of the most recycled materials in the world.

Textiles

Textiles, including carpeting, comprised 3.92 percent of our 2016 waste stream, even though according to an estimate from the Council for Textile Recycling, nearly half of discarded textiles are contributed to charities. Charities typically reuse clothes and other fabric items by selling them in secondhand stores or giving them away. Approximately 61 percent of the clothes recovered for secondhand use are exported to foreign countries.

Cotton is the most popular fiber in the world. Growing cotton currently requires large amounts of insecticides and fertilizers. Seeding is done with mechanical planters, cultivators are used to uproot weeds, and the crop is chemically defoliated to make it easier to pick. No-till methods that lessen soil erosion are catching on, but the most used method for tilling still involves mechanically cutting the stalks down, chopping them up, and turning them into the earth. The land is plowed in the spring for planting.

Semi-synthetic fibers, such as Rayon, Tencel, Viscose, and acetate are made from regenerated cellulose fiber, often sourced from wood, and most recently bamboo. Because it is produced from naturally occurring polymers[13], it is neither a truly synthetic fiber[14] like polyester nor a natural fiber[15] like wool. Making semi-synthetics requires a chemical process that starts with natural cellulose and, through multiple chemical and mechanical processes, turns it into smooth, plastic-like yarn that is extruded.

Wool is mostly shorn from sheep, but can also come from goats, camels, and other animals. Australia and New Zealand are the primary sources of wool production, although China is also a big supplier. One drawback to wool production is that sheep need to be actively tended or they harm the land through overgrazing, which results in erosion of the soil and damage to water sources. Land used for grazing animals can't support the biodiversity non-grazing land does. Sheep also create methane, a potent greenhouse gas, as a product of digestion. Wool is washed and processed to remove dirt and natural oils, and then is usually chemically bleached.

Synthetic fibers, like other plastics, are made from oil and natural gas products. They are strong and can hold pleats and creases. As with other plastics, the toxicity and other environmental impacts vary with the processes used to create the fiber. Synthetic fibers are extremely longwearing, moisture-resistant, and sometimes bacteria-resistant.

Ancient societies of hunter-gatherers were nomadic. People were constantly moving to where food was available. Their waste consisted almost entirely of organic material from plants and animals, discarded as they moved from place to place. As populations became settled, solid waste disposal became a greater problem. Rural living continued to produce mostly organic wastes, which in many communities were burned for fuel, used to fertilize crops, and fed to livestock. When resources were depleted and the garbage heap became a problem, people simply moved.

Gradually populations became more concentrated in towns and cities—and that's where the solid waste crisis began. As cities grew larger and became increasingly distant from food sources, organic waste was no longer useful to the people…and became viewed as garbage. Garbage heaps grew as populations increased. And because people could no longer pack up and move easily, the habit of throwing wastes out the door created public health hazards. Many anthropologists attribute the decline of some large civilizations to the accumulation of wastes that contaminated food sources and water. The depletion of natural resources was another contributor to the fall of some civilizations.

Some cities solved their garbage problem by hauling organic waste out to farms and composting it to revitalize croplands. Others simply took the garbage out to the country and dumped it in piles. The municipal dump was born around 500 B.C., when Athens issued the first-known law against throwing garbage into the streets. Residents were required to dump waste no less than one mile outside the city walls.

2,500 years after Athens's first garbage edicts, open dumps are rare but still exist in a few small communities. They've largely been replaced with sanitary landfills and waste incinerators. Modern sanitary landfill operators cringe at the notion of their sites being referred to as dumps. Landfills have evolved into highly regulated and specially engineered disposal sites[16].

As environmental controls have been enacted, landfills have tended toward large, regional sites to make them more cost effective. Oregon's sanitary landfills are equipped to collect leachate and methane gas. After garbage is placed in them, it is compacted and covered with soil.

EPA data show that from 1960 until 2010, the rate of waste generation increased from an average of about 2.68 pounds to 4.43 pounds per person per day. According to the EPA, in 2010, the U.S. recycled approximately 34 percent of its solid waste. (These figures include businesses and residences, but not construction, remodeling, and demolition waste.) As we will discuss, Oregon recycles at a much higher rate, but the rates aren't comparable because different materials are counted. (By comparison, the Oregon waste generation rate – which includes construction, remodeling, and demolition waste – is 6.8 pounds per person per day, and the statewide recovery rate in 2012 was nearly 50% of that.)

Modern Garbage

While growing civilizations created mounting volumes of garbage, industrialization added more complexity to these wastes. The contemporary solid material output of a community, region, and state—the waste stream—includes three primary types of material: 1) organic, 2) manufactured goods, and 3) hazardous wastes.

To decrease the amount of waste generated, we need to know what it is and where it comes from. The extent of industrialization, climate patterns, cultural differences, economic conditions, demographic patterns, and socioeconomic forces are all factors that contribute to differences in waste content.

How material is counted also effects these variations. Waste composition differs between wastesheds, and in Oregon, wastesheds are generally defined by county. A 2017 Oregon DEQ study on recovery rates showed that Oregon's waste generation is 7.19 pounds per person per day, compared to the EPA's 2015 national average of 4.48 pounds. (https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/national-overview-facts-and-figures-materials) This doesn't mean we generate more waste than other Americans. Different measuring methods explain much of the discrepancy. DEQ statistics, for example, include construction and demolition waste, which the EPA data do not.

The DEQ periodically measures the amount and composition of state and local waste. It samples, categorizes, and weighs materials entering disposal facilities.

Collection

Usually businesses and residents pay fees for garbage collection. In most Oregon communities, businesses known as haulers collect garbage, recycling, and yard debris. Businesses and individual residents may also take some wastes to transfer stations, which provide drop-off facilities for recyclables and, in some communities, household hazardous wastes.

County and city governments set collection rates and establish service standards. Throughout Oregon, most haulers are franchised, meaning they are authorized by local governments to serve allotted territories, offer standardized services, and charge established fees. In some cases, local governments direct where haulers dispose of the garbage they collect. This flow

control is used for a variety of reasons, including ensuring that government owned facilities receive sufficient amounts of material to be financially viable. For example, in Tillamook County, all franchised haulers are required to take their waste to the Tillamook Transfer Station (TTS).

Although garbage fees may be set in a number of ways, many Oregon garbage and recycling rates are set on a modified pay-as-you-throw (PAYT) basis. Customers are charged by the amount of garbage they generate. The rates may be determined by container size and/or frequency of collection. Tying garbage and recycling charges to the amount of trash a household or business generates makes customers more aware of the amount of waste they produce and encourages recycling and waste-prevention activities.

A true PAYT rate would charge the same amount per pound of trash regardless of the amount of trash generated. Our modified rate structures generally allow for some cost reduction as the number of cans or frequency of collection increases. As recycling services begin to outpace waste disposal, future rates will need to reflect the total amount of services a customer receives not just the size or weight of their garbage can.

Transfer Stations

Many haulers take collected garbage to transfer stations, where the trash from many haulers is compacted and loaded into large trailers to be taken to a landfill or waste-to-energy facility. This frees haulers to spend time collecting waste rather than traveling the extended distances to the actual landfills. This also conserves resources because only full loads are transported to landfills. Many transfer stations take loads of garbage and recycling directly from the public.

Disposal

Oregon uses two systems of disposal. The most common is landfilling. The second disposal system is combusting or burning waste in a waste-to-energy facility which we will cover in more detail when we examine Marion County's solid waste management system later in this chapter. Sadly, some people also dispose of garbage in an illegal manner by burning it in their backyards or illegally dumping it.

Oregon's most common form of disposal is landfilling.

Landfills

This map shows where all the landfills in Oregon are located. The landfill with the largest capacity in the state is the Columbia Ridge Landfill in the Columbia River Gorge. Much of the waste from the Portland/Metro region goes there, as well as garbage from Seattle. It is located in the desert, where it's less likely to contaminate groundwater. Other very large landfills in Oregon that accepted more than 100,000 tons of solid waste in 2009 include the Riverbend Landfill in Yamhill County, Coffin Butte Landfill outside of Corvallis, Dry Creek Landfill near Medford, Short Mountain Landfill near Eugene, Hillsboro Landfill, Knott Landfill near Bend, and the Wasco and Finley Buttes Landfills, also in the Columbia Gorge.

A system of collection pipes reduces methane infiltration into surrounding soils and reduces emissions of this potent greenhouse gas into the atmosphere. Although some facilities burn off their methane gas, other landfills use their methane to generate electricity. For example, the Short Mountain Landfill in Lane County has four turbine engines that generate enough electricity to power about 1,200 homes. Unfortunately, no landfill captures all of its methane and some capture little to none at all.

Columbia Ridge landfill utilizes state-of-the-art liners, leachate collection, ground water monitoring, and gas control systems to reduce risks of environmental damage.

Oregon's only waste-to-energy facility that accepts municipal solid waste is located in Brooks in Marion County. This facility incinerates waste and uses the heat to produce steam, which generates electricity. The ash residue from the incinerator is landfilled. A smaller facility in Coos County which burned mixed solid waste without energy recovery was closed in 2012.

Landfill Space Is Not the Problem

In the 1980s, the fate of the "garbage barge" caused many states and local jurisdictions to reevaluate their disposal capacities, and the general impression that the United States would soon run out of space for landfills became quite common. In addition to causing people to rethink their landfill options, the recycling movement was given a real boost by this attention.

But today, the genuine or perceived lack of landfill space is not the primary reason we need to be concerned about the waste stream. The number of landfills in the United States has been steadily decreasing—from 7,924 in 1988 to 1,754 in 2007, but the capacity has remained relatively constant because new landfills are larger. Landfill capacity in Oregon actually increased during this period, with the opening of several very large landfills that contain hundreds of years of capacity.

In some landfills, high levels of yard debris, food scraps, and paper waste are a concern because they produce methane, a known greenhouse gas. Toxic leachate, which is produced as wastes decompose in a landfill, is also an issue. Due to today's stringent regulations for facility design, siting, and operations, EPA and DEQ officials agree that modern landfills are less problematic than older facilities.

Although landfill capacity and pollution potential are valid concerns, the true costs of our modern lifestyle happen well before we dispose of our waste. These costs happen upstream. The upstream impacts of consumption include the pollution, habitat destruction, and greenhouse gas emissions created during the procuring and manufacturing of raw materials into products and packaging and transport of those products. We'll talk more about upstream impacts later.

As this course continues, we will explore how we can reduce, reuse, and recycle to make better use of the materials we already have at hand.

A typical solid waste management system has three components: collection, transfer, and disposal. Although the Oregon DEQ sets statewide standards, solid waste systems are managed at the local level.

Two other methods of disposal sometimes used by individuals are backyard burning and illegal dumping. Neither of these options is a good environmental choice.

Backyard and In-Home Burning

Burning one barrel of trash in a backyard releases as much toxic air pollution as burning 2,000 pounds of waste at a waste-to-energy plant! Burning trash in a fireplace or stove is equally polluting and may damage the quality of the air in your home. This pollution includes heavy metals, such as lead, cadmium, and chromium. It also includes carbon monoxide, particulates, formaldehyde, and dioxin. These substances are released when plastics, some paints, household batteries, motor oil, and other common items found in household garbage are burned.

The pollutants that result from backyard and in-home burning are harmful to human health and the environment. When burned in an uncontrolled manner, plastics, such as PVC, emit chlorinated dioxins and furans, both of which are known to cause cancer. PVC contains 56

percent chlorine, and when burned it produces large quantities of hydrogen chloride gas. This gas combines with water to form hydrochloric acid in the lungs, which over time can lead to chronic diseases such as emphysema and cancer.

The gases produced by backyard and in-home burning can irritate eyes, throats, and lungs. It can also cause nausea, bronchitis, pneumonia, and trigger asthma attacks. Children are especially susceptible because their immune systems aren't fully developed. A child breathing the same polluted air as an adult will absorb up to six times more toxic gasses.

The EPA has classified dioxin as an exceptionally potent human carcinogen. Because dioxin is stored in fat tissues, it bio-accumulates in the food chain. This means that backyard, in-home, and agricultural burning of trash in rural areas is particularly harmful. The particulates in the gasses released from the fire fall onto grass and crops. When polluted pastureland is grazed or the crops are harvested for animal feed, the pollutants are stored in the animals' bodies. After slaughter, humans eat the meat, so our bodies accumulate higher and higher levels of this dioxin, which can cause reproductive problems and cancer. The EPA says that our largest exposure to dioxins, one of the most potent cancer-causing pollutants, is due to eating animals that have consumed dioxin-tainted food and water.

Even burning "clean" materials can also be dangerous. In addition to the smoke and soot which comes from burning, materials such as cardboard boxes often contain plastic tape or chemical glues, which release toxic chemicals into the air when burned.

Backyard burning is banned in many Oregon cities and counties. Some materials are never legal to burn. Learn more about open burning restrictions in Oregon here[19].

Illegal Dumping

Oregon law requires that trash be disposed of only at licensed solid waste facilities. If you leave waste anywhere else, you are dumping it illegally. Illegal dumping damages the environment, is an eyesore, and is expensive to collect and dispose of properly.

Most household garbage contains items that are not naturally found in nature. These items can pollute streams and groundwater and harm wildlife. Old furniture and clothing become homes for rats and other pests. Old tires collect rainwater that can become breeding grounds for disease-carrying mosquitoes.

Old appliances and furniture are eyesores. Who wants to weave through a bunch of rusting clothes washers, beer cans, and plastic bags when out for a hike? Each year millions of Oregon tax dollars are spent cleaning up illegally dumped garbage. This means every citizen pays to clean up after these polluters.

The Legal Framework for Solid Waste Management in Oregon

The Oregon Legislature made its first comprehensive commitment to waste reduction in 1983 by passing the Opportunity to Recycle Act. The Oregon Recycling Act of 1991 deepened that commitment. These laws established solid-waste management policies, designated wastesheds, and made these wastesheds responsible for the **recovery (diversion**) of waste from landfills and waste-to-energy facilities within their jurisdictions. Cities of more than 4,000 residents are required to provide recycling opportunities for their residents. These two acts also recognized that some waste reduction practices have more environmental benefits than others. They affirmed that to conserve energy and natural resources, we must make reducing waste generation a priority over diverting material from landfills through recycling and composting. In other words: Waste prevention is more important than materials recovery!

Oregon's Waste Management Hierarchy

Oregon law emphasizes the paramount importance of waste reduction through preventing waste, reusing materials, recycling materials and composting organic waste. The Oregon Legislature set this hierarchy:

- Reduce the amount of solid waste generated.
- Reuse material for the purpose for which it was intended.
- Recycle material that cannot be reused.
- Compost material that cannot be reused or recycled (added in 1991).
- Recover energy from solid waste that cannot be reused, recycled or composted.
- Dispose by landfilling or other methods approved by the State, any solid waste that cannot be reused, recycled, composted, or from which energy cannot be recovered.

In other words: Reduce first, then Reuse, and then Recycle!

Each of these methods has several variations for implementation. Incineration systems may include magnets and eddy currents to remove ferrous and nonferrous metals and hazardous waste before burning the garbage. Many options are available when developing an integrated waste management plan.

1) Reduce

When a consumer declines to buy an item or a manufacturer opts not to produce or redesign a product to make it more efficient, they are practicing waste prevention. The reduce part of the reduce/reuse/recycle slogan refers to any method used to responsibly reduce the amount of any solid waste that requires recycling, composting, incineration, or disposal, thereby reducing the use of raw materials and energy needed to make or use the product. If it doesn't exist or we don't buy it, we don't have to figure out how to keep it out of the waste stream. Practicing thoughtful consumption means renting, borrowing, or sharing tools;

avoiding excess packaging; choosing durable products; maintaining and repairing items; choosing energy-efficient appliances and other practices that reduce our use of materials and energy. Other strategies are to design products that require fewer raw materials to produce, last longer, and are more reusable.

Waste prevention also reduces toxicity in the waste stream. Both consumers and manufacturers have important roles to play in reducing hazardous waste. We practice toxicity source reduction when we buy or use nontoxic cleaning products. Manufacturers have been working to reduce hazardous materials in many common items, including household batteries and latex paint.

2) Reuse

A step below source reduction is reuse**.** The formal, DEQ definition of reuse is "the return of a commodity into the economic stream for use in the same kind of application as before without change in its identity." Informally, reuse refers to methods that put existing materials back to their intended use. This includes reusing grocery bags, buying from and donating to thrift stores, refilling water bottles, and repairing items instead of trashing them.

3) Recycle

Recycling refers to systems that collect, process, and market materials from the waste stream so they can be manufactured into new products, such as paper, glass, metals, and motor oil. We'll look closer at recycling processes in later modules.

4) Compost

Composting is the controlled biological decomposition of organic material. Composting is most successful when organic materials, such as yard debris and food scraps, are separated from recyclables and trash. We'll cover composting in more detail in a later module.

5) Recover Energy

Waste-to-energy facilities are systems that burn mixed solid waste to reduce its volume and extract energy to use as heat or electricity. A few manufacturers use waste wood to heat their facilities or power their manufacturing processes. Some landfills also capture and use the methane gas generated from decomposing organic materials to make electricity or heat.

6) Landfill

Landfilling is the process of burying solid wastes or ashes that result from incineration underground. Combustion facilities that do not generate energy also fall into this category.

The 1991 Oregon Recycling Act (SB 66)

This Act strengthened and broadened recycling requirements and, for the first time, advocated and promoted developing markets for recycled materials. Below are some of its provisions:

- Set a statewide recovery rate goal of 50 percent by 2000 and interim recovery goals for individual wastesheds by 1995
- Enhanced recycling opportunities by providing optional program elements to recycling requirements

- Established a household hazardous waste program
- Required recycled content in glass containers, directories, and newsprint.
- Set requirements for recycling rigid plastic containers (to promote market development)
- Established government procurement requirements for recycled products
- Required DEQ to calculate annual recovery rates to measure progress toward the 50 percent goal
- Required DEQ to conduct a waste composition study every other year to assist in planning local government recycling programs
- Required DEQ to develop a solid waste management plan
- Mandated and provided funding to develop school curriculum on recycling and waste reduction
- Funded programs through tipping fees at landfills, including grants to local governments

In 2001, the Oregon Legislature extended the 50 percent recovery goal deadline to 2009. It also created an interim goal of 45 percent recovery by 2005 and established waste generation goals. The waste generation goals required no annual increase in per capita municipal solid waste generation for 2005 and subsequent years. For the year 2009 and subsequent years the law required no annual increase in total municipal solid waste generation.

Because some parts of Oregon are farther from markets and may find recovery more difficult to accomplish, larger urban areas, like the Portland/Metro region, were required to reach higher recovery rates to help achieve the statewide goals. The Metro waste-shed goal was set at 62% recovery by the end of 2005 and 64% by end of 2009.

Integrated practices, including waste prevention, conscious consumption, recycling, composting food and yard waste, and buying recycled products are needed to achieve these goals. The waste reduction hierarchy establishes priorities for structuring these practices.

The most current information[18] about Oregon laws related to solid waste management is available from DEQ Land Quality.

Where We Are Today

We've come a long way from the days when waste was just tossed out the door. Most communities now use diversified approaches for managing their solid waste. They focus on waste prevention, recycling, and/or composting to decrease the amount of material headed to landfills. Many manufacturers are designing or redesigning products so they are less toxic, use fewer materials during production, and are more energy efficient.

Oregonians are working hard to reach the waste recovery goals, but we're not there yet. With a recovery rate of 49.7 percent in 2012, we've nearly reached the 2009-legislated goal of 50 percent! Tillamook County actually achieved it's required recovery rate of 30% in 2012. Several large jurisdictions are stepping up their yard debris and food waste diversion efforts, which may help us exceed our diversion goals. Tillamook County and wastesheds throughout the state reevaluated and submitted their recovery goals to the 2015 legislative session. Tillamook County's goal is 37%.

Working Together is Essential

Transforming our systems and mindsets from waste disposal to resource conservation is a big change that we all need to work together to make happen. Government needs to partner with private industry to develop programs and services that make waste prevention and recycling more convenient. Manufacturers need to work toward reducing the environmental impacts of the products they produce. Consumers must become more aware of what we buy and why.

As consumers, we can use our purchasing power to encourage businesses to incorporate more recycled material into their products, make goods more durable, and create products that use fewer resources. We also need to let businesses and government know that healthy, natural systems are important to us. We can influence government policy by serving on Solid Waste Advisory Committees, testifying at public hearings, writing and talking to public officials, and voting. We can influence the marketplace by writing letters, calling manufacturers, talking with retailers, and buying products that reflect our values. Practicing thoughtful consumption will enable us to spend our time, money, and energy on issues that really matter to us.

As our urban areas have expanded and the amount of waste has historically increased, land suitable for dumping garbage has become scarce. The spread of suburban development leaves few large parcels of land available for landfills. Across the country, potential neighbors who do not want a landfill in their back yard are rejecting proposed disposal sites. We know this as the "Not in My Back Yard" syndrome or "NIMBY". Similar sentiments are felt when a County attempts to locate facilities for waste-to-energy, materials recovery, or other waste processing. Most recently, complaints about the Nature's Need composting facility in North Plains caused the Washington County Board of Commissioners to ban commercial food waste from the facility. Portland's commercial food waste is now shipped to an anaerobic digester in Junction City. This and other issues led to passage of SB 462 in 2013 which requires additional land use permits for siting composting facilities.

Communities are legitimately concerned over the siting of landfills near residential areas. Years of unregulated dumping have sometimes resulted in a mixture of toxic materials in our landfills. The United States Environmental Protection Agency (U.S.EPA) identified many landfills as "Superfund" sites requiring special attention due to their toxic nature.

How do landfills become toxic? As materials biodegrade in a landfill, they mix. As rainwater passes through the landfill, it leaches out water-soluble materials and forms a leachate solution. Past solid waste management techniques did not require potentially hazardous materials to be identified and either handled separately or buried in a specific location in a landfill. When not contained, leachate can contaminate streams and ground water.

Landfills also produce methane gas as a result of organic materials decomposing in the absence of oxygen. Methane gas is explosive in high concentrations and may migrate into neighboring homes if not controlled or vented. Methane gas is also a major ozone depleting gas. Even when burned for energy recovery, approximately 20 percent of the gas still escapes and affects the ozone layer.

Because of these and other problems, the U.S. EPA has adopted new standards for the siting, operation, and closing of landfills. These standards require that new and existing landfills install impermeable liners below the burial areas to collect leachate for treatment, that

methane gas be vented or utilized, and that systems be established to monitor potential surface and ground water contamination. These monitoring and control activities must continue 30 years after the landfill is closed. Many landfills in Oregon closed because they were not able to meet these requirements.

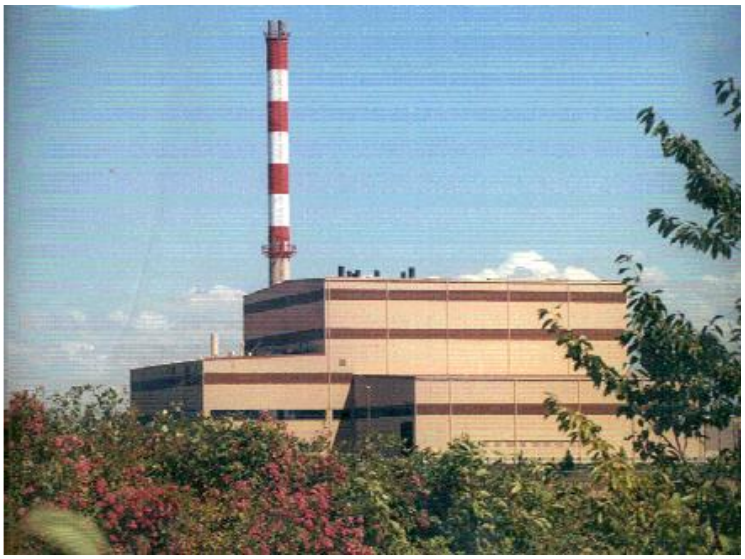
Waste-to-Energy (WTE) Facilities have experienced some of the same difficulties as landfills in obtaining sites and permits. The NIMBY factor can be strong in some communities. In the early 1980's, the decision to site a WTE facility in Marion County was a difficult process. A task force reviewed disposal options and eventually required a vote of confidence from the community before the project could continue. Air pollution and the burning of medical waste were issues of concern that had to be resolved before the facility was approved.

WTE facilities and landfills, with the recent adoption of federal landfill regulations, are tightly controlled and monitored by regulatory agencies. The environmental controls (i.e., air pollution control equipment, etc.) in place in these facilities minimize the impact on human health and the environment. We will learn more about the waste-to-energy facility in Marion County later in this chapter.

Waste disposal sites are no longer an easy, inexpensive solution to our solid waste disposal needs. We may never be able to eliminate the need for landfills but we must start to decrease the wasteful use of them as repositories for our discarded resources. We must begin to change our habits.

Waste-To- Energy

Although not used for Tillamook County's waste, we will give a brief overview of Marion County's Waste-to-Energy Facility (WTEF), since it is the only such facility in Oregon. In 1986, Marion County closed the landfills and consolidated the disposal facilities at the transfer stations. Now, the WTEF, located on Brooklake Road east of Interstate 5, is the keystone of the Marion County solid waste disposal system. Brown's Island and Woodburn landfills became demolition landfill sites handling waste rejected by the WTEF. The WTEF, which began commercial operation in March of 1987, burns municipal solid waste, generating electricity from steam produced with heat from the burning waste. The facility is owned and operated by Covanta Marion, Inc., under contract with Marion County.



Marion County's WTE plant

This facility can handle an average of 550 tons of garbage each day and provides Marion County with a reliable and environmentally safe means of garbage disposal. The WTEF typically processes a total of 180,000—200,000 tons of refuse annually, approximately 90% of which comes from in-county sources. The out-of-county portion is imported in order to keep

the facility operating economically at full capacity. Each day, about 130 loaded refuse trucks dump their cargo into a 34-foot deep pit which can hold nearly 3,000 tons of refuse. An overhead crane mixes the garbage in the pit and lifts it into one of the two hoppers that feed the two boilers.

The WTEF burns the trash at temperatures reaching 2,000 degrees Fahrenheit, producing steam, which in turn drives turbines, which generate approximately 13.1-megawatt hours (MWh) of electrical power. Covanta uses 1.5 to 2 MWh of that energy to power the facility with a net amount of 11 to 11.5 MWh which is sold to Portland General Electric and converted to kilowatt hours (KWh). The 11,000 to 11,500 KWh generated is enough to provide power for approximately 5,200 homes on a continuous basis.

The WTEF processes about 80% of the county's garbage. The remainder of the county's garbage consists of construction and demolition wastes, food processing waste, and other miscellaneous non-burnable materials that are taken to the Brown's Island Landfill, the Coffin Butte Landfill near Corvallis, or the Riverbend Landfill near McMinnville.

The WTEF carefully monitors air and ash quality to assure compliance with the Oregon DEQ and U.S. EPA standards. To date, it has an enviable environmental compliance record. Ferrous scrap metal, which was not separated from the waste prior to being burned, is plucked from the ash with large magnets. The metal is cleaned and taken to markets for recycling. In 2011, 6,392 tons of metal were recycled by the WTEF.

Ash and Metal Recovery

Municipal Solid Waste Incinerator Ash

Incineration in the WTEF reduces the volume of incoming waste by about 90 percent (or 75 percent by weight). Two forms of ash remain.

During incineration, ash is produced in two ways. Ash that falls from the stoker grate as rubbish is burned. This is called "bottom ash", which is quenched with water to reduce its temperature and removed via a conveyor. The fine particles that are carried away with the hot air which rises above the burner to heat the boiler that drives the turbines accumulate in the air pollution control (APC) equipment in the bag house and is commonly called fly ash. When APC ash is shaken loose from the bag house filters and placed on the same conveyor that carries the bottom ash, the mixture is known as combined ash. Ash on the conveyor passes under a magnet that removes a percentage of the total scrap metal. The ash is stored in an enclosed structure from which it is loaded and transported to the North Marion County Disposal Facility Ash Monofill.

Ash Monofill

A monofill is a landfill that contains only one type of material. In this case it is ash. The ash has granular characteristics similar to soil and requires a bull dozer to cut and spread large quantities. Fresh ash is handled easily, however if the ash is allowed to sit, it can setup and become more difficult to handle. Fresh ash is workable for some time and does not require immediate attention. Ash is handled by accumulating enough for daily dozer work. The dozer is used to maintain design grades in accordance with the operations and fill sequence plans. Cell IV continues to receive on average between 120 to 170 tons of ash per day from the

Waste-to-Energy facility or approximately 42,000 tons per year.

North Marion County Disposal Facility - Ash Monofill Operations Background

Over the past 20 years, a lot of metal (both ferrous and non-ferrous) has been observed in the ash. Based on the current scrap metal markets, the time was right to pursue the metal recovery from the ash.

Marion County Public Works Environmental Services (ES) initiated full time ash screening and metal recovery operations within the Cell IV ash monofill. This operation has changed the way ash is handled on a long term basis. In general, the daily management of incoming ash still involves pushing the ash up slope along the active face. However, instead of grading the ash to a final elevation and slope for closure, the ash is managed as a resource in a stockpiling fashion. The ash is pushed up slope into piles where it is allowed to de-water for future processing through the metal recovery screen plant, as described below.

Metal Recovery and ADC Operations

The metal recovery processing area is an approximately 160,000 square foot area within the Cell IV ash monofill, with a 6 inch compacted rock base that has been placed over 4 feet of ash fill. The rock base provides an all-weather surface that is tire friendly and also serves as a dust control measure for the operation. Entry and exit ramps into the processing area have been established along the east and west side of Cell IV. The processing area is graded to drain towards the drainage swale in the southwest corner of Cell IV. All storm water is contained within Cell IV and is collected and conveyed through the existing leachate collection and removal system.

Marion County is using a 5’ x 12’ CEC Screen-It vibratory screen plant and conveyor systems equipped with various drum and cross belt magnets to separate and remove the ferrous metal from the ash. The large heavy ferrous items and large non-ferrous metal items are currently removed by hand at a picking station. The County began separating motor windings, brass and copper at the picking station. These items net a higher dollar value when separated from the other ferrous and non-ferrous metals. In addition, pieces of unburned plastic and wood is removed and returned to the waste to energy.

Metal Recovery Process Flow

The screen plant is set up in a north-south orientation with the feed hopper pointing to the north along the toe of slope of the current working face. The feed hopper has an 8 inch grizzly screen that prevents oversized items from entering the hopper. The screen plant is equipped with a 2 inch square wire mesh screen on the top deck and a 3/4” “S” wire screen on the bottom deck. The screen plant also includes the ferrous metal stockpiling conveyor, picking station and ash stockpiling conveyor system. The ferrous metal conveyors are equipped with magnetic drum head pulleys and cross-belt magnet to facilitate separation of the ferrous metal from the non-ferrous metal and other inert materials.

During the past year, the county determined that in order to maximize the generation and quantity of screened ash (used for ADC) and to recover additional metals, reprocessing of the 2" and ¾" – 2" "Overs" material through a Horizontal Shaft Impact crusher (HIS) and then re-screened, was necessary.

Processing of the ash has evolved into a two-step operation. The first step is the initial screening and the second step involves crushing of the "overs" and reprocessing this material through the screen plant a second time.

Step 1 - Initial Screening : The ash is pushed down slope towards the hopper loading area with a bulldozer, then loaded into the feed hopper using an excavator where it is slowly conveyed to the top of the vibratory screen box. Any items larger than 8" are collected on the grizzly screen and removed prior to screening.

The ash falls onto the top deck of the vibrating screen where materials larger than 2 inches are retained on the top deck, tumble down and fall off of the screen onto the metal stockpile conveyor equipped with a cross-belt magnet and magnetic drum head pulley. As the material passes under the cross-belt magnet, the large ferrous metals are picked up by the magnet and flipped off onto another jump conveyor which drops the ferrous metal into a drop box. The remaining materials continue up the conveyor and roll across a magnetic drum head pulley, removing any additional ferrous metal missed by the cross belt magnet. The remaining materials drop onto a picking station conveyor where large ferrous items (not removed by the magnets) are removed by hand picking. In addition, large non-ferrous items such as aluminum, brass and copper are separated. Any garbage and woody debris is also removed at the picking station. The residual 2" overs fall off of the end of the picking station conveyor into a bunker. A front loader is used to transfer the overs to the designated stockpile area for future processing.

Ash and smaller materials passing through the 2 inch screen fall to the second deck (3/4" screen), where materials between 2 inches and 3/4 inch are captured and tumble onto a side discharge conveyor which the material to a bunker and is subsequently transferred to the designated stockpile area using a front loader.

Ash fines passing the 3/4" screen are transferred to the ash stacking conveyor system and stockpiled for loading and off-site transport to the Coffin Butte Landfill to be used as Alternate Daily Cover (ADC).

All of the ferrous and non-ferrous metal removed during the 1st Screening are conveyed into drop boxes, weighed, and transported to a scrap metal processer in Portland, Oregon for recycling.

Step 2 - Crushing and 2nd Screening: Overs removed during the first screening operation are reprocessed through a HSI crusher and rescreened for additional metal recovery and separation of ash fines. After crushing and reprocessing of the material through the screen a 2nd time (as described above), the resulting ¾" – 2" overs are processed through an Eddy Current System for the removal of the small non-ferrous metal fraction.

Health, Safety and Environmental Considerations

Marion county has implemented a Personal Air Monitoring Program. Quarterly monitoring of key personnel working on the metal recovery operation is performed to monitor exposure to total dust, silica and heavy metals.

MSW ash from the WTEF is mostly inert and contains small amounts of heavy metals. It has granular characteristics similar to rock and soil aggregate and is received in a saturated condition as a result of quench water used at the WTEF. Since the ash is received in a saturated condition and retains moisture after placement, fugitive dust has historically not been a problem. During the operation of the screen plant, both fresh ash and aged ash are blended together and loaded into the feed hopper. Blending the fresh ash with the aged ash provides optimal moisture content for screening and also assists with the control of fugitive dust during the screening and separation process. In addition, a self-contained, gas powered dust suppression misting machine (Monsoon) and or water truck spray are used to prevent dust in the blending and loading area as needed.

Medical Waste

During the 1989 legislative session, a new law (HB 2865) was passed which affected the treatment, storage, and disposal of infectious wastes. Medical waste is handled differently from regular garbage at the WTEF. It is loaded onto a special conveyor and feed directly into one of the boilers. Incinerating medical waste helps to reduce the risk of it creating a health or safety hazard.

Improper disposal of medical wastes can create a public health and safety hazard. Oregon law prohibits the disposal of infectious medical waste into the garbage. Offenders face fines of up to $500 per incident. There are both residential and commercial medical waste collection programs available in Tillamook County.

Residential

Used syringes generated by households, such as those used by diabetics, are to be disposed through a special medical waste collection program provided by the local garbage haulers and must not be put in the trash. At your request, your garbage hauler will accept, for a fee, a red sharps container. The container is a rigid, puncture-proof box made especially for medical waste disposal. Once the container is full, simply contact your hauler again, and they will exchange it for a new, empty container. Call your garbage hauler to more information.

Solid Waste Management in Tillamook County

A typical solid waste management system has three components: collection, transfer, and disposal. While the State of Oregon sets standards for collection, storage, transportation and disposal of solid wastes, the system is managed at the local level. Cities within Tillamook County and the Tillamook County Department of Public Works - Solid Waste share authority over the collection of solid waste, but Tillamook County has authority over the transfer and disposal of these wastes.

Collection

In most parts of Tillamook County residents can have their garbage picked up at their home or business for a fee or haul their waste to a disposal or transfer station. In Tillamook

County, private companies who are regulated through franchise by the county and the cities collect the garbage. Collection rates and service levels are set by these local governments. The exception to this is the City of Rockaway Beach, which does not use a franchise system.

Transfer Stations

In Tillamook County, franchised haulers take all of the garbage collected from residents and businesses to the Tillamook Transfer Station (TTS). The Tillamook Transfer Station also accepts garbage hauled by individual residents, businesses, and contractors. Both of the two satellite transfer stations in Tillamook County (Manzanita and Pacific City) accept waste brought in by individuals and businesses. All three transfer stations provide drop-off facilities for recyclables. All trash deposited at the transfer stations is loaded into large containers and hauled to the TTS or marketed directly by the operator. The three transfer stations in Tillamook County are: Tillamook Recycling & Transfer Station (TTS), Manzanita Recycling & Transfer Station (MTS), and Pacific City Recycling & Transfer Station (PCTS).

Let's take a closer look at each:

Tillamook Recycling & Transfer Station (TTS)
1315 Ekloff Road, Tillamook
Open 8am-4pm - Seven days a week

TTS, located off Tillamook River Road 2.5 miles south of Tillamook. It was an open landfill until it was closed in 1989 and is the largest of the three county stations. TTS is owned by Tillamook County and operated by Don G. Averill Recycling under a contract with Tillamook County. Tillamook County is responsible for the closed landfill.

TTS currently accepts: corrugated cardboard, container glass, newspaper, scrap metal, mixed waste paper, tin cans, motor oil, magazines, lead-acid vehicle batteries, phone books, milk jugs, computers, monitors, printers, and virtually any kind of electronics, VCR/DVD players & stereos, televisions, appliances, microwaves, vegetable oil, and tires (fee).

TTS also accepts clean loads of yard debris, wood waste and conforming (non-asbestos) asphalt roofing waste at a reduced tipping fee. These items are separated from regular refuse and taken to:

- Yard debris is chipped and transported to the composting facility operated by Dairy Compost, at the Port of Tillamook Bay, which composts thousands of tons of yard debris, wood waste and manure.
- Wood waste is chipped and transported for use as hog fuel in heating boilers at the Hampton sawmill in Tillamook or elsewhere.
- Asphalt roofing waste is transported to Road & Driveway near Lincoln City, where it is shredded and used in the production of new asphalt.

Manzanita Recycling & Transfer Station (MTS)
34995 Necarney Road, Manzanita
Open 10am-4pm, Thursday – Sunday (winter), Thursday – Monday (summer)

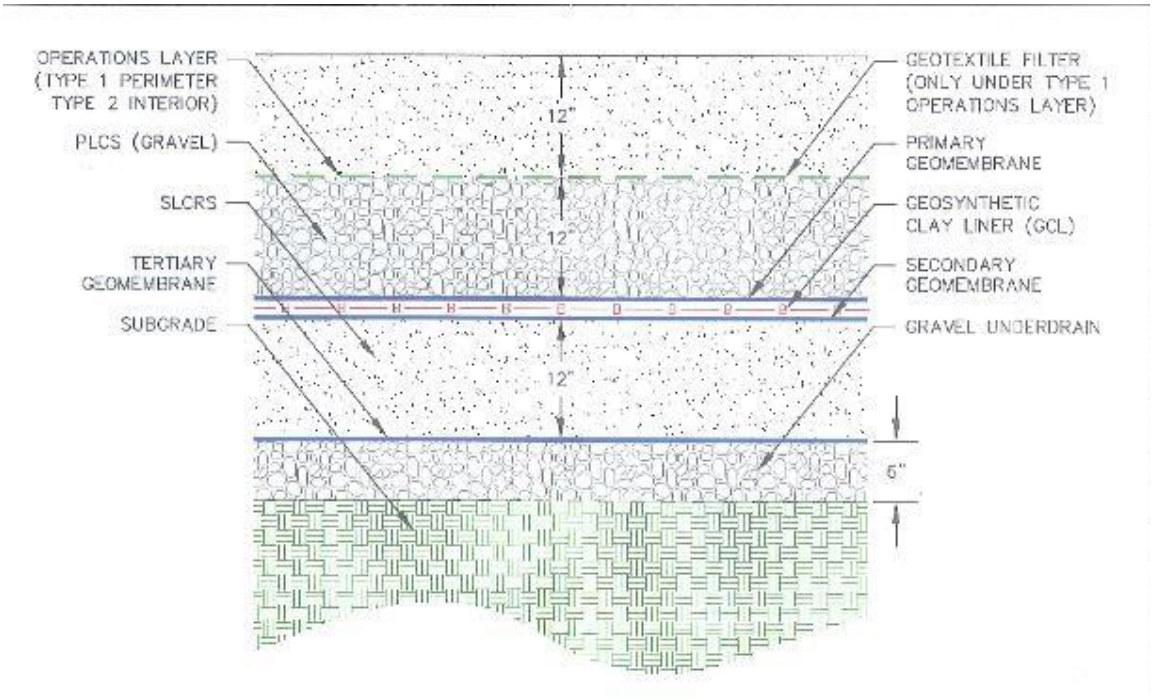
MTS is located in Manzanita. It began operating at this location following the closure of the open dump site in 1980. It served as the primary landfill for the north county area. In 1980, a transfer station was constructed at this site. The Manzanita Recycling & Transfer Station receives approximately 2% of all the waste hauled to the three active Tillamook County transfer sites. The waste collected at this transfer station is hauled to the TTS for disposal.

Pacific City Recycling & Transfer Station (PCTS)
38255 Brooten Road, Pacific City
Open 9am-4pm, Friday – Saturday (winter), Friday – Sunday (summer)

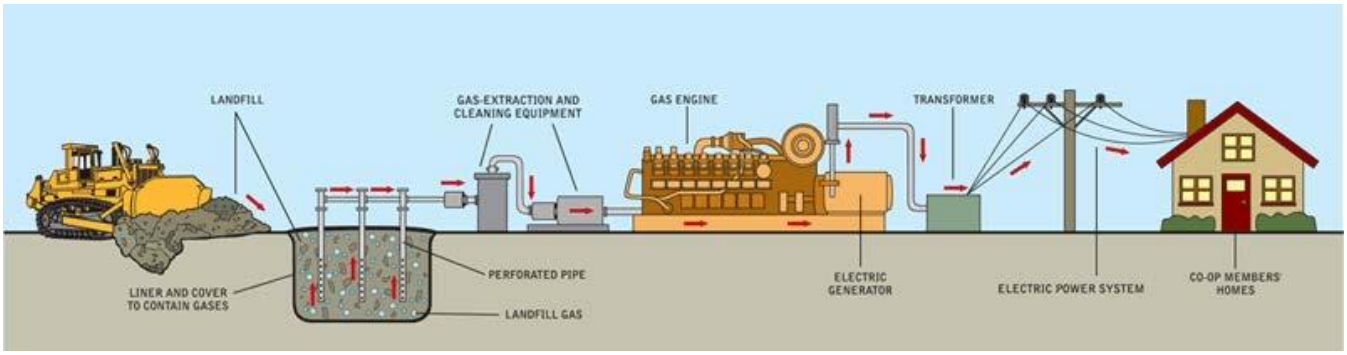
PCTS is located in Pacific City and is operated by Tillamook County Solid Waste. It began operating at this location following the closure of the open dump and burn site in 1981. It served as the primary landfill for the south county area. In 1981, a transfer station was constructed at this site. The Pacific City Recycling & Transfer Station receives less than 1% of all the waste hauled to the three active Tillamook County transfer sites. The waste collected at this transfer station is hauled to the TTS for disposal.

COFFIN BUTTE LANDFILL is located on 740 acres of property in Benton County, near the City of Corvallis. The site opened in 1944 as an open burn landfill and accepts municipal solid waste (MSW) as a regional landfill. The site is also home to the "Pacific Region Compost Facility."

Coffin Butte Landfill collects MSW from several counties. The currently operated site is equipped with a geocomposite liner system,



leachate collection system, as well as a landfill gas monitoring and capture system. Groundwater is monitored as well. The captured landfill gas (~55% CH4 and ~45% CO2) is combusted using five Caterpillar engines to produce 5.66 megawatts of power, which enough power for approximately 4,000 homes.



Tillamook County Solid Waste Programs

Master Recycler Class

A new program to Tillamook County, the Master Recyclers course offers a great way to learn more about waste reduction and recycling. Most counties that offer this program hold their classes one evening a week for eight weeks and augment them with field trips to solid waste and recycling facilities. Master Recycler students receive training in solid waste issues and opportunities. Expert guest speakers supplement the staff to teach what happens to our garbage; recycling and reusing; waste prevention; composting; vermicomposting; household hazardous waste reduction; sustainability and green building; products made with recycled content; and water conservation.

In return, students are asked to pay back the training time through a variety of volunteer outreach activities. These include setting up or expanding a recycling program at one's workplace, staffing a recycling information booth at public events and shows, working with schools and businesses, spending time at a transfer station, assisting at a HHW event, or even organizing a workshop in your own neighborhood.

American Recycles Day/Oregon Recycle Awareness Week

Beginning in 2012, TCSW started an annual Plastic Jug Collection event in response to America Recycles Day, November 15 and Oregon Recycle Awareness Week the same week. The event is open to every school in Tillamook County for grades 4 – 6 and requires students to collect plastic jugs for designated period. Those that collect over 1,500 jugs earn a bench for their school made from recycled plastic. In 2013 additional events were added to include a tin can drive for grades 7-12 and an art contest for grades K–3. The tin can drive participants were awarded a wall plaque and the art contest winners were featured in a 2014 calendar. We anticipate these activities to continue, with the exception of the tin can drive.

Oregon Green Schools

Oregon Green Schools (OGS) is a statewide program that encouraged schools to adopt sustainable habits that improve not only their school neighborhood but their homes and communities as well. Schools must do a waste audit with the assistance of an OGS coordinator and make self-recommendations of how they can improve their recycling efforts. OGS provides resources and guidance to schools while the OGS Coordinator provides local support.

Business Support

As a service to our local business communities we offer waste audits where we visit the place of business and tour their facility and evaluate their disposal habits with the intent to offer suggestions on how to improve their waste habits.

Paint Recycling Program

Tillamook County mixed their first recycled paint in 2014. The experiment

was such success that plans to grow and improve the program are already in the works. The program utilizes paint collected at our Household Hazardous Waste collections. The recycled paint was sold from the TCSW office as well as Habitat for Humanity ReStore and Pacific City Transfer Station.

Computer Recycling

It is now illegal to throw away televisions, monitors, CPU's or laptops in Oregon. Beginning in 2015 it also became illegal to throw away keyboards, mice and other computer peripherals. These items, however, can be recycled in cities throughout Oregon with populations greater than 10,000. At the Tillamook County Transfer Stations, accepted items include televisions, monitors, CPUs, printers, modems, mice, graphics/sound cards, keyboards, scanners, telephones, stereos, microwaves, and computer related peripherals. Items of value are removed for re-use such as hard drives and memory. Remaining items are typically de-manufactured, which means that they are torn apart and recycled, with valuable resources such as copper and gold extracted from the parts.

Household Hazardous Waste Collections

Nine months of the year Tillamook County holds a residential HHW collection at the facility on Ekloff Road in Tillamook. These events are well received and county residents are encouraged to bring hazardous waste items like fluorescent light tubes or bulbs, batteries, used motor oil and vegetable oil, lawn and garden supplies, paint, propane canisters, fire extinguishers etc. All items are accepted free of charge to county residents.

In 2018, the HHW Facility served nearly 1100 customers bringing in 112 thousand pounds of waste. An average of over 88 pounds per person.

This facility DOES NOT ACCEPT Ammunition, Explosives, or Medical Waste, (Sharps/Medical Syringes, Prescription Medications.)

Conditionally Exempt Businesses

Conditionally exempt businesses can bring in hazardous materials as well but only three times a year, by appointment and for a fee.

Material to Recycle		Transfer Stations			Recycle Shacks				
		T	M	P	C	B	G	O*	R
Paper	Newspaper	X	X	X	X	X	X	X	X
	Cardboard	X	X	X	X			X	
	Office Paper	X	X	X	X	X	X	X	X
	Magazines	X	X	X	X	X	X	X	X
	Mixed Paper	X	X	X	X	X	X	X	X
Cans	Tin	X	X	X	X	X	X	X	X
	Aluminum	X	X	X	X				
Plastics	Bottles #1 & #2	X	X	X	X	X	X	X	X
	Plastic clamshells	No longer accepted in Tillamook County							
	Plastic films	Bags accepted at Fred Meyer and Safeway							
Glass	Glass Jars	X	X	X	X	X	X	X	X
Organics	Wood	$	$						
	Yard Debris	$	$	$					
Appliances	Refrigerator	$	$		X				
	Washer/Dryer	X	X	X	X				
	Dishwasher	X	X	X	X				
	TV/Computer	X	X	X					
Automotive/Misc	Tires	$	$	$					
	Scrap Metal	X	X	X	X				
	Windows, etc.	$							
Styrofoam	White/bulky	X**	X***	X					

Household Hazardous Waste (visit our website for collection dates)	Propane Tanks	X	$						
	Medical Sharps				$				
	Motor Oil	X							
	Asphalt Shingles	$	$						
	Batteries	X	X		X				
	Used Cooking Oil	X	X						

*1st Saturday of the month ** Hazardous Waste Collection Days ***1st weekend of the month

Recyclable and Not Commonly Recyclable Materials

PAPER
Accepted: Newsprint, office paper, corrugated cardboard, magazines & junk mail, brown paper bags, cereal boxes, shoe boxes, egg cartons, phone books
Not commonly accepted: Soiled paper, wax or plastic-coated paper, non water-soluble self-adhesive labels, carbon paper, foil lined paper, paper towels or tissue.

GLASS
Accepted: Jars, bottles, mixed colors are okay.
Not commonly accepted: Light bulbs & window glass, drinking glasses, ovenware

METAL
Accepted: Aluminum cans/food containers (foil ok if not too dirty), scrap aluminum, iron, brass, copper, tin cans/lids, empty aerosol cans (cap removed), dried/empty paint cans
Not commonly accepted: Metal with plastic or wood attached

PLASTICS
Accepted: #1, #2 plastic jugs & bottles (with necks)
Not accepted: #5 plastics, yogurt containers/butter tubs; Pesticide, motor oil containers

YARD DEBRIS
Accepted: Plant trimmings & fruit/vegetable scraps, leaves, grass & sod strippings, dirt
Not accepted: Gravel, diseased plants

CONSTRUCTION & DEMOLITION (C&D) WASTE
Accepted: Scrap wood, pallets, dimensional lumber, cedar/wood shakes, concrete with/without rebar at specific locations, asphalt shingles (TTS & MTS)
Not accepted: Painted or treated wood, railroad ties/telephone poles

OTHER (Some items have a fee charged. This list is not all inclusive for each TS, as item acceptance varies between TS)
Accepted: Motor oil & vegetable oil, auto batteries, tires & oil filters, household batteries, large appliances, cellular phones, computers and related peripherals
Not accepted: Drywall (program in Vancouver area)

HOUSEHOLD HAZARDOUS WASTE
Paints/stains, pool/spa chemicals, pesticides & lawn/garden chemicals, motor oil, antifreeze/automotive fluids, gas/diesel, thinners/solvents, household cleaners/disinfectants, batteries, art/hobby chemicals, aerosol products, propane containers, compact fluorescent light bulbs (CFLs), fluorescent tubes, ballasts, mercury containing items, such as thermometers and thermostats, fire extinguishers

KNOW YOUR PLASTICS

	**Polyethylene Terephthalate (PET, PETE).** PET is clear, tough, and has good gas and moisture barrier properties. Commonly used in soft drink bottles and many injection molded consumer product containers. Other applications include strapping and both food and non-food containers. Cleaned, recycled PET flakes and pellets are in great demand for spinning fiber for carpet yarns, producing fiberfill and geo-textiles. Nickname: Polyester (ex: plastic soft drink, water, sports drink, beer, mouthwash, catsup and salad dressing bottles. Peanut butter, pickle, jelly and jam jars. Ovenable film and ovenable prepared food trays)
	**High Density Polyethylene (HDPE).** HDPE is used to make bottles for milk, juice, water and laundry products. Unpigmented bottles are translucent, have good barrier properties and stiffness, and are well suited to packaging products with a short shelf life such as milk. Because HDPE has good chemical resistance, it is used for packaging many household and industrial chemicals such as detergents and bleach. Pigmented HDPE bottles have better stress crack resistance than unpigmented HDPE bottles. (ex: milk, water, juice, cosmetic, shampoo, dish and laundry detergent bottles; yogurt and margarine tubs; cereal box liners; grocery, trash and retail bags)
	**Polyvinyl Chloride (PVC/Vinyl).** In addition to its stable physical properties, PVC has good chemical resistance, weatherability, flow characteristics and stable electrical properties. The diverse slate of vinyl products can be broadly divided into rigid and flexible materials. Bottles and packaging sheet are major rigid markets, but it is also widely used in the construction market for pipes and fittings, siding, carpet backing and windows frames. Flexible vinyl is used in wire and cable insulation, film and sheet, floor coverings, synthetic leather products, blood bags, medical tubing and other applications. (ex: clear food and non-food packaging, medical tubing, wire and cable insulation, film and sheet, construction products such as pipes, fittings, siding, floor tiles, carpet backing and window frames)
	**Low Density Polyethylene (LDPE).** Used predominately in film applications due to its toughness, flexibility and relative transparency, making it popular for use in applications where heat sealing is necessary. LDPE is also used to manufacture some flexible lids and bottles and it is used in wire and cable applications. (ex: dry cleaning, bread and frozen food bags, squeezable bottles, e.g. honey, mustard)
	**Polypropylene (PP).** Polypropylene has good chemical resistance, is strong, and has a high melting point making it good for hot-fill liquids. PP is found in flexible and rigid packaging to fibers and large molded parts for automotive and consumer products. (ex: catsup bottles, yogurt containers and margarine tubs, medicine bottles)
	**Polystyrene (PS).** Polystyrene is a versatile plastic that can be rigid or foamed. General purpose polystyrene is clear, hard and brittle. It has a relatively low melting point. Typical applications include protective packaging, containers, lids, cups, bottles and trays. (ex: compact disc jackets, food service applications, grocery store meat trays, egg cartons, aspirin bottles, cups, plates, cutlery)
	**Other.** Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination. (ex: three and five gallon reusable water bottles, some citrus juice and catsup bottles)

Milestones in Garbage

A historical timeline of municipal solid waste management

500 B.C. - 1700s

500 B.C.	The city of Athens organizes the first municipal dump in the Western world. Citizens are required to dispose of their waste at least one mile from the city walls.
1690	The first paper recycling mill in the United States using recycled fibers (including waste paper and old rags) is established at the Rittenhouse Mill near Philadelphia.
1757	Benjamin Franklin institutes the first municipal street cleaning service in the United States, in Philadelphia; at the same time, American households begin digging refuse pits instead of throwing garbage out of windows and doors.
1776	The first metal recycling in the United States occurs when patriots in New York City melt down a statue of King George III and make it into bullets.

1800s

1842	A report in England links disease to unsanitary environmental conditions, helping to launch the "age of sanitation."
1860s	In Washington, D.C., people still dump garbage and slop in the street, while pigs, rats, and cockroaches flourish.
1874	In Nottingham, England, a new technology called "the destructor" provides the first systematic incineration of municipal solid waste.
1885	The nation's first garbage incinerator is built on Governor's Island, New York.
1895	The New York City Street Cleaning Commissioner sets up the first comprehensive system for public sector garbage management in the country.
1896	Waste reduction plants, which compress organic wastes to extract grease, oils, and other by-products, are introduced to the United States from Vienna, Austria. The plants are later closed, since they emit noxious odors. The first recycling center in the United States is established in New York City.
1899	New York City's Street Cleaning Commissioner organizes the first rubbish sorting plant for recycling in the United States.

1900s

1900s	"Piggeries" are developed in small- to medium-sized towns in the United States. At these facilities, swine eat fresh or cooked food waste. It is estimated that 75 pigs consume 1 ton of refuse per day. Food waste is recycled as pig feed until the late 1960s.
1902	Seventy-nine percent of 161 cities in the United States surveyed in a Massachusetts Institute of Technology study provide regular collection of waste materials from people's homes.
1904	The nation's first major aluminum recycling plants open in Cleveland and Chicago.
1909	More than 100 incinerators close due to noxious smoke.
1914	After a shaky start, incinerators increase in popularity in North American cities. About 300 incinerators operate in the United States and Canada.
1916	Cities begin switching from horse-drawn to motorized refuse collection equipment.

1920s - 1934

1920s	Using wetlands located near cities as a garbage disposal facility becomes popular. Garbage is placed in the wetlands in layers, with ash and dirt layers on top as cover.
1934	The Supreme Court bans the dumping of municipal waste into the ocean, a common practice until this time.

1940s

1940s	The Fresno, California, Director of Public Works leads the effort in developing sanitary methods for disposing of trash in large urban areas.
1942-1945	Americans collect and industry recycles rubber, paper, scrap metal, fats, and tin cans—

—about 25 percent of the waste stream——to help the war effort.
During the war, Army troops bury trash in the ground, providing the initial idea for the "sanitary landfill."

1945 Almost 100 cities in the United States are using sanitary landfills.

1950s

1950s Many urban areas use close-in, open-burning dumps because they reduced the volume of refuse and extend the usability of the site. But by the end of the decade, open burning of refuse is prohibited in many areas.

1954 Olympia, Washington, enacts one of the first "pay-per-can" programs.

1955 With consumer prosperity at an all-time high in the United States, Life magazine heralds the advent of the "throwaway society."

1958-1976 The amount of packaging produced and disposed of in the United States increases by 67 percent, due to the increase in consumerism after World War II.

1959 The American Society of Civil Engineers publishes the standard guide to sanitary landfilling. To guard against rodents and odors, the guide suggests compacting the refuse and covering it with a new layer of soil each day.

1965 - 1989

1965 The first federal solid waste management law, the Solid Waste Disposal Act, authorizes research and provides for state solid waste grants. These include site inventory programs, resource recovery systems, and constructing new or improved solid waste disposal facilities.

1968 More than 33 percent of U.S. cities collect waste that is separated in some manner.

1970 The U.S. Environmental Protection Agency (EPA) is created by President Nixon. Its first Administrator is William Ruckelshaus.

1971 Oregon passes the nation's first bottle bill, paving the way for nine other states to offer refunds of 5 or 10 cents for returned containers.

1972 The first "buy-back" centers for recyclables open in Washington State. These centers accept beer bottles, aluminum cans, and newspapers.

1974 The first city-wide use of curbside bins occurs in University City, Missouri, for collecting newspapers.

1975 All 50 states have some form of solid waste regulations in place, although the requirements vary widely.

1976 The Resource Conservation and Recovery Act (RCRA) creates the first significant role for the federal government in waste management. The law emphasizes recycling, resource conservation, and proper waste management.

1979 EPA prohibits open dumping and sets first standards for landfills.

1980 The first community-wide household hazardous waste collection day is held.

1987 Mobro, the garbage barge, sails from New York up and down the U.S. East Coast, looking for a place to dispose of its waste. Rejected by facilities in six states and three countries, the barge draws public attention to the perceived landfill capacity shortage in the Northeast. The garbage is finally incinerated in Brooklyn and the ash is disposed of in a landfill near Islip, Long Island.

1989 EPA sets a 25 percent national waste reduction and recycling goal.
Twenty-six states have comprehensive laws making recycling an integral part of solid waste management.

1990s - 2002

1991 EPA sets improved solid waste landfill standards that include requirements for location, groundwater protection, monitoring, and post-closure care. EPA also issues new performance and emissions standards for MSW combustors.
More than 3,000 household hazardous waste community collection programs have been documented in all 50 states.

1992	President Bush issues Executive Order 12780, to stimulate waste reduction, recycling, and procurement of recycled goods in all federal agencies.
1994	EPA launches the WasteWise to help businesses, educational institutions, and other large facilities reduce waste and recycle more materials. EPA launches its Jobs Through Recycling initiative to bring together the economic development and recycling communities through grants, networking, and information sharing. President Clinton issues Executive Order 12873, which requires federal agencies to establish waste prevention and recycling programs and to buy and use recycled and environmentally preferable products and services. Clinton creates the Office of the Federal Environmental Executive to enforce this Executive Order.
1995	EPA issues the first Comprehensive Procurement Guideline, designating 19 recycled-content products for which the federal government should give procurement preference.
1996	The nation reaches a 25 percent recycling rate. EPA sets a new recycling goal of 35 percent. The first voluntary recycling and composting initiatives are held at the Olympics, at the 1996 Olympic Games in Atlanta. Organizers aim to divert 12 million aluminum cans, 20 million PET bottles, and 3,000 tons of paper for recycling.
1999	EPA's Municipal Solid Waste in the United States: Facts and Figures, updated ever year, provides data on U.S. waste generation, recovery, and disposal rates.
2000	EPA establishes a link between global climate change and solid waste management, showing that waste reduction and recycling help stop global climate change. More than 5,000 U.S. cities are using Pay-As-You-Throw Programs, in which residents pay for MSW collection based on the amount of waste they throw away——encouraging recycling and waste reduction.
2001	EPA policy requires its offices to use paper with 100-percent recycled content and 50-percent postconsumer content.
2002	EPA kicks off Resource Conservation Challenge urging Americans to meet or beat two goals by 2005: boosting the national recycling rate from 30 percent to at least 35 percent and curbing by 50 percent the generation of 30 harmful chemicals normally found in hazardous waste.

Source: EPA, 2003

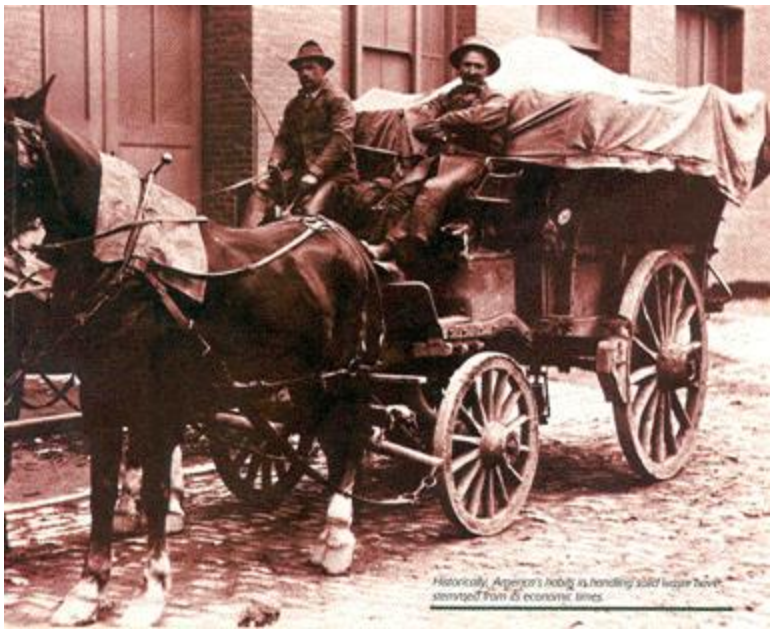
Waste & Wealth—
A 200 Year History of Solid Waste in America

Article

Like it or not, from scavengers to skilled businessmen, the history of solid waste in America is tied to cash, indelibly reflecting the fluctuating status of our nation's wealth and prosperity.

Sure, modern recycling as we know it preserves landfill space and has resulted in diverting a fair amount of garbage from land entombment. But, tracing the roots of our thrifty forefathers tells us our reuse tendencies are grounded in our country's origin and growth. Cleanliness, efficiency and industrious marketing efforts also have characterized, in one way or another, America's evolving sanitation systems.

But, in two centuries of disposable activities, our throwaway habits and reusable mindsets ultimately have mirrored the economic times in which we've lived.



The Enduring 1800s.

History professor Susan Strasser, author of the book "Waste and Want," says the most fascinating fact she gleaned from her months of researching America's social history of trash was 19th century Americans' frugality in determining something as unwantable. "The most amazing thing to me was the extent to which people avoided wasting [things] before this century," Strasser says.

Regardless of whether this was due to the overall economic leanness of the times, immigrant practices of first-generation Americans, or the prosperity of local and regional recycling markets, not much went to waste. Although packaged goods grew in popularity, Strasser notes most merchants continued to sell their products by bulk, and customers incorporated a number of reuse techniques into their daily lives.

Boiling food scraps resulted in soup stocks; chickens ate the rest and produced eggs. Items of little interest to adults were handed down to children as toys. Broken things were recycled or sold as scrap. Items of little value were burned for fuel.

"All over the country, even middle-class people traded rags to peddlers in exchange for tea kettles or buttons," Strasser writes. "The regional, national and even international trade in rags was brisk because they were in high demand for papermaking ... Grease and gelatin could be extracted from bones. Otherwise, bones were made into knife handles, ground for fertilizer or burned into charcoal for use in sugar refining. Bottles were generally refilled."

In the 1800s, it seemed most everything had a second life. Capitalizing on the trade of used goods, a fairly sophisticated reuse and recycling system evolved to feed raw materials to the sprouting roots of industrialism.

"Scavenging was essential to that system," Strasser writes, "a chore and a common pastime for poor children, who foraged for shreds of canvas or bits of metal on the docks, for coal on the railroad tracks, and for bottles and food on the street." What wasn't salvaged for revenue returned home with the children as food and fuel for the entire family.

Knee-Deep in Muck

Despite these foraging and recycling efforts, America's city streets were far from clean in the 19th century. Littering was the disposal method of choice before people began settling in one place 10,000 years ago. However, a History Channel documentary, "Modern Marvels: Garbage," indicates that solid waste only really became a nuisance with the creation of cities.

In the television special, Dr. Martin Melosi, history professor at the University of Houston, says common disposal practices in the 1800s consisted of dumping evening meal leftovers and chamber pot contents out the window into the streets. Labeled "biological vacuum cleaners," scavenger pigs, goats and stray dogs were free to roam streets prior to the Civil War.

Ordinances were enacted to contain animals, but they were widely ignored because the animals provided cities with their only form of sanitation service. In fact, in 1834, the city of Charleston, W. Va., enacted a law protecting vultures from being hunted because the birds ate the city's garbage.

By the 1850s, the link between garbage and disease was made. American doctors and health workers initiated clean up campaigns in major urban centers, enlisting volunteers to clean filth off the streets. The efforts, by today's health standards, were largely misguided since yet-to-be-discovered bacteria - not filth - caused disease.

Nevertheless, the streets of New York City were several feet deep in horse manure and garbage by 1882. The city reeked, and any garbage that was collected was dumped into rivers, lakes and oceans.

Col. George Waring Jr., a former Civil War officer, was appointed New York City's first sanitation director in 1896. He created America's first revenue-producing, residential solid waste collection and recycling program.

Launching a major public relations campaign and outfitting his sanitation workers in white uniforms to parallel the cleanliness of the medical profession, Waring used his "White Wing" workers to wage a war against waste. For a dollar a day, Waring's sanitation crews provided and serviced residents with three barrels: one for ash, one for garbage and the other for rubbish.

Workers pressed oil and grease from the garbage to be sold to industry as lubricants. Spent garbage then was dried in cakes and sold as fertilizer to farmers across the country. Ash was landfilled. Remaining garbage was dumped in the Atlantic Ocean.

This idea spread. By 1902, municipal solid waste collection was prevalent among 79 percent of all U.S. cities, according to a survey by the Massachusetts Institute of Technology, Cambridge, Mass. Although municipal waste collection program privatization hit its stride in the latter half of the 20th century, a number of cities, neighborhoods and individuals contracted collection services to immigrants.

Through the 20th Century

Trash and trashmaking became integral to the economy in a wholly new way: the growth of markets for new products came to depend in part on the continuous disposal of old things," Strasser says. In her book, she writes, "Old-fashioned reuse and recycling didn't disappear overnight," but the turn of the 20th century marked the passing of our forefather's prudent efforts.

The existence of municipal trash collection programs encouraged middle-class people to throw away, Strasser says, and America's industrial revolution meant more items were available to be purchased, used and discarded.

According to the author, "The physical volume produced by American industry nearly tripled, and the horsepower of industrial machinery quadrupled between 1899 and 1927. American industry spewed out a wealth of standardized, uniform goods that cost money to replace the makeshift, the homemade and the handmade."

America's industrialization not only promoted product consumption, but it also caused hardships on sanitation systems by creating more waste. Borrowing the idea of incineration from their British peers, U.S. officials decided to tackle the growing volume of garbage by burning it. Between 1880 and 1900, more than 180 incinerators were constructed, resulting in heat for homes while spewing noxious smoke across city landscapes. By 1909, more than 100

facilities were closed due to public outcry and pressure. Not until the soaring energy prices of 1970 was waste-to-energy technology revisited with new interest.

By 1919, New York no longer could market its recycled materials, nor keep pace with its citizens' disposable tendencies. To the outrage of New Jersey residents living in coastal communities, the city resumed dumping a large portion of its waste into the ocean, which prompted a series of class action lawsuits from the Garden State, which obviously was trying to retain some semblance of its moniker. By 1934, the U.S. Supreme Court outlawed dumping of all wastes into the ocean.

Ironically, people's reactions to the economic pressures and pains associated with the Great Depression of the 1930s were to recycle less and buy more in order to keep people working and earning money. Strasser points to House & Garden Editor Richardson Wright's appeal to his readers to keep purchasing products despite economic hardships.

"To maintain prosperity we must keep the machines working, for when machines are functioning man can labor and earn wages," Wright wrote in 1930. "The good citizen does not repair the old; he buys anew. The shoes that crack are to be thrown away. Don't patch them. When the car gets crotchety, haul it to the town's dump. Give to the Ashman's oblivion the leaky pot, the broken umbrella, the clock that doesn't tick. To maintain prosperity, we must keep the machines going."

World War II and Landfills

With no apparent desire to return to the thrifty ways of our forefathers, local officials inevitably recognized the need to establish a more permanent and environmentally sound system with which to manage solid waste. World War II and the U.S. Army proved to be the catalysts for the birth of the sanitary landfill.

With large numbers of troops overseas, army officials constructed large dump sites to handle the growing amounts of solid waste being generated daily at base camps. Collecting waste and delivering it to the dumps, army sanitation workers covered it daily with dirt.

The U.S. Army is credited as the catalyst for today's sanitary landfills. During the war, sanitation workers collected waste, disposed of it at "dumps," then covered it with dirt.

The war effort also transcended foreign frontiers, leading to organized mass recycling campaigns back home. Strasser writes, "A month after the Japanese

attack of Pearl Harbor, the high school students of Prosser, Wash., collected 10 tons of paper in a drive sponsored by the Rotary Club." Proceeds went to the local defense council. The popular "Get Some Cash for Your Trash" campaign produced vast volumes of recycled materials. Everything from scrap metal and tin foil to rubber and newspaper was collected nationwide.

The attack on Pearl Harbor killed 2,400 Americans and turned United States' public opinion firmly in favor of war. Eventually, the U.S. government actually had to ask people to stop saving paper because of a lack of storage capacity.

Yet, for all the collection and scavenging efforts, the war movement didn't motivate Americans to return to a former life. "Scrap drives offered Americans a way to contribute to the war effort without sacrificing too much," Strasser writes. "By the end of the war, Americans were fully ready to favor consumerism over reuse. Rationing, shortages, scrap drives and homefront propaganda had grown stale."

William Rathje, archeologist from the University of Arizona, Tuscon, Ariz., concurs, adding, "Very little was ever done with that stuff. It was more for public morale; to give the public a sense of participation in the war."

Toxic Takes on New Meaning

After World War II, chemical companies developed new and more toxic products. Most waste generated at chemical plants was dumped into nearby rivers and lakes with few government regulations and restrictions. Toxic waste gradually seeped into the earth's soil.

In 1962, Rachel Carson's book, "Silent Spring," caused a great public outcry and awareness about pollution in America. Carson predicted the extinction of all song birds due to pesticides and chemical pollution. And, while scientists disputed Carson's claims, it left a lasting impression on the public.

According to William Ruckelshaus, former chief of the U.S. Environmental Protection Agency (EPA), Washington, D.C., it was the onset of color television showing pollution in multicolor, along with astronauts' pictures of earth taken from space, that put public pressure on the federal government to intervene and finally regulate environmental activities.

In 1965, Congress passed the Solid Waste Disposal Act (SWDA), the nation's first federal solid waste law authorizing research and providing for state grants. Five years later, the Resource Conservation and Recovery Act (RCRA) replaced SWDA, requiring the federal government to issue waste disposal guidelines.

Also in the 1960s, two industry organizations were created, giving official voices to solid waste management professionals in both the public and private sectors. The Government Refuse Collection and Disposal Association was created in 1961, eventually becoming the Solid Waste Association of North America (SWANA), Silver Spring, Md. Following suit in 1968, the National Solid Wastes Management Association (NSWMA) formed and is now a part of the Environmental Industry Associations (EIA), Washington, D.C.

Waste Becomes Big Business

Private companies also began to play bigger roles in communities' waste collection and disposal programs in the latter half of the 20th century. In a 20-year period from 1955 to 1975, private collection efforts grew from 45 percent to almost 67 percent, while public providers decreased from 55 percent to 33 percent during the same period.

In the past few decades, large private companies such as Waste Management Inc. (WMI) and Browning-Ferris Industries (BFI) have grown by acquisition. Ironically, unlike the 1970s, smaller companies have stunned the industry with their acquisitions of much larger companies. In 1998, U.S.A. Waste, the country's third-largest solid waste company, acquired industry leader WMI, followed a year later by Allied Waste Services, which took over BFI, the second-largest waste firm at the time.

Major historical and legislative events also occurred.

In 1978, Love Canal became a household phrase as 200 families were relocated after it was determined Hooker Chemical and Plaster Corp. disposed of 21,000 tons of chemical waste during a 25-year period and later sold the property to the Niagara Falls Board of Education, which constructed a playground on the site. Love Canal is remembered as the primary cause for creating the Comprehensive Environmental Response and Reliability Act, also known as Superfund, in 1980.

In 1987, the garbage barge Mobro searched the Atlantic east coast looking for a welcome mat for its 6,000 tons of rotting waste. Rejected by five states and two foreign countries, Strasser says the barge was a precursor of future events in America. As the media covered the barge's hapless voyage, the lasting impression was etched in Americans' minds that the country was running out of landfill space.

"In response, the big waste companies raised tipping fees and built immense landfills," Strasser writes. Shortsightedly, "Observers of trash eventually declared the problem solved." In response to the national landfill shortage, EPA Assistant Administrator Winston Porter announced a 25 percent recycling goal in 1988 to be met within four years. It took Americans twice as long to hit the mark, which shouldn't be a surprise since solid waste production per person increased from 3.2 pounds per day to 4.4 pounds, according to Strasser.

"Put another way, after recycling, the trash that had to be dumped or burned increased from three pounds to 3.4 pounds per day," she writes, adding even the most dedicated recyclers continue today to buy more food in disposable containers and can't find uses for all of the plastic containers coming their way.

In 1992, mirroring the sister regulations approved for hazardous waste landfills, Subtitle D of RCRA was authorized, establishing minimum criteria for solid waste disposal facilities. In addition to expensive liner and leachate collection systems, landfills now must follow more stringent siting criteria, design standards and closure requirements. While forcing the closure of thousands of landfills, the majority being publicly owned facilities, the new regulations spawned immediate business opportunities for liner manufacturers, geo-technical companies and environmental monitoring specialists.

This business competition continues today. Faced with waste reduction mandates not placed on its private counterparts, local governments are experiencing more difficulty competing with vertically integrated waste conglomerates. Subtitle D requirements add to the financial pressures. In 1994, the U.S. Supreme Court dealt a stunning blow to public providers of solid waste services when it concluded that mandating waste flow to specific disposal facilities is unconstitutional.

The precedent-setting C&A Carbone ruling continues to reverberate throughout the industry today as Virginians brace themselves for the closure of New York City's Fresh Kills Landfill and the inevitability of hundreds of thousands of tons of imported waste a year. Owners of the large Virginian landfills stand to make millions of dollars.

Carbone's irony is Virginia's proverbial thorn in its side: You can't keep waste from leaving, but you can't stop it from coming either.

Source: Waste Age Magazine, December 1999, “Waste and Wealth” by Cheryl L. Dunson.

Is Burning Trash Bad?

By Earth911.com writer Mary Mazzoni
Published on August 2, 2010

There are currently 90 waste-to-energy facilities operating in the country that torch 14 percent of our trash and convert the heat into electricity.

The growing popularity of modern waste-to-energy (WTE) facilities in Europe and Asia has many in America asking: is burning trash bad?

We're not big burners here in the U.S., but we've been known to light up some litter from time to time. The majority of our waste is buried in landfills, while 31 percent is recycled, but there are currently 90 waste-to-energy facilities operating in the country that torch 14 percent of our trash and convert the heat into electricity.

John Norton, engineering consultant and owner of Norton Engineering LLC, ran a now-defunct WTE plant in Dayton, Ohio for over a decade, and he is familiar with the internal goings-on of waste-to-energy and the misconceptions that often surround the facilities.

"Sometimes people would ask me if the plant was running," Norton remembers. "When I asked them why, they said 'because there's no smoke!'"

"If you see smoke, you can bet that those operating the plant are running around like rats trying to fix something," he says. "If there is visible smoke of any sort, we have a big problem. The EPA monitors all of the stack emissions all of the time. There's just no cheating possible."

Engineers like Norton advocate the cleanliness and safety of WTE facilities and are puzzled why an energy source as renewable as trash has not been explored further here in the states, but many environmental activists are pleased with American skepticism about waste-to-energy.

"There are incinerators in Japan and Europe that are newer than the ones in the U.S. because communities are so successful in questioning the approach of burning all of those resources," says Monica Wilson, director of the Global Alliance for Incinerator Alternatives (GAIA).

In this hot-button debate, activists like Wilson remain unconvinced that waste-to-energy facilities are free of the hazardous fly ash, human health concerns and environmental impact of their predecessors. So, how do these plants work, and are they really safe? Could garbage really be the renewable energy solution of the future, or is big-business pulling the wool over our eyes with a fancy new name and a "greener" business model?

The experts weigh in

The EPA points out that "combusting municipal solid waste has a negative public perception in some communities," and while many are quick to point out the draw-backs of waste-to-energy disposal, there are plenty of voices speaking out on both sides of the issue.

"We all picture a burning 55 gallon barrel in somebody's back yard, but that's not what we're talking about," says Norton. "We're talking about very clean combustion under very controlled conditions."

But emissions are not the only concern for environmental activists like Monica Wilson. Financial burdens and the possible impediment to recycling expansion are also big problems.

“There are so many economic reasons for local governments to look into expanding their recycling programs,” says Wilson. “Recycling programs create local jobs and feed materials back into local, regional and national industry [...] That’s a really important thing to be thinking about instead of spending millions and potentially up to a billion dollars on a new facility.”

“It is important to talk about zero-waste in local government and to adopt zero-waste as a goal,” Wilson says. “It doesn’t mean we’re going to be at zero-waste tomorrow, but the only way to reach that goal is to set it.”

“There is a lot that communities can do in the short-term that will have a huge impact,” she adds. “I think we can achieve a lot and a lot faster than the waste industry would say, because their profits come from wasting as much as possible.”

Others argue that with waste constantly streaming in, WTE facilities should be explored as a cleaner alternative to landfills.

“If I had a primary goal, I would not call it zero-waste,” says Norton. “I’d call it zero-landfill.”

The environmental bottom-line

The strict standards of the Clean Air Act significantly reduce the environmental impact of waste-to-energy facilities by controlling the emissions of hazardous organics including dioxins and furans, hazardous metals and acid gases.

A variety of processes are put in place to ensure the clean operation of a WTE plant, including “dry scrubbers,” which use the old gardener’s trick of spraying lime to neutralize acids and electrostatic precipitators, a fancy term for electrically charged plates that capture small particles and fly ash in the same way your TV screen attracts dust.

Federal standards are also imposed on landfills, which must be designed “to protect the environment from contaminants which may be present in the solid waste stream,” says a spokesperson for the EPA.

To comply with these standards, landfills must be methodically constructed to avoid groundwater and environmental contamination. Although both WTE plants and landfills are subject to stringent EPA standards, neither are free of potential environmental and public health problems.

“Emissions of hazardous air pollutants from waste-to-energy combustors and fossil fuel boilers can be controlled to trace levels,” explains the EPA. “However, environmentalists express concerns about these residual emissions.”

Activists such as Monica Wilson point out that residual emission from both landfills and WTE facilities pose a potential threat to public health and may still contain gases harmful to the environment.

“Landfills generate methane, which is a very potent greenhouse gas,” says Wilson. “When you throw waste into an incinerator, no matter how clean it claims to be, greenhouse gases are still produced and so are other potentially harmful emissions.”

The concerns of environmental activists like Wilson are warranted. Both landfills and WTE facilities do emit greenhouse gases.

However, when you compare the two, there is a difference.

According to a report by P. Ozge Kaplan, Joseph DeCarolis and Susan Thornloe, "Burning one ton of waste in a waste-to-energy unit saves between 0.5 and one ton of greenhouse gas emissions compared to landfilling the same amount of waste."

How recycling fits into the equation

When a WTE facility is constructed contracts are formed between the company operating the facility and the municipality, which mandate the flow of trash into the facility.

From a business standpoint, this means that the operating company and the municipality are shelling out millions to construct the plant. So, they want to make sure enough electricity will be produced to make it worth their while.

The EPA admits that "WTE facilities may be an impediment to further waste reduction, reuse and recycling given that the economic viability of the WTE facility is based on a given supply of wastes." For this reason many environmental activists like Wilson express concern that WTE plants may prove to be a disincentive to recycling, composting and reuse.

"If a community has a facility that must receive a certain amount of tons per day, they can't build a recycling program that's bigger than that," says Wilson. "Often times the amount of waste that is required to go into the incinerator cancels out a community's recycling goals. It's simply not possible to recycle what the community wants to recycle and still feed the incinerator enough waste per day."

But according to Norton, most waste-to-energy plants don't need your recyclables to meet their bottom-line.

"When you take all bottles, cans and paper out of a load of waste and study what's left, the combustion characteristics haven't changed at all," Norton says. "Recycling programs are no threat to a waste-to-energy plant. When one of these plants is proposed you often find that the plant itself becomes the agency that encourages recycling."

A 2009 study conducted by Eileen Brettler Berenyi examined the recycling rates of more than 500 communities with waste-to-energy facilities and seems to prove Norton's theory. The findings of this study were that communities with waste-to-energy facilities had a higher recycling rate than the national average.

Recycling also takes place within the plants themselves. After residual ash cools, magnets and other devices remove metal scrap. These scraps of metal, usually iron and steel, can be as small as paper clips and staples, but add up to thousands of tons over time.

Why burn trash in the first place?

The average American tosses 1,600 pounds of trash per year, which is enough to take up two cubic yards of landfill space.

At that rate, our purple mountain majesties could turn into an Appalachian Trail of trash. So, it's no wonder that facilities that can decrease the volume of waste and provide renewable energy are so attractive to the U.S. government.

After being burned in an incinerator, residual ash is only about 15 percent of the original load of waste. Translation: after incineration your 1,600 pounds of trash becomes 240 pounds of ash, which is much more manageable for waste management workers.

Some incineration facilities, called solid waste incinerators, only exist to serve this purpose. They don't produce electricity. They only burn your trash to make it smaller, easier to dispose of and less space-consuming in landfills.

On the other hand, waste-to-energy facilities shrink trash *and* use the heat to produce steam and electricity. These facilities have the added benefit of producing energy from material that would otherwise be landfilled.

U.S. WTE plants dispose of the waste of 40 million people and generate enough electricity for nearly 3 million households.

What about that ash?
The amount of residual ash varies depending on the waste being used. It usually represents between 15 and 20 percent of the original load of waste, which sounds great. Less landfills the size of Mount Everest, right?

Right, but there's a catch. Disposing of ash can be problematic, and the issue of residual fly ash is huge with environmental activists. Ash can contain high concentrations of various metals once present in the original waste. For example, printer inks and textile dyes can release iron and cadmium into the residual ash.

Sorting trash before incineration significantly reduces this problem. The major culprits of metal residue are batteries and paints. Removing these materials before loading the boilers reduces metal concentration in the ash.

Don't worry, the EPA isn't simply taking a plant-owner's word for it. They test the ash from WTE plants to make sure it is safe. Tests are generally looking for chemicals and metals that may contaminate groundwater if placed in a landfill, and once ash is pronounced safe, it is landfilled or used for a number of applications.

About one-third of all the ash produced by WTE facilities is reused in landfills as a daily or final cover-layer or to build roads and make cement.

The final verdict
According to the EPA, "The decision to build a waste-to-energy facility depends on many factors, including geography and population density, the willingness of citizens to accept the technology, the willingness of investors to support it, and on state and local officials who determine how solid waste is handled in a particular area of the country."

While environmental activists and the waste management industry disagree about whether the U.S. should burn or bury its trash, all agree that recycling is still the No. 1 disposal option. The EPA promotes a waste reduction hierarchy that encourages reducing waste at its source, then recycling. Recycling is preferable to waste-to-energy and landfilling for materials.

The waste-to-energy debate will likely rage on, America, but at least we're all on the same page in our knowledge that the chasing arrows are still our best disposal bet.

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Waste-to-energy ignorance slows growth

by Mike Breslin

The main barrier holding back the building of waste-to-energy (WTE) plants in the United States is a misunderstanding of facts among the general population. Mention burning garbage to generate energy and the reaction is usually negative because people envision stinking, billowing black smoke and ash falling on their heads – unenlightened heads. They are thinking of old fashioned, dirty incineration where burning only serves to reduce mass with no energy harvest.

Incineration has come a long way. Today, municipal waste combustion units (MWC) are in compliance with the Clean Air Act for Maximum Achievable Control Technology (MACT). A United States Environmental Protection Agency (EPA) memorandum issued in 2007 actually called MWC-MACT performance "outstanding."

Disposal of waste by burning dates back to man's first use of fire, but it was not until 1975 that burning solid waste to generate energy became commercially viable in the United States. That's when the first commercial plant opened. It still operates in Saugus, Massachusetts.

Over the intervening 35 years, the industry has advanced its technology considerably and developed pollution controls that make it one of the cleanest forms of energy generation. We asked Paul Gilman, chief sustainability officer at Covanta Energy about pollution: "We produce electricity with fewer emissions than coal and oil, and most of our plants emit less than natural gas facilities. In some plants we tie natural gas."

Covanta is the largest WTE company in North America with 41 plants in 16 states and one in Canada. In North America they annually process more than 20 million tons of municipal solid waste to generate over 10 billion pounds of steam and approximately 9 million megawatt-hours of electricity.

If Americans knew the facts about using WTE plants as compared to landfilling, or burning coal, oil or natural gas, public attitude could be changed. The EPA actually stated that our nation's 86 waste-to-energy plants produce electricity with less environmental impact than almost any other source of electricity.

Unlike coal, oil, natural gas or nuclear, WTE is classified as renewable energy under the Energy Policy Act of 2005 and by the Department of Energy (DOE). Twenty-five states plus the District of Columbia have laws that define WTE as renewable energy and 15 states include WTE in renewable energy portfolios (state policies mandating electricity providers get a percentage of their power from renewable resources by a certain date). Five states have set nonbinding renewable energy targets.

DOE says turning garbage into energy makes "important contributions to the overall effort to achieve increased renewable energy use and the many associated positive environmental benefits."

Generally speaking, however, people do not understand the benefits of converting solid waste into power, nor the state of the American industry.

The New York Times published a story in April entitled, "Europe Finds Clean Energy in Trash, but U.S. Lags." The article told how Europe has embraced WTE, has about 400 plants, is expanding existing facilities and building new ones. The article covered positive aspects of WTE, but erred in one important statement: "By contrast, no new waste-to-energy plants are being planned or built in the United States…"

Ted Michaels, president of the Energy Recovery Council, the trade organization representing the United States waste-to-energy industry, wrote a letter to the Times editor (as yet unpublished) that said in part: "…I would take issue with the assertion that there are no new waste-to-energy facilities being planned or constructed in the United States. On the contrary, the United States has seen a resurgence of interest in waste-to-energy and new capacity has been planned and constructed."

Michaels cited expansions within the past three years of two facilities, each of which added over 50 percent capacity to meet new demand. Other expansions are currently underway in Hawaii and New York, two in Minnesota and several more are being considered at other locations. New facilities have been proposed and are underway in Florida and Maryland. Other facilities are being actively considered in many parts of the country, including plants in Los Angeles and Chester County, South Carolina. Michaels concluded his letter with: "While these facilities will take time to wind their way through the necessary processes, it is clear that waste-to-energy is on the rise in the United States and we will begin to close the gap with our European counterparts."

"Europe tends to focus less on generating electricity and more on district heating and cooling. In Europe, community-based plants primarily feed hot water into buildings, whereas in the United States it is used to generate electricity to feed into the grid," Michaels explained.

Nonetheless, both the EPA and the European Commission's Eurostat estimate that the European Union (EU) annually sends 50 million metric tons to WTE plants while the United

States sends about 26 million metric tons. The disparity is less considering that the EU-27 have a population of nearly 500 million and the United States about 300 million. The EU also aggressively discourages landfills through taxation while in the United States landfills are still relatively cheap, but getting more expensive. “When we construct a facility we are in effect competing with landfills. So we have to have a fee that is competitive as well as utilize revenues we get from recycling metals and the energy sales,” said Gilman of Covanta’s business model.

Covanta broke ground in December for a 40 percent expansion of the plant it operates for the city and county of Honolulu to process an additional 900 tons a day and recently completed a 600 ton per day expansion at the plant it operates in Hillsborough County, Florida. As landfilling continues to present environmental challenges, communities across North America are exploring alternatives.

Maryland recently awarded contracts for two new WTE plants. West Palm Beach, Florida has issued a request for proposals. “We have a community in South Carolina that is interested in a facility and we are talking to the City of Vancouver where we operate their existing WTE facility about a new project where there is no guarantee on waste delivery. The plan is to barge the waste, which is better than long haul trucking. We are essentially saying that whatever you have left over after recycling we will take it. Then the burden of risk is on us to keep the fuel supply going by working with other communities. Increasingly, it’s about working with groups of communities,” said Gilman.

It appears that countries and communities with more progressive recycling programs better understand the interrelation of energy production, recycling and effects on the environment. “The communities we serve have recycling programs with greater recovery rates than the United States national average. Some communities we serve like Marion County, Oregon have a recycling rate over 60 percent and a target of 70, ” Gilman explained.

More advanced municipal recycling operations do a good job of separately recovering plastic, paper and metal, but invariably some of these materials wind up in the garbage going to WTE plants – a composition of roughly two-thirds biomass and one-third fossil based. The plants use waste as fuel to recover the energy value. In the process, the original volume is reduced to a 10 percent residue. Covanta calculates its residue at 22 percent ash, which is landfilled, and 78 percent metal that is recycled. The Energy Recovery Council estimates that over 700,000 tons of ferrous is recovered from United States WTE plants annually. But there is a trend towards more nonferrous recovery.

Gilman told us about metals at Covanta. “We process about 20 million tons of municipal solid waste every year. About 98 percent of that waste has ferrous recovery and about 60 percent has nonferrous recovery. For 2010 we project to do about 15 thousand tons of nonferrous and about 430 thousand tons of ferrous. Of waste by weight going through our plants it’s about 2.6 percent metals.”

Water heated by combustion is converted into steam that drives turbines to generate electricity. Using a multi-step pollution control system, WTE plants employ scrubbers to control acid gas, fabric filters to control particulate, selective non-catalytic reduction to control nitrogen oxides and carbon injection to control mercury and organic emissions to meet strict standards. Covanta claims that it operates, on average, at about 80 percent below permitted levels.

The Energy Recovery Council said that for every ton of waste processed in a WTE plant nearly one ton of greenhouse gas (GHG) is avoided. This calculation is complex, but based on the EPA's Municipal Solid Waste Decision Support Tool, modern waste-to-energy plants help reduce greenhouse gases three different ways:

1. When a ton of solid waste is delivered to a waste-to-energy facility, the methane that would have otherwise been generated in a landfill is avoided. While some landfill methane is collected and burned to generate electricity, the vast majority is emitted into the atmosphere.

2. For every megawatt of electricity generated through the combustion of solid waste, a megawatt of electricity from a conventional coal or oil-fired plant is avoided, creating a net savings of GHG emissions.

3. A modern WTE facility separates ferrous and nonferrous metals, which are recycled. This is more energy efficient than mining and processing virgin materials, saves the required energy and avoids GHG emissions.

There are other pluses. For every ton of domestic waste processed, the United States avoids the need to import one barrel of oil, or mine a quarter ton of coal. Since WTE plants are usually located near large metropolitan areas with high volume waste generation, shorter hauls are required. This reduces costs for long-distance trucking, highway congestion and transportation emissions.

Covanta instituted a preventative program two years ago to help keep mercury out of solid waste. By working with the communities it serves, the company offers a $5 gift card to consumers who turn in mercury thermostats, or elemental mercury. In 2009, over 500 pounds of mercury was preempted from their WTE plants.

With tipping fees rising, more complex and costly EPA landfill GHG regulations in the offing and the high costs of transportation, it seems a waste to waste solid waste when WTE is a proven green technology that is becoming cleaner as it progresses.

In this exploration of waste to energy it is apparent that the industry and government agencies need to better inform the public that WTE is one of the more intelligent environmental choices.

Landfills, waste-to-energy facilities, composting facilities, recycling facilities and any other facilities that deal with garbage, recycling or composting are prone to criticism. For an alternative view on the waste-to-energy facility, you may be interested in visiting the Physicians for Social Responsibility's website: http://www.psr.org/chapters/oregon/Marion-county-incinerator.html

Chapter 2: Thoughtful Consumption

What's in Our Garbage?

Each year we throw away about 200,000 tons of garbage! That's about 3 ½ pounds per person every day. Of everything that's thrown away, about 60% could have been recycled or composted instead of wasted as garbage. The pictures below represent what's in our garbage.

How do the decisions we make every day impact our pocketbooks, our time, and our planet?

In this module we'll focus on reducing what we consume by making the best use of what we already have. We're not talking about denying ourselves the things we need and want, but rather how to live well with less waste.

First, we'll look at reasons to reduce, reuse, and recycle. Next we'll explore waste prevention principles and why waste prevention is even more important for the environment than recycling. We'll discuss strategies we can use to reduce waste every day, including the roles of advertising and packaging in today's consumer culture. Finally, we'll look at the decisions that have the greatest long-range, positive environmental effects.

You'll learn how we can broaden our shopping criteria beyond issues of quality and price to also include the environmental impacts and total ownership costs of our purchasing decisions without sacrificing lifestyle quality.

As we saw in the Overview, there are many reasons to reduce, reuse, and recycle. Most of the environmental impacts of our consumption happen when we extract raw materials and turn them into products, not when we dispose of them. This means that preventing waste by reducing the quantity of goods that we consume is a particularly potent way to save money and resources.

Making better use of what we've already grown, mined, manufactured, and built by reusing, recycling, and composting helps conserve natural resources and energy. It also ensures the continuation of the healthy natural systems we all depend on: air, water, and land. When we buy a product we are telling the manufacturer that we like what they make – a signal that they should make more. This means that as consumers we also have the power to influence the marketplace by not buying things.

The Oregon Solid Waste Hierarchy ranks these activities from highest priority to lowest: reduce, reuse, recycle, compost, recover energy, and landfill. Conserving resources and developing sources of renewable energy also increases the potential for the creation of living-wage jobs in local and state industries instead of in oil refineries, mines, and factories in other states and countries.

According to the Oregon Department of Environmental Quality (DEQ) research, in 2011 Oregonians recovered 52.3 percent of our waste! Our recycling efforts saved approximately 32 trillion BTU (British Thermal Unit)—the equivalent of 258,000,000 gallons of gasoline or roughly 3 percent of total energy used by all sectors of the economy in Oregon in 2010!

Our 2010 recycling, composting, and energy recovery efforts kept approximately 3 million metric tons of carbon dioxide equivalents—the equivalent of tailpipe emissions from 620,000 average passenger cars or roughly 4.3 percent of all greenhouse gas emissions—out of the atmosphere!

Recycling is an important tool to reduce greenhouse gas emissions. In 2009 Oregonians recycled enough cardboard to make it the greatest source of greenhouse gas reduction, nearly 1.13 million tons of CO^2 equivalent, followed by paper with a little more than 592,000 tons, scrap metal with 516,000 tons, and aluminum with 409,000 tons

To translate these large numbers into everyday figures, here are a couple of people scale examples:

- ☐ The energy saved by recycling one glass bottle will illuminate a 100-watt incandescent light bulb for four hours or a CFL for 17.4 hours.
- ☐ It takes 5 percent of the energy to make a can from recycled aluminum than it does from virgin material. This means that we can make 20 recycled-content cans for the same amount of energy as making one can from virgin aluminum.

How do the 3 R's help the environment?

Reduce oil imports. The U.S. is now more dependent on foreign oil than before the oil embargo in the early 1970s. Oil imports are the single largest item making up our trade deficit. Oil is used to make many of our manufactured products and packaging, to transport the products we consume, and to provide energy to heat our homes and support our lifestyle.

Stop exporting harm. The Basel Action Network[19] urges mindful reuse and recycling of electronic waste, much of which is currently exported to Asia and Africa, exposing people on these continents to high levels of toxins, creating mountains of trash, and wasting potential energy and resources. The Oregon e-Cycles Program[20] works to prevent the practice of exporting electronic waste and ensure that electronics covered under the program are managed responsibly.

Protect nature. To obtain metal for new products and the fuel for manufacturing them, large mines permanently scar landscapes and leave behind harmful and acidic drainage that pollutes our water, kills wildlife, and damages soil. Many of the United States' Superfund[21] sites are abandoned mines. In the southeastern U.S., coal is mined by dynamiting mountaintops and then pushing the rubble into nearby valleys and streams. This causes widespread damage to water systems and downstream habitat. In other countries, mining negatively impacts tropical areas and devastates large tracts of rainforest, which are essential to a healthy global ecology.

Preserve forests. Eight thousand years ago our planet had 1.5 billion acres of forest; today close to half of it is gone, and the rate of destruction is increasing. In Oregon and Washington, more than 90 percent of old growth forests have been cut. Loss of forests leads to erosion of topsoil and wildlife devastation. The loss of the environment's ability to absorb carbon increases global warming. Road building to transport the logs also damages the land. Modern forestry practices in the United States work to include reforestation and selective harvesting to counter the negative impact of logging, but this is often not the case in other parts of the world.

Paper and wood products represent more than 24 percent of Oregon's 2009 landfilled waste. On the average, 20 office workers consume one ton of paper each year! According to the

Conservatree[22], each ton of paper we recycle saves the equivalent of 17 – 24 southern pine trees. In Oregon, wood waste from milling trees into lumber has been the traditional source of wood used in paper- making.

Create jobs and increase U.S. competitiveness. According to a 2001 study conducted by W R Beck for the US EPA, in general, recycling creates six times as many jobs as landfilling waste. Recycling is big business in Oregon. According to a 2011 study commissioned by the Scrap Recycling Industry (ISRI), scrap recyclers directly create 2,340 jobs in Oregon and indirectly support 6,800 more. The full report is available in the course resources tab. These jobs pay more than the average Oregon wage. The industry also generated $84.3 million in tax revenues for Oregon and its local governments.

Reduce Air and Water Pollution. Although U.S. environmental standards are increasingly strict, there are still many ways we can use our resources more effectively. Many manufacturers in other parts of the world are essentially unregulated. Without proper safeguards, metal and paper manufacturing are major contributors to air pollution, including acid rain[23].

Plastic manufacturing is one of the largest contributors to hazardous waste. Even regulated, these processes pollute groundwater, rivers, and the environment overall, so we need to work to minimize and even reverse the negative impacts of manufacturing.

Reduce Greenhouse Gas Emissions. Gases that trap heat in the atmosphere are often called greenhouse gases. Some greenhouse gases such as carbon dioxide occur naturally and are emitted to the atmosphere through natural processes and human activities, others enter the atmosphere because of our making, transporting, using and disposal of products. The heat trapped in the atmosphere can cause long-term changes to the temperature of the Earth that will affect all living systems.

The principal greenhouse gases that are human-related are:

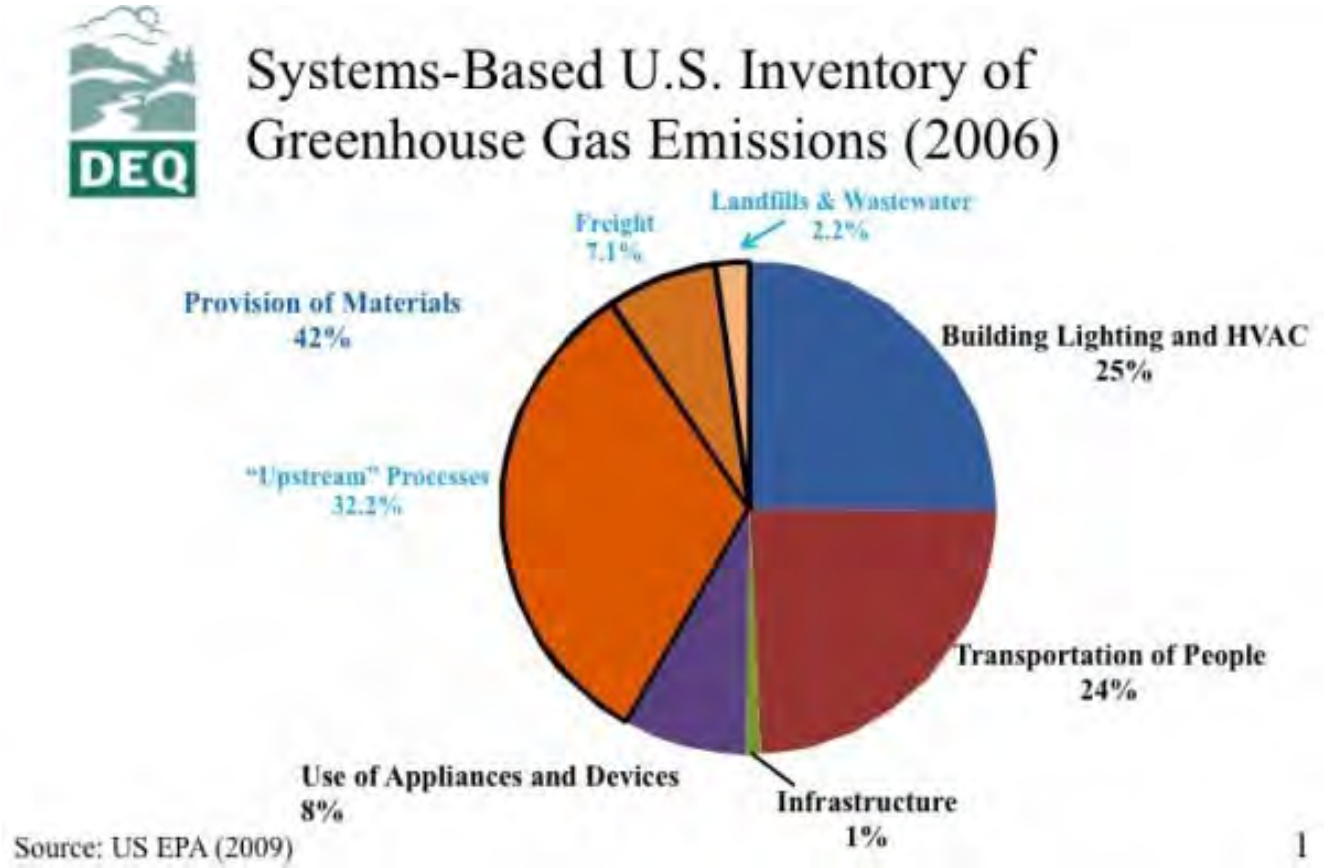
- ☐ **Carbon Dioxide (CO_2)**: Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and are also a result of other chemical reactions (e.g., manufacture of cement). Carbon dioxide is also removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle[24].
- ☐ **Methane (CH_4)**: Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills and compost operations[25].
- ☐ **Nitrous Oxide (N_2O):** Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste[26].
- ☐ **Fluorinated Gases**: Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting[27] substances (i.e., CFCs, HCFCs, and halons). These gases are typically emitted in

smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases ("High GWP gases")[28].

Greenhouse Gas Emissions and Consumption. As the list on the previous pages demonstrates, many of these gasses are produced during the making, consuming and disposal of consumer goods, including food and energy. A study released by the EPA in 2009 shows that just looking at where things go when we dispose of them is a very limited perspective; the 'upstream' effects from extracting the raw materials and energy needed to make consumer products is much higher than the impacts of disposal.

At 42%, Provision of Goods is by far the largest contributor to U.S. produced greenhouse gas emissions. This category is divided to separate Upstream Processes (32.2%) from the effects from transporting (7.1%) and disposing of materials. The second largest producer of greenhouse gasses (25%) is lighting and operating our buildings; the third (24%) is transporting people; using our appliances and devices is 8%.

Disposal only accounts for a small portion (2.2%) of the greenhouse gasses our things create; most of the environmental impact of our consumption is from making and using products. Recycling can reduce these disposal emissions and significantly reduce upstream emissions, but recycling alone can't reduce most of our greenhouse gas production. Other strategies are needed as well – thus the broader focus on reducing and reusing as part of thoughtful consumption.



Many of the goods we consume are imported from other countries and we, in turn, export goods to them. Many of the items we use every day are made in countries that have lower environmental standards than ours. This means that they are likely to emit more greenhouse gasses in the production process. When Provision of Goods is adjusted to show these pollution impacts the percent of greenhouse gasses emitted grows from 37% to 49% - almost half of our total greenhouse gas emissions!

Greenhouse gases trap radiation from the sun and warm the planet's surface. The more the concentrations of these gases increase, the more the climate changes. To learn more of what you can do to influence climate change check out the Climate Masters at Home[29] and Climate Masters at Work training programs[30].

For more information on the science of climate change, visit EPA's climate change science home page[31] or the Oregon Climate Change Research Institute[32].

Saving Resources Helps Us Feel Good: Doing the right thing for the environment feels good!

Reducing Waste Every Day

The benefits of reducing and reusing are compelling, but how can we get started? We'll first look at the cultural influences that encourage high consumption. If we don't understand our cultural values, we may feel guilty or deprived when we start to buy fewer things or self-conscious when we reuse items we might have discarded last week. We'll also look at strategies for reducing the amount of things we buy. The Story of Stuff[33] gives an overview of this process.

Consumption

As consumers living in a market economy we need to be aware of how we make our buying decisions. One of the largest influences on how we think about what we want and need is advertising.

What we want does not measure happiness or contentment. To spur a discussion about the relationship between GDP and happiness try reading The Geography of Bliss: One Grump's Search for the Happiest Places in the World[34], viewing The Economics of Happiness[35], or contemplating the notion of a Gross National Happiness scale[36].

Advertising. Advertising is the tool used to implement a product's marketing strategy; it is designed to influence our wants and needs. While it provides us with information about new and improved products, its primary goal is to get us to purchase more things. We are constantly exposed to advertising via television, the Internet, radio, billboards, and even on the inside of bathroom doors! And as much as we would like to believe we are not influenced by these messages, research shows we are—and sometimes in ways we don't recognize.

Advertisers rely on basic emotional triggers to make their products more appealing: happiness, youth, status, success, luxury, convenience, and the desire to belong. Convenience is the most frequent concept that relates directly to the creation of solid waste. This is especially true when convenience is linked with disposability.

Time-saving items such as prepackaged lunches containing cut cheese, crackers, and instant pudding—all individually wrapped "for freshness" and repackaged in another container with more overwrap—is an example of convenience directly linked with disposability. One-use floor cleaning pads, single-use wipes, and other products consumers use for a short while then "throw away" link convenience with disposability, making waste an expected, tolerated, and accepted consequence of everyday living.

As we'll see in the next slide, the effect of advertising on children is even more problematic because children lack the ability to think critically about the messages they receive in the media.

Advertisers and marketers have spent many years perfecting messages to stimulate desire for their products. They are also very efficient in creating the sense of social insecurity that drives children to want to have everything their schoolmates have. According to Susan Linn in "Consumerism in Children's Lives," in 2010 marketers spent $17 billion targeting children. This is 170 times as much as the 100 million spent in 1983! As anyone with a middle-schooler knows, last year's technology is just, "so last year!" Linn contends that "immersing children in a message that material goods are essential to self-fulfillment promotes the acquisition of materialistic values" and that "children with more materialistic values are …less likely to engage in environmentally sustainable behaviors."

As consumers have become more conscious of the environmental impact of their product choices, advertisers have started making claims about the environmental benefits of their products. This means that environmental claims have become another means of selling goods– one that can help justify a continuing overconsumption of natural resources.

According to a new study by the TerraChoice Group[37], the number of advertisements with green messages in mainstream magazines has risen since 1987 and was at 10.4 percent in 2008.

Unfortunately, claims to greenness may have little bearing on the environmental soundness of the product or the product's packaging.

Greenwashing describes advertising claims that are disingenuous. Some websites, such as the University of Oregon's Greenwashing Index[38] reveal the facts about such claims. There

are also a number of organizations that scientifically evaluate the environmental impacts of product manufacturing and use. You can use this information to help you make the best environmental choice between competing brands and share the facts with your family and friends to spread the word.

These organizations offer independent certification of products that meet their standards:

- Green Seal[39];
- The Environmental Protection Agency's Design for the Environment[40];
- The Canadian Government's EcoLogo Program[41]; and,
- The Forest Stewardship Council[42]

You can look online to find other organizations that don't offer certification of products or companies, but do conduct research on the environmental, health, and ethical benefits of products. These organizations include:

- The Environmental Working Group[43]
- The Environmental Working Group's Skin Deep Cosmetic Safety Database[44]
- The Good Guide[45]

Always evaluate the criteria that organizations use to make their recommendations and ratings. Some organizations are little more than promotional vehicles for particular products or services, but others provide legitimate, bias-free information.

The EPA's Greener Products portal[46] is designed to help find information about the world of greener products. You can search for EPA programs related to greener products, like Energy Star and Design for the Environment, and link to other green products information from the EPA and others. The portal allows you to indicate what you're looking for and whether you're buying for a business.

Common Green Advertising Terms

- biodegradable
- photodegradable
- recyclable
- made of recycled content
- environment friendly
- earth-friendly
- bio-green
- nontoxic
- all natural
- organic
- compostable
- eco- just about anything (eco-friendly, etc.)

The Federal Trade Commission (FTC) has the authority to regulate the use of some green claims. With the proliferation of eco-friendly terms on packaging and products, monitoring has fallen behind, but the FTC has recently proposed tighter regulations to promote truth in advertising. One problem with green terms is that some sound good but aren't defined precisely. This means manufacturers can use them freely without providing specifics so we have no way of evaluating their accuracy.

Green marketing can make packages look environmentally friendly, but that doesn't mean the products live up to the claims. For instance, the familiar chasing arrows recyclable logo is widely misunderstood and is sometimes misused. While the symbol may be accurate overall, its appearance on products is no guarantee that the item is recyclable in your community. Recyclability requires infrastructure for collection, processing, and remanufacturing. If your community lacks access to even one of these processes, that product can't accurately be considered recyclable in your area.

A general made of recycled content claim is also vague. It could mean one percent recycled content, 100 percent recycled content, or any amount in between. If the recycled content symbol is used without a qualifier stating how much pre- or post-consumer content is used, don't assume 100 percent post-consumer content. Sadly, this symbol is also commonly misused.

"Environmentally friendly," "natural," "earth-friendly," and "bio-green" are terms that are hard to evaluate because they aren't precisely or legally defined. If you have a question about how a company is using a term, check out their website or give their 1-800 number a call and ask, that way you'll both be working from the same definition.

Not all eco-marketing is misleading. More and more firms are becoming concerned about their environmental footprint and are taking action to shrink it. Packaging that states it's made with a specific percentage of pre- or post-consumer content is usually legitimate (and verifiable). Regardless of what's on a label, make sure the "recyclable" products or packaging you purchase can actually be recycled in your community.

Buying recycled products and recycling are equally important because they help save resources and create a market for the recycling you leave at the curb or the depot. Buying things made from recycled materials is considered "closing the loop" because without a demand for products containing recycled materials, recyclables have nowhere to go. If you see an environmental claim that you question, ask your retailer or the manufacturer for more information. The more we consumers show we care and are paying attention to environmental claims, the more accurate the manufacturers will become in their claims.

There are three basic types of products we produce and purchase: consumables, durables, and disposables.

Consumable products, such as food and fuel, are permanently transformed into energy and wastes when used. Gasoline is an example of a consumable product. The consumption of gasoline propels our vehicles and produces air pollution as a waste product.

Durable products are designed to be used over and over again. They can be maintained and repaired for long life. These include items such as clothing, furniture, and tools. Only at the end of their long and useful lives do they wind up in the solid waste stream. A sweater, for example, can last for many years if it is cleaned and cared for properly.

Disposable products are designed and produced for limited use—usually once or twice. Plastic shopping bags, paper and plastic dishware and utensils, alkaline batteries, personal hygiene products, paper towels, and plastic wrap are examples of this category. Among the first disposables to appear on the market were hospital supply products, such as disposable syringes and gloves. They were promoted as being more sanitary than their durable counterparts and required less maintenance and care, and their use was quickly accepted.

The use of disposables has expanded from the medical field to include offices and homes. Disposables for home use are often designed for convenience more than hygiene. They were originally intended to serve as a backup to durables.

Paper towels, for example, were originally promoted as being great to keep on hand for the occasional "big spill," but they largely replaced their reusable cloth counterparts; now disposable wipes are taking a big bite out of the paper towel market. Likewise, disposable diapers were initially advocated for use in emergencies or when traveling; the Real Diaper Association[47] estimates that 92.5 percent of parents use disposables all the time.

Plastic bags create a number of challenges in the recycling process, but according to the Christian Science Monitor News less than one percent of plastic bags are recycled. The others may end up in the environment instead of the trash. See where else they go by opening the Plastic Bag slideshow in the course resources tab.

Product Obsolescence. Another, more subtle, form of disposable is the "durable" product designed for obsolescence. This planned obsolescence is a marketing ploy that has become extremely effective. What exactly is planned obsolescence? It's when a product that is still useful is discarded because it is viewed as out of fashion, out-of-date, or is seen as behind the times.

Advertising executive Earnest Calkins is often given credit for introducing this strategy of rapid, planned stylistic change. In 1930 he wrote in Modern Publicity, "The purpose is to make the customer discontented with his old type of fountain pen, kitchen utensil, bathroom, or motor car, because it is old-fashioned, out-of-date. The technical term for this idea is obsoletism. We no longer wait for things to wear out. We displace them with others that are not more effective but more attractive." He also said, "Does there seem to be a sad waste in this process? Not at all. Wearing things out does not produce prosperity. Buying things does." Modern Advertising, Earnest Elmo Calkins and Ralph Holden, Garland Pub., (1985)

This strategy of planned obsolescence is now common in many industries, most notably computers, clothing, sporting equipment, home interiors, and automobile design. For example, each year manufacturers of men's and women's clothing forecast which colors they expect to be popular in the upcoming season. And, year after year, consumers fall in line and purchase the color that is "in." Louis Cheskin, of the Color Research Institute, contends,

"Most design changes are not made for improving the product either aesthetically or functionally, but for making it obsolete."

Many manufacturers are no longer content to spur repeat sales by making consumer goods that break down or wear out, and now offer products that tell the consumer when they're breaking down or wearing out. For example, some new shaving cartridges include a strip that changes colors or fades after a specific number of uses to indicate that it needs to be replaced. And many consumers obey even if the product is still working well.

The computer industry often makes computer systems and software obsolete by discontinuing parts, updating programs, or switching programs. One method for implying obsolescence is to number updates to refer to the year in the title. Many times the changes in software from edition to edition are not significant to most users, but people "upgrade" even if their current setups are adequate and meet their needs. Many of the upgrades don't work with the old versions, so consumers have no choice but to purchase new products.

One computer manufacturer radically redesigned its basic operating system several years ago, but during the transition they included the older operating system in their new computers so that users would not need to immediately replace their software. This concern for the consumer is less evident in their newer, mobile products that require the newest computer hardware and operating systems to operate.

There are legitimate reasons to upgrade products; we would be very unhappy using a computer with a 24k memory, but planned obsolescence helps companies sell new products and is an active part of many firms' marketing strategies. And whether we like to admit it or not, we're so entranced by new things that we're sometimes embarrassed to admit that our software or gadgets are out of date.

The marketing strategy of product obsolescence turns durable products into commodities that need to be upgraded or replaced long before they fail. The result is that significantly more energy and natural resources are consumed – and of course, more garbage is created.

The Wrap on Packaging. Packaging waste makes up a significant portion of landfill and waste-to-energy facility waste. Although its share of the Oregon waste stream has decreased from 32 percent in 2000 to around 16 percent in 2009, it is still a large component of household waste. Packaging also accounts for a significant portion of a family's food costs. In many cases, the cost of the product inside the package is minimal compared to the combined costs of manufacturing the packaging and advertising. We spend more, for example, on an aluminum can than we do on the soda pop inside the can.

The Purpose of Packaging. Packaging has different purposes and functions. Some are critical; others aren't. There are various purposes of packaging:

Product protection: Sealed glass jars prevent food from spoiling; wax, cellophane, and plastic wrap prevent moisture loss. Rigid foam, cardboard, paper, and plastic padding keep delicate products from being damaged during shipping.

Identification: Packaging identifies the product and contains legally required information, such as ingredients, nutritional value, and manufacturing details.

Convenience: Containers that allow for ready-to-eat salads, fast foods, and microwavable dinners are seen as time-savers.

Theft prevention: Often small items are placed in larger containers to prevent them from being easily stolen. That's why things like thumb drives, handheld electronics or nail polish are sometimes contained in see-through plastic containers that are much larger than they are. When music CDs were first introduced into the marketplace they were often packaged in 8 ½ by 11" plastic packages to prevent theft. Consumers objected and now they are only shrink-wrapped. They are still devilishly hard to open.

Marketing: Packaging is designed to attract the attention of consumers and sell them the product by highlighting the positive qualities and making it look more desirable than competitors' products. This function often causes products to be over packaged. For example, some products come in larger than necessary packaging to attract attention. Children's toys are often seen as more appealing if packaged so the product can be seen through hard plastic containers. For more examples, do a web search for over packaged products or visit:

- http://www.flickr.com/groups/overpackagedproducts/pool
- http://www.greenlivingonline.com/article/overpackaged

Keep your eye on which examples serve only a marketing function and which serve other functions, such as product protection.

Packaging Materials

The five most common materials used in packaging are glass, paper, plastic, aluminum, and steel. Each material can be used in single-material as well as mixed-material packaging. The type of material and the ease that the materials can be separated from one another affect the ability and viability of recycling them.

The aluminum can is a good example of single-material packaging. Single-material packages generally are easier to recycle than mixed-material packaging because they do not have to be deconstructed before they can be recycled.

Although they are made of only one material, some plastics are difficult to recycle. Expanded polystyrene foam (Styrofoam ©) is expensive to transport because, although mostly air, it is very bulky for the amount of recoverable material. This is why there are only a few places in Oregon that recycle Styrofoam.[48] Check with your local hauler to get information on where you can recycle Styrofoam in your area, as some accept it at their public depots.

Plastic film can be another difficult product to include in the recycling process. It is a serious contaminant when it is added to mixed recyclables at the curb or at depots because it clogs the sorting chutes, screens, and machinery at material recovery facilities. This is a product that needs to be handled through special collection programs, like those at grocery stores.

A mixed-material package is comprised of more than one type of material. Most of the products we buy come in this type of packaging. Wine, for example, is usually sold in bottles made of glass, labeled with paper or plastic, sealed with a cork and then covered with plastic or metal.

There are two types of mixed-material packaging. The first includes combinations of materials that are easily separated, like bottles where the caps can be easily removed. Another example is the cereal box: it is easy to remove the inside plastic or wax paper liner and then recycle the paperboard.

The other type of mixed-material packaging is made from materials that are very difficult to separate—composite materials. Examples of composite-material packages are milk cartons made of plastic-coated paper and individual-sized juice containers called brick packs or aseptic boxes that are fabricated from plastic-coated paper with aluminum foil backing and crimped metal ends. Separating the paper from the plastic or foil makes recycling such composites difficult and expensive.

In 1995 an industry subsidy helped some Oregon paper mills recover the high-quality paper used in these containers. Over a decade later, these containers are still so difficult to sort and manage that their recyclability is widely disputed.

Reusable packages had almost disappeared, but they are making a comeback, at least in wineries and brew pubs. The Rinse Project in Northern California is teaming up with wineries to sanitize old wine bottles for reuse. Customers return their used bottles to the winery and the winery sends the bottles off for cleaning. The winery then repurchases the bottles and the cycle continues. Many brew pubs and wineries also offer reusable half-gallon glass jugs, often called growlers, which customers can take home and bring back for a refill.

Another example of a reusable package is the Bio-Cask, a large stainless steel wine cask that keeps the equivalent of 26 bottles of wine fresh while allowing individual glasses to be served. When it is empty it is returned to Willamette Valley Vineyards for sanitizing and refilling.

Recyclability Is Not Always the Most Important Attribute. Although some packaging materials may be difficult to recycle, they may be more environmentally sound to use in some shipping situations. In 2004, Oregon DEQ commissioned research on the environmental impacts of packaging materials used to ship mail-order soft goods, like clothing, to retail customers. The study used Life Cycle Analysis, a tool that analyzes the total environmental impact of a material or product from the extraction of raw materials through packaging, production, use, and disposal.

This analysis determined that the most important factor influencing the environmental burden was not the material used for the packaging, but the weight of the packaging. This means that even though a cardboard box has a relatively low environmental impact per pound, it has a higher environmental impact than a package made of lightweight material, such as a low- density polyethylene shipping bag. This is because that environmental burden for production, transportation, and disposal are directly related to the weight of a material.

In 2009, the DEQ conducted another study looking at packaging, in this case "to evaluate the environmental implications of various systems for delivery and consumption of drinking water." This study found that drinking tap water from reusable water containers, even when they were washed in the least energy efficient way, had a lower total environmental impact than using the most recyclable disposable bottle. Once again, reducing waste by reusing containers is more environmentally beneficial than using and recycling new containers.

The Oregon Bottle Bill. The Oregon Bottle Bill had an immediate and profound impact on product packaging in the state. Passed in 1971, the bill required that retailers pay a nickel deposit for beer and carbonated beverage containers. This charge is passed on to customers, who receive their deposits back when they return the containers. This bill also banned detachable metal pull- tabs and, by a 1977 amendment, required that plastic 6-pack rings decompose within four months.

The deposit has been extremely successful: the first year after passage, 93 percent of deposit beverage containers were returned in Oregon. The Bottle Bill did not factor in inflation. The five-cent deposit set in the early 1970s would be worth over 26 cents in today's dollars. For many consumers five-cents is not worth the effort to return the cans for the deposit. As a result, the redemption rate of beverage containers dropped to 75 percent in 2009. An additional reason this rate is low is that it reflects only the bottles collected via the Bottle Bill; it does not include containers that are collected through curbside recycling programs. Because the deposit is low and returning containers to the store seems difficult, many consumers just put their deposit containers in the recycling bin. These containers are still getting recycled, but they are no longer counted in the deposit/refund system.

When the Bottle Bill was first passed, many of the glass containers were going back to the bottlers to be refilled. Now they are returned to the distributors' warehouse primarily for recycling.

The Bottle Bill was updated by the 2007 Oregon Legislature to include bottled water and flavored water beverages beginning in 2009. In 2011 it was updated to include sports and energy drinks, coffee, tea and juice starting in 2018. Adding these containers to the redemption system should significantly increase the recycling of PET (#1) plastics in the state.

The new law also states that if the redemption rate stays below 80% for two consecutive calendar years, the bottle deposit will increase from 5 to 10 cents. The buying power of a nickel in 1971 is equal to about 25 cents today; increasing the deposit might provide an additional incentive to get those bottles back for redemption instead of putting them in the recycling bin or the trash.

Many recycling advocates would like to add all nondairy beverages (i.e., wine, liquor, and so on) to the bill's purview.

Although grocery stores have been the standard site for the return of beverage containers, that may be changing. Stores have often complained about being required to handle old, sometimes dirty containers. Now beverage container redemption centers located separately from grocery stores are being tested around the state. These centers will collect containers from consumers, pay the refund, and assure that the materials are recycled.

The 1991 Oregon Recycling Act (SB 66). This addition to the Opportunity to Recycle Act strengthened and broadened recycling requirements. For the first time activities were added to help develop markets for recycled materials. This 1991 Act also required recycled content in glass containers and set requirements for recycling rigid plastic containers to promote the use of recycled materials.

How You Can Reduce Waste Every Day. Every day you make decisions about how you will spend your time and money. By being aware of the influences that urge you to buy, you can take control of how you live. We've looked at the influences that urge us to buy the newest, fastest, and most flashy items on the market and at the different types of product packaging that encourage us to buy the products. Now we'll explore a three-step strategy for reducing waste and living more sustainably.

Waste Prevention Begins at Home. Home is where we usually first decide what we need and want. That's the first step. The second step is to consider what alternatives there are to buying the new products we want. The third step is to find and purchase the best product that will fill the need and be environmentally sound.

Most of the time, we make purchase decisions with minimal prior thought or planning. As a result, we may own items we don't really need or want. As we accumulate more stuff, we may have to go out and buy yet another product to help us store what we already own. This process produces clutter in our homes, our garages, our sheds, and even in commercial storage facilities. The temptation is to throw the clutter in the trash just to get rid of it quickly, but unless we've become clear about what we really need, we may start the whole needing- buying-tossing-process all over again.

Step 1. Reduce: Deciding What You Need

All of us are targets of alluring marketing campaigns designed to make us think we really need a particular product. When the urge to buy strikes, it is important to take a moment and distinguish between what you really need and what advertising is wanting you to believe. Take the time to make wise purchasing decisions by asking these questions:

- Why do I want this?
- How often will I use it?
- Is this a priority item?
- Could I spend my money and time on something else that would be more fulfilling?
- What would happen if I didn't buy this product?

Structuring your home environment to help reduce clutter can simplify purchasing decisions. For example, some former clothes-hogs swear by the "30 hanger rule" that allows for 30 clothes hangers in their closet. Whenever they consider buying a new item, they have to give

up one already in their possession. Some take this a step further and choose to downscale the size of their homes, recognizing that for many households, things seem to expand to fill the available space.

Step 2. Reuse: Ask "Do I Need to Buy Something New?"

Once you've decided what you need, it's time to think about how to meet that need without buying something new. Perhaps this means repairing, reusing, or repurposing something you already own; renting or borrowing; or buying used goods. Reuse is important in waste prevention. There are three aspects: using what you already own; donating, reselling, or loaning items so others can use them; and buying used items from charities, garage sales, consignment shops, or other venues.

Before purchasing a new item, ask:

- Is there something I already have that would serve the same purpose?
- Can I make what I need from items I already have on hand?
- Can I borrow or rent it?
- Can I buy it used?

Many people remember to donate unneeded items to charities, but forget to shop there when they need something new. Every community has organizations like St. Vincent de Paul, Goodwill, or Salvation Army that take donations of reusable items and then resell them to others. Sometimes you can find unexpected items, like the tuxedos Eugene's St. Vincent de Paul sourced from the Philadelphia Symphony Orchestra. Other unexpected items are the used doors, lighting fixtures, and surplus home improvement items that can be found at Habitat for Humanity's ReStores, the Rebuilding Center, or Bring Recycling.

Many towns have other places to buy new-to-you items: consignment shops often carry specialized items like vintage or designer clothing and for-profit resellers may focus on mid-century house wares or imported furniture. These places can be great resources whether you're looking for everyday items like kitchen utensils or items to spark your creativity. Government agencies often sell items that are no longer needed. Oregon State University sells surplus items through its OSUsed Store, online, or through live auctions.[49] And many police departments auction older cars. Check with your local government or university to learn how they dispose of surplus property.

Some communities have special programs to help you reuse and reduce; contact your local solid waste representative to learn whether your town is one of them.

Neighborhood associations or communities sometimes have tool banks that let you borrow tools instead of buying them or have programs for lending durable dinnerware for gatherings. Some auto parts stores lend tools to help with simple projects. If there is not one in your neighborhood, maybe you will start one?

Don't forget about finding items through your local newspaper's classified ads, on eBay[50] or Craigslist[51], or via a local freecycle[52] group.

Some items are best not purchased used. These include old, energy-inefficient appliances and cars, leaky single-pane windows and items that may contain toxins such as lead-based paint.

Step 3. Select the Product and the Package

Sometimes a new product is the best or only option. When this is the case, select the product carefully to get the most value from your purchase.

Since all manufacturers want you to believe their products are the best, it is wise to research products using neutral information sources, such as the Consumer Reports website[53] or organizations like those mentioned earlier in this module, that research and certify products for their performance and environmental attributes. Online product reviews and magazine articles can be helpful, or ask people you trust about their experiences.

Thoughtful Consumption Tips

1. Start with a shopping list and stick to it.
2. Buy long-lasting products that can be repaired.
3. Invest in high quality and energy efficient products.
4. Avoid disposables by buying durable and reusable alternatives.
5. Carry your own reusable bag when shopping.
6. Shop where you can buy in bulk.
7. Be picky about packaging:
8. Avoid individually wrapped, single-serving products.
9. Say no to bags you don't need. Reuse or recycle those you do use.
10. If you're considering an impulse purchase or have mixed feelings set the item aside for 24 hours and sleep on the decision.
11. Check out the Organics module for shopping tips to prevent food waste.

The following questions will also help you make good, long-term purchasing decisions:

- How long will the product last? Is it well made or will it break easily? Are the materials flimsy? Is the construction poor?
- Will buying this keep me from buying disposable items in the future? Cloth napkins, reusable lunch containers, and durable picnic plates will help you keep your trash bill down and your environmental footprint small.
- Is it repairable? Will I be able to get new or reconditioned parts? Can these shoes or boots be re-soled?
- Is it a classic I will be happy with years from now, even when new styles and models come out?
- What will I do with it when it's no longer useful? Is it made out of materials that can be recycled, reused, recovered, or that can be safely returned to the natural environment?
- Finally, if there are two products that are equally good, consider the packaging as a tiebreaker: Is the product free of unnecessary packaging? Is the package refillable? Is it recyclable? Is it compostable?

Step 4. Stop Junk Mail

Studies show that an average of 675 pieces of junk mail end up in every mailbox every year, totaling four million tons nationwide. Learn how to stop junk mail at this handy Metro website[54].

Optional Step 5: Practice Voluntary Simplicity

The Voluntary Simplicity Movement[55] helps people look at the effects of consumerism and asks whether this lifestyle is good for people and good for the planet. The movement helps individuals define their values and then helps them implement those values in their lives. Voluntary Simplicity does not advocate living in poverty; it emphasizes living in balance. By embracing even some of the tenets of voluntary simplicity—frugal consumption, ecological awareness, and personal growth—we can change our lives and our communities. When we understand that our day-to-day decisions matter, we can move from feeling powerless to knowing that our actions are helping improve our world.

Over the past few years, the resources to help people explore voluntary simplicity and related topics have grown. There are a number of organizations that can help you evaluate your spending habits and connect you to additional resources. For example, the Northwest Earth Institute[56] helps people investigate voluntary simplicity and a variety of related topics via organized discussion groups. The book Your Money or Your Life has a companion website with blogs and events.[57]

Make your own. There are tons of things that you can make from old items, such as: notepads from scrap paper; canisters from glass jars or plastic tubs; greeting cards from old cards and colored paper; quilts from old clothing; quilt batting from old wool blankets; and new candles from old ones by melting and combining old wax and adding a new wick. There are lots of do-it-yourself sites on the web that can help you make new things from old.

Rent or borrow. Ladders, digital projectors, party supplies, yard equipment, camping gear, wedding gowns, designer clothes, card tables and chairs, furniture dollies, and more; these are just some of the things you can rent and borow. Talk to your neighbors, check the yellow pages or ask at your community center about tool banks and other places to borrow or rent. Don't forget to use your library for books, DVDs, and art prints.

Maintain and repair. Vehicles, bicycles, shoes, clothing, appliances, tools, handbags, and knapsacks are just a few of the things you can maintain and repair. Check to see if your community has something or start your own.[58]

Buy used. There are tons of items you can buy used, such as kitchenware, tools, clothing, furniture, toys, musical instruments, books, sports, and camping gear. Remember to check out EBay and Craigslist as well as local classified ads and websites. Don't forget about local freecycle-type websites for giving and getting things for nothing.

We've all seen books like 50 Simple Things You Can Do to Save the Earth, watched news and television stories about saving energy, and learned about reducing waste. There are so many useful ideas about what we can do that it can be difficult to decide what things to do.

This class is filled with useful and important ways to reduce waste every day, but how do we, as average consumers, know which efforts have the biggest payback for the environment? The Union of Concerned Scientists[59] asked that question, and to find the answers they conducted research into where products come from and where they go. They then evaluated which consumer decisions have the most environmental impact.

The Consumers Guide to Effective Environmental Choices (1999) is the result of the research conducted. It analyzes the environmental impacts of consumer activities and prioritizes actions we can take to reduce our daily environmental footprint. Although this is a slightly older work, it is still a valuable guide to use for making the decisions that count. The following information was taken from that consumer guide:

Most Environmentally Significant Action Areas:

- How we get around.
- What we eat.
- How we operate our homes: heating, hot water and air conditioning.
- What we bring into our homes.
- What leaves our homes: water, sewage and solid waste.
- How we build our houses.

How We Get Around. This category is where our decisions can have an enormous impact. Transportation is responsible for more than 50% of toxic air pollution; more than 30% of greenhouse gas emissions; more than 20% of toxic water pollution; and approximately 15% of land use impacts. Although this course doesn't deal directly with this topic, this module will help you explore your transportation needs.

What We Eat. Food accounts for a big share of our total consumer impact. It is responsible for more than 70% of water use, more than 40% of land use, almost 40% of common water pollution, and 22% of toxic water pollution. It also impacts both toxic and common air pollution and greenhouse gases. Eating a balanced diet rich in vegetables, fruits and whole grains will help you stay healthy with less waste. The Organics Module in this course includes tips on how to reduce food waste, improve soil, and compost food scraps.

How We Operate Our Homes. How we heat, cool, light, furnish, and clean our homes is a vital area when it comes to being good stewards of the earth's resources. And don't forget to consider what leaves your home: water, sewage, and solid waste. These items are responsible for 35% of greenhouse gas impacts, more than 32% of common air pollution, and more than 19% of toxic air pollution. Water pollution is also a factor: more than 21% of common water pollution and approximately 13% of toxic water pollution come from household operations. Households account for close to 11% of water use impacts.

The Things We Buy. Although this category is a subset of the items included in home operation, we've broken it out because it includes most of our daily shopping decisions. This is a good place to practice thoughtful consumption skills explored in this module. This segment includes yard care, personal items, and services.

The pesticides and fertilizers we use in our yards are responsible for approximately 14% of combined toxic and common water pollution. The Hazardous Waste and Organics modules will help you reduce toxic water and air pollution in your home and yard.

How We Build Our Homes. This category includes not only how we construct our housing, but also the impacts of maintenance, repair, and mobile homes. New home construction accounts for around a quarter of the threats to wildlife and natural ecosystems by land use. Home construction also impacts water pollution, generating approximately 10% of toxic and common water pollution. Information and sources on green building techniques are covered in the Sustainable Materials Management module.

What We Can Do. Each of us can take action to reduce our environmental impact, and this class has multiple modules where you will learn about the many ways to do it: decreasing our food waste in the Organics module; avoiding toxic chemicals in our homes and yards in the Hazardous Waste and Organics modules; green building in the Sustainable Materials Management module; preventing waste at work and at school in the Waste Reduction at Work and at Play module; and how to recycle effectively in the Recycling Processes module.

The Consumers Guide to Effective Environmental Choices also lists important rules for being responsible and wise consumers:

The Union of Concerned Scientists' Seven Rules for Responsible Consumption

- Give special attention to major purchases.
- Become a weight watcher.
- Analyze your consumption quantitatively.
- Don't worry or feel guilty about unimportant decisions.
- Buy more of those things that help the environment.
- Become a leader.
- Think about non-environmental reasons for reducing consumption.

Give Special Attention to Major Purchases. Although the environmental impact of day-to-day articles adds up, it is the large, less-frequent purchases that can have the most significant long-term environmental impact. Where you live; the size of your home; and how efficiently your vehicles, major appliances, home heating and cooling systems operate all have long-term consequences that can contribute to a strong foundation for daily good-use habits. Choosing a home that is close to work or school, for example, will reduce the environmental impacts of a daily commute. You might even be able to walk, take the bus, or ride a bike instead of driving. An energy-efficient refrigerator can use 40% less power than the least- efficient model; you'll be avoiding 40% of the greenhouse gasses and air pollution that result from generating electrical energy and saving money. A high-efficiency hot-water heater will pay off every time you shower, wash dishes, and do the laundry. These savings would be hard to accomplish using standard conservation techniques, such as taking five-minute showers. Combining high-efficiency purchases with good conservation habits makes you a double winner.

Home remodeling and major repairs are another area for considering long-term durability.

Choosing materials and techniques that have the least environmental impact and the most energy savings will keep you comfortable for many years to come. Low VOC paints and building materials will protect you and your family from breathing environmental toxins every day.

If you're replacing a roof, heating system, or other major component, consider the long-term operating costs as part of your decision-making process. Sometimes spending more upfront will actually save more money over the lifetime of the item. A high-efficiency heat pump, for example, may cost more to buy and install, but you'll be warmer and spend less money every winter.

Sometimes new is better when considering replacing outdated technology. Holding on to older, less efficient appliances or vehicles isn't always the best bet. Although you'll be disposing of an item that still works, for many large purchases the biggest environmental impact is not on the production end but in the daily use. A 20-year-old refrigerator is much less efficient than a new high-efficiency model. A newer, more energy-efficient vehicle will burn less fuel and put fewer pollutants into the air than one that is 15 years old. Older woodstoves are so inefficient and polluting that, as of August 1, 2010, Oregon law requires that uncertified wood stoves must be removed from a home before it is sold.[60]

Sometimes charm is expensive. Multifaceted, wood-frame, single-pane windows are lovely to look at, but they don't keep the cold out or the heat in very well. Look for double pane, low-E windows when you remodel.

The size of your home has a direct impact on the amount of energy required to heat it, cool it, and maintain it. Furnishing and decorating a large home is also expensive. Bigger is not always better, so carefully consider the amount of space your lifestyle actually requires and how much time and energy you want to spend taking care of a home before you decide to buy a different home, build an addition, or remodel.

Give special thought to recreational purchases, too. Motorized vehicles such as jet skis and snowmobiles have a larger environmental impact than sailing or cross-country skiing. Swimming pools are water hogs and require energy to operate cleaning filters and pumps. Consider whether you can experience the same joy of recreating while using a less energy-intensive method of entertainment and relaxation.

Become a Weight Watcher. Do you remember from the DEQ E-Commerce study[61] how heavier items often have a greater environmental impact than lighter ones?

In a practical sense, this means you don't need to worry about the effects of activities you don't do very often. Using a lightweight Styrofoam cup once a month will have less of an impact than neglecting to recycle your newspapers, magazines, and junk mail, which are very heavy. Reducing the amount of paper entering your home by getting off mailing lists or reading the news online will make a huge difference in the amount of waste you produce.

Analyze Your Consumption Quantitatively. This is an expansion of weight watching. When resources are limited, use them in ways that will make the most difference. This calls for some simple analysis. If you want to cut down on water use, look at how you use water

in your home and then determine two or three actions you can take that will reduce your water requirements. If your water use rises during the summer because of lawn watering, consider several water- saving options: installing drip irrigation, using drought-resistant plants, or letting your yard turn brown.

Before you decide on an action, consider how much of a payback you'll get and whether the action is consistent with your values. Letting your lawn turn brown saves time and requires no special equipment or additional cost, but you may hate brown lawns or have community rules that object to dry lawns. Installing drip irrigation can be costly, but you'll see an immediate impact on your water use. Switching to drought-resistant plants can be done gradually as your resources allow, and replacing your lawn with easier-to-care for landscaping means less work in the future. Choosing plants that attract birds and other wildlife may be just the boost you're looking for.

If you don't have a big summer spike in water use, consider how you use water in your home. How much goes to showers, flushing toilets, washing clothes, and doing dishes? How can you reduce water use? Consider installing low-flow showerheads or toilets, wash only full loads of laundry or dishes.

Don't Worry or Feel Guilty About Unimportant Decisions. An environmental column in a national magazine asked this earth-shaking question: Which is better for the environment, regular yogurt or Greek yogurt? Yes, there are folks who ponder questions like this, but you don't need to be one of them. Focus on areas that truly matter. Take care of the big wasteful items in your life—where small changes can create huge savings. For instance, make your home more energy efficient by replacing incandescent lights with compact fluorescent or LED lights. Then you won't need to worry as much about which yogurt to eat.

Buy More of Those Items That Help the Environment. Your purchasing decisions make a difference! Each time you buy something you demonstrate your values to the business world; they will produce more things like those you have purchased. This means that consumers have the power to shape the marketplace.

Here are some simple solutions that have a big impact:

- Switch to compact fluorescent or LED light bulbs and buy energy efficient appliances.
- Buy water-saving toilets, showerheads and faucets.
- Buy renewable energy from your electric company.
- Shop at used building supply stores.
- Skip the toxic yard products and household cleaners.
- Shop at your local farmers' market and purchase certified organic produce, eat seasonal foods.
- Buy fresh, whole foods and fewer pre-packaged meals.
- Eat lower on the food chain – add more vegetables and use less meat.
- Buy fewer things, but pay for quality.
- Support local repair shops, second-hand and consignment stores.
- Buy used books.
- Right-size your appliances.

- Buy from local artist or artisan.
- Think before you buy.

And when you're done:

- Donate items you no longer use to a charity or offer it on a Free-cycle site.
- Hold a garage sale and sell no-longer-needed items to someone else.
- Re-gift not-quite-right-items to someone who will treasure them.

Become a Leader. Don't be afraid to share your knowledge or experience with the people you know. You don't need to lecture anyone; leading by example works best. When you're practicing wise conservation and your family, friends, and neighbors ask why, let them know what you've been learning and explain why you have only a small garbage can, compost your food and yard debris, have a reusable shopping bag, and ride your bike to work. They may have ideas of their own to share too. You'll explore this further in the Taking Action module. Another way to become a leader is to become an early adopter of new resource-saving technologies. You'll use your buying power to support new and often struggling businesses, giving them a chance to continue to make new and useful products or services.

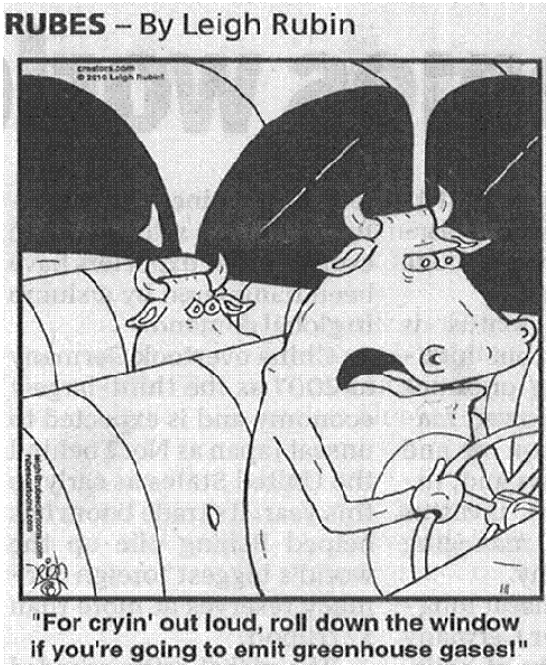
Think About Non-environmental Reasons for Reducing Consumption. For many of us, the environment is not always uppermost in our minds, but there are a lot of non-environmental reasons for practicing conscious consumption.

- You'll save money.
- You'll improve your health.
- You'll have less clutter.
- You'll have fewer things to clean and take care of.
- You'll spend less time shopping.
- You'll be more engaged in your local economy.
- You'll be making better use of what you already have.
- You'll be teaching your children critical thinking skills.
- You'll be in control of your consumption, instead of driven by it.
- You'll have more time for the things that matter.

As consumers, we have a tremendous amount of power. Don't be afraid to use it. Speak up.

- Ask clerks not to double and triple bag your purchases.
- Let store managers know the kinds of products and packaging you prefer.
- Don't buy products that won't last—and let the manufacturers know why you aren't buying their goods.
- If you have a question about a product or environmental claim, call the 1-800 number or write the manufacturer.
- Ask for information and share your concerns.
- When you find a good product tell the manufacturer how happy you are and tell your friends.

If enough people do this, manufacturers will change their practices. What we do in our daily lives matters. Be wise about how you spend your money. Don't waste it on purchasing tomorrow's clutter. Owning fewer things means you'll have more time and money for the things that matter most: family, friends and joy.


RUBES – By Leigh Rubin
"For cryin' out loud, roll down the window if you're going to emit greenhouse gases!"

Chapter 3: Recycling Processes

In the Overview we learned where our trash goes once it is collected. In the Thoughtful Consumption module we looked at ways we can reduce our waste and conserve resources. In this module we'll learn where our recycling goes after it leaves our home or office. Recycling is a process that starts when we set aside something to be recycled instead of putting it in the trash and ends when we buy items or packaging that contain recycled materials. At its best, recycling is a circular process that saves resources and energy by using the same material time after time.

This module examines the recycling loop, taking us from proper preparation of our recyclables through processing, remanufacturing, and on to buying recycled content products. We'll look at different collection systems and the factors that go into making recycling a successful tool for resource conservation. We'll finish up with a look at the importance of creating markets for recycled content products.

As we saw in Thoughtful Consumption, there are many reasons to reduce, reuse, and recycle. Recycling is an essential way to protect the Earth and the natural systems we all depend upon. When we recycle, we keep materials out of the garbage and return them to the manufacturing loop. We create a circle-of-use that reduces the need to take raw materials from the Earth and still allows us to have the things we need and desire.

When we recycle we:

- Protect nature
- Preserve forests
- Decrease air and water pollution
- Create jobs and increase U.S. competitiveness
- Reduce oil imports
- Stop exporting harm
- Reduce greenhouse gas emissions
- Feel good

Visit the Environmental Protection Agency (EPA) website at http://www2.epa.gov/recycle to find out more about the benefits of recycling[62].

Resource conservation is an important reason to recycle. Our natural resources are limited and the world's population grows every year; we can't afford to waste our land, water, and air.

Recycling is a useful tool to reduce our use of natural resources, but it doesn't happen on its own. Each one of us must do our share: shopping selectively, properly sorting and preparing our recyclables, and buying goods made from our recycled materials. The success of the entire process depends on our willingness to take the few extra steps to make it work.

There are three common symbols that are related to recycling. The first two were created by the paper industry in the 1970s to help the public know what items were recyclable and which contain recycled content. These are the familiar chasing arrows symbols based on a Möbius strip that have since been adopted by some other manufacturers. The three arrows in the symbols stand for three elements of the recycling process: (1) collection and processing, (2) manufacturing, and (3) purchasing.

The third symbol contains a similar chasing arrows design with a number in the center. This symbol was created by the plastics' industry to help plastics processors sort items by resin type. IT DOES NOT GUARANTEE THAT THE ITEM IS RECYCLABLE IN YOUR AREA. Plastic recycling is discussed later in this module.

There are two types of recycled content. Pre-consumer content refers to material that is recovered waste from the manufacturer or converter, such as factory trimmings or leftover material. Post-consumer content, on the other hand, comes from the recyclables we put into our recycling bins. Both types of recycled content save virgin resources. Using post-consumer helps markets for the materials we recycle curbside.

Remember, just because an item has the recycling symbol doesn't mean you can put it in your recycling bin.

Recycling in Oregon

The recycling process starts when we keep recyclables separate from the trash, continues through collection, processing, and remanufacturing, and ends when we purchase products that contain recycled content. We discuss each step in more depth below.

Keeping recyclables out of the trash

Keeping recyclables separate from the trash is the first step in any recycling process. How we sort and prepare recyclable items depends on the local collection system and

the specifications of materials markets. Residents and businesses can also opt to source separate materials that are taken at depots or grocery stores but not at the curb. Plastic bags are an example of this because they cannot be recycled in the mixed recycling and must be taken to a recycling center that can accept them. Non-curbside collection options are discussed on the next page.

What is Recyclable?

Most solid waste experts agree that up to 75% of the materials found in our trash can are recyclable or compostable. However, just because an item is technically recyclable doesn't mean it will be collected at the curb. The items that are collected in different parts of Oregon can vary depending on access to markets and the availability of sorting technology.[63] That's why labels on nationally distributed brands can be misleading. They may say the product is recyclable, but the facilities to recycle that product may not be available in your community.

The DEQ requires that jurisdictions with more than 4,000 people provide at least monthly curbside collection of several principal recyclable materials (Oregon Revised Statutes [ORS] 340-90-0040). Local jurisdictions decide whether additional materials will be included in the local recycling system and how they will be collected[64]. They work closely with haulers to make these decisions. The decisions are based on access to stable markets, the availability of collection and sorting technology, the ability of the public to understand preparation requirements, and public demand.

Segregating Recyclables

The first step in the recycling process is to segregate recyclables from other wastes at the point of generation—at home or work—and then to collect them separately from garbage. According to ORS 459.005 (26), this process is technically known as source separation. However, this term is commonly used to refer to the practice of keeping each material separate from others— milk jugs with milk jugs, newspaper with newspaper, cardboard with cardboard, etc.

After recyclables are kept out of the trash, they need to be sorted to meet the demands of the local recycling system. In Oregon, virtually all jurisdictions keep glass separate from other recyclables. Because glass breaks easily, it embeds itself into other recyclables, in particular the scrap papers that are purchased by mills to make recycled paper. This can harm workers, damage sorting equipment, and increase the amount of contaminated waste that mills are forced to dispose of, all of which degrade the system as a whole.

There are a number of ways to sort recyclables for collection. The sort will depend on the requirements of the facility that will process the material, the style of the collection vehicle, and, last but not least, the economics of the organization that is collecting the material.

Source Separated Materials vs. Commingled Material Stream

There are two philosophies about how to sort materials for recycling: source separation and commingling. Each method has benefits and deficits. Generally, source separated collection results in higher quality recyclables, while a commingled sort results in the collection of significantly more material. The specific differences are discussed below.

Most Oregon communities have opted for commingled collection, although there are still some source separated collection programs around the state. As mentioned earlier, source separation is the term commonly used to indicate that recyclables have been separated at the source (by the consumer) instead of at a Material Recovery Facility or MRF. In this system, each recyclable material is sorted into a separate container. The items are kept separate during collection and then are baled or condensed and sent directly to end- use markets such as paper or steel mills. Because they have never been mixed together, the items don't have to be separated at a MRF. The process saves resources and reduces the capital investment needed to run the system.

Source separated recyclables produce higher value material for remanufacture with fewer contamination problems. This higher quality is reflected in the higher prices end markets are willing to pay for the material.

The downside to source separation is that it puts the responsibility for sorting and storing a long list of materials on the customer. Not everyone has the time, space, or dedication to sort recyclables and store them until the next pick-up.

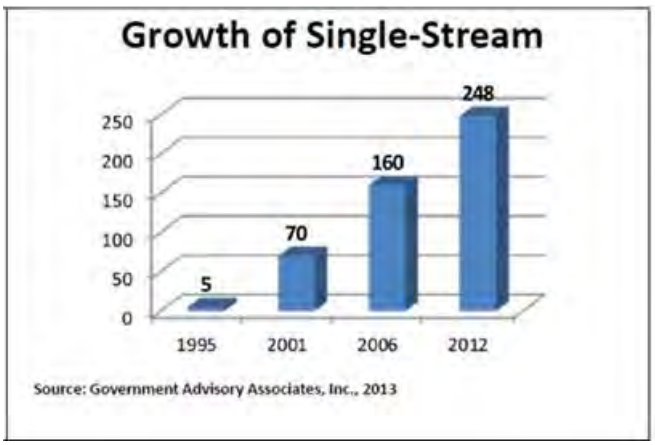
A source-separated stream also makes collecting recyclables complex and less efficient. A hauler needs many compartments to keep the items separate and those compartments don't usually fill up at the same pace. A truck with a full newspaper compartment, but mostly empty compartments for the other materials, will need to drive to a drop site to deliver the newsprint before it can finish its route. Emptying hundreds of small containers by hand is also time consuming for the route drivers and increases the cost of collection. It can lead to worker injuries and causes increased pollution in neighborhoods as the truck idles during the loading.

A commingled stream allows customers to combine many recyclables in the same bin. Most of Oregon's curbside collection programs now have a commingled sort of recyclables with glass kept separate; this is called a dual stream sort. Currently, this service is not available in Tillamook County.

Commingled recycling reduces the time and space required to sort, store, and transport recyclables. It increases on-route efficiency because the hauler only has to empty a couple of containers, and the capacity of the entire truck can be used before the material needs to be delivered. Commingled roll carts can be collected in an automated collection truck; this reduces the chance that workers will be injured and reduces idle time on neighborhood streets.

When systems switch from a source separated to a commingled stream, participation in recycling program increases dramatically – often by 25%. Commingling makes it easier for customers to separate their recyclables and store them for collection and requires fewer trips to the curb on collection day. More people using the system means that much more recycled materials are collected.

The graph to the right shows that the number of commingled (aka "mixed recycling") curbside recycling programs nation-wide has grown over the years, largely in response to local government's desire for increased recovery and haulers' desire for collection efficiencies. According to Resource Recycling, 29% of the nation had access to commingled recycling in 2005. This increased to 64% by 2010. Only 7 states do not have any single-stream MRFs.



The downside of commingled systems results from the difficulty in separating the materials once they are collected. MRFs are businesses that use both mechanical and hand-sorting systems to separate and sort recyclables as they prepare them for shipping to end- markets. These facilities require a large capital investment and lots of maintenance. They are also labor intensive, so the system as a whole is much more expensive and complex to manage than a source separated system.

Proper Preparation is Key

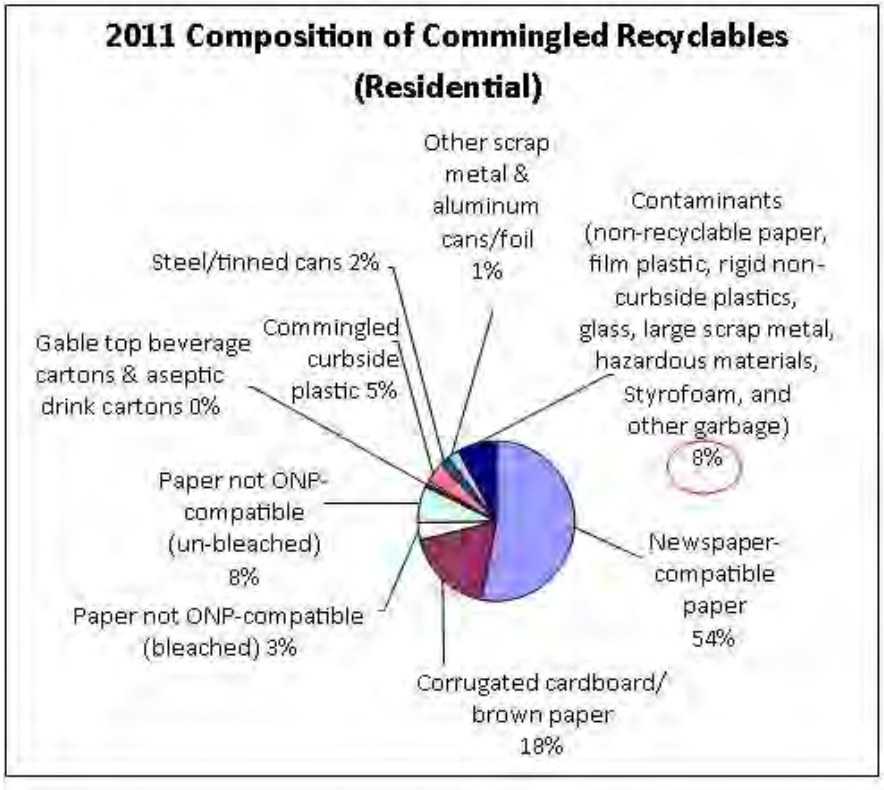
The move to commingled collection streams makes proper preparation even more important to the success of the process. Properly prepared materials will go to the markets for which they were intended and will be successfully recycled. On the most basic level, materials must be free of food and dirt. There are different preparation requirements for each material. As the technology for processing recyclables has evolved, the preparation requirements have also been changing. We will discuss the preparation of individual materials later in the module.

The word contamination is used in a couple of different ways in the recycling industry. Contamination can refer to food-soiled or dirty recyclables. But recyclers also refer to contaminants as materials that are in the wrong place, like glass in with plastics or fibers. Poor sorting and preparation can contaminate otherwise good materials and get them sent to the landfill.

Getting the word out about proper sorting and preparation can be challenging. Local governments and haulers work hard to make preparation information easy to understand, but in the Portland Metro area alone, twenty tons of improperly sorted and prepared materials were still sent to the landfill every day in 2004. Processing materials that do not belong in the recycling is costly for processors, and materials still get through the system and end up contaminating loads headed to markets.

Common Contaminants

It is important to keep non-recyclables out of the collection stream. Items that are mistakenly placed in the recycling bin need to be removed, wasting time and resources and adding costs to the system. Although MRF's are good at what they do, they are fast-moving places and not every item can be removed before the materials are baled and sent to end-markets.



Unfortunately in their zeal to recycle, some people include materials that do not belong in the recycling bin. Non-program plastics, medical waste, and multi-material paper packaging are items that frequently cause problems in our recycling system.

Non-program plastics
There is some variance in the plastics that are accepted in Oregon recycling programs. Nearly all programs accept plastic bottles and tubs that are larger than 6 ounces, but not all do. Check with your hauler or depot to learn which items are collected in your area.

Aside from a few very small pilot projects, the following plastics are **not accepted in any curbside program** in the state.

- Non-container plastics like VCR tapes, children's toys, and hoses.
- Blister pack product packaging shaped to form bubble over product.
- Bakery and deli clear plastic trays and clamshells.
- Flexible bag and film plastics.

Plastic bags and plastic film (Saran Wrap, agricultural film and similar items) are common contaminants and cause many problems at the MRF. These thin plastics are not recyclable in any curbside collection program in Oregon. Although some grocery stores have special programs to collect and recycle them, they should not be put in the curbside containers.

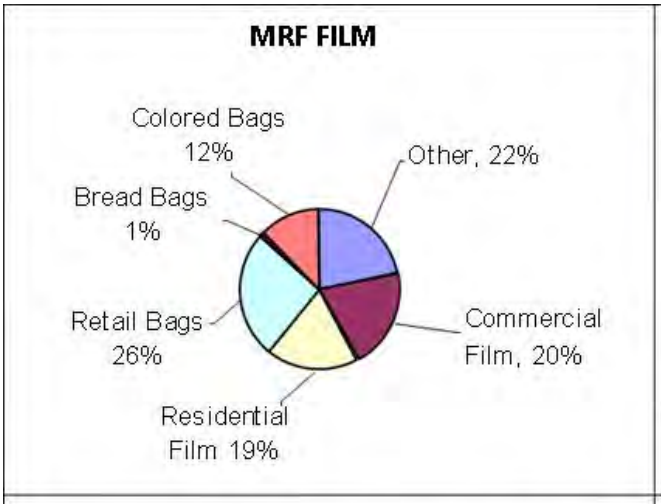
Plastic bags in the recycling cause problems the moment they are set at the curb. Because they are lightweight, the wind often blows them down the street, creating litter. In the collection vehicle and at the MRF they tangle with other recyclables, blow around the floor and get caught in the equipment that helps sort materials.

Check out the video to learn about the effects of film plastics on MRF operations.:
http://www.youtube.com/watch?v=KxOLA935kuA&feature=c4-overview-vl&list=PLUO9E3cULi8NcmphSP-y3d3ipjdtI3qwH

So many bags are mistakenly put in the recycling that one local MRF hand-pulled over 50 tons (100,000 pounds) of film each month of 2009. That MRF also cuts off about 400 pounds of retail and grocery bags from its sorting screens - every day. That's 10,000 pounds per month. This means that the MRF handled 1,320,000 pounds of plastic bags and other film in 2009.

And none of it should have been in the recycling!

MRFs in the Portland area estimate that 20 - 30% of their labor costs are spent dealing with plastic bag film. The estimated labor cost for this ranges from $30,000 to $40,000 for each facility each month. That is a lot of effort, time, and money that could be spent on sorting the items that really belong in the recycling. And after all this time and money are expended, 24% of plastic film still ends up contaminating other recyclables, especially newspaper.



This graph represents the types of plastic film that MRFs are encountering.

This is a photograph of a screen at a MRF that has become jammed with plastic bags. When this happens they must stop processing recyclables and cut out the bags.

Other non-recyclable plastic items also show up frequently: fast food and deli take-out clamshell containers; Styrofoam; VCR tapes; children's toys; hoses; and blister-pack product packaging are far too common.

In many communities, lids of plastic bottles and tubs can also be another common contaminant. Because of their size and shape, these items are difficult to sort properly and are likely to become caught in equipment or be screened out as trash.

As plastic material becomes more valuable, more plastics may be added to curbside programs.

Medical Waste

Medical waste is also a common contaminant. As more people receive in-home medical care, items like plastic tubing and injection needles (often called sharps) are also showing up in recycling bins. These items are not recyclable. Plastic tubing that is free of bodily fluids should be put in the trash. Sharps can injure workers and damage equipment and other recyclables. It is illegal to put them in the trash; they must be placed in special containers and disposed of through specially designed programs. Call your hauler, recycling contact, or pharmacist to learn about sharps collection in your community.

Non-Container Glass

Glass is kept separate from all other items in virtually all Oregon curbside recycling programs. It breaks easily, can harm workers, damage equipment and cause problems in the manufacturing process when embedded in other recyclables.

Paper mills regularly sample the bales of incoming paper to evaluate how much contamination there is. They sometimes reject loads that have too much contamination. In this photo you can see the amount of glass found in a sample taken from a commingled/mixed recycling program that does not allow glass. On the right is a sample taken from a program (probably from California) that does allow glass in the mixed recycling. Both of these samples come from MRFs that try to sort out all the recyclables so in theory there should be no glass in either sample.

Just as with plastics, people often place items in the glass bin that don't belong there. Only glass jars and bottles are accepted in Oregon's recycling programs. Window glass, drinking glasses, vases, light bulbs, ceramics, and clear baking dishes may look like container glass, but the melt-points are very different. This glass doesn't melt but causes a fault in the bottle or jar that will make it likely to break. Non-glass ceramics are also a serious contaminant in the recycling and manufacturing process.

Multi-Material Paper Packaging

Milk cartons and aseptic containers are accepted into some recycling programs and are discussed later in this module. Other multi-material paper packaging is sometimes mistakenly placed in recycling bins. These are paper containers that are lined with a polyethylene layer to protect the paper from the product inside, like ice cream boxes, to-go cartons, coffee cups, and frozen food boxes. There is no industry standard for these materials: fiber content, wet-strength content, and coatings vary from item to item. This means that it is impossible to sort these items into usable recycling categories.

Wet strength is a chemical agent added to paper to increase fiber adhesion when it encounters water. This additional stickiness helps items such as paper towels, plates, ice cream cartons, to-go food containers, and frozen food boxes resist the usual disintegrating effects of moisture and stay strong when they're wet. Since the pulping

process uses water to separate and re-align fibers into paper, contamination with wet strength causes major problems at paper plants. Instead of the fibers separating, they clump together into big masses. Additional chemicals or special agitation is required to separate them again and many mills are not equipped to do this.

Most recycling programs in Oregon instruct citizens to put most multi-material paper packages such as frozen food boxes, to-go containers, and paper cups in the trash rather than contaminate the paper recycling system. To learn more about recycling aseptic and milk cartons, read the report by Peter Spendlow in the course resources tab.

Miscellaneous Contaminants

Do not put any items in your recycling container that are not specifically allowed in your local program. Always check with your hauler if you have any questions about an item. This includes clothing, shoes and electrical cords. And remember: When in doubt, keep it out!

Contaminants and End Markets

When sorted recycled materials leave the MRF, they are sent to manufacturers who have purchased them. Loads that contain contaminants cause many headaches for end-market users and decrease their willingness to use recycled materials.

Imagine that you came home from grocery shopping, opened your new bag of potatoes and discovered not just potatoes, but also beets, rocks, and turnips. You would not be happy: you didn't get what you paid for, you need to sort the potatoes from the other items, and you have garbage to throw away. Now imagine that you are purchasing many tons of those potatoes each day, and you can understand the problem contamination causes in the manufacturing plant. Even if those potatoes were very cheap, the sorting time, trash, and inability to predict how many good potatoes you were buying might cause you to stop buying potatoes. These contaminants are known as out-throws and they are expensive and cumbersome for manufacturers.

There is often a tension between city and county representatives and MRF operators. The representatives, in response to public demand, want to add new materials to the curbside recycling stream. The push to accept more materials puts pressure on MRFs to accept them in order to keep their contracts. This sometimes results in more contamination, which can affect the quality of material received by manufacturers. Non-program plastics and multi-material paper products such as milk cartons and aseptic cartons are examples of these items. These and other common contaminants will be discussed in the sections about each specific material.

A group of haulers, processors, end-market users, government officials, and others have been meeting to work on the problem of contaminants. Known as the Oregon Commingled Recycling Systems Improvement Working Group, they are hoping to devise a more uniform

system for managing recycled materials. In 2011, the DEQ conducted research about the nature and extent of contamination in Oregon's recycling system. For more information, read the Composition of Commingled Recyclables Before and After Processing report[65].

Collection Methods

In Oregon, source separated recyclables are typically collected one of five ways, using curbside collection, recycling depots, transfer stations, specialized collection sites, or a refund/redemption system.

Curbside Collection

According to Oregon law, cities and counties must offer curbside recycling services to all residents with garbage service in any Oregon community of 4,000 or more people. In these communities, recycling trucks collect materials at the curbside of both residences and, where offered, of businesses. In most jurisdictions, private trash haulers are franchised or licensed to pick up residential recyclables at least once a month in compartmentalized trucks. Haulers provide recycling containers to each household. Two Oregon communities, Junction City and Milton-Freewater, provide municipal garbage collection. For a full text of Oregon's recycling law visit the DEQ Website at: http://www.deq.state.or.us/lq/sw/recyclinglaws.htm.

Some recycling trucks have separate compartments for paper, plastic bottles and metal, and glass. Others commingle paper, plastic, and metals. In Oregon, glass is almost always kept separate because it can break and cause problems with worker safety and material quality.

Recycling service to apartments and businesses is not uniform. If a jurisdiction has chosen apartment recycling as one of their DEQ compliance options, the licensed or franchised hauler must offer the service to landlords that request it. Apartments can be provided with centralized recycling in two containers: one for newspaper, plastic bottles, jugs and sometimes tubs, aluminum, tin, and cardboard, and another for glass.

Because apartment or multi-family recycling programs can provide special challenges to building owners many do not request services. Only where local governments employ specialized incentive programs, or municipal coded, do we see consistent recycling service to these communities. To keep a program running smoothly, building managers need to regularly educate both new and existing tenants about the program and keep an eye on contamination levels. Since space is often at a premium, finding an easily accessible area to place the recycling collection containers is sometimes a challenge.

Multi-Material Depots

These sites all accept curbside recyclables and sometimes additional items, such as plastics not accepted through the curbside program. Some materials are taken for no charge. Fees may be charged for materials that are costly to recycle. Depots are used primarily by those without curbside recycling service, including apartment dwellers, rural residents, and people who wish to recycle more than what is offered at the curb.

Transfer Stations

These are one-stop locations that usually handle both trash and recyclables. They can be used by residents and businesses who want to self-haul their garbage and recyclables. They can also be the drop-off point for trash haulers.

Single Material Collection Sites, Including Retailers

These commonly accept only one class of item, like e-waste, textiles, batteries, or newspapers. An increasing number of retailers are offering take-back services for items they commonly sell, like ink cartridges, printers, cell phones, compact fluorescent bulbs, rechargeable batteries, and plastic bags and film. These retailers include home improvement centers and hardware, office supply, and electronics stores. Check with your local retailers to learn what is accepted in your area.

Redemption Systems

Oregon's primary refund system is the result of the 1971 Bottle Bill. Originally passed as a measure to cut down on roadside litter, it has proved to be a boon for recycling. The bill required that retailers pay a nickel deposit for beer and carbonated beverage containers. This charge is passed on to customers, who receive their deposits back when they return the containers.

Containers received through the Oregon Bottle Bill redemption system are more desirable than containers collected from commingled recycling systems because they are generally free from contamination and out-throw.

The Oregon Bottle Bill was updated by the 2007 Oregon Legislature to include bottled water and flavored water beverages beginning in 2009. In 2011 it was updated to include sports and energy drinks, coffee, tea, and juice, starting in 2018. Adding these containers to the redemption system should significantly increase the recycling of PET (#1) plastics in the state.

The updated law also states that if the redemption rate goes below 80% for two consecutive calendar years, the bottle deposit will increase from 5 to 10 cents. When the Bottle Bill first passed, the redemption rate was as high as 90%, but in 2009 the beverage container redemption rate was only 75%. The buying power of a nickel in 1971 is equal to about 25 cents today; increasing the deposit might provide an additional incentive to get those bottles back for redemption instead of putting them in the recycling bin or the trash.

The Oregon Beverage Recycling Cooperative has set up successful pilot redemption centers in the Portland and Salem areas to make returns easier for consumers[66]. More experimentation in collection facilities is expected under the new law. Visit this DEQ website for a summary of the Bottle Bill and lots of current, useful information. [67]

Processing

After collection, commingled recyclables are taken to MRFs to be sorted and processed to prepare them for sale to end users or manufacturers.

Some MRFs specialize in processing specific streams of materials like curbside recyclables or office loads. Although the process may vary, commingled items are usually first run down a conveyor belt, where they are automatically sorted according to their physical properties, such as weight or magnetic attraction. Further down the belt, workers sort the remaining items into designated categories.

Other MRFs conduct mixed waste processing, which means that recyclables must be separated from mixed dry waste only. Facilities that accept construction and demolition debris, for example, do not take source-separated recyclables exclusively. The waste is either dumped onto a concrete pad or placed on a conveyor and sorted by hand. While prevalent in other parts of the country, there are no facilities in Oregon that sort recyclables from municipal solid waste.[68]

Learn how the MRF process works by watching a video: http://www.youtube.com/watch?v=BsIiD1nRE8M&list=PLUO9E3cULi8NcmphSP-y3d3ipjdtI3qwH

Once sorted or graded, fiber, plastic bottles, and metals are compacted, baled, or condensed in other ways for economical transport to end users. Glass is usually crushed into cullet. Processing reduces contaminants that can lower the quality of recycled products or damage manufacturing equipment. Processed materials are sold to manufacturers to make new products.

The separation of commingled material is not a perfect process. For a MRF to be sustainable, the material must be processed very efficiently. Even with well-trained employees, sorting is never perfect. This means that some recyclables can end up mixed with others. The amount of cross contamination varies from facility to facility.

Local jurisdictions, haulers, and MRFs are always striving to identify ways to reduce this contamination while still enjoying the high levels of recycling resulting from the commingling of materials. Consumers can help make the process more efficient by properly preparing their recyclables before they put them on the curb.

"Dirty MRFs" are facilities that accept loads of household garbage and then sort out recyclables. There are no dirty MRFs that process residential garbage in Oregon.

Transportation

Even though curbside recyclables sometimes travel great distances to get to a MRF and even farther to get to end-markets, it is still an environmentally good choice to recycle. The Department of Environmental Quality did research to find out how far recyclable materials needed to travel before the energy savings from using the recycled content was outweighed by the energy needed to get them to market. The results of this study showed clear energy savings from recycling: even the least efficient way (truck) to transport the heaviest material (glass) resulted in energy savings if the glass was transported less than 1,300 miles – that's almost half-way across the U.S.!

Manufacturing

For recycling to be effective, manufacturers must make new products from recycled materials. Manufacturers are generally interested in three main issues when they choose materials to use in their products:

1. quality
2. price
3. convenience

Additional qualities may be important for firms that are pursuing environmental sustainability as a core value: local purchasing, greenhouse gas emissions, and public demand.

Recycled materials are sold as commodities in international exchanges just like raw materials. This means that processors have access to worldwide markets to sell their goods; the plastic milk jugs you place at the curb may be in China in two to four weeks. The emergence of international markets for recycled materials has caused major changes in the recycling industry. It means that demand has increased for many materials, but it also means that prices respond to global economic conditions as much as to the U.S. economy.

Competing in global markets also means that recycled materials compete head-to-head with virgin materials. Some manufacturers switch between using recycled and virgin materials depending on the price and quality of the available goods. When the price of virgin material is not much different from the recycled product, they will often go with the raw material, especially if recycled materials are perceived as being less convenient to use.

The quality of the recycled material is crucial. A manufacturer can't make quality products without quality ingredients. This means the recycled content materials they purchase must be free of as many contaminants as possible. For example, different plastics have different

melting points. Polypropylene plastic (#5) melts at a much higher temperature than polystyrene (#6). This means that polystyrene will burn and create carbon residue in a batch of melted polypropylene, not a desirable condition. Contamination can ruin an entire production run and is a very expensive problem for a manufacturer.

Contamination costs manufacturers money in other ways too. When product tolerances are tight, a manufacturer may need to hire staff to sort the good material from the contaminants before it enters the production process. Out-throws and prohibitives are generally sent to the landfill which adds to the cost of using the material.

Even though many of our recycled commodities now go to international markets, the jobs of collecting and processing the material stay at home.

Office Paper

Some office paper is used to make 100% recycled paper. However, most of it is mixed with virgin fiber for a variety of products: book covers, gift boxes, game boards, egg cartons, napkins, towels, toilet tissue, or even matches.

At a mill, the used paper is mixed with water and heated in vats to turn it into pulp. The pulp may be forced through a series of screens to remove contaminants such as paper clips, staples, and plastic tape. It then goes through a series of tanks and is repeatedly cleaned and rinsed. This washing along with bleaching and de-inking is necessary to produce white paper.

The watery pulp is spread over rotating screens, pressed, and dried to form paper. Paper fibers can be recycled approximately five to seven times until the fibers are too short to be useful.

The drum above is at the paper mill in Newberg. It's where the paper is turned into pulp and chemicals are added to remove inks. To the right is where the garbage (i.e. glass and plastic bags) is removed.

Newspaper

Newspaper, or old newspaper (ONP), is a highly recyclable product and one of the initial commodities that helped jump-start the early days of recycling in the United States. ONP is primarily used to make new newsprint but is also used to make egg cartons insulation, fruit trays, etc. In the early days of recycling, ONP was primarily collected at drop-off depots and other source separated collection points. Currently, a

majority of the ONP collected is through commingled systems. The ONP is then sorted out of the mixed stream by an MRF before getting sent to the mill.

Once the ONP gets to the mill, it is mixed with water and turned into pulp. Ink is removed from the pulp and the pulp is sent through a cleaning process to remove any unusable fibers and fines such as glass, rocks, or dirt. Some mills make this cleaned pulp directly into newspaper, while others mix the pulped ONP with pulp made from wood chips.

At this point in the process, the pulp has about 96% moisture content. The pulp is sprayed onto a large screen that goes through a series of presses and driers at 4,000 feet per minute, 45 miles per hour, to create finished newsprint at about 10% moisture content.

ONP consumption in the US is falling at a rapid pace. Since 2006, consumption is down over 40%. This is due to a variety of factors including competition from global markets, like China; fewer and smaller newspapers with fewer advertisers; and paper mill closures.

In Oregon, a majority of the ONP produced is consumed at the local mills in Oregon and Washington, although a small percentage of ONP is sold to overseas markets such as China. There are several large newsprint mills in Oregon and SW Washington that can consume more ONP than is produced in the region. ONP has to be brought in from all over the Western States to meet production requirements.

Corrugated Cardboard

Corrugated cardboard is composed of a ribbed layer inside two flat sides and it is usually brown. Corrugated cardboard and Kraft (grocery) bags are baled together and then shipped to a paper mill for processing. Demand for this material is international, so it may be shipped to overseas markets. At the mill, the material is mixed with wood-chip fiber and is usually made into the middle layer of new cardboard, although some may be used in outside layers of cardboard, Kraft bags, or boxboard.

Waxed cardboard and black asphalt tape can cause problems in the recycling process and should be kept out of the recycling stream; other tape is easily removed.

Mixed Waste Paper

This is the paper left over after the higher grades have been separated out. It is usually composed of discarded mail and paperboard boxes. It is used in both foreign and domestic markets as the middle layer of corrugated cardboard or for boxboard.

Milk Cartons and Aseptic Containers

Although milk cartons have been around for a long time, the aseptic containers used to package shelf-stable milk alternatives, soups, and a growing list of other food

products are a newer and growing part of the waste stream. These containers are made from a layer of high quality paper sandwiched between thin layers of polyethylene film or polyethylene film and aluminum. These layers must be separated before the paper fiber can be recycled. Separating the layers requires specialized equipment, processing technologies, and occasionally chemical agents. Since not all paper mills are equipped to do this separation, these multi-material containers must be separated from other paper at the MRF before being sent to mills that can process them.

MRFs often have difficulty pulling aseptic containers from fast moving conveyor belts because these containers are small and difficult to see. Many MRFs also have very little room to sort out another recycling stream. Data collected by DEQ for the Oregon Commingled Recycling Systems Improvement Working Group suggests that approximately 25-30% of milk and aseptic cartons find their way to paper mills that can extract and make use of the fibers. The other 70 – 75% often become out-throws.

Since aseptic containers are a growing portion of the food packaging industry, and contain high-quality paper fiber, efforts are underway to find solutions to the problems they present. Source separation is one possible solution. When milk and aseptic containers can be collected as a source separated material, such as at transfer stations, they can be marketed directly to the mills that can process them.

But even in this case, extra vigilance on the part of the citizen recycler is needed to ensure all liquids are removed from containers before recycling. A paper mill cannot make new paper out of moldy decomposing fibers, and the stench of soured milk can sicken MRF and mill employees.

Glass

Glass must be kept separate in virtually all Oregon curbside recycling programs and depots. Mixing glass with other recyclables reduces the quality of all commodities and renders the glass unusable after it is removed. In Oregon, recycled glass is used for making glass bottles and fiberglass insulation and as a replacement for gravel in road construction.

Consumers no longer have to remove labels and rings from bottles because processors have equipment with blowers and magnets; however, lead foil on some wine bottles can’t be removed magnetically. As discussed earlier, ceramics, Pyrex, window glass, and glass baking dishes are serious contaminants.

Tin (Steel) Cans

These cans are made of steel that is electroplated with tin to protect foods from rust. If a can is not shiny, it may have a resin coating instead of tin. Some cans are shipped to the Midwest for detinning so the steel can be used for new cans. Cans that go to West Coast mills will be mixed with ferrous scrap and made into rebar, railroad ties, or bridge spans.

Aluminum

Aluminum is one of the most frequently recycled materials in the world, mainly because it takes so much energy to mine and process bauxite. Making a can from recycled aluminum requires 95% less energy than making one from virgin material.

Baled aluminum cans are delivered to a smelter where they can be processed into more aluminum products. Other scrap, such as patio furniture, window frames, and pie plates are sent first to a local facility where they are sorted and graded according to the alloys they contain. They are then sent out of state for smelting and reprocessing into similar products. Foil is not as valuable as the other items because it is so thin and is frequently contaminated. However, if it is clean it can be included in most curbside recycling programs. For information on usage rates of aluminum, check out this Aluminum Usage Report.

Other Metals

Iron and steel have been recycled since the beginning of their use. Steel mills have different capabilities in using scrap metal. Fortunately, most newer mills, including those in Oregon and Washington, are using electric furnaces that can make steel out of 100 percent scrap while using 75 percent less energy than older furnaces.

Non-ferrous metals like aluminum, copper, and brass are the most valuable of the metals typically recycled.

Motor Oil

Used motor oil is accumulated in drums and then delivered to an oil processor where it is cleaned to meet EPA requirements. In Oregon, most of it is used as fuel to heat ship boilers or as tar for asphalting roads. A small portion is reused as machinery or chainsaw lubricant or is recycled back into motor oil. Portland based Oil Re-Refining Company[69] recycles motor oil into diesel, industrial, and fuel oil as well as asphalt flux to be used on roads and roofs. And some large motor oil companies, like Valvoline, are also incorporating recycled oil into their products[70]. Unfortunately, only a very small percentage of motor oil is recovered.

Tires

A small proportion of tires are recycled, or retreaded. Retreading involves buffing carefully selected, old tires to create a smooth surface so that a new layer of tread can be applied. Although there are about 850 retread plants in North America, the market for recycled tires is limited so most tires in Oregon are ground into large chips and deposited in a monofill. State law requires that tires be chipped or ground before being disposed in a landfill. Some used tires are sold as fuel for cement kilns or as construction fill. Still others are sold to manufacturers (several in Oregon) who make them into rubber products such as mats, playground surfaces, highway cones, and parking or traffic bumpers. Some states are experimenting with using chipped tires as road base.

Plastics

Due to the high cost of oil, the market for plastic, which is mostly made of oils and natural gas, recycling is growing. Just about all jurisdictions have expanded their plastics curbside programs to include all plastics with a neck, tubs larger than 6 oz., buckets, and rigid flower pots. Today, some depots collect many of the plastics not accepted at the curb.[71]

Contrary to popular belief, the chasing arrows imprint on the bottom of a plastic container does not mean that the container is recyclable in your community. The plastics packaging industry adopted this symbol to help plastics processors sort the most common resins from each other; it was never intended as a recycling symbol for the general public. The number in the center of the arrows indicates the type of plastic resin that was used to make the item.

Plastic packaging labeling identifies six main resins, each with its own characteristics including hardness, flexibility, and melting point. The number seven is used to indicate other resins or combinations of resins. "Biodegradable" and "compostable" plastics are also labeled with a 7; however, they are not recyclable and pose many problems to plastics recyclers. The number of items in the 7 category has been increasing. The American Chemistry Council: Plastics Resin Code document describes the characteristics and uses of the seven resin groups.

But knowing the resin type is only one of the elements that go into determining the recyclability of a plastic product. By their nature, plastics can be used in many different ways. This flexibility means that the resin can be customized for specific uses by changing its viscosity or other characteristics. High Density Polyethylene (HDPE) is used to make milk jugs, but it can also be used for making plastic bags.

For information on plastic resin codes, see the Plastics Packaging Resin document from the American Chemistry Council.

Since all changes to a standard resin-type may change basic properties like the melting point, it is important to sort plastics beyond just the resin numbers. For most manufacturing purposes the recycled feedstock must be consistent. This is why shape is used as a principle means of sorting plastics for recycling. The resin codes are useful to recyclers, but from a consumer standpoint, it is easier to talk about shape than about resin-type. Most collection programs concentrate on bottles and tubs because those categories help capture the largest percentage, by weight, of consumer plastics that have a consistent end market.

Although there are three ways to form plastic into a desired shape, only two of these methods are used to make the plastic bottles and tubs many of us can recycle curbside. The first method is blow molding. This is used to make most plastic bottles. In the direct blow molding method, a partially shaped, heated plastic form is inserted into a mold. Air is blown into the form, forcing it to expand to the shape of the mold. The plastic used in this process is relatively liquid so that it can be easily blown into the form.

The second method is injection molding. In this method, the plastic compound, heated to a semi-fluid state, is squirted into a mold under great pressure. It hardens quickly and then the mold is opened and the item is released. Injection molding is used for items that require more detail like butter and yogurt tubs. This method uses a thicker plastic mixture so the item will hold its shape well.

Extrusion molding is the most used plastics-forming process, but it is seldom used to form the food packaging containers we use and recycle every day. In this process, heated plastic is forced continuously through a die made in the desired shape, like squeezing toothpaste from a tube, and produces a long, usually narrow, continuous product. The formed plastic cools under blown air or in a water bath and hardens on a moving belt. Rods, tubes, pipes, and sheet and thin film, such as food wraps, are formed and then coiled or cut.

Each of these methods requires materials with different melt-points and other qualities; as a result, these plastics cannot generally be recycled together.

Increased plastic recycling faces another barrier: plastics weigh very little for the volume of space they take up. In other words, a truck full of expanded polystyrene foam, or Styrofoam, contains very little actual material when it is melted down for recycling. This means that transportation costs are very expensive.

Only a few places in the state accept Styrofoam for recycling:

- St. Vincent de Paul (Eugene)[72]
- Fresh Start Market (3020 Center St., NE, Salem)[73]
- Recology (Portland)[74]
- Total Reclaim (Portland)[75]

Plant-based Plastics

In March of 2011, Pepsi-Cola announced that they had created a soda bottle made entirely from plant-based oil instead of petroleum.[76] In addition, they planned to make this oil from agricultural waste such as switch grass, pine bark, cornhusks, and other materials. Ultimately, Pepsi planned to also use orange peels, oat hulls, potato scraps, and other leftovers from its food business. Pepsi also owns the Frito-Lay, Tropicana, Gatorade, and Quaker brands. If manufacturing these bottles in large quantities is viable, the potential to make a big impact on the plastic bottle industry, as well as to reduce their food waste, would be immense.

The development of plant-based or bio-plastics could be an exciting development for recyclers because this plastic would be identical in molecular structure to other PET and could be recycled with other PET bottles. However, to evaluate the full environmental impact of these bottles we need to look beyond the simple issue of recyclability to evaluate their entire lifecycle. A reliable life cycle analysis would help us compare the benefits of traditional vs. bio-plastics to the environment.

About Biodegradable or Compostable Plastics

Not to be confused with the plant-based plastics above are the so-called biodegradable or compostable plastics that have been showing up in local delis and stores[77]. Contrary to marketing claims, these biodegradable products do not break down in landfills and compostable plastics will not break down in a home composting bin. They may not break down in commercial composting facilities or in a marine environment.

These products look and feel like regular plastics, but they don't act like them in the recycling stream. Although these plastics won't biodegrade in landfills or compost at home, they may eventually break down. This is problematic if they are collected and processed with regular plastics because manufacturers do not know if or when these degradable additives might break down. That means that these plastics are a serious contaminant in the plastics recycling stream and a potential threat to the entire plastics recycling infrastructure. Who, after all, wants their fancy new car to disintegrate? We will discuss compostable plastics in more detail in the "Managing Organic Wastes at Home and Work" chapter.

Wood

Wood became worth recycling or burning for fuel as landfill fees rose dramatically in the early 1990s. Most recovered wood goes to the hog fuel market where it is burned in boilers for fuel. Some is used for particleboard.

Recycling At Home

It only takes a few simple steps start recycling at home:

- Contact your hauler and learn what is recyclable in your local program and how to prepare it. Most haulers provide collection bins or roll carts to place at the curb or take to the depot. Some people use the bins inside to collect recyclables, while others use paper bags, cardboard boxes, or other containers in the house.
- Set aside a convenient space to collect your recyclables. Many people have a bin or bag under the sink, next to the trashcan.
- Learn the proper way to prepare your items and then show your family members or housemates the correct method.
- Make sure everyone understands which items go into which bin. Many haulers supply a list of items with preparation and sorting instructions. These are good to post in your recycling area for quick reference.
- Keep your eye on the items in the bin to make sure nothing else sneaks in and that all items are properly prepared.
- Keeping an eye on the trash is good, too. If all your recyclables are getting into the right place, you'll be able to reduce the size of your trash can and use that collection space for more recycling. If some items aren't making it into the recycling bin, you'll need to find out why and fix the problem.
- Make sure someone is responsible for taking the recycling to the curb or depot.
- You'll learn what works best as you go along. Be open to changes to make the system work for you and your household.
- Setting up a recycling program in the workplace can be a little more complex. We'll

cover that in Waste Reduction at Work and Play.

How to Maximize the Value of Your Recyclables

The preparation and sorting of recyclables can vary from program to program, so check with your hauler or depot to learn the requirements for your area. Proper preparation and sorting will mean your recyclables are likely to receive their maximum value as they go through the collection, sorting, marketing, and manufacturing processes.

Tips to make sure your recyclables end up in the right place:

- Always keep glass separate.
- Don't put one type of recyclable inside another: a can inside a plastic tub, for instance.
- No paper that came into direct contact with food (pizza boxes, coffee cup etc.).
- No mildewed paper (out in the weather too long).

Because new sorting equipment uses dimension as a sorting criterion, everything that is basically flat looks like paper to the machines. This means that lids of tin (steel) cans, flat aluminum foil, lids from plastic tubs and other flat items can end up in bales of paper.

- Clean all aluminum foil and trays and form into a ball.
- If possible, keep the lid attached when you open a can, then tuck it inside so it won't cut you or the sorters at the MRF.
- Leave containers uncrushed; new sorting equipment works best with non-flattened containers.

And the most important rule: IF IN DOUBT, KEEP IT OUT! If you're not sure an item is recyclable, don't put it in the bin.

Local governments, haulers, and processors are always looking for innovative ways to improve recycling and garbage services. There are also some small-scale pilot projects that accept special items like source-separated plastic bags. If you have questions about the services available in your area call your hauler or wasteshed representative[78].

Recycling Non-curbside Items

Many communities have recycling depots or transfer stations that collect items not taken at the curb. Tillamook County maintains an extensive recycling guide to help you find out how to get rid of unusual materials[79]. As a Master Recycler, this will be a great tool for you.

And don't forget that some retailers also recycle items that they sell. For example, Radio Shack collects rechargeable batteries and many grocery stores collect used plastic bags or other plastics.

Buying Recycled

As we learned at the beginning of this module, the recycling process starts when recyclables are segregated from the trash, continues through collection, processing, and manufacturing and ends when a consumer buys an item containing recycled content. It is just as important to buy recycled-content products as it is to place properly prepared items

at the curb.
Buying recycled–content products is often called closing the loop. This step is important because creating stable markets for recycling ensures the continuation and expansion of recycling programs everywhere. Closed loop recycling occurs when a product is continually recycled into the same product, for example glass bottles into glass bottles. Businesses need to know there is a demand for recycled and sustainably produced products. Investing in more environmentally friendly processing and manufacturing equipment is expensive, and businesses won't change their processes unless they believe the investment will pay off in more customers and better sales. For example, mills that recycle paper must purchase expensive de-inking equipment.

Consumer spending makes up two-thirds of the Gross National Product and businesses are responsive to consumer demand. Let manufacturers know that you care about the environmental impact of the items you buy. Send an email, letter or postcard, make a phone call, or fill out a comment card at your favorite store. These things can make a big difference. We wouldn't have dolphin-free tuna, or pesticide protection for grape farmers, if consumers hadn't voted with their dollars!

Recycling Symbols Do Not Guarantee That an Item Is Recyclable or Recycled. A recycling symbol does not mean that a product is made with recycled content or can be recycled in your community. It may just be a reminder for you to recycle. Look for specific information on recycled content. If the information is not available or is unclear ask the seller or call the 1-800- number on the label and ask.

Recycled Products Are Not Always Labeled
Recycled products can be found in a variety of locations from grocery and hardware stores to office product stores. Look for the highest percentage of post-consumer recycled content before you make a purchase. The more you ask retailers if they have a recycled content item, the more likely they will be to start ordering them.

Many products contain recycled content, but don't publicize it. In some industries the use of recycled materials is now a standard practice. The Pacific Northwest is rich in manufacturers who incorporate recycled content into their products.

These six products are safe bets for containing a significant amount of recycled content:

- Steel: Anything made with steel, including tin cans, cars, appliances, bicycles, furniture, nails.
- Aluminum: About 50% of the aluminum in beverage cans comes from recycled cans.
- Glass bottles and jars: Glass recycling is a closed loop system. The glass packaging industry uses an average of 30% post-consumer glass in the production of new jars. Owens Brockway plant uses some of the highest recycled content in the nation. Brown and green glass has the highest recycled content.
- Paper bags: Paper grocery bags are made from Kraft paper that contains post-consumer grocery bags and corrugated cardboard.
- Molded pulp containers: These include gray or brown cardboard, egg containers, and flower boxes.
- Newspapers: Oregon's newsprint manufacturers use some of the highest

recycled content in the country.

Remember, buying recycled-content products creates markets for the items we recycle at the curb. Ask store managers, vendors, and manufacturers about recycled content. Spending your money to help create stable markets for recycled material is the single most important thing you can do to ensure that recycling works for our economy and our environment.

Buy Recycled Myths

Labeling is not the only issue to overcome. Negative attitudes about the quality and reliability of recycled products are also issues. Here are some of the most common myths you will hear about recycled products:

Myth #1: Recycled products are hard to find. This is no longer true. Recycled goods are available in neighborhood grocery stores as well as national retail chains. Read the labels on paper and plastic items. Look for **safe bets**: steel, aluminum, paper bags, molded pulp containers, and glass.

Myth #2: Recycled products are inferior in quality. Products containing recycled content usually look the same non-recycled goods and have the same quality, reliability, and dependability as virgin products.

Myth #3: Recycled products cost more. Many recycled products are priced competitively with their non-recycled counterparts and some products, like retreaded tires, may be less expensive. Even if the price is more, this is money well spent because it will encourage manufacturers to use recycled content in their products.

Four Reasons to Use Remanufactured Products: Remanufactured items are a great example of reuse. These items are repaired, refitted with needed parts, and restored to new condition. There are many items that can be purchased remanufactured, including computers, iPods, and other electronic gear. Retreaded tires are a widely available alternative to buying new. Some thrift stores, like St. Vincent de Paul in Eugene, remanufacture mattresses and appliances.

1. Remanufactured products sell for 25% to 50% less than new products.
2. Remanufactured products can often substitute for products that are no longer made.
3. Remanufacturing uses 85% less energy than buying new.
4. The raw materials saved in one year by remanufacturing worldwide would fill 155,000 railroad cars forming a train 1,100 miles long, the distance from Tacoma to L.A.

Strategies and tips on how to start a sustainable purchasing program in your workplace will be discussed in Waste Reduction at Work and Play.

Chapter 4: Managing Organic Waste at Home and Work

Introduction

Since the passage of The Opportunity to Recycle Act in 1992[80], Oregon communities have implemented a variety of systems to divert reusable materials from the waste stream. We've looked at the reduce, reuse, and recycle portions of the solid waste hierarchy in earlier modules. In this module, we'll look at the fourth level of that triangle — composting. We'll start by defining what organic waste is and why it matters. Then we'll focus on methods for reducing yard debris and food waste. Next we'll discuss a variety of ways to use organic waste to make the world a more verdant place. We'll finish by looking at curbside and depot collection options. Because organics are a large portion of our waste stream and produce methane gas when they're disposed of in landfills, creating systems to collect and process them is the new frontier in municipal solid waste management.

What Is Organic Waste?

Any waste derived from a living organism is organic. All plants and animals and everything made from them, excreted by them, or remaining after their deaths are organic. This is obviously a broad category: for most of human history all waste was organic. Now we also have items made from synthetic materials as a portion of our waste stream.

In this module, we'll focus on the most common forms of organic material found in most homes and businesses: food waste and yard debris. For our purposes, "organics" will refer specifically to these two items, although the organics definition under ORS 459 is broader.

Why Do We Care About It?

In 2009, organic waste accounted for almost 23% of Oregon's trash! Yard debris made up approximately 5% of our garbage, and food waste another 18%. Wood waste is another portion of the organic waste stream at 11%, but since it's primarily construction debris, we will discuss it in the Waste Reduction at Work and Play module. As we work to decrease the amount of material put into our landfill, these organics are an obvious place to start.

But extending the life of landfills is not the only reason to keep organics out of the trash. As we saw in earlier modules, when organic materials biodegrade in a modern landfill they produce methane gas, a potent contributor to global climate change. Most large landfills capture methane for energy or burn it off, but it is impossible to capture all of it.

According to the U.S. Composting Council:

"Disposing of food waste in a landfill contributes to global warming. Every metric dry ton of food that goes to a landfill may generate .25 metric tons of methane in the first 120 days. Thus, composting this food waste would reduce emissions by the equivalent of up to 6 metric tons of CO2."

Check out the U.S. Composting Council (USCC) Fact Sheet, "Greenhouse Gases and the Role of Composting: A Primer for Compost Producers"[81]

Other disposal options are not very good either. Backyard burning of food and yard waste is not a good environmental option. Burning produces air pollution, and unless the energy

created by the fire is harnessed for heat or to make electricity, the energy embodied in the material is wasted. In Oregon it is illegal to burn household garbage because of the health and environmental problems it creates.[82] Landfilling organics wastes the energy and resources required to grow them or create them in the first place (embodied energy).

Better handling of organics can also provide us with an almost magical product: compost. Compost helps soil retain water, improves soil fertility, reduces the need for pesticides, improves land cultivation (tilth), and helps control erosion. What could be better?

There are two simple methods for dealing with organics: reducing the amount of waste we produce and composting. There are many techniques for reducing yard and food waste and most of them will save you time and money. Many communities offer options for composting organics, including curbside collection of yard debris and food waste; yard debris drop-off service at transfer stations; access to commercial composting operations; and composting organics at home for your gardening needs.[83]

Reducing Yard Debris

There are several strategies you can use to reduce the amount of organic waste produced by your landscapes. The alternatives range from making simple changes to your maintenance procedures to rethinking your landscaping scheme. Here are a few ideas.

"Grasscycling"

Grass clippings are the largest component of landscape waste in most yards. While beautiful lawns are a source of pride for many people, maintaining that great expanse can be a lot of work. Grasscycling is the practice of leaving grass clippings on your lawn. This will save you time because you don't have to collect the clippings. Because nutrients from the cut grass go back into the soil as the grass degrades, grasscycling can improve the health of your lawn and reduce your need for fertilizers by 50 percent.

Mulching

Mulches are organic materials spread over the surface of the soil to suppress weeds, keep plant roots cool and moist, and prevent soil from eroding or compacting. Mulches are used around plants in the garden or as soft "paving" for paths and play areas. An ideal mulch material costs nothing, is easy to keep in place, and reduces evaporation of soil moisture while permitting the rapid penetration of water.

Many common yard clippings make excellent mulches. Grass clippings, leaves, and pine needles are all suitable for mulching landscapes. Wood chips from pruning and removing trees are a natural-looking substitute for beauty bark.

Yard debris mulches can be applied just like compost mulches. Mulch annual flower and vegetable gardens with grass clippings or other non-woody materials break down quickly. Woody materials require nitrogen to break down, so using them in the garden robs the soil of the nitrogen annuals need to be healthy.

Trees and shrubs can be mulched with one-half to one-inch layers of grass clippings or with two- to four-inch layers of wood chips, twigs, or pine needles. Avoid making thick layers of fine green materials. They can mat down and become an aerobic mass that keeps air and water from plant roots.

Turning in Crop Wastes

Don't trash the healthy annual vegetable matter and flower plants at harvest time. Chop or till them back into the soil. They'll break down and provide nutrients for next year. Spring crops will decompose quickly if cut when they are still green. Adding nitrogen fertilizer will also speed up decomposition. Fall crop wastes can be tilled into the soil or be cut roughly and left on the surface to protect the soil from erosion and compaction. Till these in with fertilizers a few weeks before spring planting.

Rethinking Your Lawn

Lawns produce more waste and require more maintenance than any other type of landscaping, so they are a good place to look for ways to reduce water and pesticide use[84].

Here are some suggestions for rethinking your lawn:

Reduce Lawn Size

Replace your lawn with different plantings, such as low-maintenance ground covers or woodland gardens where fallen leaves are left on the ground to decompose and supply nutrients and soil protection. Be sure to choose plants that are suitable for your climate, soil, and light conditions.[85]

Plant an Eco-Lawn

Eco-lawns are turf-type ground covers that are a mix of broad leaf and grass species. These lawns require little if any watering even in the summer months, don't need to be mowed as often as standard lawns, require little or no fertilizer, and usually have small flowers that give the yard color. Oregon State University Extension Service has published a useful brochure on eco-lawns that can give you some more information[86].

Reducing Food Waste

Two facts say a great deal about our relationship with food:

- According to research by former University of Arizona anthropologist Timothy Jones, more than 40 percent of all food produced in America is not eaten. That amounts to more than 29 million tons of food waste each year, or enough to fill the Rose Bowl every three days[87].
- In 2009 food scraps made up almost 18 percent of what we sent to Oregon landfills.

Food Waste Reduction Strategies

Most home- and work-based food waste comes from two sources: buying too much and not using leftovers effectively. Menu planning can help reduce both sources of waste and save money[88]. There are many online resources to help you get started. Type "menu planning tips" in a search engine to find ideas that fit your style.

"Use by" or "best before" dates indicate when the manufacturer believes the food will be at its peak, not when it will go bad[89]. According to Grist and other sources, these dates do not indicate whether food is safe to eat or not. According to the USDA's food labeling site, the only regulated use by date is required for infant formula. "Sell by" dates on preserved food also do not indicate when the food is spoiled. "Sell by" dates are used by stores to help them know when to rotate their stock[90]. Unless otherwise damaged, frozen food
lasts indefinitely, although the flavor and texture may deteriorate. The USDA site has more information on the shelf life of fresh, frozen and prepared foods, as well as how to store them safely[91]. These smart shopping tips will also help you reduce food waste and save money:

- Choose the meals you want to make.
- Check your refrigerator and pantry to see what you need to buy.
- Make a shopping list and stick to it.
- Stick with the familiar. Don't buy something new unless you know how you will prepare it. Exotic items often end up in the trash.
- Don't over-buy items on sale. It doesn't save you money if you don't eat it all.
- Keep your eye on what's left over. Should you make less next time? Serve fewer items?
- Cook once, eat twice recipes help you use the same main course in two different meals and save you time and money.

If you have a large garden, fruit trees, or other food-producing plants on your property, share your bounty with family, neighbors, and friends. Some community groups have developed systems to distribute excess tree fruits/nuts among their members and the community. Check local food co-ops, agriculture extension services, or Master Gardener programs to locate or start a food-sharing group in your area.

If you still have more food than you need, donate to food banks, gleaner's organization, or charitable food programs. They might be able to help you find people to harvest the food and share it with others.

Tamar Adler's book, *An Everlasting Meal*, provides creative ideas about how to both avoid and use leftover food.

What Is Compost?

Compost refers to decomposed organic matter that can provide nutrients to plants, control weeds, improve soil, and save water. Compost is also an easy and inexpensive process of reducing yard and kitchen waste while making your yard healthier and more beautiful.

Why Compost?

There are many reasons to compost your yard debris and food waste. It:

- Reduces your trash. Composting can cut 25 percent of the waste in your trash can. In some communities that means that you can save money by switching to a smaller garbage can or requesting less frequent service.

- Improves your soil. Compost improves the structure of the soil. It makes soil easier to work, improves its aeration and water retention, and makes it more resistant to erosion.

- Makes plants healthier. Compost also helps hold elemental plant nutrients until plants are ready to use them. Soils improved by added compost are more likely to produce healthy plants that are better able to resist insect attacks and disease. Using compost reduces the need for water, pesticides, and fertilizers.

- Reduces greenhouse gasses. Composting food waste and yard debris keeps it out of the landfill, where it can create potent greenhouse gasses (methane) through anaerobic decomposition.

Compost Benefits

Most of the wastes that made up the pile are no longer recognizable in the finished compost -- with the exception of some persistent, woody parts. What remains is dark, loose, crumbly material that resembles rich soil. The volume of the finished compost has been reduced because of biochemical breakdown and water respiration to about 30 to 50 percent of what went into the pile. The compost is now ready to use for growing new plants, and begin the cycle over again.

Compost will improve the quality of almost any soil. The main benefit is to improve the "structure" of the soil. The structure of a soil determines its ability to drain well, store adequate moisture, and meet the many needs of healthy plants. Although compost provides important nutrients, it is not a substitute for fertilizers. More important than the nutrients supplies by compost is its ability to make existing nutrients more easily available to plants.

Soil Structure

The value of compost as a soil amendment is suggested by its appearance. Even a casual observation of soil amended with compost shows that it is made up of many round, irregular "aggregates". Aggregates are groups of particles loosely bound together by the secretions of worms and compost bacteria. If these aggregates are rubbed between a finger and thumb, they break down into smaller aggregates. In between and within the aggregates themselves are many small air channels like the empty spaces left in a jar of marbles.

A well-structured soil with lots of small aggregates stays loose and easy to cultivate. The channels that aggregates create through the soil allow plant roots and moisture to penetrate easily. The smaller pores within the aggregates loosely hold moisture until a plant needs it. The larger pore spaces between the aggregates allow excess water to drain out and air to circulate and warm the soil.

By encouraging the formation of aggregates, compost improves the structure of every type of soil: silt, sand, or clay. In loose sandy soils, compost helps to bind unconsolidated particles together to retain water and nutrients that would normally wash right through. Added to a clay or silt soil, compost breaks up the small tightly bound particles and forms larger aggregations, which allow water to drain and air to penetrate.

Nutrient Content

Dark, loose compost looks like it should be rich in nutrients. Indeed, compost contains a variety of the basic nutrients that plants require for healthy growth. Of special importance are the micro-nutrients present in compost, such as iron, manganese, copper, and zinc. They are only needed in small doses, like vitamins in our diet, but without them plants have difficulty extracting nutrients from other foods. Micro-nutrients are often absent from commercial fertilizers, so compost is an essential dietary supplement in any soil.

Compost also contains small amounts of the macro-nutrients that plants need in larger doses. Macro-nutrients include nitrogen, phosphorous, potassium, calcium, and magnesium. These nutrients are usually applied in measured amounts through commercial fertilizers and lime. The three numbers listed on fertilizer bags (e.g., 10-10-10) refer to the percentage of the three primary macro-nutrients -- nitrogen, phosphorous, and potassium (N-P-K) -- available in the fertilizer.

Although compost generally contains small amounts of these macro-nutrients, they are typically present in forms that are not readily available to plants. When applied in four to six inch layers, compost may provide significant amounts of these nutrients. However, due to the variability and slow release of major nutrients, compost is considered a supplement to fertilization with more reliable nutrient sources.

Nutrient Storage And Availability

To understand how compost is able to store nutrients and make them available when needed by plants requires a closer look. When viewing compost through a microscope that enlarges things 1,000 times, individual compost particles resemble the aggregates that are observed with the unaided eye. Like the aggregates, individual particles of compost contain many porous channels. Just as the channels in the aggregates provide space to store water, these spaces in compost particles provide spaces to store nutrients.

The sides of the channels provide vast surfaces inside the particles where individual ions of minerals and fertilizers can cling. These ions are given up to plant roots as the plants require them. Thus, compost is able to store nutrients that might otherwise wash through a sandy soil or be locked up in the right spaces of a clay soil.

The ions clinging to the surfaces of our compost particles tend to be those that give soil a "neutral" pH. A measure of soil acidity or alkalinity is its pH. The acidity or alkalinity of a soil affects the availability of nutrients to plants. Most important plant nutrients are relatively easily available to plants at a pH range of 5.5 to 7.5. At pH levels above this range (alkaline) or below this range (acid), essential nutrients become chemically bound in the soil and are unavailable to plants. Recycled yard debris compost typically has a pH range of 5.5 to 7.5. When mixed into soil, this compost will help keep the pH at optimum levels for nutrient availability.

Beneficial Soil Life

Taking a step back from the microscopic view, another beneficial characteristic of compost is evident. The presence of Red worms, centipedes, sow bugs, and others show that compost is a healthy living material.

The presence of decomposer organisms means that there is still some organic material being slowly broken down which is releasing nutrients. They are also indicators of a balanced soil ecology, which includes organisms that keep diseases and pests in check. Many experiments have shown that the rich soil life in compost helps to control diseases and pests that might otherwise overrun a more sterile soil lacking natural checks against their spread.

Make Your Own Compost: Compost Happens

A compost pile is a teeming community of microorganisms that help break down yard debris into usable nutrients and materials. The basic ingredients are high-carbon material, high-nitrogen material, air, water, and time. The goal is to create an environment that encourages microorganism communities and growth. Happy microorganisms multiply quickly and work hard. Combining these elements will make compost, but using the following recipe will help you get high-quality compost in a hurry.

Two Parts Brown to One Part Green

All living organisms are made up of large amounts of the element carbon (C) combined with smaller amounts of nitrogen (N). The balance of these elements in a material is called the **carbon-to-nitrogen ratio** (C:N)[92]. This ratio is an important factor determining how easily bacteria can decompose an organic waste. The micro-organisms in compost use carbon for energy and nitrogen for protein synthesis. The proportion of these two elements used by the bacteria averages about 30 parts carbon to 1 part nitrogen. Given a steady diet at this 30:1 ratio they can work on organic material very quickly.

Most materials available for composting do not have this ratio, so to speed-up composting our job is to balance the numbers. For instance, a mixture of one-half brown tree leaves (40:1 ratio) could be used with one-half grass clippings (20:1 ratio) to make a pile with the ideal 30:1 ratio. This will work best on a weight, not volume, basis. Mixing materials of different sizes and textures also helps to provide a well- drained and well-aerated compost pile.

The C:N ratios listed in this table are only guidelines; they are not accurate for every material of that type. For instance brown grass clippings from a poorly kept lawn will have far less nitrogen content than lush green clippings from an abundantly fertilized lawn. Also, the leaves from different types of trees vary in the C:N balance. It helps to think of materials high in nitrogen as "Greens," and woody, carbon-rich material as "Browns."

The best way to become familiar with this balancing is to be specific about it at first, then relax into an intuitive assessment of what a pile needs. Some people like to think in terms of half brown and half green material when building a compost pile out of kitchen and yard wastes. While this may not give the optimum C:N balance, it is a useful rule of thumb for those new to composting and not familiar with the materials.

Think like a chef varying the ingredients for a recipe. Be curious, write down the type and quantity of materials used, and take note of the temperature your pile reaches and the quality of the finished compost. After a while, the process becomes no more technical than making a cake.

Actually, building a compost pile is often compared to making a layer cake. Materials are added in 2" to 6" layers. Water and amendments can be added between layers, like frosting. Alternating layers of "greens" and "browns" helps to proportion carbon and nitrogen throughout the pile. After you put down two layers always mix them together. This will ensure speedy multiplication of bacteria.

A pile that is too high in carbon will stay cool and sit a long time without breaking down. A pile too high in nitrogen will give off the smell of ammonia gas, and is also likely to get slimy and have a foul odor. Remember that the decomposition process is working on everything organic, and if you have the time to wait and the space to keep these materials, you'll eventually be rewarded with compost.

Common Compostable Organic Waste Resources	Organic Waste That is NOT Recommended in Backyard Composters
Glass clippings Landscapers are always trying to get rid of them. **Yard Wastes** Weeds, old plants, wilted flowers **Leaves** You'll find these bagged and waiting at neighbors' curbside. **Food scraps** Minus bread, meat, fat, bones, dairy, or oily foods. They must be buried under 8" of soil, composted by earthworms, or in a hot compost pile. **Wood Chip** A tree service will deliver a load if you are willing to take a large quantity. Use first on garden paths, then compost it after the initial decay has begun. **Sawdust** This is best if first used as a livestock litter or allowed to weather, since it takes a lot of nitrogen to break it down. **Seaweed** Found washed up on some beaches. It's an excellent source of many plant nutrients. **Hair** Very high in nitrogen. Rescue some from the garbage at barber shops and beauty parlors. **Coffee grounds and filters** Almost every home and office has coffee grounds. Coffee chaff is a beautiful mulch. Available from coffee roasters. **Manures** Rabbit, cow and goat manures are the only sterile manures to use. These manures provide useful organisms.	**Plants infected with disease or a severe insect attack** where eggs could be preserved or where the insects themselves could survive in spite of the compost pile's heat (examples are apple scab, aphids and tent caterpillars). These are accepted in curbside yard debris roll carts. **Ivy, succulents and certain pernicious weeds** such as morning glory and buttercups; and **grasses which spread by rhizomes** such as quack grass. These may not be killed by the heat of decomposition and can choke out other plants when compost is used in the garden. These are accepted in curbside yard debris roll carts. **Cat, dog and bird manures**, which contain pathogens harmful to children. These pathogens are not always killed in the heat of the compost pile. **Meat and fish leftovers, bones, or greasy fatty foods** such as oils, butter, and cheeses. While some people do compost these materials in their backyards, it's generally discouraged due to the increased risk of pathogens and vectors like rats, raccoons, etc. Currently these items are accepted in some municipal yard debris programs, such as in Salem and Keizer. **Piles made entirely of waxy leaves** such as rhododendron and English Laurel, or pine needles break down very slowly. Try composting small amounts of these mixed with other materials, shred them first or use them as mulch. These are accepted in commercial yard debris programs

Air and Water. Most life on earth needs a certain amount of water and air to survive. The microorganisms in the compost pile function best when the materials are as damp as a wrung-out sponge andhave many air passages. At less than 40 percent moisture, the bacteria are slowed by the lack of water. At greater than 60 percent moisture, there is not enough air for aerobic decomposition, and anaerobic bacteria can take over the pile. Extreme sun or rain can adversely affect the balance of air and moisture in your pile. The air in the pile is usually used up faster than the moisture, so the materials must be turned or mixed up occasionally to add air. Air helps sustain high temperatures and control odor.

Viewed as a micro-organism farm, the compost pile may need tending to its moisture needs just as the farmer tends to the irrigation of crops. Fortunately, we have a simple rule of thumb: Compost should be about as moist as a wrung-out sponge. It should be obviously moist to touch, but yield no liquid when squeezed. This level of moisture provides a thin film of water on materials for the decomposer organisms while still allowing air into their surroundings.

If the pile is too wet, it should be turned (pulled apart and restacked). This will allow air back into the pile and loosen up the materials for better draining and air drying. A pitchfork is the best tool for turning compost piles. Shovels are not very useful for picking up loose, mixed yard waste.

If the pile is too dry you can try soaking it from above with a trickling hose. A more effective practice is to turn the pile and re-wet the materials in the process. Once dry, certain materials such as dead leaves, sawdust, hay, straw, and some dried weeds and vegetables will shed water or absorb it only on their surface. These dry materials must be gradually wetted until they glisten with moisture. Then they should be mixed until the water has been absorbed into their fibers.

Chop It Small. Small pieces of material compost faster. Chop garden debris with shears, a machete, or use a chipper-shredder or lawn mower to shred material. A melting block of ice is a great analogy for organic materials in compost. When the block is large it melts quite slowly, but when it is broken into smaller pieces the surface area increases, and the melting increases. Similarly, when organic materials are chopped or shredded into smaller pieces, the composting process speeds up. With more surface area exposed, decomposer bacteria have more food easily available, so they can reproduce and grow quicker.

It is not essential to break organic materials into small pieces to compost them, it just speeds the process. Sometimes, such as when using **mulches**, slow decomposition is advantageous. It can certainly be less work! Mulches are organic materials placed on the soil surface to control weeds, lessen evaporation, and stop soil erosion. Wood chips and sawdust are

commonly used as mulches. As they weather and slowly break down they work to save water, labor, soil and money.

If coarse materials are run through a shredder until only small bits remain, much more surface area is exposed for micro-organisms to work on. This allows decomposer organisms to digest more material, makes them multiply faster and generates more heat. Any coarse, woody materials added to compost piles should be chopped, shredded, split or bruised to speed the rotting process.

Many types of shredders and chippers are available, from large models used by tree services to small hand-cranked types. Some homeowners are finding it appropriate to purchase a small electric model jointly with their neighbors. A rotary lawn mower with its bag removed can be used to shred leaves on a hard surface, such as a driveway.

Size Matters. Compost piles trap heat generated by the activity of millions of microorganisms. A three-foot square compost pile is considered a minimum size for hot, fast composting. Piles wider or taller than five feet don't allow enough air to reach the center.

A pile should be large enough to hold heat and small enough to admit air to the center. As a rule of thumb, the minimum dimensions of a pile should be 3 ft. by 3 ft. to hold heat. The maximum dimensions that will allow air to the center of the pile are 5 ft. by 5 ft. by any length.

There are ways around this rule of thumb. By insulating the sides of the pile, higher temperatures can be maintained in a much smaller volume. This is a labor-intensive procedure, but it works. By turning a pile or using "ventilation stacks" in the center of the pile, dimensions larger than 5 ft. wide are possible. However, this large a pile is unnecessary in most back yard situations.

Time and Temperature

The most efficient decomposing bacteria thrive in temperatures between 110 degrees and 160 degrees Fahrenheit. The hotter it is inside the pile, the faster the material composts. Placing your pile in the sun will not create faster composting. If you achieve a good balance of carbon and nitrogen, provide lots of surface area within a large volume of material, and maintain adequate moisture and aeration, the temperature will rise over several days.

Once the pile begins to cool down, turning it and adjusting the moisture level will kick-start a rise in temperature again. To kill most weed seeds and to ensure pathogen destruction, do this approximately five times within six weeks.

Uses for Compost

Compost is classified as a soil conditioner rather than a fertilizer, but it contains a good range of major and minor plant nutrients plus trace elements essential for healthy plant growth. It also holds these nutrients in the soil until plants are ready to use them. By using compost, you're returning organic matter to the soil in a usable form.

Compost also improves plant growth by helping to break up heavy clay soils for better drainage and easier digging. It will improve thin sandy soils by adding water and nutrient-holding capacity. If you don't create your own compost, buying compost is the next best thing.

Here are some common ways to use finished compost:

Soil Amendment

The best time to dig compost into your garden is when you are preparing the bed for planting. Using a shovel, turn two to five inches of compost into vegetable or flower gardens each year before planting. If only a small amount of compost is available, it can be spread under the seed furrow or a handful can be added to each transplant hole. For new tree and shrub plantings, mix compost into the bottom of the planting hole and with the surrounding soil.

Potting Mixture

Sifted compost makes a rich, loose potting soil for houseplants and seedlings. Keep in mind that too much compost in potting soil will affect drainage and hold too much water. Add one-part compost to two-parts commercial potting soil. To make your own mixture, use equal parts compost and sand or perlite (a lightweight volcanic glass that helps prevent water loss and soil compaction).

Mulch

Compost is an excellent top dressing that can be used to mulch around flower and vegetable plants, shrubs, and trees. Place finished compost around trees, shrubs, and annuals to keep roots moist, smother weeds, prevent soil compaction, and halt erosion.

Layer compost starting a few inches away from the stem or trunk out to beyond the plant's spread of leaves or branches (known as the drip line). Use an inch or two of compost around annual flowers and vegetables, and up to six inches around trees and shrubs.

Top Dressing for Lawns

Using compost as top dressing for your lawn will help keep it healthy and happy. Mix finely sifted compost with sand and sprinkle evenly over your lawn.

Aerated Compost Tea

Aerated compost tea is a soluble extract of the beneficial organisms and nutrients in compost[93]. To make it, place compost into a paint strainer bag and insert the bag into a barrel of water. Use a powerful air pump to aerate the water and provide enough air to support the growth of beneficial organisms. Keep the water well agitated to help dislodge the organisms from the
generations beneficial organisms.

Some people add liquid kelp and liquid fish emulsion (two ounces each per five gallons of water) to feed the multiplying organisms. The nutrient rich tea can be mixed with water and sprayed on the foliage of plants or watered into the root zone.

Compost tea provides plants and soil with a wide range of nutrients and beneficial organisms essential to healthy growth and disease prevention. Only use the best quality compost for teas, and always compost manure properly before using it in compost tea. Although aerated compost tea requires more work than other uses for compost, many gardeners swear by the results.

Compost Extract

Compost extract is a less labor intense version of compost tea. It will provide your potted plants and garden with liquid nutrients extracted from your compost. To make this simple extract, take compost and place it in a burlap bag. Let it soak for several hours in a container of water. This extracts the soluble portion of the compost and allows these liquid nutrients to be poured into potted plants and around the garden. Unlike compost tea, this liquid will not contain generations of beneficial aerobic bacteria.

Choosing a Composting System

There are many ways to make compost. Home composting methods range from mulched paths that are replenished every other year to installing turning units that are maintained weekly. Many compost systems can be built with scavenged materials—some require nothing but the soil in your garden while others can cost more than $300. Some communities provide composters at subsidized rates, so check with your city or county recycling representative or local garbage hauler to find out if your community is one of them[94].

To determine the best composting system for your yard, consider these questions:

- What materials will I compost: Leaves? Grass? Chipped limbs? Weeds? Kitchen waste?
- How much waste do I want to process?
- How fast do I want to make the compost?
- How much time do I want to spend maintaining the system?
- Where will the system go? Is it handy enough to where the waste is generated?
- Does it need to be pretty or will it be camouflaged?
- Will it keep the pests out?
- How much money do I want to spend?
- Where will I store the carbon-rich materials (dried leaves, straw, paper, sawdust, etc.) until I can add them to the nitrogen-rich material (food scraps, grass clippings, etc.) as they become available?

Types of composting systems

Static systems are simply piles or containers used to contain yard and garden waste while the materials break down. This is the easiest way to compost. It requires no turning or other labor except placing the wastes into the pile or bin as they are generated.

A mix of small woody and non-woody materials such as grass clippings, crop wastes, and leaves works best in these systems. The small woody branches and leaves will help keep passages for air to circulate through the pile and keep it from getting too moist. Decomposition can take from six months to two years.

Since materials are continuously added to static systems, they are at various stages of decomposition. Generally, the more finished compost is at the bottom of the pile, while partially decomposed materials are near the top. When the compost at the bottom of the unit looks like rich soil, it is ready to harvest. Lift off or empty the compost bin and place it next to the compost pile. Fork the materials from the top of the pile into the bottom of the empty holding unit to start the process again. The rich and ready material will be easily accessible after you've reloaded the bin.

When you reach the finished compost, use it!

Hardware cloth, old wooden pallets lashed together, or wire framed with wood make good holding units. Five wooden pallets wired together can create a stationary two bin system, and seven pallets can form a three bin system. (Many businesses give away used pallets or check Yellow Page listings.) More permanent static systems can be made by stacking cinder blocks or by mortaring bricks or rocks together. It is convenient to have three of these stationary bins: one to use for fresh wastes, one to be curing, and one to store carbon materials until you're ready to add them to the pile.

Static Systems

Pros
Units are simple and cheap to make
Requires little maintenance

Cons
Composting process is slow
Not recommended for composting food

Active systems for composting yard debris and vegetable wastes from the kitchen are typically a series of bins used for building and turning compost piles in hot, active composting units. An alternative active system is a horizontally mounted rotation barrel. Active composting allows wastes to be conveniently mixed for regular aeration. This speeds composting by providing bacteria with the air they need to break down materials. Active systems require frequent maintenance and involve preparation of the wastes to be composted. These units can be expensive to buy or

build or they
can be made with free pallets strapped together with wire. However, your effort and expense will be rewarded with large quantities of high-quality compost.

Active Systems

Pros
Composting process is fast
Suitable for food waste if animal-proofed
Makes high quality compost relatively quickly

Cons
Requires active monitoring
Requires active maintenance
Purchased units can be expensive

Best Raw Materials for Home Composting

Leaves, grass, pine needles, small woody waste, fruit and vegetable waste, and dead plants are all good raw materials (feedstock) for your compost pile. Not all organic material that comes from your yard is suitable for home composting. Unless you intend to keep a high-maintenance, hot compost pile, diseased plants and noxious weeds should be disposed of in the trash. A hot, active composting system will kill weed seeds and most diseases only if the temperature is kept above 140 degrees for six weeks. A cool, static system will not kill weeds or weed seeds.

Making a HOT Compost Pile

Hot compost piles are the only safe way to compost food and yard wastes together without pest problems. They are also the best way to kill soil diseases and weed seeds[95] in compost, and to produce compost in a short period. Not everyone wants or needs to make hot compost piles. Here is a recipe but for those who do.

Gather all the materials needed to make a pile that is at least 3 cubic feet. Use both green and brown materials to approximate the 30:1 carbon to nitrogen balance.

1. To increase decomposition rate of the materials, run them through a shredder or chop them with a spade or machete on a piece of plywood. Brown leaves may be run over with a rotary lawn mower to break them down.
2. Start building the pile with a 4- to 6-inch base of brown material. If the pile is going to sit for a few weeks or more, use coarse material (small branches, corn stalks, straw) for this base layer to let air into the pile. Moisten materials.
3. Next, add a 4- to 6-inch layer of green materials. If the greens are not very fresh, sprinkle on a small amount of blood meal or cottonseed meal, poultry manure or other high-nitrogen source. Fresh grass clippings should be used in thin layers. Mix the green and brown layers together so bacteria can feed on both simultaneously.
4. Continue alternating and mixing layers of green and brown materials, adding water and extra green materials as needed, until the pile is 3 to 4 feet high (fill the bin).
5. Close bin or cover pile and wait.
6. Monitor temperature in the interior of the pile regularly. It should peak between 120^{o} to 160^{o} F in 5 to 10 days.
7. When the temperature begins to decrease, turn the pile. Take materials from the outer edges and top of the pile and place them at the base and middle of the new pile. Those from the middle should be on the outside edges and top of the new pile.
8. Continue monitoring the temperature in the pile.
9. About one week later, the temperature of the pile should peak. Turn the pile again.

After another week the compost should be finished. Piles made this way without food wastes do not need to be turned; they will be finished in 3 to 4 months.

Large limbs aren't suitable for home composting because they take a long time to breakdown, plus they take up a lot of space. If the limbs are thick enough to use as firewood, check with your friends and neighbors to see if they can use them. Another option is to place an ad or notice on a local freecycle web site[96], in classified ads, or on Craigslist.

Large limbs can sometimes be hauled to your local composter or transfer station for commercial composting. If you often have woody waste, buying or renting a chipper makes composting it at home much easier. Another option is to rent a chipper with neighbors and hold an annual community yard work weekend.

Composting Food Waste

Food waste is high in nitrogen (the green element of the composting recipe) and is plentiful in many households, so it is a great candidate for the compost bin. There are some important caveats about recycling food waste. Food wastes can go anaerobic quickly, which means they become very smelly. And smells, of course, attract pests like rats and skunks and other animals. Also, you don't want to compost any meat products because of the pests (including microscopic) they attract.

If you are new at composting, it's best to start with fruit and vegetable scraps. If this goes well you could consider adding other items as you gain more experience. A smelly compost pile will repel neighbors and attract rats and other animals—not the results you're looking for.

There are three primary methods for do-it-yourself food-waste composting: soil incorporation, worm bins, and yard debris composting systems.

Compostable Food Wastes in Backyard Composters	
CAN BE USED	CAN NOT BE USED*
Apples	Butter
Apple peels	Bones
Cabbage	Cheese
Carrots	Chicken
Celery	Fish scraps
Coffee grounds/filters	Lard
Egg shells	Mayonnaise
Grapefruit	Meat scraps
Lettuce	Milk
Onion peel	Peanut butter
Orange peel	Sour cream
Pears	Vegetable oil
Pineapple	Yogurt
Potatoes	
Pumpkin shell	
Squash	
Tea leaves and bags	
Tomatoes	
Turnip leaves	
*While some people do compost these materials in their backyards, it's generally discouraged due to the increased risk of pathogens and vectors like rats, raccoons, etc. Currently these items are accepted in some municipal yard debris programs, such as in Salem and Keizer.	

Soil Incorporation

Soil incorporation is the simplest method for composting food waste. Choose an out-of-the-way place and dig a hole at least 8 inches deeper than the space the food waste will require.

Chop the food waste, mix it with some of the soil, and then bury the waste under at least 8 inches of additional soil. Depending on the soil temperature, the number of microorganisms in the soil, and the carbon content of the wastes, decomposition will take one month to a year.

Pet waste may contain harmful microbes, so they should never be buried in areas where food will be grown. Ornamental gardens okay; vegetable gardens not okay.

Food wastes such as meat, bones, or fatty foods (such as cheese and salad dressing) are not recommended for soil incorporation. These foods have the potential of attracting rodents, dogs, cats, flies, and even bears in rural areas.

Food wastes can be incorporated around the drip lines of trees or shrubs by using a posthole digger or shovel. Tree roots actively feed in this zone and will greatly benefit from the nutrients in the compost. Food wastes may also be buried in a fallow area of an annual garden. If you will be composting a significant amount of food waste, you can dig a trench, add the food waste in sections, and cover with soil each time you add waste.

Many English garden managers practice a form of soil incorporation known as pit and trench composting. This involves a three-year rotation of three rows: One row is for burying food waste, one is for growing crops, and a third is used as a path. In the second year, the fertile soil of the former compost trench is used to grow crops, the former crop row becomes the path, and the path is dug out as a new compost trench. After the third year of rotation, the cycle starts over. This form of composting keeps the garden perpetually fertile with little organizational effort.

Soil Incorporation

Pros
Simple system

Compost is made where it will be used

Cons
Attracts pests if not buried well
Can be messy when rainy

Incorporating Food Waste into Yard Debris Composting Systems

Food waste can be incorporated into well-maintained, hot composting systems. Make sure your compost pile is pest-proof so animals won't be able to get to the food waste. Usually lining the sides and the area beneath the bin with hardware cloth will do the trick. Place the waste toward the center of the pile and cover so it can't be smelled by animals.

Food Waste in Yard Debris Compost

Pros:
System already in place
Produces compost relatively quickly

Cons:
May attract pests
Needs to be actively
maintained

In the above picture, the plants to the left had no worm compost added, the plants in the middle had 11% worm composting added, and the plants to the right had 21% worm composted added.

Worm Bins

Worm bins are a fun and interesting way to compost kitchen wastes. Wood or plastic containers with lids provide red wiggler worms (not earthworms) with the dark and moist environment they prefer. Worms are "bedded" within these boxes in shredded, moist paper, newsprint, corrugated cardboard, leaves, or other high-cellulose materials

Food wastes (no meat or dairy) are then buried in this bedding. The burial spots are rotated in an organized progression.

Worms eat the food waste and bedding and their excrement, called worm castings, is a high-quality soil amendment suitable for use on houseplants, vegetable seedlings, and flowers.

Studies have shown that worm castings contain plant growth hormones and other elements that dramatically improve soil and plant health. Worm castings are highly concentrated, so use

them sparingly as a top dressing or combine them with additional soil.

With a little understanding of worms' needs, these vermicomposting systems are simple to maintain. Two or three times each year, you'll need to spend a few hours preparing fresh bedding and harvesting the compost and the worms.

Worm bins are most efficient if sized and stocked according to the amount of waste to be handled. Mary Appelhof's book *Worms Eat My Garbage* provides excellent information on how to determine what size a worm bin should be and the amount of bedding and worms required for an efficient system. Surface area is more important than depth in sizing a worm system. Generally, one square foot of surface is required for every pound of food waste to be composted per week.

You can order Worms Eat My Garbage and find more vermicomposting information including three short videos of worms at Mary Appelhof's website[97]. Metro also has very good information about how to start and maintain a worm bin. There are also many other websites[98] on vermicomposting. For instructions on how to build a composter or worm bin or where to buy worms, check out the Marion County website: http://www.co.marion.or.us/PW/ES/wastereduction/compost/foodwaste.htm

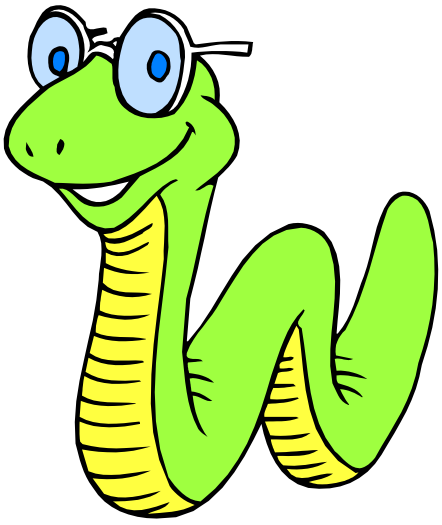
Worm Bins

Pros
Excellent for food waste
Fun for kids and adults
Makes excellent soil amendment

Cons
Not good in extreme temperatures
Need to like worms and bugs
Need to separate castings from worms before use.

Fun Facts About Worms

- There are more than 3,500 species of earthworms worldwide, including red worms.
- Each worm has five pairs of hearts and a simple brain.
- The average worm is made up of 100 to 200 ringed segments.
- A worm can grow a new head or tail if some of its segments are nipped off.
- Worms have no teeth or eyes but have highly sensitive skin.
- Worms breath through their skin.
- A worm can eat about half its own weight in food scraps every day.
- An enlarged cummerbund-like band near the worm's head holds the reproductive organs.
- Each worm is both male and female (hermaphroditic).
- Worms exchange sperm to reproduce and each produces an egg (cocoon) from which 2 to 4 baby worms emerge.
- Eight breeding worms can become 1,500 worms in 6 months.
- Each healthy worm may produce an egg capsule every 7 to 10 days. These capsules incubate for 14 to 21 days.
- The baby worms will mature to breeding age in 2 to 3 months.
- A healthy red worm can live from 7 to 10 years and grows to about 3 inches.



Source: City of Eugene Solid Waste & Recycling Program and OSU Lane County Extension Service

Co

mposting in the Workplace

Food waste and yard debris are not just issues at home. Waste audits of workplaces often identify organics as a primary element of the company's waste stream. Usually the elements of composting are the same. The primary difference between most home and workplace systems is one of scale.

Check out the Reducing Waste at Work and Play module for how businesses can reduce organic waste and examine case studies of workplace composting systems.

Curbside Composting Options

Many communities provide curbside yard debris collection and some have added food waste collection to this service. This is a great solution when you don't have the time or interest to do your own composting. Curbside composting service removes large quantities of material from the waste stream and turns it into a very useful product.

Organics collected curbside are taken to large commercial composting operations. These facilities process organic material in large windrows and are able to obtain consistently higher temperatures than most home composters. This allows them to compost a broader range of materials, including brush, yard trimmings, and food waste. The Oregon Department of Environmental Quality[99] (DEQ) regulates and monitors commercial composting facilities.

You can close the loop by buying locally produced compost at garden stores and nurseries. Many facilities also sell compost by the truckload and some will deliver it right to your garden.

Click here [100] to see a video about PRC, the first food-waste composting facility in Oregon.

The Green Economy has a video showing Recology [101], a large-scale yard debris composting operation in Oregon.

Self-hauling Yard Debris

Communities that don't have curbside yard debris collection often have facilities that will take and/or process yard debris. Click here [102] to find where you can take your yard debris for local composting.

Anaerobic Composting / Digestors

Closed-air composting units, sometimes called digestors, are used just like a holding bin to produce compost. These work almost as fast as a turning bin. Digestors have solid sides and tight-fitting lids to conserve moisture, hold in unpleasant odors, and eliminate visible clutter of composting kitchen scraps.

Using the same principals as an anaerobic digestor, you don't have to turn the contents of your backyard composter if you choose to compost anaerobically. Place the bin in a sunny location. If the materials dry out, add water. If they become soggy, add more dry ingredients. Spread a thin layer of dry leaves or soil over every 6 to 8 inches of waste to control odors and ensure an adequate bacteria supply.

A Word About "Compostable" Plastics

New containers that look like conventional plastics but are labeled "biodegradable," "compostable," or "Polylactic Acid (PLA)" have been appearing in delis, grocery stores, and

fast-food restaurants. As well-meaning businesses work to make their companies green, many are turning to these new and usually corn-based products called "bioplastics."

In Oregon, bioplastics are a problem for the plastic recycling industry. Bioplastics often look like regular plastics, making it difficult for businesses and consumers to distinguish between the two materials. They also create multiple problems in curbside collection. These items cannot be recycled, are difficult to distinguish from regular plastics, and contaminate plastics at recycling facilities.

When bioplastics are mistakenly included in a plastics sort, they cause multiple problems for end users. Mark Burstall, chairman of the British Plastics Federation (BPF) Recycling Council, has stated, "If full degradation takes place in the conventional recycled processes, it can affect the quality of the plastic material. If it doesn't fully degrade, then residual biodegradable material can pose very serious problems to the long term stability of the recycled product." This means that bioplastics are a serious problem for manufacturers. If 10% of a plastics load is bioplastic, the entire load must be disposed of.

Bioplastics will not break down in a home compost system because there isn't enough heat generated. They must be composted in a commercial facility where temperatures are higher. And many forms of bioplastics will not successfully compost even in a commercial composting operation.

Check with your hauler to learn if compostable plastics are accepted at the local compost facility.

In a backyard experiment, this "compostable" plastic tray was placed in a backyard compost bin and another one was placed outside, exposed to the elements. After 2 years, neither had broken down.

Although single-use items are convenient, their use is not sustainable. The environmentally sound practice is to carry your own mug and water bottles and take along your own containers for leftovers when you eat out. As you will see in the Sustainable Materials Management module, these are your best choices even when considering the water, soap, and energy needed to clean the containers.

Are Bioplastics Better For The Environment Than Regular Plastic?

As eco-conscious consumers, it is important to weigh potential gains against new problems the material may cause, and to consider whether the stated benefits are real. Does the switch save or use more natural resources and energy? Does it reduce or increase the greenhouse gas emissions that contribute to climate change?

With bioplastics, consider these issues:

Landfill decomposition increases greenhouse gas emissions. When biodegradable materials

break down in a landfill, they create methane, a greenhouse gas that is more potent than carbon dioxide. Some landfill facilities are turning methane into energy, but the current technology is not able to capture all of the methane produced. Some have estimated that 20% still escapes into the atmosphere. It is important to reduce materials that breakdown in a landfill—not increase them.
Bioplastics require fossil fuels for production. Corn-based plastics will not remove the need for petroleum to make the container. Corn production requires farm machinery, fertilizers, and pesticides, all of which are petroleum intensive. Converting corn to bioplastics usually requires the use of fossil fuels.

Fertile land is used to grow material for packaging. Six billion people depend on 11 percent of the earth's land surface to produce food. Shifting land use to produce packaging decreases food crop production and will impact the world's hunger problems.

Pollution in oceans is an issue. Unfortunately, garbage gets dumped and some of it enters our oceans. Since bioplastics need high heat to break down, they remain in the ocean and eventually collect with other plastics, polluting our environment, and threatening the livelihood of ocean-dwelling animals and plants.

Bioplastics may not decompose. Not all bioplastic products have been tested for commercial composting. And of those that have , not all were found to decompose successfully even in the hot piles of a commercial composting facility. There are products that may not live up to their compost labels.

Consumers have limited ability to compost bioplastic containers. Home compost does not reach the temperatures necessary to break down bioplastic. In order for bioplastics to decompose, they must be sent to a commercial composting facility but not all facilities accept them.

Conclusion
Organic waste makes up a large portion of the waste stream. We can reduce our yard debris and food waste by taking a few simple steps. After we've reduced our waste, we can compost what we have left.

Composting is a great way to deal with organic waste. It contains a good range of major and minor plant nutrients plus trace elements essential for healthy plant growth. It holds these nutrients in the soil until plants can use them. By using compost, you are returning organic matter to the soil in a usable form.

Do-it-yourself home composting allows you to save money by turning your own waste into nutrients for your lawn and garden. There are a number of methods for processing your waste at home and at work: static systems; active systems; mulching; grasscycling; worm bins; soil incorporation, . You can find a system that fits your needs and lifestyle.
Curbside composting of yard debris, and sometimes food waste, is available in many communities and is a convenient option for those that may not have the time or space to devote to home composting. As technology improves, more communities will be adding food waste to their curbside programs. Hauling your own waste to a commercial composter or transfer station is another option in many towns.

Whether you make it yourself or buy it at a processor or store, compost is a wonderful item to use in your yard. Remember to close the loop and use compost for all of your gardening needs.

And when it comes to bioplastics, avoiding disposables is the best environmental choice. Carry your own reusable mug, water bottle and containers for restaurant leftovers. Every little bit helps!

Using compost as Mulch: On Flower and Vegetable Beds:

- Screen or pick through compost to remove large, woody material. They are less attractive, and will compete for nitrogen if mixed into the soil.
- Apply ½ to 1 inch of compost over the entire bed, or place in rings around each plant extending as far as the outermost leaves. Always keep mulches a few inches away from the base of the plant to prevent damage by pests and disease.

On Lawns:

- Use screened commercial compost, or sift homemade compost through a ½ inch or finer mesh. Mix with an equal amount of sand or sandy soil.
- Spread compost / sand mix in 1/4 to ½ inch layers after thatching or coring, and before reseeding.

On Trees and Shrubs:

- Remove sod from around trees and shrubs as far as branches spread. If this is impractical, remove sod in a circle a minimum of 4 feet in diameter around plants.
- Use coarse compost or material left after sifting. Remove only the largest branches and rocks.

For Erosion Control:

- Spread coarse compost, or materials left after sifting, in 2 to 4 inch deep layers over entire planting area or in rings extending to the drip line.
- Mulch exposed slopes or erosion prone areas with 2 to 4 inches of coarse compost.

Using Compost in Potting Mixes

For Starting and Growing Seedlings in Flats or Small Containers:

Sift compost through a ½ inch or finer mesh. Mix 2 parts sifted compost, 1 part coarse sand and 1 part Sphagnum peat moss. Add ½ cup of lime for each bushel (8 gallons) of mix. Use liquid fertilizers when true leaves emerge.

For Growing Transplants and Plants in Larger Containers:

Sift compost through 1 inch mesh or remove larger particles by hand. Mix 2 parts compost: 1 part ground bark, Perlite or pumice; 1 part coarse sand and 1 part loamy soil or peat moss. Add ½ cup of lime and ½ cup of 10-10-10 fertilizer for each bushel (8 gallons) of mix. (An organic fertilizer alternative can be made from ½ cup blood or cottonseed meal, 1 cup of rock phosphate, and ½ cup of kelp meal.)

Using Compost as Soil Amendment

In Flower and Vegetable Beds and Ground Covers:

Dig or till base soil to a minimum 8-10 inches depth.

Mix 3 to 4 inches of compost through the entire depth. For poor soils, mix an additional 3 inches of compost into the top 3 inches of amended soil. In established gardens, mix 2 to 4 inches

of compost into top 6 to 10 inches of soil each year before planting.

On Lawns:

Till base soil to 6 inch dept.

Mix 4 inches of fine textured compost into the loosened base soil.

Planting Trees and Shrubs:

Dig or till base soil to a minimum 8 to 10 inch depth throughout planting area, or an area 2 to 5 times the width of the root ball of individual specimens.

Mix 3 to 4 inches of compost through the entire depth. For poor soils, mix an additional 3 inches of compost into the amended topsoil.

Do not use compost at the bottom of individual planting holes or to fill the holes. Mulch the surface with wood chips or coarse compost.

Questions and Answers About Composting

Do I need a bin to make compost?
No, organic matter will eventually decompose without human help. But a container of some sort will keep your pile neat, protect it from the weather and pests, and make the job of tending it much easier.

Where is the best place to put a compost pile?
Pick a sheltered spot, out of the full summer sun if possible. Avoid trees and shrubs that may push their roots up into the pile. And give some thought to both convenience and appearance in choosing a location.

What is the "laziest" way to compost yard wastes? food wastes?
Woody or "brown" yard wastes, like tree trimmings and autumn leaves, can be shredded and used as mulch around plants and on paths. Eventually they'll return to the soil. Food wastes, as well as green yard wastes like vegetable tops and grass clippings, can be dug into the ground. Use larger-scale "soil incorporation" only where you won't be planting for a few months.

Can I compost in the winter?
Even research teams on the South Pole have composted their garbage successfully! You can retain heat a little longer in the fall by covering the pile and insulating the container, perhaps with bags of leaves. Increasing the amount of "green" or using a compost activator may help keep the temperature up. Keep adding to the compost through the winter: it may not seem to be doing much, but the frozen materials will quickly finish breaking down when spring comes.

Should I add ground limestone? soil? fertilizer?
A perfectly good compost pile can be built out of nothing fancier than leaves and grass clippings. Lime will balance out the pH of a pile of highly acidic materials, like pine needles. However, most compost is naturally close to neutral in pH by the time it is ready for use. A scattering of soil should be added if your compost isn't in contact with the ground, because it is the soil organisms that do the decomposing work. With a variety of ingredients, fertilizer is seldom necessary.

What if the compost pile doesn't heat up?
The odds are that an inactive compost pile just doesn't have enough "greens" in it to start its temperature rising. The answer is to rebuild the pile with more high-nitrogen materials or a "starter" like manure "tea." That will probably solve the problem, but also check that the pile is as moist as a wrung-out sponge.

How do I compost with too many high-nitrogen materials?
You can dig extra "greens" directly into the soil, store some in a sealed container, buy straw or sawdust to mix with it, or dry some in the sun to decrease the nitrogen content.

How do I compost with too many high-carbon materials?

This is often a problem in autumn, when there's no shortage of dead leaves. If you have space, bag some and store them for covering up the food scraps you'll add through the winter, or for spring and summer when "browns" are harder to find. Bags of leaves also make insulating windbreaks for compost bins. Or moisten the leaves and store them in sealed bags to begin decomposing. In spring, add them to the compost. Mulching is another alternative, but shred the leaves finely... and again, a composting neighbor might be able to use your surplus.

When is compost "finished" and safe to use?

When an active compost pile fails to heat up once more, and very little of the original material can be recognized (perhaps an eggshell or the shapes of old leaves), the compost is ready to use. It will be the rich brown color of good soil and smell something like the humus of a forest floor.

Do I need to fertilize if I use compost?

The nutritional value of compost depends on the materials that were used to make it -- one very good reason for putting as much variety into the pile as possible. If you're trying to enrich a severely depleted garden plot, or growing plants like peonies that demand a lot of food, you might want to add some commercially produced organic fertilizer. Soil testing is a good idea in this case. For most gardens and flower beds, however, compost provides a concentrated source of balanced nutrients as well as the organic matter the soil needs to store them.

Source: New Brunswick Department of the Environment, "Black Magic, The Composting Handbook"

Troubleshooting Compost Piles		
Compost pile does not heat up	Too Wet: compost materials are soggy; not enough air	Turn the pile, adding dry absorbent material (carbon or "brown") like straw or corn stalks
	Too Dry: not enough moisture	Moisten pile without saturating it
	The pile is damp and warm right in the middle, but nowhere else. Pile is not decomposing.	Turn pile, adding nitrogen-rich materials such as manure, grass clippings, fresh leaves, vegetable or fruit wastes.
Ammonia smell	Too much nitrogen (green matter such as grass clippings) in the pile or pile is too alkaline (possibly too much limestone added to the pile	If nitrogen problem: turn pile and add more carbon (brown) material. If alkaline related: turn pile and add acid material like sawdust, oak leaves, or vegetable scraps.
"Rotten Egg" smell	Pile is too wet and not enough oxygen	Turn pile to aerate it and add dry carbon (brown) materials to absorb excessive moisture
The center is dry and contains tough, woody wastes.	Not enough water in pile. Too woody.	Turn and moisten; add fresh green wastes; chop or shred.
Pests (rats, raccoons, fruit flies, etc.)	Rodents and raccoons are attracted to meat and fatty food scraps like cheese and other dairy products.	Remove meat/fatty foods from pile. Turn pile to increase temperature. Balance carbon to nitrogen ratio. Use rodent-proof bin; keep lid on, put 1/4-inch wire mesh on bottom or sides and insure air venting holes are less than 1/2-inch diameter.
	Flies, gnats, etc. are attracted to uncovered wastes, especially fruits, melons, and vegetables.	Don't leave exposed! Mix or cover with carbon (brown) materials, finished compost or some soil.
The heap is damp and sweet-smelling, but will not heat up.	Lack of nitrogen in pile. Compost is done!	Mix in fresh grass clippings or Nitrogen fertilizer.

Technical Information

As Master Recyclers, you may be asked to explain the chemical and biological factors affecting the decompostion of organic materials. Remember, you don't have to be an expert on all of the biological aspects if you can just remember the basics of composting described above.

The Life Cycle of a Heap

The decomposition and recombining of various forms of plant and animal life (**organic matter**) create compost. Inseparable from these decaying dead residues are the living microorganisms that decompose, or digest, them. The length of the process depends on several factors: the **density** of the material, the amount of **surface area** exposed, the **balance of carbon and nitrogen**; and environmental conditions such as moisture, air, and the presence of insulating materials around the composting object. These factors, in various combinations, set the stage for our cast of characters--bacteria, fungi, millipedes, earthworms, and other living inhabitants of the compost pile--and determine the speed at which these characters perform.

The process of decomposition is a very complex but natural one. There are many organisms that create the breakdown of organic matter. Most are not seen by the human eye, but they are there throughout the process. Others that are large enough to see are usually associated with the later breakdown stages.

Not all bugs are bad. In fact, all bugs play a role in nature. Many compost pile organisms eat other organisms and turn them into compost. At least one-third of the volume in a compost pile is made up of the dead, decomposed bodies of soil organisms. Still, you don't want just any old bugs in your compost pile.

If you are just trying composting for the first time, you may be surprised by the size and complexity of the community of small organisms that take up residence in your compost pile. These organisms, which include many insects, bugs, slugs, bacteria, and fungi, form what is called a "food web." (Figure VI-10) In the food web, each organism has a job to do in turning your organic waste into dark, crumbly finished compost.

The food web decomposition process is divided into three levels:

Level One (primary consumers) is comprised of the organisms that shred organic matter and the microscopic organisms that eat the shredded organic residues.

Level Two (secondary consumers) is comprised of the organisms that eat level one organisms.

Level Three (tertiary consumers) is comprised of the organisms that eat level two organisms.

All members of the compost food web are very beneficial to your compost pile and should be left alone to do their work. They need each other to survive. If you remove any of the member organisms through the use of insecticides, you will interfere with their natural cycle as well as contaminate your compost with insecticide residues.

Level One - Primary Consumers
This level is made up of herbivores: bacteria, fungi, actinomycetes, nematodes, mites, snails, slugs, earthworms, millipedes, sowbugs and worms. Note that some types of mites are carnivores.

The most productive members of your compost pile's food web are the bacteria, which are chemical decomposers. As a group, they can eat nearly anything. Some are so adaptable that they can use more than a hundred different organic compounds as their source of carbon because of their ability to produce a variety of enzymes. Usually, they can produce the appropriate enzyme to digest whatever material they find themselves on.

Every piece of organic matter you place in the pile is covered with varying amounts of bacteria. As they digest the organic material and break it down into its basic elements, they are also reproducing at an incredible rate. One gram of bacteria can become about 450 grams of bacteria in only three hours.

There are many kinds of specialized bacteria operating in different temperature ranges.

Psychrophilic bacteria work best in temperatures of about 13 degrees C (55 degrees F), but can stay on the job even in near freezing conditions. This is why you will notice your compost pile sinking in the winter; these bacteria are busy breaking down organic matter. As these cooler bacteria go to work, their activity actually begins to heat up the pile. The increased temperature creates the ideal conditions for the next type of bacteria to arrive.

Mesophilic bacteria work best in temperatures of about 21 degrees C to 32 degrees C (70 degrees F to 90 degrees F), but can stay on the job in even hotter conditions. The activity of mesophilic bacteria can heat the pile up to even greater temperatures of 43 degrees C (110 degrees F).

Thermophilic bacteria become active when the temperature reaches between 40 degrees to 93 degrees C (104 degrees F to 200 degrees F). If you notice your compost pile steaming in the morning or on a frosty day, it's because these bacteria are busy at work, decomposing your organic waste. These bacteria generally last for up to five days, and then the pile begins to cool.

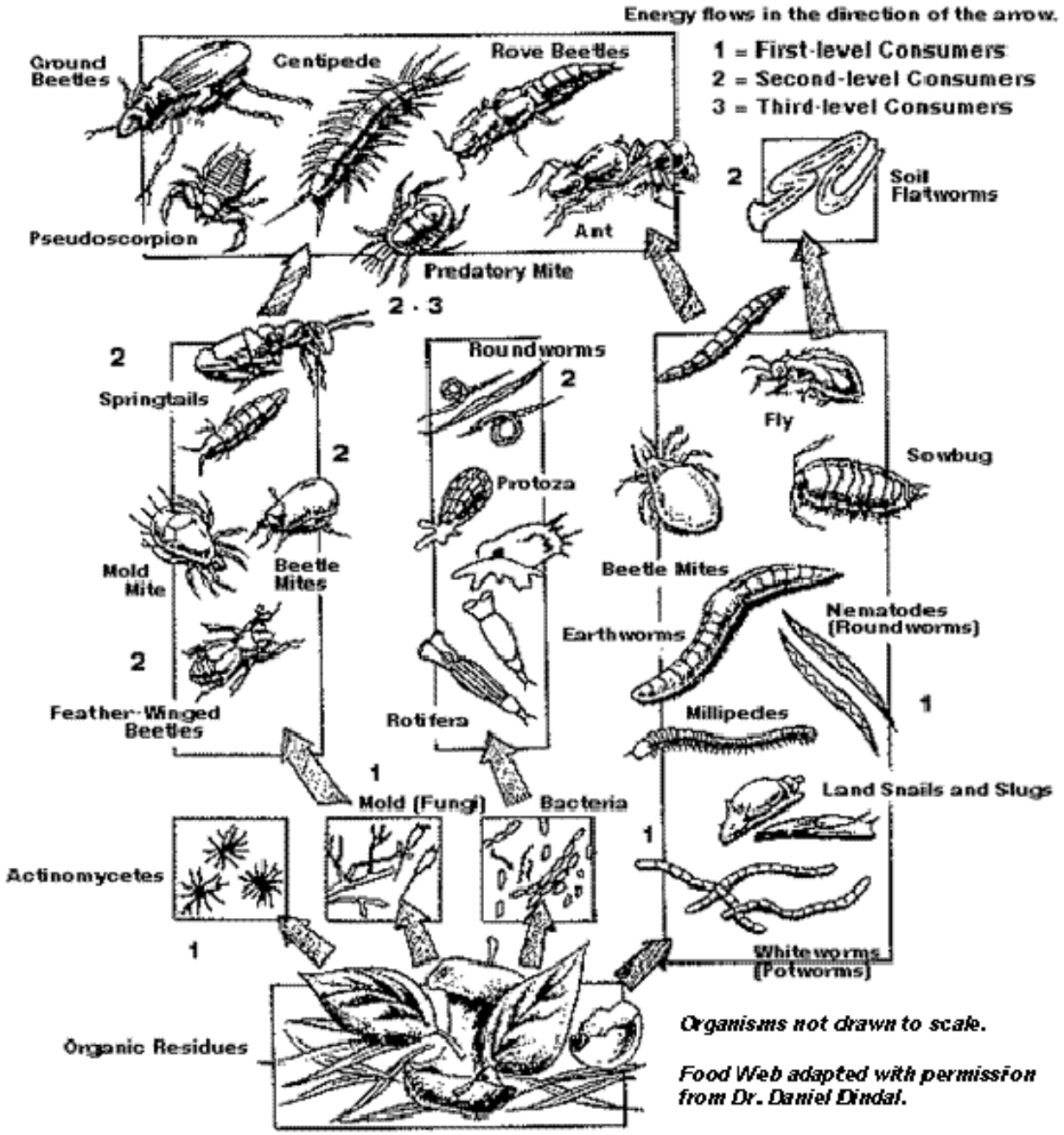


Figure VI-10. Food web at the compost pile. (Source: The Ecology of Compost, Daniel Dindal, 1972.)

As the psychrophiles eat away at organic matter they give off a small amount of heat. If conditions are right for rapid growth, this heat will be sufficient to set the stage for the mesophiles. In many compost piles these efficient mid-range bacteria do most of the work. However, given optimal conditions they may produce enough heat to kick in the real hot shots--the thermophiles.

Although at first they are the most active decomposers, the bacteria are not alone in all of this work. Other microbes, fungi, and a host of invertebrate decomposers also take part. Some are active in the heating cycle, but most other organisms prefer the cooler temperatures of later decomposition. After temperatures go down, the decomposing pile becomes a real zoo. Larger organisms, many of them feeding on the piles' earlier inhabitants, add diversity to the action.

Actinomycetes produce grayish cobwebby growths (molds) throughout the compost that give the pile a pleasing, earthy smell similar to a rotting log. They are frequently seen in drier parts of the pile and survive a wide range of temperatures.

Fungi send their thin mycelial fibers out far from their spore-forming reproductive bodies. Molds are actually a form of fungi. The presence of mold and fungi usually implies decay. The most common of these pop up on a cool pile. Fungal decomposition is not as efficient as bacterial decay since cold temperatures greatly restrict its growth.

Snails, slugs, millipedes, sow bugs, pill bugs, mites and earthworms are the larger invertebrates that shred the plant materials, creating more surface area for action by the microscopic fungi, bacteria and actinomycetes, which are in turn eaten by organisms such as mites and springtails. These creatures all excrete "castings" that are very dark and fine, and great for your plants.

Snails are terrestrial mollusks, typically having a spirally coiled shell, broad retractile foot, and distinct head. They generally feed on living plant material but will attack fresh garbage and plant debris and will therefore appear in the compost heap.

Slugs are basically snails without the shell. They, too, feed on living plant material, fresh garbage, and plant debris, and will also show up in the compost heap.

Millipedes are nonpoisonous arthropods with cylindrical bodies of 20 to 100 segments, with two pairs of legs per segment. They feed mainly on decaying plant tissue but will also eat insect carcasses and excrement.

Sow Bugs are fat bodied crustaceans with delicate plate-like gills along the lower surface of their abdomens which must be kept moist. They move slowly, and feed on rotting woody materials and highly durable leaf tissues such as the veins comprised of woody tubes. The sow bugs that roll up like armadillos are known as pill bugs.

Pill bugs look similar to sow bugs and also graze on decaying vegetation, but are more flexible. They can roll themselves into a ball to protect themselves, which gives them their common nickname: "roly polys."

Mites (Fermentation) are the second most common invertebrate found in compost. They are transparent-bodied creatures with eight leg-like jointed appendages. Some can be seen with the naked eye and others are microscopic. Some scavenge in leaves, rotten wood, fungi, and other organic debris. Others are predators and feed on nematodes, eggs, insect larvae, and other mites and springtails. Considered pests in fermenting industries such as wineries and cheese factories, they are not pests in the compost pile.

Worms play an important part in breaking down organic materials and forming finished compost. Redworms process organic materials, they coat their wastes with a mucus film that binds small particles together into stable aggregates and prevents nutrients from leaching out with rainwater. These stable aggregates give the soil a loose and well draining structure. Earthworms pull organic materials into the mineral soil along many burrows. As a result of the worm's well-deserved reputation for being excellent decomposers, many people think that it's a great idea to add extra worms to their compost pile. This is unnecessary. Let the worms find their own way into the pile, when the conditions are right. They prefer the pile when it is cooler, so adding worms could lead to their quick demise in a hot, steamy pile.

Level Two - Secondary Consumers

This level includes both herbivores and carnivores: nematodes, protozoa, rotifers, soil flatworms, springtails, some types of mites, and feather-winged beetles.

Nematodes, or roundworms, are tiny, cylindrical, often transparent microscopic worms, and are the most abundant invertebrates in the soil. Typically less than one millimeter in length, a handful of decaying compost can contain several million nematodes. Under a magnifying lens, nematodes resemble fine human hair. They can be classified into three categories: 1) those that live on decaying vegetation; 2) those that are predators on other nematodes, bacteria, algae, protozoa, etc.; and 3) those that can be serious pests in gardens where they suck the juices of plant roots, especially root vegetables. Though there are pest forms of nematodes, most of those found in soil and compost are beneficial.

Protozoa are the simplest form of animal organism. Even though they are single-celled and microscopic in size, they are larger and more complex in their activities than most bacteria. Protozoa obtain their food from organic matter in the same way bacteria will, but because they are present in far fewer numbers than bacteria, they play a much smaller part in the composting process.

Rotifers are minute worms which usually have one or two groups of vibrating cilia on the head. Their bodies are round and divisible into three parts: a head, trunk, and tail. They are generally found in films of water and many forms are aquatic. The rotifers in compost are found in water which adheres to plant substances where they feed on microorganisms.

Flatworms are, for the most part, general scavengers that graze on a wide variety of things including animal matter. As their name implies, flatworms are flat and usually quite small in their free-living form. Most flatworms are carnivorous and live in films of water within the compost structure.

Springtails, along with nematodes and mites, are extremely numerous in compost. They are very small wingless insects and can be distinguished by their ability to jump when disturbed. They run in and around the particles in the compost and have a small spring-like structure under the belly that catapults them into the air when the spring catch is triggered. They feed mainly on fungi, although they also eat nematodes and small bits of organic debris. They are a major population controlling factor on fungi.

Feather-winged beetles are the smallest of all beetles and possibly of all insects. These beetles are distinguished by their feather-like wings. Some are blind and most live under bark in forests and woodland. Not surprisingly they go unnoticed. Most species feed on fungi.

Level Three - Tertiary Consumers

This level is made up of carnivores, or physical decomposers, and include centipedes, predatory mites, rove beetles, ants, spiders, pseudoscorpions, and earwigs. Most of these creatures function best at medium or mesophilic temperatures, so they will not be in the pile at all times.

Wolf Spiders are truly wolves of the soil and litter micro-communities. They build no webs, merely run freely hunting their prey, which include all sizes of arthropods, from mites to centipedes, depending on the size of the spider.

Centipedes, are found frequently in soil micro-communities. Centipedes are flattened, segmented worms with 15 or more pairs of legs--one pair per segment. They hatch from eggs laid during the warm months and gradually grow to their adult size. They feed only on living animals, especially insects and spiders.

Mites are related to ticks, spiders, and horseshoe crabs because they have in common six leg-like, jointed appendages. Some mites are small enough to be invisible to the naked eye, while some tropical species are up to a half-inch in length. Mites reproduce very rapidly, moving through larval, nymph, adult, and dormant stages. They attack plant matter, but some are also second-level consumers, ingesting nematodes, fly larvae, other mites, and springtails.

Rove Beetles are the most common beetles in compost. While feather-winged beetles feed on fungal spores, the larger rove beetles prey on other insects. Beetles are easily visible insects with two pairs of wings, the more forward-placed of these serving as a cover or shield for the folded and thinner back-set ones that are used for flying. These beetles prey on snails, insects, and other small animals. The black rove beetle is an acknowledged predator of snails and slugs. Some people import them to their gardens when slugs become a garden problem.

Ants feed on a variety of material, including aphid honeydew, fungi, seeds, sweets, scraps, other insects, and sometimes other ants. Compost provides some of these foods, and it also provides shelter for nests and hills. They will remain only while the pile is relatively cool. Ants prey on first-level consumers, and may benefit the composting process by bringing fungi and other organisms into their nests. The work of ants can make compost richer in phosphorus and potassium by moving minerals from one place to another.

Pseudoscorpions are predators which seize victims with their visible front claws, then inject poison from glands located at the tips of the claws. But don't panic! Pseudoscorpians are so small, their prey include tiny nematode worms, mites, larvae, and small earthworms.

Earwigs are large predators, easily seen with the naked eye. They move about quickly. Some are predators, others feed chiefly on decayed vegetation.

Source: California Integrated Waste Management Board (2005) "Critters in Your Pile"; www.ciwmb.ca.gov/Organics/HomeCompost/Critters/Default.htm

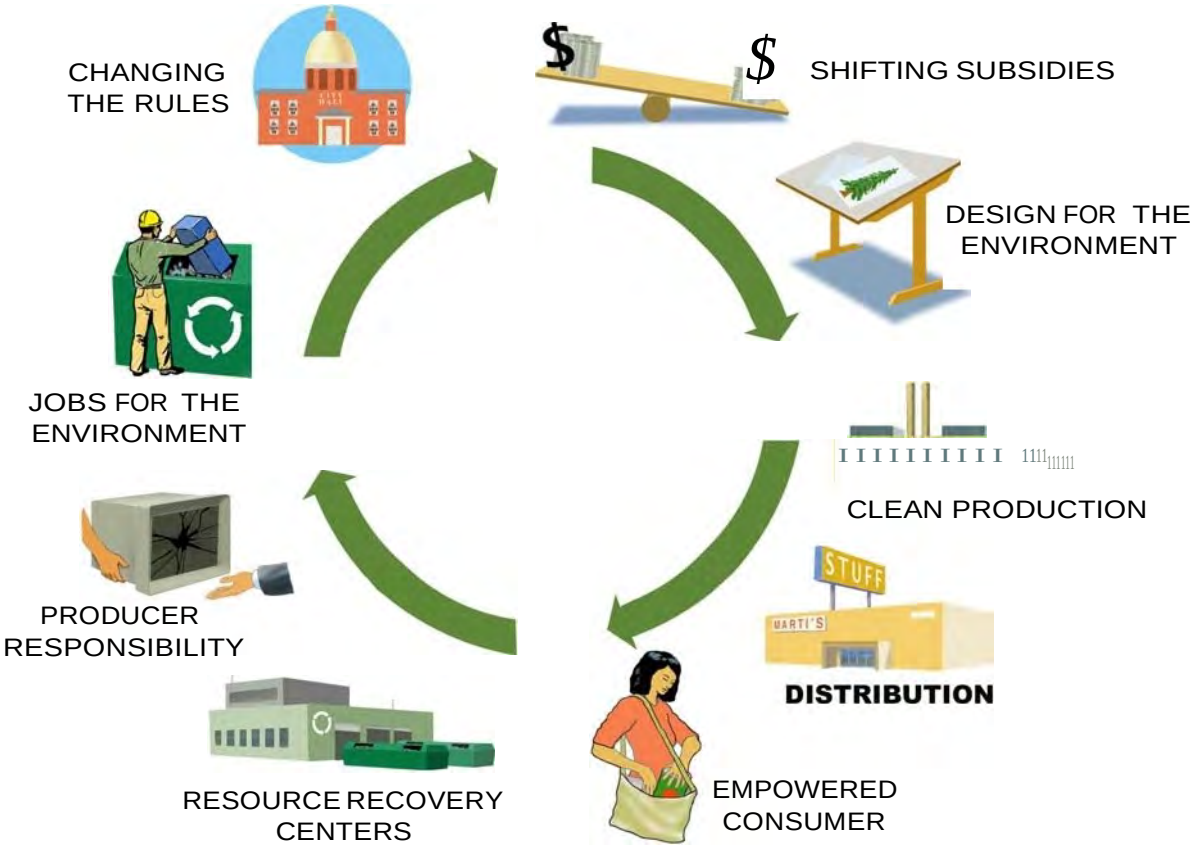
Unwanted Guests: The Pests of the Pile

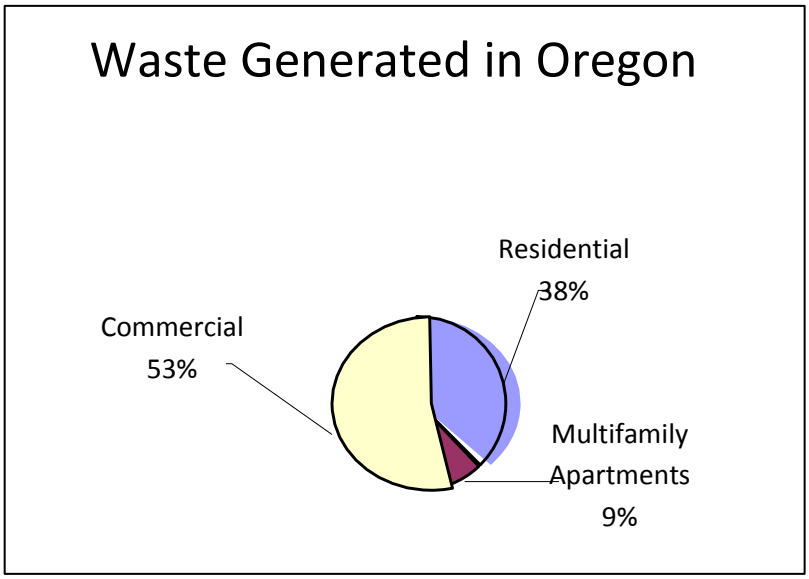
Given a comfortable or nourishing environment, pest species will show up to "get in on the action." Rats are probably the least-wanted guests of all. With a hospitable environment and plenty of food, their numbers increase quickly and they may become transmitters of disease. So it is important to compost food wastes by burying them in the garden, in rodent-proof worm bins, or in hot compost piles. Always keep high-protein and fatty food wastes out of the compost pile. Wastes that should not be composted include meat and fish scraps, bones, cheeses, butter and other dairy products.

Many flies, including house flies, can spend their larval phase as maggots in decomposing food wastes. Though they play an important part in the recycling, breaking down of all types of organic debris, they are unwanted guests around human households. There are several ways to control their numbers: by frequently turning compost piles with food in them (larvae die at high temperatures); covering piles with a dry material having a high carbon content, such as straw or old grass clippings; or just not composting food wastes in yard waste piles.

Chapter 5: Waste Reduction at Work and Play

ZERO WASTE SYSTEM





Home may be where the heart is, but it is not where most of Oregon's waste is generated. Slightly over half of our waste is generated commercially, in the places we work, worship, learn, and socialize. In 2009, single-family homes and apartments of up to four units generated 37.5% percent of Oregon's waste. Multi-family units (five-plex or bigger) generated 8.9%. This means the largest share, 53.6% percent, was generated by other sources, including businesses, factories, restaurants, places of worship, and institutions like schools and prisons. That's a lot of waste!

In this module we're going to explore how we can reduce waste and improve recycling where we spend time when we're not at home: work, school, places of worship, and community gathering places like the Grange or fraternal organizations. To keep things simple, we'll use the term "commercial" to refer to these sources. The same guidelines apply to working with your community group or church as apply to working with a business, so don't be put off by our reference to "businesses" later in the module.

We'll also focus on waste reduction, the combined practice of recycling and waste prevention.

Commercial recycling services vary from wasteshed to wasteshed, so we'll start by comparing recycling collection opportunities. Then we'll briefly review why an organization might want to reduce waste. Next we'll look at the basics of setting up a commercial recycling program with a focus on reducing waste and conserving resources so we have less to recycle or throw away. We'll also look at how to recycle and reduce waste at events, schools, and multi-family dwellings. Finally, we'll explore how to manage organic waste from these settings.

In most parts of Oregon, haulers serving businesses are franchised or licensed. They contract to serve allotted territories and offer standardized services and fees, much like residential waste service[103]. These haulers may be required to meet specific service standards. In other parts of the state, haulers compete for commercial accounts and set their own rates. A few jurisdictions, including the City of Portland, require that businesses recycle. Presently, Portland businesses must recycle 75 percent of their waste. Differing jurisdictions, standards, fees, and regulations can make understanding business waste reduction in Oregon complex. In Marion County we have a group of 7 franchised haulers and there is no requirement that businesses recycle or participate in the composting program.

Most recyclable materials that are accepted in curbside residential recycling programs are also accepted from businesses. Your hauler will be a valuable ally in creating an effective recycling

program. Always check with the company that handles your garbage when setting up or improving a waste reduction system. They can tell you which items are accepted and how they must be prepared and sorted. They'll also let you know what collection containers are available and the schedule for your location.

In addition to promoting increased recycling, some cities and counties (including Marion County) provide free consulting services to organizations that want to reduce their waste and institute comprehensive recycling and composting programs[104].

According to the 2009 Oregon DEQ Waste Composition Report, commercial generators disposed of 204,102 tons (or 408,204,000 pounds!) of recyclable paper. This means that 49 tons of recyclable paper was discarded each half hour of every workday! That's enough to fill almost two and a half 40-foot semi-trucks each half hour! The number of trees used to make a ton of paper depends on the type of paper, like office paper or newspaper[105].

The recycling industry is always responding to changes in technology and market conditions for recycled materials. As a result, most commercial recycling programs accept many more items now than in the past, and preparation requirements are much simpler than they were five years ago. Today, colored paper, envelopes with windows and paper with staples are accepted in most commercial recycling programs. In the past, this was not the case. The ability to process commingled recycling streams has also simplified recycling in commercial settings and made it more user-friendly.

Owners and managers sometimes start waste reduction programs because they are interested in gaining a business advantage by improving their firm's environmental performance. Most often, though, recycling programs are started by employees who want to practice the same values at work as they do at home. Starting a waste reduction program is a good way to network between departments, gain the attention of managers, and showcase planning and leadership skills. Making the workplace and world better can lead to new career opportunities.

Reducing the waste your business or community organization creates helps it:

- preserve a healthy environment for future generations
- establish a sustainable resource base
- be a better community steward
- make a positive difference in the world
- create a competitive advantage
- create greater control over material costs
- reduce production and overhead costs
- set a good example for employees and other businesses
- enable employees to participate in protecting the environment
- save on your garbage disposal by reducing frequency of pick-up or dumpster size

Your business may want to commit to purchasing environmentally preferable products by adopting, and following, a Sustainable Purchasing Policy. Even if you already purchase environmentally preferable products, creating a policy and following it will ensure that the

practice continues for years to come. For inspiration you can check out the State of Oregon's Comprehensive Sustainability Plan[106]

The following 12 steps will help you start a comprehensive waste reduction program. If you work for a smaller business or organization, the work involved in each step may be very simple. Don't let the list worry you.

1. Get Management Support. Gaining management support is critical. Think about what motivates your manager and then focus on those reasons when you make your sales pitch. Address the concerns your employer may have: acknowledge there will be some costs and time commitment involved, especially initially. Emphasize your belief that the benefits will outweigh any negatives.

As your planning progresses, you'll be able to provide much more detail about how the program will work: time, costs, and responsibilities. Later on, you'll be able to document any savings that result from the program.

2. Don't Go It Alone. Your task will be much easier if you can establish a green team at your business. This is a group of employees/managers that will help plan, implement and evaluate the program. As you talk with your co-workers, you'll identify potential green team members. Make sure you have key players on board like managers, lead workers, janitorial and grounds maintenance staff. Rotate meeting places between departments so everyone can see how other work sites are set up. Decide on a fun name for your team— Waste Busters, The Reducers, Less is More, or simply the Green Team—then get to work!

Your hauler or wasteshed representative is a valuable ally. Some wastesheds have staff that can help you get your workplace waste prevention and recycling systems up and running. They often provide items to help make your program a success, such as desk-side recycling boxes; central collection containers; Junk Mail Reduction kits; recycling posters; stickers to label recycling containers and items to use as prompts or reminders. To see if your community has a program contact your local wasteshed.

Waste is in the eye of the beholder. Your waste may be a valuable commodity for someone else, especially if you have a lot of one thing, plastic pallet wrap for example. Network with local businesses and contact recycling firms, waste exchanges and other organizations that may value your waste as a resource. Even in rural areas, there may be independent recyclers who will work with your firm to recycle items not collected in local programs.

Some waste, especially some plastics, are troublesome in small quantities, but are desirable in larger ones. If you don't have enough material to interest an independent recycler, consider joining with other firms to pool your material.

Although our focus is on solid waste, Green Teams often look at other resource issues, like water and energy use. The Oregon DEQ produces a variety of tools that can help your business reduce its use of resources. A good place to start is with the Resource Efficiency Tool Kit[107].

3. Set Preliminary Goals. Your green team should set general goals as a framework for action. If your company has an environmental mission statement, that's a good starting point. If it doesn't, you may want to draft one. Your goal can be as broad as stating the firm will reduce the waste it produces by 25% during the next year. The team should develop an overall structure and schedule of activities to reach the company's goals. Management support for your preliminary plan and goals is necessary before you can move forward.

4. Announce the Program. Let your co-workers know what is in the offing and how they can get involved. A memo from the president or CEO announcing the creation of your team and supporting its goals is a great way to get started. Let co-workers know you'll be looking for ways to cut waste and ask for their ideas and support. Tell them your timeframe. Get them excited about participating in something new. You can do this via a company-wide email, staff meetings, articles in the newsletter, posters, a contest – if you can make it fun, that's a plus!

5. Gather Data. Whether your organization is large or small, the first step is to set a baseline for progress. If your firm is small, this may be a simple task, if it is large or includes different departments or functions the task will be more complex. A waste assessment will help you learn what wastes your business generates, where they are generated, and how much money you are spending to get rid of them. There are links below to several forms that can help you evaluate your organization's waste; you may not need to use them all[108].

If possible, review your firm's garbage and recycling records for the past year. They should show any seasonal fluctuations in waste production and give you month-by-month figures to use for comparison when you get your program up and running. If a year's records are not available, the records for the past quarter can be used, they just won't provide as accurate an overview.

You'll need to understand where waste is generated in your firm, so physically evaluate your company's waste stream. This either can be done as a tour of the facility or as a hands-on sort of the waste your firm produces. Either way, the tour will supply your team with valuable information about how and where your company can begin to look for waste savings. Use this as an opportunity to talk with line staff about how they think things could be done more efficiently. Have a team member take good notes about what your team sees and hears. Pay attention to what, where, and how waste is generated in your firm.

A waste audit, or waste sort (the terms are used interchangeably) is a hands-on sort of your company's garbage. This will give you much more accurate and detailed information than the walk-through and can serve as a baseline to measure reductions in the disposal of targeted materials. But a waste audit may supply more information than you need to get started. We'll discuss how to conduct a waste sort later in the module.

6. Identify and Evaluate Waste Reduction Options. Your waste evaluation will have told you which items are the biggest components of your waste stream. This is often paper in an office setting. You may also have noticed some very expensive items in the trash – either expensive to buy or expensive to dispose of – hazardous chemicals for example.

Setting up a recycling system is often the first step in implementing a waste reduction plan. Your team will want to show solid results for your first effort, so focus on the items that will make the most difference in your waste stream.

Using ideas from the Master Recycler class and any ideas generated by your team or co-workers, begin to think of methods for preventing the wastes identified in your assessment. There are methods for reducing office paper waste for example, or for replacing hazardous cleaning chemicals with less toxic formulas.

As you think about each waste item and possible solutions, evaluate these options for time, cost and waste prevention effectiveness. Don't forget to think of potential obstacles. If you know a co-worker is resistant to change, begin your work in another department. If you can anticipate potential problems, you can often find ways to prevent them.

Go for the big wins with the lowest cost and least effort when you are starting out. This will give both your team and management confidence in what you can accomplish.

If your program is ambitious, you'll want to phase in different aspects. Many Green Teams start with setting up a recycling program and then move on to implement various waste prevention strategies, like decreasing the use of toxics or using less paper.

We'll discuss how to identify waste prevention options later in this module.

7. Set Specific, Achievable Goals. Now that you've evaluated your waste and evaluated the options, it is time to set specific targets for your business. Use your waste evaluation to help you determine how much progress is reasonable. If your review shows that your firm recycles only a quarter of its waste and your evaluation shows that most trashcans are filled with office paper, it is not unreasonable to plan to reduce your firm's garbage by half within six months.

Start with easily achievable goals. This will allow you and your co-workers to gain confidence in the program and get a win under your belts.

8. Plan the Physical Aspects of the Program. Think about where bins and storage areas will be sited. Remember to consider workflow and high traffic areas. Talk with co-workers, maintenance crews and your hauler about placement and other factors. Don't forget to talk with your local Fire department about safe places for your recycling bins inside buildings. They may have concerns about placing them too close to exists or escape routes in the event of a fire.

Make Recycling Easy:

- Place a recycling container next to every garbage can so it is as convenient to recycle as it is to throw recyclables into the trash.
- If possible, have janitorial staff collect recycling containers. Recycling is significantly higher when office workers don't have to empty their own containers.
- Clearly and prominently label recycling containers and include pictures of items that can be recycled[109].
- Make recycling systems consistent throughout the business to reduce confusion

9. Start the Education Campaign. Have a big kick-off if possible. Let people know how they can participate and what is expected of them. Share the company's goals. Let your co- workers know how their needs and input have helped shape the plan. Make being involved productive and fun.

10. Evaluate and Monitor the Program. Keep an eye on what is happening. Gather data. Talk with co-workers. Stay in touch. If recyclables are getting contaminated by other items, figure out why:

- Are the instructions confusing?
- Is it difficult to separate recyclables from non-recyclables?
- Do you need to put a trashcan next to the recycling bin?

Let participants know you're interested in how the process is working for them and how it can be improved.

If you conducted a waste sort when you started the program, do another one in six months and compare the results. Use this handy form to help you keep track of paper purchases before and after you start the waste prevention program.

11. Share the Results and Celebrate Success! You'll keep folks on board and excited if you let them know what their efforts are accomplishing. Share the results of the program so they know they are making a difference. Celebrate when you reach a goal!

12. Set New Goals as You Reach the Original Goals. Your Green Team doesn't need to confine itself to solid waste issues. Consider looking at ways to save energy and water, too. You'll be helping the environment and saving more money for your company or organization.

How to Conduct a Waste Sort

A waste sort will help you understand what is in your trash and where it is coming from. As mentioned earlier, a facility walk-through may give you all the information you need to get start and monitor your program started, but if you have a large firm or want to track the performance of different departments, a waste sort is useful tool. The Marion County website has handy

Waste Audit forms[110] that can be downloaded and modified to fit the waste your business produces. It will automatically compute your waste audit results. Just follow these instructions on the first tab.

1. Determine the categories you will use for your sort. Use the information you gathered in your facility walk-through to get you started. Target the most common items in your waste stream and note the materials included in your local recycling program. Clearly define each category in writing to make your sort consistent and repeatable. Include a catchall "other" category for miscellaneous items. Note the items that are regularly discarded and items that are only partly used when they are discarded – paper used on only one side, for example.

2. Identify a representative sample of your organization's waste. This sample may actually be several samples, each taken from a different location in your firm on a series of days at different times. If you are not worried about statistical accuracy, you can take as many or as few samples as your want. Just try to keep your samples as representative of the amount and content of your usual waste as possible. If statistical reliability and validity are important, you will need to conduct a large number of sorts.

You can sort samples from each work area (manufacturing, office, shipping and warehouse, for example) separately or you can mix all the samples together. If you keep the samples separate you will get a better idea of where specific wastes are generated. If you already have a recycling program, this will also give you a sense of how well each department is doing with your current program. In a large office, comparing the results between different floors or departments could be a fun way to create a competition. If you combine your samples, you will have less record keeping to do.

3. Set a time and place to sort the waste. Unless your firm is small, plan on at least an hour of actual sorting time. Any less and your sample probably will be too small to be representative. The ideal sorting location is a large table at waist height surrounded by clearly marked buckets or boxes for each material. You may wish to cover the table with a plastic sheet or tarp. Waste sorting outside is ideal, as long as it is not too hot, windy or wet. Avoid rain since sample weights will be inaccurate if your paper gets soggy.

4. Protect sorters from potential health and safety hazards. Potential hazards include, but are not limited to, exposure to toxic or hazardous chemicals; fire or explosion caused by ignition of combustible materials; heat stress (if weather is hot); exposure to pathogens (diseases, infectious waste, needles, etc.); and hazards related to the site where you will be sorting, such as uneven ground.

Wear clothing that will protect you from predictable hazards. Wear gloves and goggles. Waterproof clothing made from Tyvek© or related materials may also be useful. Your firm's health and safety officer can determine the best protective equipment to use.

5. Weigh the containers you are sorting into. Then sort garbage into the pre-determined categories. When each sample has been sorted, weigh the containers then subtract the original container weight. This will give you the weight of the waste.

6. Figure the percentage each material in the waste stream.

A Waste Sort will give you a reasonably good assessment of what is in the company waste. This will allow you to figure material-specific recycling rates that can be used to design and measure the success of your company's waste reduction program.

A Final Word About Waste Sorts Despite the time involved in organizing and conducting a waste sort and its potential hazards, the event can have many additional benefits. Sorting garbage with a group of inquisitive co-workers can be fun. Spending a few hours outside on a cool, sunny day while you and your co-sorters critically inspect the remains from the activities of your firm can be a great team-building experience. You may even gain valuable insights into the inner functioning of your organization.

A waste sort can also provide a promotional opportunity for your waste reduction program. You may not want your co-workers to know beforehand that you will be collecting their garbage, but you can invite them to see the result of your sort. The media may also be interested in your activity. A garbage sort can provide a good photo opportunity and sound bite. One company received positive newspaper and radio coverage when their Green Team waded through a few hundred pounds of garbage during their waste sort.

As with residential waste reduction, businesses can easily recycle materials haulers will take in curbside programs. The challenge is to find a home for other common, but hard to place items, including:

Household batteries (alkaline, and carbon-zinc): Although alkaline batteries have been mercury-free since 1997, these batteries still contain some heavy metals that can slowly release into leachate in landfills. Although the EPA does not classify them as hazardous waste, it is best to recycle them. In Tillamook County, residents can recycle batteries for free during the regularly scheduled Household Hazardous Waste events at the Tillamook transfer station. The best way to deal with battery waste is to switch to rechargeable batteries. They last a long time, and when they are no longer good they can be recycled at many venues.

Lithium/lithium ion, rechargeable batteries, and cell phones: Many office supply stores, cell phone distributers, and home repair and electronics stores have collection

programs[111]. You may also want to collect rechargeable batteries as a company. In Tillamook County, residents can recycle batteries for free during the regularly scheduled Household Hazardous Waste events at the Tillamook transfer station.

Toner and ink cartridges: These are recyclable at several office supply stores and at a variety of internet sites. Businesses that sell remanufactured ink and toner cartridges are found in several Oregon towns; they also accept used cartridges to refill. The Oregon Green Schools Association[112] has a program where businesses collect phones and cartridges as a fundraiser for the association. If your business is not currently recycling cell phones and printer cartridges, it's easy to set up a free collection program and help Oregon Green Schools at the same time. Individual schools can also fundraise by collecting toner cartridges and cell phones.

Non-curbside plastics (strapping material; plastic film used as pallet wrap, shrink-wrap, and agricultural row covers, plastic bags): Some of these are valuable commodities if you have them in large quantities. Ask your suppliers, network with other businesses, and check with independent recycling firms to see what companies might be interested in your leftover plastics. If the recyclable quantities are small, talk with other businesses to see if you can combine enough material to interest a recycler.

Medical plastics: Many medical suppliers now have take-back programs for non-bio-contaminated medical plastics. Check with your supplier. Also check with other medical facilities in your area to learn how they deal with their plastics. If you don't have enough material to interest a recycler, perhaps you can collaborate with other facilities to collect enough to interest a recycler.

Styrofoam packaging products: Styrofoam is a brand-name for expanded polystyrene (EPS). EPS is difficult to recycle because the quality that makes it attractive for shipping - namely that it's lightweight - makes it a challenge to transport economically to recycling markets. If you can't reuse EPS shipping peanuts in your shipping department, check the phone book for pack-and-ship stores, such as Mailboxes Etc.[113] They often accept EPS for reuse. If you have large quantities of EPS peanuts, you may be able to sell them via Craigslist or through a local waste exchange. There are a few firms in Oregon that collect and/or recycle EPS, including Fresh Start Market in Salem, St. Vincent de Paul in Lane County and Eugene[114], and Total Reclaim in Portland[115]. CARTM in Manzanita also collects EPS peanuts. Be sure to call and confirm that they are accepting the product and what their policies are before you load your vehicle.

Agricultural chemical containers: Check with your chemical supplier because many of them will accept triple-rinsed containers for recycling. Some have special depots or drop-off sites. A company called Agri-Plas[116] in Brooks, Oregon specializes in the recycling of agricultural and other plastics.

Many businesses start their waste reduction program by setting up a recycling system. This is a great way to reduce the waste going to the landfill and save money on your garbage bill. It is also a good way to get co-workers thinking about the waste your firm generates. But

preventing waste saves a lot more energy and resources than recycling. So the next step in your plan needs to address preventing the waste your firm generates. Waste prevention can save your company or organization a lot of money, too!

The following ideas will help you add waste prevention to your waste reduction plan.

1. Reduce the amount of packaging entering and leaving your company. Packaging accounts for approximately one-third of the commercial waste stream, so this is a good place to begin[117].

2. Work with your suppliers. Let them know your company's goals and ask it they have products that will help you reach the goals. As a customer, your company has a unique ability to affect markets. Encourage your suppliers to use minimal, reusable, or recyclable packaging. (Since preventing waste is the priority, try the other options before choosing recyclable packaging.) Some suppliers are willing to take back their packaging materials for recycling or reuse. If you are a substantial customer or you can join with other customers to create a large, influential group, the supplier may be willing to rethink its packaging practices.

3. Buy in bulk. Can you get rid of individually packaged items and purchase them in bulk instead? Besides cutting down on waste, bulk purchasing usually saves money. This principle works well in cafeterias too. A large container of ketchup or mustard is much less expensive and waste-producing than individual packets.

4. Evaluate your firm's packaging practices. Can you incorporate reusability, reduce the amount of material used or switch to recyclable packaging? Are there other technologies and options that might be even better? Do you really need multiple layers of packaging even though you switched shippers? Are those extra layers necessary for safety or security?

5. Identify reuse options within your company. What happens with extra office supplies? Does your receiving department get mailing boxes that could be reused by shipping? Can three-ring binders, interoffice envelopes, file folders, notebook dividers, and other items be collected and reused? Can printer or cash register cartridges be refilled and reused? Can paper printed on one side be reused for drafts or made into scratch pads? (Tips on preventing office paper waste will be offered later in this module.) Can you reuse shipping containers and packaging? One option to facilitate reducing waste is to set aside an area as an "exchange" for excess supplies.

Many firms ship items between offices or stores using wooden pallets. If this is a regular feature of your business, consider using durable pallets that can be reused many times. This will save money in the long run and cut down on waste. You may be able to work out a similar plan with your suppliers. For instance, they could back haul their empty containers for reuse.

6. Switch from disposable to durable items. Keep your eyes open for durable items that can substitute for those now thrown into the trash (or even getting recycled). Replace disposable plastic coffee cups with durable mugs, paper towels with cloths or sponges. Switch from individual servings to refillable containers. Replace paper or disposable plastic plates with

glass or ceramic items. Use rechargeable batteries. As mentioned previously, use reusable plastic pallets in place of wood.

7. Choose and maintain equipment that will last. Replacing equipment regularly is expensive. Make sure durability and ease of repair are part of the purchasing criteria. Setting up and keeping regular maintenance schedules can extend the life of an item substantially.

8. Buy used equipment. Many large ticket items, such as office furniture, restaurant equipment, and heavy machinery can be purchased used. Does a chair, desk, file cabinet, or oven need to be new? Buying used items saves money and resources! There are many stores that sell used office, restaurant and other types of equipment.

9. Resell used items or donate them to charity. If you no longer need office equipment, such as file cabinets, chairs, or computers, someone else can use them. You may be able to sell them or get a tax write-off if you donate them. Check it out!

10. Investigate waste exchanges. One person's waste is another's resource. Waste exchanges provide a network for businesses to find other businesses that have a surplus of materials. They can help you link up with business that have what you need or who want what you have. Northwest Materials Mart[117] provides links to regional and local materials exchanges.

11. Switch to less hazardous products. Today there are more options for replacing hazardous chemicals than ever before. Low-toxicity inks, cleaning supplies, and low-VOC paints are now available. Check with your suppliers to see what else is new on the market.

12. Rethink processes. If a process produces a lot of waste, do an evaluation to see if using different materials, different procedures, or even a product redesign may decrease your materials needs. This principle can be applied to records management as well as manufacturing.

13. Ask Why? Just because something has been done a certain way for years doesn't mean it has to continue that way. New technologies, new procedures, and new ways of thinking about products and materials can often save time and money and prevent waste. Waste-producing behavior is often unconscious: It is what we do when we're not paying attention. Don't overlook the obvious.

Preventing Office Paper Waste

Even the smallest businesses require paperwork. And paper waste adds up fast. By following these guidelines, you can save money and trees:

Before Printing

- Check documents for errors using spelling and grammar check. Encourage onscreen proofreading.
- Use "Print Preview" to double-check page breaks and avoid blank pages.
- Use "Page Setup" to reduce document margins.

- Reduce font size (within reason).

Sharing Documents

- Share documents electronically through e-mail or by posting them online.
- File documents electronically: save files on disks, hard drives, flash drives or in the cloud.
- Create a central file for shared paper documents instead of maintaining individual files.
- Route one copy of a document around the office (use routing lists to make sure the appropriate people see the document).

Faxing

- Send and receive faxes from your computer instead of on paper.
- Program printers so they don't print confirmation sheets.
- Eliminate fax cover sheets by using fax sticky notes.

Printing and Copying

- Set copier and printer defaults to double-sided printing.
- Combine several short related pages into one.
- Make sure everyone knows how to cancel print jobs from both the computer and printer.
- Print one test copy and proof it carefully before printing multiple copies.

Other Paper Conservation Strategies

- Place reminders at copiers to conserve paper by double-sided copying.
- Reuse paper printed on one side by printing drafts on the unused sides or cut and use for notepads. (Make sure copies of truly confidential documents are shredded and recycled.)
- Reduce unnecessary mail. Eliminate returned mail and duplicate mailings by double-checking addresses and keeping mailing lists updated.
- Reduce junk mail. Handling unwanted mail takes time and costs money. Notify senders of duplicate or unwanted mailings and if former employees receive mail, contact the company and have their names removed from the mailing list.

Resources for Commercial Waste Reduction Information

In many areas of the state, local governments offer free assistance programs, incentives or maintain informative websites to help their businesses reduce waste.

EarthWISE Business Assistance Program (Workplace Initiative for Sustainable Enterprise)

The EarthWISE program helps businesses save natural resources and money by reducing waste, recycling more, and conserving energy and water. The EarthWISE program is a FREE business assistance program offered to all businesses in Marion County. EarthWISE program staff is available for anything from a quick phone call to a

full-service environmental assessment. All services are customized to meet your business' specific needs. Businesses can receive resources and assistance in any or all of the EarthWISE focus areas of recycling, waste reduction and prevention, environmentally preferable purchasing, energy efficiency and conservation, water pollution prevention, and employee outreach and education. To get involved, give our program staff a call and we'll set up a time to do an environmental assessment of your business. After the assessment, you'll receive a report with suggestions to help conserve resources and hopefully save money. To schedule an assessment, or for more information, call 503-365-3188 or visit our website at: http://MCEarthWISE.net

Additional Resources for Businesses:

- The Association of Oregon Recyclers[118] is the premier organization in Oregon for waste prevention and recycling information. They hold an annual conference that is packed with useful information and strategies to help you make your program a success. You'll also establish great networking contacts.
- The EPA Waste Wise Program is a free, voluntary program that promotes the reduction of solid waste through waste prevention, recycling, and the purchase or manufacture of recycled products. Their Internet site[119] offers a list of buy-recycled publications or you can call their helpline: 800/EPA-WISE.
- The National Waste Prevention Coalition[120] is an informal networking organization that works to advance waste prevention— reusing and reducing. It does not generally include recycling.
- The Commercial Waste Reduction Clearinghouse[121] is a DEQ site that includes examples and case studies of waste reduction for a variety of business sectors, including offices, hotels and motels, restaurants, schools, hospitals, and retail.
- The DEQ Packaging Waste Prevention website[122] helps business users of packaging save money by suggesting changes that reduce packaging waste and the environmental burdens of packaging. The focus is on prevention, not recycling. The website includes best practices, case studies, checklists, and other resources.
- The Northwest Materialsmart[123] website helps businesses find online waste exchanges, services that facilitate the reuse of materials between businesses.
- The Natural Step Network organization[124] provides training, support and networking opportunities for businesses interested in "greening" their operations. The Natural Step Framework, a systems-based approach to making business decisions, can help guide your firm to a more environmentally sustainable future.
- In many communities, local business assistance programs provide assistance to businesses that want to reduce waste.

Because they are not everyday occurrences, large meetings and special events present special waste prevention and recycling challenges to even the most conscientious organization[125]. If you are working with an event planner be sure to ask what steps will be taken to reduce waste and recycle. Also voice your interest to the event venue and participating vendors.

It's not just conferences and meetings that produce waste, sporting events, from football games to bicycle and road races, can also be big contributors to the waste stream. The Council

for Responsible Sport[126] provides training resources and certification to help sports organizations improve their environmental and social performance.
Many larger jurisdictions have staff and other resources that can help you plan a greener event. Some communities (including Lane and Clackamas Counties, the City of Florence and the Tri-County Recycling Program in the Gorge) even have easy-to-use recycling and compost collection containers they lend out to organizations to use for special events[127]. These bins make recycling as easy to collect as trash.

Recycling Advocates[128] has published a comprehensive guide on how to reduce waste at events. Download PDF of this publication[129].

There are also private businesses that will help your event go green:

Elysium Events[130]

Garten Services Zero Waste Events[131]

In The Schools

Schools present special challenges and opportunities for those wanting to reduce waste. The Oregon Green Schools Program[132] provides information, tools and support to schools that want to save resources and prevent waste. Find out how your business can partner with local Oregon Green Schools or how to get your school or your child's school signed up by visiting the link above.

Tillamook County Public Works – Solid Waste currently has 3 schools throughout the county participating in the Oregon Green Schools (OGS) Program. OGS is a non-profit organization that began in 1995 to assist Oregon schools in setting up, maintaining, and recognizing effective permanent waste reduction and resource efficiency programs that improve the school environment and community. Participating schools receive educational support, guidance, resources, and recognition for their efforts. For more information on the Green Schools Program visit their website at www.oregongreenschools.org

Tillamook County Solid Waste recently added a recycling coordinator to work directly with schools and community organizations.

Although we've been focusing on how to save resources and money by reducing and reusing, another important element in your plan may be to start a Buy Recycled Program. Recycling only saves resources if products made from recycled material take the place of virgin materials in the marketplace. When you buy products made from recycled materials you are encouraging the development of stable markets for the recycling industry. You'll also be demonstrating your commitment to the sustainable practices favored by many customers.

An element that will shape your plan is whether your organization has centralized purchasing, through a purchasing department for example, or whether each department or person does its own ordering. A centralized Green Procurement program is easier to implement, as you only need to get management support and then get the purchasing staff on board. There are more implementation challenges in a decentralized ordering system: many more people need to be educated about the policy and it is more difficult to track the results of the program. The upside is that more people will become familiar with your firm's environmental goals.

If you're working in a small business or organization, your task will also be simpler than if you work for a large firm. A small business or organization doesn't need an elaborate structure for its program, so it will be easy to get started. Often just letting your vendors know your preference for recycled-content goods will get you on your way.

Researching Buy Recycled Programs

Many of the easiest buy recycled programs to research have been started by governments, including the State of Oregon. Oregon's Buy Recycled Statute ORS 279-545 advocates that state agencies should give preference to materials and supplies made from recycled products if…

- the recycled product is available,
- the recycled product meets applicable standards,
- the recycled product can be substituted for a comparable non-recycled product, and the recycled product costs do not exceed the costs of non-recycled products by 5%.

This statute also states that, under some circumstances, a state or public agency may give preference to the purchase of materials and supplies manufactured from recycled materials even if the cost differential exceeds 5%.

If you are interested in green procurement and want to participate in a national dialogue and information exchange, check out EPPnet[133]. It's a listserv that links public- and private-sector procurement specialists. It provides subscribers with quick access to information, such as: product specifications, vendors, pricing information, and strategies to achieve recycled product procurement goals and federal procurement policies. Originally created with EPA support, the Northeast Recycling Council (NERC)[134] has managed and maintained this listserv for over a decade.

The Recycling Processes module includes additional information about buying recycled items:

- Handy Terms to Know
- Recycled Products Are Not Always Labeled
- Buy Recycled Myths
- Four Reasons to Use Remanufactured Products
- Seven Reasons to Buy Recycled

Buying Recycled Is Good; Buying Less Is Better

As we saw in earlier modules, most of the environmental impact from our production of goods comes upstream, when the raw materials are sourced and the product is manufactured. Remember to always ask the following questions before deciding to purchase an item, even one made from recycled material:

- Does it contain toxic chemicals?
- Is it reusable?
- Is it durable?
- Can it be repaired?
- Can we recycle it?

Hazardous wastes generated by businesses are regulated at both the Federal and state levels. The EPA sets the federal regulations and the DEQ sets Oregon State standards. If your organization produces more than 220 but fewer than 2,200 pounds of hazardous waste per month it is classified as a Small Quantity Hazardous Waste Generator (SQG) in Oregon. SQGs are governed by specific rules for managing and disposing of their hazardous waste. The DEQ publishes a handbook that outlines your responsibilities for proper hazardous waste management[135].

If your organization does not produce enough hazardous waste to be considered a SQG it can generally take advantage of the same hazardous waste management options as households. Check with your local wasteshed representative[136], hauler or local DEQ office to learn if you qualify for this option.

Electronics Recycling

As of January 1, 2010, computers, monitors, and TVs cannot be disposed of in the trash or as garbage at disposal sites, such as landfills, transfer stations, and incinerators. Anyone who knowingly disposes of these items in a landfill or other illegal manner faces legal prosecution and fines.

The DEQ's Oregon E-Cycles Program[137] provides free recycling of up to seven computers (desktops and laptops), monitors, and TVs brought to a participating collection site. (Computer peripherals, such as keyboards and mice, and other types of electronics will be included as of January 2015. It also allows small businesses and small nonprofits to recycle more than seven items at one time. Oregon E-Cycles defines small businesses and nonprofits as having 10 or fewer employees. Tillamook County currently has 3 sites participating in the Oregon E-Cycles program. Please call the collection site ahead of time to inquire about any verification needed and to ensure the collection site has the capacity to handle your items. To find a collection site near you call 1-888-5-ECYCLE (532-9253).

Larger Organizations

Larger organizations can take computers, monitors, and TVs to an Oregon E-Cycles collection site or service for recycling, but they may be charged for items over the seven-item limit. Please call the collection site ahead of time to make arrangements. In addition, the EPA's SMM Electronics Challenge [138] is a great way for organizations to find out about responsible purchasing and recycling options for electronics.

Alternatively, they can contract with a recycler outside of the Oregon E-Cycles program to handle electronics recycling needs. For a list of questions to consider when looking for a responsible recycler visit this website: Telecommunications Industry Association [139] and click the Checklist for the Selection of Electronic Recycling Services PDF.

Although not specifically covered in the Oregon E-Cycles Program, many other types of electronics are accepted by some commercial recyclers, including printers, printer cartridges, cell phones, and almost anything with a cord. If the recycler in your area does not accept these materials, consider mailing them to recyclers that will. For a complete list of electronics recyclers, visit the Oregon Department of Environmental Quality's E-Cycles website.[140]

To learn about other special wastes see the Household Hazardous Waste module.

The options for dealing with organic waste in a business setting are no different from those in a residential setting; the difference is that of scale. Because businesses tend to produce more organic waste (like unneeded or unconsumed food and landscape trimmings) than single residences, many Oregon firms are finding creative ways to use their lawn trimmings, food wastes and other organics to enhance their operations.

Reducing Food Waste

Food waste is a big issue for many in the food and hospitality industries. Many businesses are working to reduce their food waste through a combination of sharpening their purchasing strategy, reducing preparation waste and composting both pre-and post- consumer food waste.

LeanPath[141], a Portland-based company offers food waste tracking software for commercial and institutional kitchens, plus a whole host of other resources for foodservice businesses. SustainableFoodService.com provides useful information and resources on topics as diverse as energy efficiency, food waste reduction and water conversation to help foodservice businesses interested in sustainability issues.

Composting food waste on-site is another option[142].

Food Donation Programs

Local Food Banks can provide alternatives to throwing out unneeded, just-past-pull-date, and slightly blemished food. Some donations can include dairy, deli, produce, meat, bakery, frozen, and bulk items as well as dry goods. Food rescued from farms, public, and produce wholesalers provide even more food to needy residents. To find a food donation program near you, visit Oregon Food Bank.[143]

Gleaners

Most agricultural crops do not ripen evenly during a growing season. This means that usable food may be left in a field following the regular harvest. Many food banks are connected with volunteer-based organizations that will harvest excess or post-picked agricultural crops and then distribute them to the hungry[144].

Your community does not need to be big to have a food bank or other food reuse program. The Oregon Food Bank website can direct you to food donation program near you[145].

You are Protected from Liability When Donating Food

In order to encourage businesses and individuals to share excess food, Oregon State and Federal laws protect donators from liability. Oregon's Good Samaritan laws (ORS Chapter 30.890 and 30.892) and the Federal Good Samaritan law (The Bill Emerson Food Donation Act) state that you cannot be held liable if you donate food you believe to be safe and edible.

The Dealing With Organic Wastes module has more information on how to reduce and compost organic waste.

Multi-Family Recycling

If you are the owner or manager of an apartment or condominium complex of more than five residential units or of five or more manufactured homes in a single facility, you may be required to provide recycling services to your tenants. Even if recycling services are not required, your hauler may provide them as part of your regular service. Check with your hauler or local wasteshed representative to learn about multi-family recycling requirements and opportunities in your area.

Many tenants view recycling services as a benefit. It shows the owner cares about the environment and wants to provide up-to-date services to tenants. A well-marked and -maintained recycling area is viewed as the sign of thoughtful and professional management.

Making multi-family recycling work well requires a little special effort. The centralized

collection area must be well-maintained and the containers must be clearly marked so that users know the correct place to put their materials. Providing new tenants with recycling information and reminding all tenants about how the service works at least once a year will keep everyone on board. Many buildings have one or two residents who are willing to help orient new tenants, answer questions about what and how to recycle and keep an eye on contamination levels. Talk with your most motivated tenants to see if they will help make the recycling system a success and then provide them with brochures and contacts that will help them do it.

Oregon businesses, community centers, houses of worship, schools and other institutions are taking the lead on preventing workplace waste. It's good for employee and member morale, the environment and the bottom line. Many communities have business recognition programs that will provide information and support as well as help publicize your good work. Some of these programs are operated by local governments and others by local Chambers of Commerce or other business groups. As always, check with your local wasteshed representative, garbage/recycling hauler, or city or county solid waste staff to find resources near you.

Chapter 6: Household Hazardous Waste

Household Hazardous Waste

According to the National Handbook on Household Hazardous Waste[146], in 2008 household hazardous waste (HHW) accounted for 0.3 to 0.6% (by weight) of municipal solid waste. That doesn't sound like much until you do the math. Those figures translate into more than one million tons per year! And this is only what's disposed of through trashcans. Household toxic waste that is dumped on the ground, poured down the drain, or burned in the backyard isn't figured in.

The average homeowner can accumulate as many as 100 pounds of household, gardening, and automotive chemicals in the basement, kitchen, bathroom, and garage. If these products are harmful to people or the environment, they are classified as household hazardous waste (HHW) when we dispose of them.

Of course, chemical waste isn't limited to households. Commercial, industrial, and agricultural business may generate hazardous waste, too. These include manufacturers, dry cleaners, service stations, mines, and medical facilities. Hazardous wastes generated by businesses are very strictly regulated. We discuss this waste in the Waste Reduction At Work And Play module.

Household hazardous waste comes in many forms. In the first section, we're going to identify hazardous products, discuss the types of materials commonly found in homes, and explore how to use and dispose of them safely. We're also going to look at safer alternatives to these products that will get the job done while being less toxic to people and safer for the environment.

To wrap up this chapter, we'll take a look at safe and legal ways to dispose of hazardous products. We'll also look at how to dispose of wastes that are banned from landfills or that require special handling, such as tires and medical wastes.

What Is Hazardous?

The Federal Hazardous Substances Act[147] defines a hazardous substance as "one that may cause substantial personal injury or illness during reasonable handling or use, including possible ingestion by children."

To learn if a product is hazardous read the label! Signal words such as Danger, Warning, and Caution are required by law on most products that pose immediate hazards.

- Danger indicates an extremely dangerous product that is poisonous, flammable, or corrosive.
- Warning or Caution indicates products that are somewhat less hazardous, but still require caution in handling, using, and disposing.

Products without these signal words are usually the least hazardous. These labels indicate general hazards. Depending on exposure and sensitivity, even products that don't seem especially hazardous may be harmful.

The chemical industry evaluates toxicity by determining the amount of the chemical that kills 50 percent of the laboratory test animals exposed to the product. You can learn the lethal dose (LD50) of any pesticide by calling the National Pesticide Information Center[148] at 800-858-7378 or by visiting their website.

Product labels provide clues to the specific hazards of the product. Other signal words that reveal chemical toxicity are:

- Flammable/combustible: can easily be set on fire or ignited.
- Explosive/reactive: can detonate or explode with exposure to heat, sudden shock or pressure.
- Corrosive/caustic: can burn and destroy living tissue.
- Toxic/poisonous: capable of causing injury or death.
- Radioactive: can damage or destroy living cells and chromosomal material.

All products should be handled with care. Products marked hazardous should be used with extra caution. Always carefully read the warnings, usage parameters, and follow the directions for safe use.

Products without warning labels are not necessarily safe. Only 7 percent of the more than 3,000 chemicals produced in quantities of more than one million pounds a year have been tested for safety. That means the bulk of chemicals in use haven't been fully evaluated, tested, or had safety measures established. No safety data exists for most of the chemicals in use today.

Not all products are required to list all of their ingredients. Many products are only required to list their active ingredients—the chemicals that do the actual cleaning, for example. This means that hazardous ingredients like stabilizers or propellants that are not directly responsible for the chemical action of the product are not listed.

Combined chemical toxicity level is another potential hazard. Because households often use multiple products with toxic contents at the same time, gauging the effects of exposure is

extremely difficult, if not impossible. Mixtures of some products produce dangerous vapors, explosions, fires, and other hazards.

Many household products contribute to air pollution, making some indoor air more polluted and toxic than the outside air. Children, seniors, and people with respiratory issues are especially vulnerable to air contaminants inside their homes. Since assessing individual sensitivity to chemical toxicity is very difficult, especially when multiple chemicals are in use, the best approach is to avoid toxic products as much as possible.

A wide variety of household products use hazardous chemicals in their formulations. General household product categories include:

- Pesticides: weed killers, herbicides, insecticides, slug bait, flea collars, mothballs, and wood preservatives
- Paints and Solvents: oil-based paints, paint thinner, furniture stripper, varnish, stains, WD-40
- Household Cleaners and Disinfectants: drain, oven, and toilet bowl cleaners; general purpose cleaners, spot removers, disinfectants, deodorizers
- Pool and Spa Chemicals: chlorine, disinfectants
- Polishes and Waxes: floor wax, furniture polish, shoe polish, nail polish, auto wax, metal polish, rubbing compound
- Automotive: motor oil, antifreeze, brake fluid, solvents, batteries
- Mercury and Other Heavy Materials: thermometers, thermostats, fluorescent lamps, energy efficient light bulbs, some types of battery
- Miscellaneous: Glues, aerosols, photographic supplies, computer monitor cleaners, inks, markers, hobby supplies

Fertilizers, pesticides, and other hazardous materials can get into storm drains which empty in our rivers.

Evidence is accumulating that chemicals from some plastics may leach into food with harmful consequences[149].

Problems Caused by Hazardous Products

While Household Hazardous Waste (HHW) currently represents a small percentage of the waste stream, disposal is critical because some chemicals bio-accumulate and even small amounts are harmful to people and can create havoc in the environment.

Products such as pesticides and drain and oven cleaners can burn skin or eyes and cause poisoning or respiratory problems. Exposure to some pesticides, paints, and solvents may produce weakness, confusion, dizziness, irritability, headaches, nausea, sweating, tremor, and convulsions. Repeated exposure to some chemicals can cause cancer or birth defects.

In 2008, U.S. Poison Control Centers reported 2,491,049 non-industrial human exposure cases. Household cleaning products were the third largest group of substances involved in those exposures. An estimated 2 million poisonings go unreported to the Control Centers annually.

In 2009, the Oregon Poison Center at Oregon Health & Science University received 57,811 poison-related calls[150]. Of those, 46,229 were for human exposure to toxic materials. Approximately 39% involved accidental exposures in children under the age of six. Personal care items with toxic chemicals, including cosmetics, perfumes, and nail products, represent the largest category of pediatric exposure substances. Exposure to household cleaners is also common.

Not everyone reads and follows the instructions for the safe use and storage on product labels. For example, homeowners often over-apply pesticides. In fact one study showed that suburbanites apply heavier doses to their lawns than farmers apply to their fields. Fertilizers and pesticides can run off into storm drains, ultimately polluting rivers, streams, and lakes.

Leftover products are often stored indefinitely in the garage or basement. As chemicals age, their ingredients may become more dangerous. When labels fall off or deteriorate, it is impossible to know what a chemical is or how to use or dispose of it safely. Someone may be inadvertently exposed to a dangerous product. Storage also increases fire hazards and puts family members and fire personnel at greater risk from burning chemicals.

When hazardous products are not disposed of properly, they cause a variety of problems. Thrown in the trash, these wastes pose a risk to sanitation workers, who may be injured by acids and fumes that can also cause fires and explosions.

Chemicals poured down the drain can cause serious problems for sewage treatment systems. Some chemicals, such as mercury, can pass unaltered through treatment systems, polluting rivers and streams. These chemicals can then contaminate fish. When we eat those fish, the chemicals can bio-accumulate in our bodies to toxic levels.

Even when properly used and disposed of, household hazardous products can cause environmental harm. Some hazardous products will eventually degrade into harmless elements, but others will not. Disposed in a landfill, even a hazardous waste landfill, they will be more concentrated than if used as directed in the environment. Although modern hazardous waste landfills are state-of-the-art, specially regulated and engineered facilities, there is always the potential for hazardous chemicals to end up where they can cause harm.

Using Hazardous Products

Sometimes there are no satisfactory alternatives to chemical products. When this is the case, it is important to select the products you use with care and follow all of the instructions for safe use. Here are some tips for decreasing your exposure to hazardous chemicals:

Buy Only What You Need

Buy only what you need right now, resist the urge to stock up just in case you might need more. Better yet, why not see if you can borrow some from a friend or neighbor? And if you buy a product and have leftovers, share them with a friend, neighbor, or organization that can use them. Exception: Don't give away old pesticides because they may contain chemicals that have since been banned, such as DDT or Kelthane.

Follow Directions Exactly

Read the warnings and use instructions. Follow the directions carefully.

Wear Protective Clothing and Gear

Poisons can enter your system through your skin, lungs, eyes, and mouth so protect yourself. Gloves, goggles, and long-sleeved shirts prevent direct contact with chemicals and absorption through the skin. Respirators and dust masks prevent inhalation of particulates, mists, vapors, and fumes.

Use Products in Well-ventilated Areas

To avoid breathing fumes, use products outdoors whenever possible. When indoors, open as many windows and doors as possible to provide maximum air circulation. Position a fan between your work area and an open door window so the fan will pull the fumes or vapors away from the work area and circulate fresh air into the room. A kitchen or bathroom exhaust fan or one open window will not provide adequate ventilation. Keep containers tightly closed when not in use to prevent evaporation into the air.

When using an aerosol, be especially careful. The small size of the aerosol particles makes it easy for them to be inhaled and quickly absorbed into the bloodstream. Aerosol cans will explode when exposed to heat or pressure.

Never Mix Products

Mixing chemicals, hazardous or nonhazardous, may start a chemical reaction that could result in toxic fumes, explosions, or mixtures that burn or destroy human tissue.

Store Products Safely

Store unused portions of products in their original containers, tightly sealed. If packages can't be sealed, put the product in a secondary container, mark the container with a permanent marker, and seal with a lid. Tape product information and use from the label onto the new container. Products that emit fumes should be stored outside in a protected area that pets and children can't access.

Store all chemical products out of reach of children and pets. If they do get exposed, read the labels for first aid instructions, and then verify those instructions with a doctor or the Poison Control Center (800-222-1222). First-aid advice and antidotes on product labels are sometimes incorrect or outdated. It is a good idea to post the Poison Control Center number in the areas where you store chemicals.

Use it Up. This is the preferred disposal. To avoid having leftover product, carefully assess how much you need and then buy only that amount. If you have leftover product, store it carefully. Use what you have before purchasing more. Exception: Carefully check labels of stored pesticides. If the chemicals have been banned, such as DDT, consult your wasteshed representative or hauler for disposal instructions[151].

Share with a Friend or Neighbor. If you don't use all of the product, find someone who can use what you have left. Exception: Pesticides more than two years old may be ineffective. Because breakdown of these chemicals may be more hazardous than the original active ingredient, take outdated pesticides to a hazardous waste collection program or event.

Use Separate Collection Programs for Special Products

You don't need to wait for a hazardous waste collection event to dispose of some items that shouldn't go into the trash. Here are some specific materials that require special handling but do not need to be taken to the hazardous waste facility.

Paint Recycling Program

In 2010 a state-wide paint recycling program was initiated by the leading paint manufacturers. Oil based paints, stains and other "architectural paints" are now included in the program, however these paints cannot be recycled so they are instead burned for energy recovery.

Tillamook County performed a trial latex paint recycling mix in May 2014. The recycled paint was made available for low-cost sale through a cooperative effort with CARTM, Habitat for Humanity's ReStore (Bay City), and Tillamook County Public Works. As awareness of this program increased, the County began developing the program, and soon intends to host regional paint collection events. The collected paint is separated by color and then mixed together, resulting in 6-9 shades. This paint is now available on a first come, first serve basis. Since it is a combination of interior and exterior paints, it should be used for projects that are outside or in well-ventilated areas.

Computer Recycling

It is now illegal to throw away televisions, monitors, CPU's or laptops in Oregon. These items, however, can be recycled in cities throughout Oregon with populations greater than 10,000. At the Tillamook County Recycling & Transfer Stations, accepted items include televisions, monitors, CPUs, printers, modems, mice, graphics/sound cards, keyboards, scanners, telephones, stereos, microwaves, and computer related peripherals. (Pacific City Transfer Station accepts them for a fee.) Remaining items are typically de-manufactured, which means that they are torn apart and recycled, with valuable resources such as copper and gold extracted from the parts.

Fluorescent Light Bulb Recycling

Residents can take up to 10 fluorescent light tubes or bulbs to the HHW events at TTS and recycle them at no charge. The glass, metal, and hazardous mercury phosphor powder are removed and recycled.

Conditionally exempt businesses are able to recycle fluorescent bulbs at the CEG events, held 2-3 times a year at the HHW facility at the TTS. Click here for more information on Oregon recycling laws[152].

Unsafe Disposal Methods:

- Flushing hazardous waste down drains or toilets
- Pouring them down storm drains
- Emptying containers on driveways and streets
- Dumping them illegally is never appropriate or safe

To understand why none of these options are safe, it is helpful to understand what happens to waste when it "goes away." Diluting or flushing hazardous chemicals down the drain or toilet is not safe for several reasons. In some Oregon cities with older drain systems, rainwater run-off is sometimes combined with sewage in the sewer system. When there is a lot of rain, the pipes can overflow, causing the waste fluids to go directly into nearby rivers. Pouring hazardous material down the drain or onto the ground in these areas is essentially like pouring them directly into the river.

At sewage treatment plants, bacteria are used to break down organic solids in the water. Most toxic wastes can't be broken down in this way, so they remain hazardous and can damage the treatment plant and kill the helpful bacteria needed to treat sanitary waste.

If your home is on a septic system, flushing chemicals down a drain or toilet is also not safe. Toxic substances kill the helpful bacteria in the tank and percolate through the drain field into the soil, where they contaminate ground water and local wells.

Never put hazardous products or their empty containers into recycling bins. Empty pesticide, herbicide, and rodenticide containers should be triple-rinsed, and the rinse water used just as the original product was used, per the directions on the containers. Even when triple-rinsed, these containers still contain residue, so dispose of them in the trash. Containers that held hazardous waste products should never be recycled through the curbside recycling program although there are periodic collection events where they are collected for free.

Tillamook County Household Hazardous Waste Collection Facility

The Household Hazardous Waste Collection Facility (HHW)[153], located at the Tillamook Recycling and Transfer station (TTS)[154], accepts household hazardous waste materials for free from residents, regardless of which county they live in. Hazardous waste can be delivered on the regularly scheduled collection

events. Small businesses can also use the facility for a fee but must schedule an appointment by calling 1-800-547-236 x2523. In 2013, the HHW Facility was visited by 844 customers during the year. A total of 94,608 pounds was collected in 2013. Master Recyclers can help educate the public and direct traffic so keep this in mind as a volunteer payback opportunity!

What Happens to Hazardous Waste When It's Collected?

The waste collected from special events or at hazardous waste facilities is handled in several ways. In some cases, containers that are in good condition and still contain usable product are donated to nonprofits for use in their operations. Wastes that can be recycled, such as antifreeze, are sent for reprocessing. Some flammables are burned as fuel in special facilities. Still other items are sent to special high-heat incinerators to be destroyed. The remaining hazardous waste materials are packaged in special containers and sent to special hazardous waste landfills that are designed and licensed to manage toxic wastes with as little negative impact to the environmental as possible.

At this point in time, hazardous products are commonly used, and sometimes there are few alternatives. However, we can do as much as possible to reduce our dependence on them. And when we must use them, we can handle and dispose of them with care and prudence to protect people, our communities, and the environment.

Alternatives to Hazardous Products

The best way to prevent the hazards of household chemicals is to not use them, or at least reduce their use. By not purchasing chemical products, consumers not only protect their families and the environment, they also send a message to manufacturers to produce fewer toxic products.

- In addition to avoiding hazardous household products, it also helps to examine some aesthetic assumptions:
  - Lawns can be attractive without looking like putting greens.
  - Toilets can be clean without the odor of disinfectants.
  - Furniture and floors can be handsome and clean without being shiny.

Alternatives to Hazardous Chemicals

For this...	Try this...
All purpose cleaner	1 tsp liquid soap, 1 tsp borax, 1/4 cup vinegar, and 1 quart warm water. Or 1/4 cup white vinegar with 1 quart warm water.
Brass polish	Paste of equal parts vinegar, salt and flour. Be sure to rinse completely afterward to prevent corrosion.
Car battery corrosion removal	Baking soda and water
Chrome	Vinegar polish
Coffee cup stain removal	Rub with moist salt or baking soda.
Crayon mark remover	Rub mark with toothpaste and a damp cloth. Do not use on non-vinyl wallpaper.
Decal removal	Soak in hot water if practical; otherwise use white vinegar.
Dishwashing	Washing dishes by hand with a liquid soap or mild detergent is preferable to using strong electric dishwasher detergents. Look for detergents without phosphates or chlorine.
Disinfectants	Mix 1/2 cup borax with 1 gallon of boiling water. Or undiluted white vinegar.
Drain cleaner	Try plunger first. Then pour 1/2 cup baking soda down, then 1/2 cup vinegar; wait a few minutes, then follow with 2 quarts boiling water. Repeat if needed. If this fails, rent or buy a drain snake. Use solution weekly to prevent buildup.
Furniture polish	Olive oil or almond oil.
Garbage disposal deodorizer	Used lemons or baking soda
Grout and stain cleaner	Paste made of baking soda and water, clean with toothbrush, spray with vinegar and water mix and after foaming is finished, rinse with water.
Hand cleaner for paint/grease	Baby oil or margarine, then wash with soap and water.
Laundry detergent	1/2 cup white vinegar or baking soda or borax per load. Or laundry soap or a liquid detergent with low or no phosphate. A tablespoon of vinegar in the rinse increases the brightness.
Linoleum cleaner	1 cup white vinegar plus 2 gallons water floor
Linoleum floor polish	Polish with skim milk (it doesn't smell, milk evaporates!)
Mildew remover	A non-chlorinated scouring power cleans mildew stains from grout. Scrub hard.
Moths (in clothes)	Thoroughly clean any used clothing or furniture before introducing into home. Wash woolens before storing; store in tight container with cedar chips, newspapers or lavender flowers instead of mothballs). Vacuum rugs, behind ad under furniture. Shake out woolens periodically.
Oven cleaner	As preventative measure, cover the oven bottom with a sheet of aluminum foil. Clean up spills promptly. To clean, use baking soda, soap and water with a copper scrubber and lots of elbow grease. Or use a non-chlorinated scouring powder or non-caustic oven cleaner.
Paint (oil based)	Latex paint, avoid aerosols
Porcelain stain removal	Brush with baking soda
Refrigerator deodorizer	Open box of baking soda
Carpet cleaner	Sprinkle baking soda, then vacuum. Or clean immediately with soda water or baking soda paste, then vacuum.
Scouring cleanser	Baking soda or borax. Or rub area with ½ lemon dipped in borax rinse and dry.
Silver cleaner	Rub gently with baking soda and damp sponge (large items)
Stain removal	For small objects place in pot of water on stove with small piece of aluminum foil; add 1 tsp baking soda and 1 tsp salt: boil 2-3 minutes. Or rub gently with toothpaste on a cotton ball.
Stainless steel cleaner	Depends on kind of spill. Treat as quickly as possible and blot as much liquid as you can with paper towel or cloth (don't rub). For most stains, safest to try cold water first, then hot water with a little detergent.
Toilet cleaner	Baking soda
Tub and tile cleaner	Baking soda or borax or soak with white vinegar
Vinyl floor cleaner	Use vinegar (full strength) on a sponge, then use baking soda as a scouring powder. Rinse well
Wine stain removal	1 gallon warm water and ½ cup white vinegar or ¼ cup borax water or rubbing alcohol
Window cleaner	½ cup vinegar in 1 quart warm water, wipe with crumped newspaper

Prevention

One way to reduce hazardous chemical use is to prevent problems from occurring in the first place. Treating spots as soon as they occur, pouring baking soda on fresh spills in the oven, and periodically pouring baking soda and vinegar down drains are all ways of avoiding situations where only harsh chemicals will work.

The Washington Toxics Coalition's "Alternatives"[155] fact sheets detail ways of preventing problems caused by household pests like fleas, moths, spiders, ants, flies, and cockroaches. Other "Alternatives" sheets help with yard and garden issues, such as selecting and caring for plants that resist diseases and weeds. Planting to attract birds and insects that prey on pests can help as well.

Vacuuming is the principal nonchemical control method for clothes moths. Be sure to remove cushions from stuffed furniture and reach into crevices. Immediately remove and discard the vacuum bag.

Less Toxic Alternatives

There are lots of publications that contain tips and recipes to help you avoid toxic products in your home. Check out the following safer alternatives and publications.

Paint

Use water-based acrylic or latex paints whenever possible. Because they do not require the use of toxic paint thinner, they are safer than oil-based paints to use, clean up, and dispose of. There are now no- or low-volatile organic compound (VOC) paints on the market. These contain few or no solvents, thus minimizing toxic off-gassing. Avoid aerosol spray paints whenever possible.

When paint thinner or turpentine must be used, buy only what you need. If there is leftover product, store it in a sealed jar to allow the particles from the paintbrush to settle. Carefully pour the clear liquid into a clean jar, seal it, label it, and store in a safe place. Seal the toxic particles in a jar and dispose of properly at a hazardous waste facility or collection event.

Pesticides

Commercial alternatives to pesticides are becoming more available on the market[156]. These include insecticidal soaps and biological treatments, such as a spray of Bacillus thurengensis (Bt) for tent caterpillars and gypsy moths, or an application of nematodes for cabbageworms.

Resources for these alternatives include a number of different fact sheets from the Washington Toxics Coalition[157]. Tillamook County Master Gardeners can help you identify solutions to common garden woes.

Household Cleaners

Alternatives to hazardous cleaning products have been used successfully for generations[158]]. Most jobs can be done with a few basic ingredients. A good way to get started is to set up your own safe cleaning kit that includes baking soda, salt, vinegar, borax, soap, and vegetable oil. If you prepare your own recipes, you may want to keep them in handy spray bottles. Don't forget to list the ingredients on the label. Always use caution when combining cleaning ingredients.

It's not just the cleaning ingredients in a product that can create problems, chemical fragrances added to make products smell "clean" and "fresh" can also be hazardous.

The alternative products listed are often safer for your health and the environment. However, keep in mind that some may still present hazards if not used properly.

The Hazardless Home Handbook provides information on common hazardous ingredients, potential hazards, responsible use and storage, proper disposal and safer alternatives for most common hazardous household products. A reference section and a glossary are included.

Building and operating permanent household hazardous waste collection and storage facilities or holding periodic household hazardous waste collection events is expensive. Tillamook County is proud to have the only HHW facility on the Oregon coast offering environmentally sound disposal options for county residents at no charge.

Third-party Certification

To be sure the product you're using is the least toxic available, look for third-party vertification/verification. Green Seal[159] and EcoLogo[160] are among the most respected, independent nonprofit organizations that certify environmentally responsible products. They review a wide array of cleaning products and offer verification that products have met strict environmental standards. Look for the logos below when purchasing cleaners you're your home or work[161]. Click on the following links for more information about these organizations:

	Green Seal: http://www.greenseal.org/
	EcoLogo: http://www.ecologo.org/en/abouttheprogram/
Design for the Environment U.S. EPA	**EPA Design For The Environment: http://www.epa.gov/dfe/**

10 Steps to Protect Your Family's Health and the Environment

Removing toxic products from our homes is a process of gradual re-education. Toxic products have found their way onto our shelves over a period of years, so it may take awhile to change our habits. Start with these 10 strategies to reduce household toxics around your home:

1. Reduce or Eliminate Pesticide Use

- No preventive applications, "weed 'n' feed," or calendar application.
- Reassess your tolerance for each type of pest.
- Learn about pests and how to target them effectively.
- Plant resistant species and maintain plant health.
- Use non-chemical controls first.

2. Examine Your Painting Needs

- Use latex or water based paints whenever possible.
- Buy only what you need and use it all up or give it away.
- To estimate how much paint you need, use a paint calculator[162].

3. Use Wood Preservatives Only When Necessary

- Don't use a wood preservative if water repellant will do.
- Don't use wood treated with creosote or penta.

4. Use and Store Cleaners Wisely

- Use heavy-duty cleaners only for heavy-duty jobs.
- Clean more often so that dirt is easier to remove.
- A little extra elbow grease will reduce the amount of solvents needed.

5. Avoid Aerosol Products

- Wipe-on applications are safest.
- Use pump sprays, avoid propellants.

6. Avoid Chemical Air Fresheners

- Address specific causes of odors.
- Use baking soda to soak up unwanted odors.
- Use flowers, sachets, or simmer cinnamon in hot water to mask odors.

7. Reuse Solvents

- Use Water-based Products When Possible
- Buy or Rent a Hand Snake for Unclogging Drains

10. Read Product Labels and Buy Accordingly

- Look for signal words, such as Caution, Warning, and Danger. Buy the least-toxic products you can find.
- Avoid products that contain chlorinated compounds, petroleum distillates, phenols, and formaldehyde.

Special Wastes

Oregon DEQ defines special wastes as materials that require special management or handling. Do not put them in your trash. Use the information and links below to learn how to properly
dispose of them.

Sharps

Sharps (syringes and needles) and other medical items do not belong in either the trash or the recycling[163]. Sharps include needles, IV tubing with needles attached, scalpel blades, lancets, glass tubes and slides, and syringes. It is illegal to dispose of sharps except in approved sharps containers. These containers must be rigid, leak-proof, puncture resistant, sealed, and clearly marked with the biohazard symbol. In Tillamook County sharps can be taken to Nestucca Valley Sanitary Service in Hebo, City Sanitary Service in Tillamook and north county residents may contact Recology to arrange disposal. Call the individual companies for prices and other details.

The population of the U.S. is aging and more people are receiving medical care in their own homes. This has led to confusion about how to dispose of medical plastics. All medical items, except sharps, belong in the trash, not the recycling**.** IV tubing, empty IV solution bags, and related items should be put in the trash—but only after all liquids and bodily fluids have been cleaned or flushed out of them.

Asbestos

Asbestos is a hazardous air pollutant and known carcinogen. There is no safe level of exposure to asbestos[164]. DEQ and other air quality agencies strictly regulate the handling, removal, and disposal of asbestos-containing materials to prevent asbestos fibers from entering the air and the lungs[165]. The DEQ provides information on how to identify and remove asbestos from your home.

Contaminated Soils

When property owners replace or remove underground oil tanks, they may discover that the old tank leaked. Soil that has been contaminated with oil may have legally mandated handling and disposal requirements. The DEQ has a publication outlining disposal options for contaminated soils, be sure to check with them for proper handling procedures[166].

Lead Paint

If you are remodeling or repairing a building built before 1978, you may be exposing yourself to unsafe levels of lead. Renovation and painting activities such as sanding, cutting, and

scraping can create and spread lead-tainted dust, which can cause lead poisoning. These activities were the cause of almost half of childhood lead poisoning cases investigated in Oregon.

When working on property built prior to 1978, use special care. When sanding or sawing, be sure to contain sanding dust within the room, wear a good respirator and protective gloves, and vacuum thoroughly when finished. Debris that contains lead-based paint must be disposed of as hazardous waste in a certified landfill. It should be taken to a hazardous waste facility or collection event. Beginning April 2010, contractors performing renovation on homes, child-care facilities, and schools built before 1978 must be certified and follow specific work practices to prevent lead contamination[167].

Items Banned from Landfills

Over the years, Oregon lawmakers have banned certain items from landfills in the state. The intent of the bans was to keep reusable or recyclable materials out of the landfill, especially items that are toxic and can harm the environment. Junk vehicles, home and industrial appliances (white goods), motor oil, tires, and lead-acid batteries were banned over a decade ago. In 2010, four items were added to the ban: televisions, desktop computers, laptop computers, and monitors. There are fines for disposing of these items in the trash. Luckily, disposing of them legally is fairly straightforward. In 2015 additional items will be added to the list of banned electronics, including printers, keyboards, mice, etc. Consult your solid waste service provider for more information.

White Goods (Metal Jacketed)

Water heaters, dishwashers, washing machines, clothes dryers, and similar items contain large amounts of recyclable metal. Refrigerators, freezers, and air conditioners contain Freon, a federally regulated and dangerous air pollutant[168]. Scrap metal dealers, most landfills, and transfer stations usually accept these items for their scrap value. A processing fee may be charged to pay for removing the non-recyclable parts and to handle the hazardous materials appropriately[169]. Scrap metal recyclers and trash haulers may also haul these items away for a fee.

Motor Oil

Motor oil is recyclable at the TTS and MTS and the HHW events. If the oil has been mixed with anything, it must be disposed of at the household hazardous waste collection event.

Tires

According to the DEQ, Oregonians throw away approximately four million tires per year. Why are old tires such a waste problem? Piles of tires can accumulate rainwater, and become breeding grounds for mosquitoes that carry diseases such as the West Nile virus. Large tire piles can catch fire, causing air and water pollution, and tire piles are just plain ugly. Tires are also a problem at landfills because they don't stay buried; their shape and weight cause them to continually work their way to the surface.

Tires are generally easy to dispose of properly. Some transfer stations and drop-off depots, and many high-volume tire dealers accept used tires for recycling; they often charge a fee for this service. Oregon's disposal ban refers to whole tires. When cut to certain size, tires may be disposed in permitted disposal facilities.

Lead-acid vehicle batteries

Lead-acid batteries from cars, boats, motorcycles, and other uses are banned from Oregon landfills because of the toxicity of the internal acid. For disposal, businesses that sell lead-acid batteries are required to accept the old, replaced batteries for recycling. You can trade in as many used lead-acid batteries as you purchase. Lead-acid or car batteries can be brought to a HHW collection event.

Electronic Waste (E-waste)

Electronic wastes are the newest items to be banned from the landfill. Effective January 1, 2010, computers, monitors and TVs cannot be disposed of in the trash or as garbage at disposal sites such as landfills, transfer stations, and incinerators. In 2015 additional items will be added to the list of banned electronics, including printers, keyboards, mice, etc. Anyone who knowingly disposes of these items in the garbage will face prosecution and fines.

The purpose of the ban isn't to make it difficult to clean out your stash of electronics but to promote reuse or recycling of electronics and their components. Reusing and recycling saves energy, conserves resources, reduces greenhouse gas emissions, and softens environmental impacts. Responsible recycling keeps heavy metals and other dangerous components from entering the environment or poisoning workers.

The DEQ's Oregon E-Cycles Program provides free recycling of desktop and laptop computers, monitors, and TVs to anyone bringing seven or fewer items to a participating collection site. Computer peripherals, such as keyboards and mice, and other types of electronics will be included in this program as of January 1, 2015.

Oregon E-Cycles requires electronics manufacturers to provide responsible recycling for computers, monitors, and TVs. This is product stewardship in action! In addition to providing recycling, Oregon law outlines other requirements for manufacturers and retailers. To learn more about the E- Cycles program or to find the collection center near you, check out the Oregon E-Cycles program page[170]. The requirement that items collected through the E-Cycles Program be responsibly recycled is especially important[171]. For years, massive amounts of electronic waste have been sent to China and other developing countries for recycling. The environmental standards and worker safety requirements in those countries are either low or not enforced. The result? Pollution, and people who have been poisoned or sickened from handling hazardous waste.

Although not specifically covered in the Oregon E-Cycles Program, many other types of electronics are accepted by some recyclers including printers, printer cartridges, cell phones, and almost anything else with a cord. If the recycler in your area does not accept these

materials, consider mailing them to a recycler that will. For a complete list of electronics recyclers, visit the Oregon Department of Environmental Quality's[172] website.

Things to Remember When Recycling Your Computer:
Erase all hard drives. Oregon E-Cycles assumes no liability for personal or confidential information left on computers. It is recommended that you erase all data before recycling. Reformatting your drive or deleting files does NOT destroy your data. Contact your favorite computer technician for information on how to do this[173].

Call ahead if you have large or heavy items. If you have large or heavy items (e.g. console TVs), please call ahead to ensure the collection site has capacity to handle your items.

More Items Requiring Special Handling
The following materials are not banned from landfills or waste-to-energy facilities in Oregon unless they come from businesses that produce more than 220 pounds of hazardous waste per month. However, they do require special handling for safety. Check with your local waste haulers to learn how to dispose of them properly.

Household Battery Recycling
Although used batteries are a small percentage of the solid waste stream, they are a concentrated source of heavy metals, including cadmium, lead, and mercury that can harm humans and the environment. The best choice is to use rechargeable batteries whenever possible. They save money and resources.

Used household batteries can impact the environment by leaching into our air and water when disposed of improperly.
Small batteries may look innocent, but they are made from metals like mercury, nickel, cadmium, silver, and zinc. Recycle the following used batteries through this program: Flashlight, toy, and smoke detector batteries--sizes AAAA through D and 9-volt cells; Lantern batteries, 6 volt through 9 volt; Rechargeable battery packs - NiCd, NiMH, or Lithium Ion; Hearing aid, calculator, and watch batteries - small button cells.
NO lead-acid vehicle batteries. These batteries can be recycled through the HHW program.

Pharmaceuticals

Concern about trace amounts of medicines and personal care chemicals in surface water has been increasing since a 2001 USGS study found that 80% of the streams, rivers, and lakes across the US were polluted with these micro-contaminants. The chemicals include the painkillers acetaminophen and ibuprofen, prescription medicines for cardiac disorders and hypertension, and female sex hormones used in birth control pills and hormone replacement therapy. In addition to medications, caffeine and cotinine, a nicotine breakdown

product, were among the most frequently detected compounds.

Rounding out the list of most frequently detected compounds were the insect repellant DEET, the active ingredient in antimicrobial soaps and detergents (triclosan), a flame retardant (trichloroethyl phosphate), and a detergent breakdown product with endocrine disruptive properties (4-nonylphenol). These contaminants were also detected in landfill leachate, which, as in the case of Southern Oregon's Short Mountain Landfill, is often sent to public wastewater treatment plants for treatment and released into the waterways.

There is currently no definitive proof of harm to humans from these trace chemicals, but evidence is increasing that they can cause birth defects and reproductive damage in frogs and fish as well as other wildlife[174,175].

"The main way drug residues enter water systems is by people taking medications and then naturally passing them through their bodies," says Raanan Bloom, Ph.D., an Environmental Assessment Expert in FDA's Center for Drug Evaluation and Research. "Most drugs are not completely absorbed or metabolized by the body, and enter the environment after passing through waste water treatment plants."

Sewage treatment systems were designed to process harmful bacteria, not to remove man-made chemicals. Wastes from animals treated with antibiotics and growth hormones as well as agricultural chemicals are also sources of this pollution[176].

Although little can be done to reduce the amount of the chemicals secreted by humans, we can stop putting outdated and unused medications down the drain or directly into the garbage.

The Food and Drug Administration (FDA) has issued the following guidelines to safely dispose of medicines[177]:

1. Take medications out of their original containers and mix them with an undesirable substance such as used coffee grounds or kitty litter. The medication will be less appealing to children and pets, and unrecognizable to people who may intentionally go through your trash.

2. Put them in a sealable bag, empty can, or other container to prevent the medication from leaking or breaking out of a garbage bag.

Most Tillamook County police departments accept pharmaceuticals during office hours[178]. Phone ahead to be sure before planning your trip. Be sure all personal information is removed from containers. For safety and convenience, please leave the medication name visible.

The following items are accepted: prescriptions, over-the-counter medications, vitamins, medication samples, medication for pets, ointments, lotions and liquid medications that are contained within a leak proof container.

The following items are NOT accepted: Needles (sharps), thermometers, bloody or infectious

waste, medications from businesses/clinics/pharmacies/hospitals, hydrogen peroxide, aerosol cans and inhalers.

Items Containing Mercury

Mercury is a toxic metal. It can travel great distances when airborne and enters watersheds through rain. It bio-accumulates in the food chain and can stay in the environment for 30 years or more. It builds up in living tissue and can cause poor health. Children's growth and development may be permanently damaged by mercury exposure because it can affect memory, hearing, vision, learning ability, speaking, behavior control, and cause tremors and damage to the central nervous system.

Mercury Thermometers and Thermostats

Every year, Oregonians throw thousands of mercury-containing thermostats [179]and thermometers in the trash making them one of the largest sources of mercury in our landfills.

Take thermometers and thermostats that contain mercury to a hazardous waste collection facility or collection event. Do not put them in the trash. They can be easily broken and the mercury will be released into the environment to contaminate the air, water and ground. Businesses, governments, and institutions can use the Thermostat Recycling Corporation collection program[180].

Fluorescent Lights

Fluorescent lights, including energy efficient compact fluorescents bulbs, provide tremendous energy savings and last much longer than other lights bulbs. They contain mercury, so care should be used so they are not broken. The "DEQ estimates that more than 6 million fluorescent bulbs are disposed of each year in Oregon, and only 2 percent of household lights and 30 percent of commercial lights are recycled."

Burning coal generates 8% of Oregon's electricity and mercury is a byproduct of this process. Even though fluorescent lights contain small amounts of mercury, they use approximately one- fourth as much electricity as standard incandescent light bulbs. These lights are so energy efficient that the mercury in the bulbs is more than offset by the reduction in mercury emissions at the generating facility.

Residents can take fluorescent light tubes or bulbs to the HHW collection events for no charge. The glass, metal, and hazardous mercury phosphor powder are removed and recycled. Conditionally exempt businesses can recycle fluorescent bulbs through a CEG collection.

Lamp/Light Ballasts

Light ballasts are the primary electrical components of fluorescent light fixtures. They are generally located within the fixture under a metal cover plate. Lamp ballasts manufactured prior to 1978 likely contain polychlorinated biphenyls (PCBs). These ballasts contain

approximately 1 to 1½ ounces of PCBs. If the ballast fails, PCBs may drip out of the fixture.

PCBs are very toxic. When released into the environment, they persist for many years and bio-accumulate in organisms. Studies have shown that PCBs cause cancer in animals, and repeated exposure to PCBs causes reproductive and developmental damage. Exposure to PCBs also can cause liver damage, nausea, dizziness, eye irritation, and bronchitis in humans.

Lamp ballasts manufactured from 1978 and after should display a "No PCBs" sign. Ballasts that do not contain this statement probably contain PCBs and should be handled carefully.

Take all ballasts containing PCBs (or ones you suspect might contain them) to hazardous waste collection facilities or events. Businesses should contact a company that specializes in handling hazardous wastes or fluorescent lights.

Ballasts that do not contain PCBs may be recyclable as scrap metal.

Latex and Oil-Based Paints

House paint is the largest component of many HHW collection programs. An estimated 75 million gallons of paint sold each year is unused. Oil-based paint is considered hazardous; latex (water-based) paint has a very low toxicity.

Oregon's 2009 Paint Product Stewardship Law[181] established the nation's first manufacturer-financed system for managing leftover house paint. To sell paint in Oregon, manufacturers must contribute financial support to a convenient, statewide system to collect post-consumer paint. The law was enacted to promote the reuse, recycling, energy recovery, or safe disposal of an estimated 800,000 gallons of leftover paint each year.

Taking this paint out of the hazardous waste management system is expected to save Oregon more than $6 million annually.

Tillamook County performed a trial latex paint recycling mix in May 2014. The recycled paint was made available for low-cost sale through a cooperative effort with CARTM, Habitat for Humanity's ReStore (Bay City), and Tillamook County Public Works. As awareness of this program increased, the County began developing the program, and soon intends to host regional paint collection events. The collected paint is separated by color and then mixed together, resulting

in 6-9 shades. This paint is now available on a first come, first served basis. Since it is a combination of interior and exterior paints, it should be used for projects that are outside or in well-ventilated areas.

Oil based paints, stains and other "architectural paints" are included in the PaintCare program, however these paints cannot be recycled so they are instead burned for energy recovery.

Antifreeze

Antifreeze is a common engine coolant used in vehicles. Usually containing ethylene glycol or propylene glycol, antifreeze is toxic to humans and pets. The chemicals pollute surface and groundwater if not disposed of properly. Do not pour antifreeze on the ground, into septic systems, or into storm drains or streams. If your local transfer station doesn't accept antifreeze for recycling, take it to a hazardous waste collection event or facility. For businesses that use antifreeze, there are several companies that will recycle antifreeze.

Potentially Hazardous Waste

The Environmental Working Group is a nonprofit organization dedicated to dispensing information to people to protect public health and the environment. They conduct and publish research about the chemicals in products we use every day, including cosmetics and food. For information on this organization, their goals, and their philosophy, go to their website: http://www.ewg.org/ They also offer downloadable shopping guides.

Summary

Many of the products we use every day can contain hazardous chemicals. Always read the labels of cleaning supplies, garden chemicals, paints, solvents, automotive products, and other chemicals you use around the house. If the label says Danger, Warning, Caution, or Poison, the product is hazardous and can hurt you and the environment. Always use and store hazardous products according to the safety directions on the label. Or better yet, find safer alternatives to these products[182].

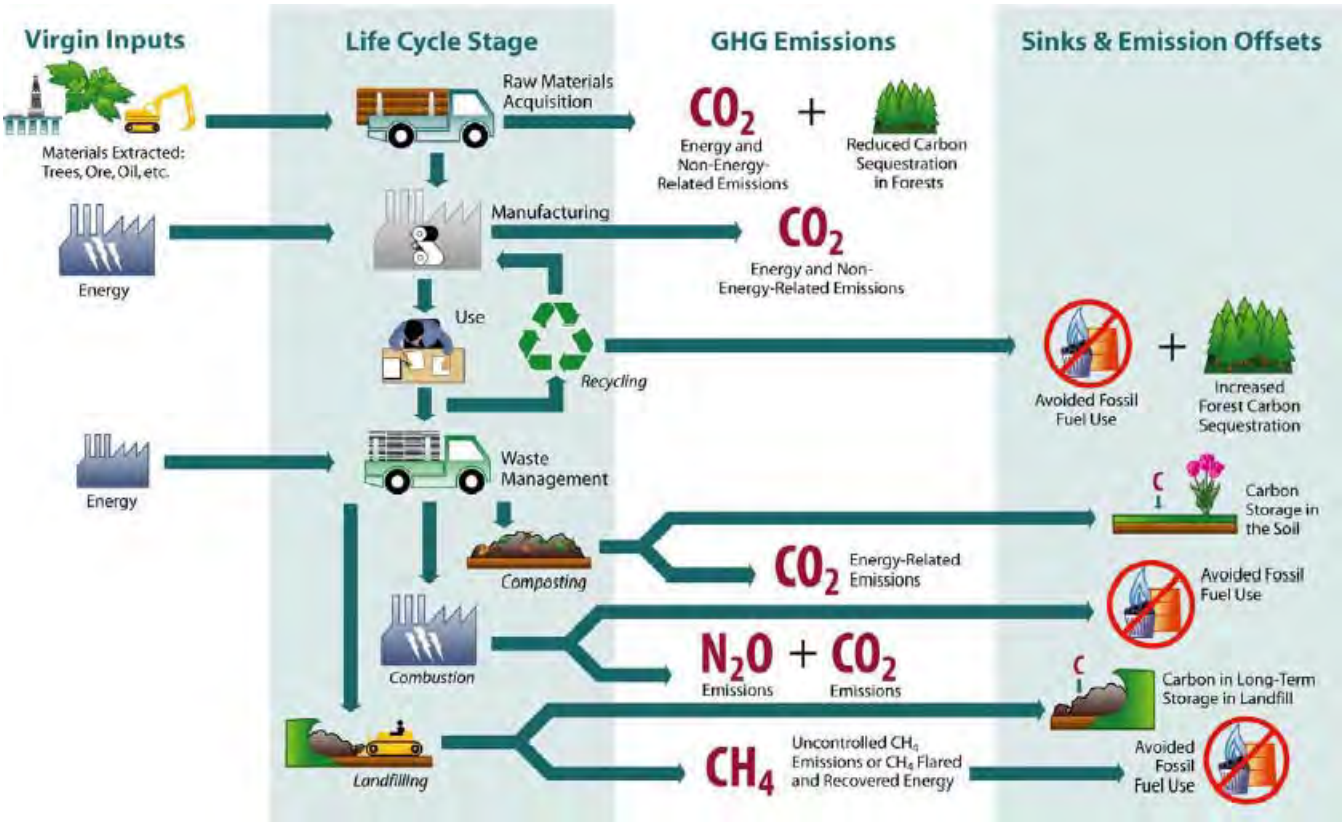
Do not pour these products down the drain, on the ground, or flush them down the toilet. They can pollute streams and groundwater; damage sewage and septic systems; and kill fish and other animals. If you are not going to use up a hazardous product, give it to a friend or neighbor who will, or take it to a hazardous waste facility or collection event where it will be disposed of safely.

A number of items have been banned from Oregon landfills. These include medical sharps, motor oil, tires, computers, televisions, monitors, lead-acid batteries, refrigerators, asbestos, and oil contaminated soil. These require special handling.

Finally, there are items, like antifreeze, lamp ballasts, paint, and products containing mercury that require special handling and disposal.

Whenever possible, avoid the use of hazardous products. Using safer alternatives will help preserve the health of our families and our environment—and many of them can save you money, too!

Chapter 7: Sustainable Materials Management



Sustainable Materials Management

In this module, we explore the concept of Sustainable Materials Management (SMM), a new way of looking at how we use our resources to make, transport, use, and dispose of our "things." We'll discuss what SMM is, why it matters, and how it fits with what you have been learning in the class. Then we'll briefly explore a couple of philosophical frameworks for understanding resource use. Next we'll look at Life Cycle Analysis, a tool that helps evaluate the health and environmental impacts of the products we use. We'll also explore the tools and practices businesses and governments can use to make our use of materials more sustainable, including Product Stewardship, supply chain management, and, of course, recycling.

What is Sustainable Materials Management?

Sustainable Materials Management (SMM) is an analytical framework that is being developed by the US EPA in conjunction with the Oregon DEQ and other organizations. This perspective looks at the entire life cycle of a product. It aims to understand the total amount of resources used to produce, transport, use and recycle, or dispose of that product, and then assess methods to reduce the environmental impacts of those resources.

By looking at the entire life cycle of a product, not just at its disposal, an SMM perspective provides a more thorough understanding of the environmental costs and benefits of our activities. It allows us to look at the total picture of a material's environmental costs and benefits and helps us evaluate our choices in a comprehensive way.

The SMM framework is useful for public policy makers, planners, and the elected officials they inform because it keeps the focus on the big picture and encourages a systems-based approach to finding solutions to environmental challenges. This model is also useful for businesses that want to be part of a sustainable future.

But it is also useful for everyday people. As we saw in the Thoughtful Consumption module, understanding the total impacts of our life choices helps us prioritize our actions and put our efforts where they will make the biggest difference. This means that we can focus our energies on solving our environmental challenges, and not waste valuable time on ineffective strategies. The E-commerce packaging study later in this module shows that when a product is put into this broader perspective, our basic assumptions about waste may be challenged.

Why Does SMM Matter?

In June 2009, the US EPA developed a report entitled Sustainable Materials Management: The Road Ahead. This report advocates a shift away from looking just at what we throw away to evaluating the total system impacts of our materials and products, including sourcing, producing, and disposing of them. The report states:

- In the past 50 years, humans have consumed more resources than in all previous history.
- The U.S. consumed 57% more materials in the year 2000 than in 1975; the global increase was even higher.

- With less than 5% of the world's population, the U.S. was responsible for about one-third of the world's total material consumption in 1970-1995.
- In 1900, 41% of the materials used in the U.S. were renewable (e.g., agricultural, fishery, and forestry products); by 1995, only 6% of materials consumed were renewable. The majority of materials now consumed in the U.S. are nonrenewable, including metals, minerals, and fossil fuel derived products.
- Our reliance on minerals as fundamental ingredients in the manufactured products used in the U.S.—including cell phones, flat-screen monitors, paint, and toothpaste—requires the extraction of more than 25,000 pounds of new nonfuel minerals per capita each year.
- This rapid rise in material use has led to serious environmental effects such as habitat destruction, biodiversity loss, overly stressed fisheries, and desertification.

The report goes on to say that world population is expected to grow by 50% between 2000 and 2050 and that global economic activity is projected to grow 500% during the same period. As we discussed in earlier modules, the origin of the materials we use has a broader impact upon the Earth's resources than our disposal of them. With the global economy rapidly expanding, those impacts will severely strain the Earth's ability to support human and other life. The clash between human desires and the Earth's ability to fulfill them is one of the most important challenges we are facing today.

As we have seen in earlier modules, much of what we produce is made inefficiently or is discarded after only one use. We must learn to use our resources wisely and to design items more effectively. By supplying us with the total environmental and health impacts of the products we use, the SMM perspective allows us to choose better ways to design, build, and use products.

One of the benefits of an SMM perspective is that it allows us to consider the externalized costs and benefits of a product or service. Externalized costs are those related to an activity or product that are not directly included in the price that is paid for that product or activity.

An example of externalized costs involves water pollution. Some agricultural practices involve the use of chemical pesticides and fertilizers or require that animals be kept in highly confined areas where their wastes accumulate in vast "lagoons." These practices often result in water that is polluted with toxic chemicals. This polluted water may adversely affect the health and habitat of wildlife and humans living downstream. The businesses engaging in these practices do not generally pay the costs of restoring habitat or of treating polluted

water so that it is drinkable again. These costs are often borne by others, most often, taxpayers. And sometimes the habitat or water isn't restored, causing financial hardships through increased illness and Higher fees for drinking water.

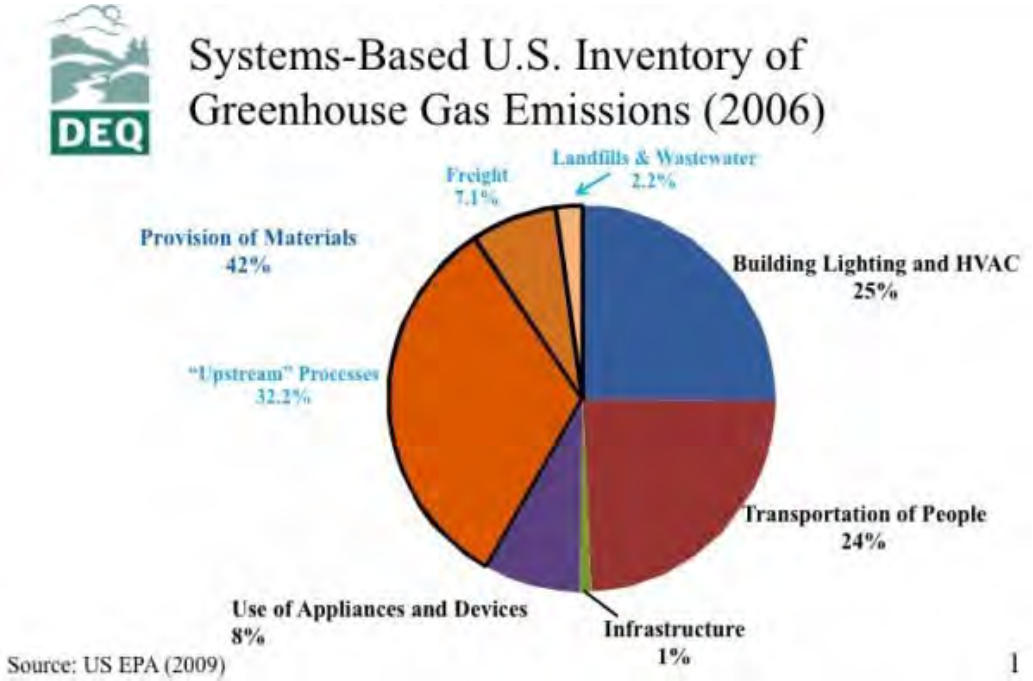
Because SMM does not look at who pays or benefits but at the total impacts of a product or service, it also helps us look at externalized benefits—the positive effects of an activity that don't show up on anyone's bottom line. For example, trees consume carbon dioxide and produce oxygen. They also store or sequester the carbon they remove from the atmosphere. Healthy forests provide other social benefits as well, including flood control, temperature regulation, recreational opportunities, and habitat for species that provide both commercial and non-commercial value to people.

Since SMM looks at both externalized costs and benefits, an analysis of a Christmas tree farm using conventional growing methods would show both. Runoff from pesticides and soil erosion would be listed on the costs side and carbon dioxide reduction and sequestration would be listed on the benefits side. The amount of time the trees were grown before getting cut would also be a factor, as would cutting methods and other items.

In other words, the SMM perspective helps us understand the total impact of an activity on our health and the environment. This also means we can make informed choices about which actions will make the biggest difference to the environment.

How SMM Fits With What You've Been Learning in This Class

As we saw in the Thoughtful Consumption module, just looking at where things go when we dispose of them is a very limited perspective; the 'upstream' effects from extracting the raw materials and energy needed to make consumer products is much higher than the impacts of disposal.



This graph illustrates which elements of the consumption cycle generate the most greenhouse gasses. At 42%, Provision of Goods is by far the largest contributor to U.S. produced greenhouse gas emissions. This category is divided to separate Upstream Processes (32.2%) from the effects from transporting (7.1%) and disposing of materials. The second largest producer of greenhouse gasses (25%) is lighting and operating our buildings; the third (24%) is transporting people; using our appliances and devices is 8%.

As the graph above illustrates, disposal only accounts for a small portion (2.2%) of the greenhouse gasses our things create. Recycling our products can reduce these disposal emissions and significantly reduce upstream emissions, but recycling alone can't reduce most of our greenhouse gas production. Other strategies are needed as well, thus the broader focus on sustainable materials management.

Recycling is an important element in SMM. It allows us to recover and reuse materials that would otherwise be wasted and often allows us to save energy in the manufacturing process. This means that the upstream effects of consumption are reduced. For example, recycling an aluminum can uses only 5% of the energy that is required to make the can to begin with. When this energy savings is combined with the benefits of not needing to mine, smelt, and transport new material, the environmental benefits are very high. Aluminum is an unusual example because the benefits of using recycled feedstock are not as high for other materials. But using recycled wastes to produce new products is one important method of conserving energy and reducing greenhouse gases and other pollutants.

Understanding Environmental and Health Impacts

Recycling is an important element in practicing SMM but it is not the only one. And reducing and reusing may not always be the best answers either. Remember that replacing a twenty-year-old refrigerator with a new, energy-efficient model was a better choice than keeping the old one. That's because the resources used to make the new one (steel is one of the most recycled materials in the world) have a lower impact than producing the electricity to run the inefficient older one.

But how do we know when to reduce, reuse or recycle a particular product? Research by the Oregon DEQ and others shows that following the solid waste hierarchy makes good environmental sense most of the time and for most materials.

Where decisions become more difficult is when we enter the realm of purchasing. Is it better to purchase product X or product Y? And as a producer, how can I best reduce the environmental impacts of my product? To answer these questions, what we need is a way to evaluate the environmental and health impacts of our goods and services.

Life Cycle Analysis

We know that some products and services are better for human health and the environment than others, but how do we determine which choices are the best? One approach is Life Cycle Analysis, or LCA. LCA reverse engineers a product to determine the total environmental impacts of its life. It looks at the energy and materials required to extract the raw materials, manufacture, transport, use, repair, maintain, and dispose of a product during its entire life span. An LCA helps us understand the full impact of our consumption of a product or activity, including positive ones like carbon sequestration.

This illustration shows the processes that are considered in an LCA of a product.

An LCA looks at both the negative and positive aspects of an activity. For example, some greenhouse gas is emitted when food waste composts, but compost also enriches soil, increases the efficiency of water use, and keeps additional carbon from entering the atmosphere. This chart illustrates one aspect of an LCA: how greenhouse gasses are generated and absorbed by our consumption and disposal of products.

By evaluating the effects of the production, use, and disposal of an item, an LCA can help us make better decisions about which products are best for a particular job. And the answers may surprise us. In 2004 the DEQ, Metro, and the EPA commissioned an LCA to determine the best way for businesses to package non-breakable items that were to be sent through the mail or via UPS[183]. This study compared the environmental impacts of using cardboard boxes

and padded plastic or plastic/paper mailing bags. It also evaluated different types of void fill, such as plastic peanuts or crumpled paper. Each evaluation included comparisons using different amounts of recycled content in each item. To the surprise of some, this study showed that non-recyclable, plastic, or plastic/paper mailing envelopes were more resource efficient than cardboard boxes, even those with very high recycled content. The most important element in determining the best mailer was the mass (weight) of the container, not the material it was made from. And the addition of recycled content did relatively little to make a difference. In other words, the smallest or most reduced size was the best choice. The differences between the various void fill products were generally small even though some were non-recyclable plastic and others were recyclable and made with high levels of recycled content.

The packaging study does not mean that recycled content doesn't matter; it is very important when comparing items made from the same material. But recycled content doesn't offset the impacts of using less material overall. And when comparing dissimilar materials, recycled content and recyclability are not good predictors of the overall environmental impact. Just because Product A can be recycled and/or contains recycled content doesn't make it a better choice than Product B, which cannot be recycled or contains no recycled content, unless both products are largely made of the same material. The graph to the right shows the environmental impacts of packaging in terms of its impact on climate change. The study confirmed that Reduce still belongs at the top of the solid waste hierarchy.

The history of LCAs is mixed. When they were first developed, they were often used to promote a particular product or perspective like choosing sides in the cloth diaper vs. disposal diaper debate. But as concerns about energy, water, and other resource use have sharpened our understanding of the health and environmental impacts of the materials we use, LCAs have become more sophisticated. Because a good LCA requires the storage and analysis of data, advances in computer technology have also helped move LCAs forward. There are now several computer programs on the market that help businesses analyze the impacts of the materials that go into their products. More research and data and improvements in methodologies are also helping.

Product Stewardship

We touched on the concept of product stewardship in the Overview and Household Hazardous Waste modules. Product stewardship is an environmental management strategy in which all parties involved in the design, production, sale, and use of a product take responsibility for minimizing the product's environmental impact. In this model, responsibility for lowering the environmental and health impacts of a product lie with those who are involved in the entire lifespan of the product: designers, manufacturers, retailers, customers, and recyclers. The greatest responsibility lies with those who can most affect the lifecycle impacts of a product. In practice, this means that manufacturers are involved, not just in designing and producing a product, but also helping dispose of it at the end of its life. Under this model, consumers generally return the used product to a collection site, often one provided by retailers of the item. Manufacturers and retailers may share the costs of disposal.

Because product stewardship shares responsibility for the entire lifespan of a product including end-of-life management, it encourages manufacturers to redesign products to lower their toxicity, increase their recyclability and make repair easier.

One element of product stewardship is the idea of Extended Producer Responsibility (EPR). In 2012 three product stewardship organizations, the California Product Stewardship Council, the Product Policy Institute, and the Product Stewardship Institute, came to an agreement on this definition of EPR:

"Extended Producer Responsibility (EPR) is a mandatory type of product stewardship that includes, at a minimum, the requirement that the producer's responsibility for their product extends to post-consumer management of that product and its packaging. There are two related features of EPR policy: (1) shifting financial and management responsibility, with government oversight, upstream to the producer and away from the public sector; and (2) providing incentives to producers to incorporate environmental considerations in the design of their products and packaging."

The focus of many legislated product stewardship initiatives has been on reducing disposal because the impetus to begin them came from governments that were responsible for disposing of hazardous materials created by private industry. These governments wanted manufacturers to share the externalized costs associated with managing their products at end- of-life. They also hoped to induce changes upstream in production and design as well. For example, Oregon's product stewardship laws for electronics waste and paint are expected to save local governments millions of dollars annually in disposal costs, while also redirecting waste materials to higher uses (reuse and recycling, rather than disposal).

But not all product stewardship efforts focus on end-of-life. For example Electronic Product Environmental Assessment Tool (EPEAT)[184] is a global registry for greener electronic products. It rates products on a number of environmental criteria including the reduction/elimination of environmentally sensitive materials, product longevity/life extension, energy conservation, and packaging. Its goal is to help individuals, businesses, and governments purchase environmentally preferable electronics products. By making

environmentally sound decisions easier, EPEAT also intends to provide market incentives for product manufacturers. A legislative example would be the European Union's Restriction on Hazardous Substances (RoHS) directive which limits the use of toxic chemicals in consumer electronics products.

Other product stewardship examples focus on the reduction of greenhouse gasses or the reduction of toxic materials. For example, Maine's procurement standards for mercury lamps require that the most energy efficient, longest lasting, lowest mercury content lamps be bought when product prices are comparable. There are several examples of product stewardship in Oregon, including the PaintCare[185] pilot program to manage the disposal and recycling of household paint and the Oregon E-Cycles Program that manages some consumer electronics products.

Product stewardship efforts may be either mandated or voluntary. The Oregon E-cycles Program[186] is required by Oregon law, but the rechargeable battery and cell phone recycling program operated by the RBRC[187] is a totally voluntary program.

The Northwest Product Stewardship Council[188] is a coalition of government organizations in Oregon and Washington that works with other governments, businesses, and nonprofit groups to integrate product stewardship principles into the policies and economic structures of the Northwest.

Advance Disposal Fees

Advance disposal fees may be part of a product stewardship program. These fees are charged when an item is purchased and are used towards disposal of the item when it is recycled or returned to the store or manufacturer for disposal. The fee you pay when you purchase household paint in Oregon is an advance disposal fee.

Pay-As-You Throw Disposal Fees

Pay-As-You-Throw (PAYT) is a method of pricing garbage disposal fees. Under PAYT, the cost of garbage disposal stays the same per increment whether you are disposing of one pound or 200,000 pounds. In other words, there is no volume discount for producing more waste. PAYT encourages waste reduction because the generator is made aware of how much waste is produced.

Government Mandates and Regulations

Federal, state, and local governments use a number of tools to encourage individuals and businesses to manage their waste more effectively or to make other changes in their use of materials.

State, local, and federal governments may pass legislation that affects how organizations deal with their waste. Two examples are the Oregon Bottle Bill and Opportunity to Recycle Acts we discussed in the Overview. Each of these pieces of legislation encouraged the development of Oregon's current recycling infrastructure. Two additional tools that are often used at the local-government level are landfill tipping fees and the franchising or licensing of garbage and recycling collection services.

Tipping Fees

A tipping fee is the cost to dispose of garbage at a landfill, transfer station, incinerator, or waste-to-energy plant. It is generally charged on a per-ton basis. The name comes from the practice of tipping the bed of a garbage truck to empty it. Tipping fees can directly impact the amount of waste ending up at a landfill because high tipping fees mean that garbage is expensive to dispose of. High garbage costs provide an incentive for consumers to reduce the amount of trash that is generated. As we've seen, most businesses and households can substantially decrease the amount of waste they produce. When disposal fees are high, waste reduction can result in much lower garbage costs.

Franchising Garbage and Recycling Services

Most garbage and recycling services in Oregon are franchised or licensed by the wastesheds they serve. This means local or county governments authorize haulers to serve allotted territories, offer standardized services, and charge established fees. In some cases, local governments direct where haulers dispose of the garbage they collect.

Franchising allows local governments to determine the services that are supplied to citizens and to set service standards. Since franchising or licensing agreements are typically multi-year, these agreements allow haulers to extrapolate costs and revenues and make long-term investments to improve equipment and facilities.

Government Fuel and Greenhouse Gas Emission Standards

Product stewardship legislation is not restricted to end-of-life issues. In November 2011, the Obama administration proposed stronger fuel efficiency and global warming emissions standards for cars and light trucks. The proposed rules would nearly double fuel efficiency and cut emissions in half for new cars and trucks by 2025. The state of California followed with a set of policies designed to encourage development of electronic car technology and cleaner gasoline vehicles. When combined with other market forces, this legislation will require manufacturers to take more responsibility for the environmental and health impacts of the vehicles they produce.

How we view the world and our place within it affects daily decision-making and our long-term choices. SMM helps us look at the total environmental impacts of a particular product or service, so SMM helps us make choices between similar items. What SMM does not do is put those items into a larger vision of the world. In other words, it helps us choose better ways to build a house, but it doesn't help us fit that house into a neighborhood. SMM gives us data, but it doesn't give us priorities or values for making decisions based on that data.

There are several philosophical frameworks that provide a vision for a healthier environmental future. Each addresses a different aspect of our "neighborhood." One is the Natural Step framework. The other is the concept of Cradle-to-Cradle.

The Natural Step Framework

The Natural Step (TNS)[189,190] provides a scientific and philosophical framework for viewing and evaluating the sustainability of a system such as an ecosystem or a business. TNS identities
four system conditions that are necessary to sustain human activities on Earth and uses them as the basis for creating the vision of a sustainable future. The framework helps users identify actions that will move a society, government, or business toward greater sustainability.

These conditions of sustainability require that we eliminate our contribution to:

1. The concentration of substances extracted from the Earth's crust, like heavy metals and fossil fuels.
2. Concentrations of substances produced by society, like dioxins, PCBs and DDT.
3. The degradation and destruction of nature and natural processes, such as over-harvesting forests and disrupting critical wildlife habitat.
4. Conditions that systematically fail to meet basic human needs, such as unsafe working conditions or not enough food to eat.

TNS is based in Oregon and works with businesses and governments to increase their environmental sustainability. It provides a variety of services, including training and networking opportunities.

Cradle-to-Cradle Design

The concept of cradle-to-cradle design allows us to look at how we can make better use of the Earth's resources while still meeting our social and physical needs. This perspective helps us look at what our things are made of and where they go— not as separate ideas, but as complete systems. In 2002's Cradle to Cradle: Remaking the Way We Make Things, William McDonough and his colleague Michael Braungart posit that materials should be derived from one of two different systems: one technical and the other biological. The technical materials stream consists of man-made chemicals and materials. The biological steam consists of substances found in nature. They argue that these streams should be kept separate and managed differently from one another.

McDonough argues that our industrial processes should mimic natural metabolic processes. We should think of materials as nutrients circulating within one of two healthy organisms: one biological and the other human made. In this perspective, waste is not discarded but becomes food to nourish and maintain the total system.

All materials derived from the natural materials stream biodegrade and return to it as nutrients and enrich it. McDonough believes we should design products so that man-made materials can be returned to a technical stream and be used infinitely.

McDonough sees many of our environmental challenges as the result of an outmoded production system that encourages bad product design, waste and pollution. His vision is not limited to standard products, but can be applied to all forms of design, including buildings and towns.

The concept of cradle-to-cradle design provides a practical vision for meeting the system conditions outlined in The Natural Step Framework. Returning both technical and biological materials to their respective healthy metabolic systems and re-circulating them as food for that system will keep both natural and man-made materials from accumulating in the environment. Returning things derived from nature back to nature will slow environmental degradation. And using both technical and biological resources wisely will mean there will be more to share among humans. McDonough argues that if we mimic nature, which is a system that produces abundance, human-kind be able not only to survive, but to thrive.

We have already focused on the importance of recycling and composting in managing materials effectively. Recycling allows us to use discarded materials to make new products. Because it saves energy and reduces the demand for virgin materials, recycling helps preserve our natural ecosystems. It is a foundational practice of SMM and a key element in a cradle-to- cradle materials cycle. Composting is a key element of the biological materials cycle. When we compost, we are returning items taken from nature back to nature where they will be used as food for creating new life.

Supply Chain Management

A supply chain assessment tracks the organizations that are directly linked with the upstream and downstream flows of a product or service, from the origin of its materials until it reaches the final consumer. Supply chain management uses this information, including the origin, movement, and storage of all materials, to increase the efficiency and effectiveness of a supply system. Understanding and coordinating the elements of a supply chain can help a firm save both money and resources.

Understanding a supply chain has many advantages. Many organizations use supply chain management to help them plan for possible threats to their materials streams. For example, a firm with suppliers in politically unstable nations might want to be prepared for a potential revolution or nationalization of a production facility. Walmart, a leader in supply chain management, uses this information to keep its costs low.

Unless a business understands its supply chain, it will have a difficult time evaluating and increasing its environmental sustainability. If, for example, a firm makes notebooks with cotton fabric covers, it should understand not just where and how the cotton is grown but also how it is processed, dyed, woven, and sewn. It may also want to know about employment conditions in the businesses that supply its fabric.

Each step in a supply chain provides opportunities to improve environmental performance. The notebook company may learn that toxic dyes are used in coloring the fabrics it uses. It will then have the option of changing the color of its fabric, motivating its supplier to use non-toxic dyes, or finding a supplier that uses less-toxic chemicals in coloring fabric. Or it might decide to switch to a fabric made from organically grown cotton.

As a company evaluates its supply chain, it may discover that some of its products are much more environmentally destructive than they believed. Understanding its supply chain may allow it to redesign its products to take advantage of healthier materials and production techniques as well as save money.

Green Procurement

Buying recycled-content products has been discussed in earlier modules, but Green Procurement in the context of SMM looks beyond recycled content to focus on the total impacts of a buying decision. While this may complicate our purchasing practices a bit, it assures that the decisions we make will be the best for the entire planet. The EPA's Environmentally Preferable Purchasing website[191] contains guidelines and provides useful tools.

Green Building

As you may remember from the Thoughtful Consumption module, how we build and operate our buildings is an important area for taking action. About a quarter of negative impacts to wildlife and natural ecosystems comes from building new homes on formerly vacant land. And the construction and remodeling of buildings generates about 10% of toxic and common water pollution. We also saw that the energy we use to power buildings accounted for about 31% of US greenhouse gas emissions in 2005. Clearly, using more earth-friendly building practices would help save resources.

Building green means using construction practices that conserve resources and designing buildings that consume less energy cost less to maintain and are healthier for the inhabitants. This means looking not only at the materials used in constructing the building, but also at energy and water use, indoor air quality, integrating the building into local habitat, and lowering the use of toxic materials[192].

New Building and Remodeling

A resource-efficient building starts with good planning. In 2010 the DEQ conducted a study using life cycle analysis to evaluate waste-reducing building and design practices. The study found that only 6% of building material-related waste is generated during construction while about 50% is generated from repairing and maintaining an average home during its 70-year life. It also found that more than 80% of greenhouse gas emissions occurred during operation of the home and 44% of the total solid waste production occurred when the structure was demolished.

This study showed that how a building operates and is disposed of has a larger environmental impact than the waste generated during its construction or demolition. This does not mean that reducing construction waste is not important. It does mean that

designing a building with an eye toward saving resources like water and energy every day is very important. This is also the time to look at using construction materials that are less toxic and materials that are sustainably harvested. Avoid materials with high levels of VOCs, like some paints, glues, and types of particle or fiberboard. Don't scrimp on insulation; you'll save money and energy on heating and cooling. Also look at using techniques that allow for the ultimate deconstruction of the building, like using screws or nails instead of glue.

When you're taking all or part of a building down to remodel or rebuild, consider deconstructing instead of demolishing it. Deconstructing a building involves taking it apart piece-by-piece so the materials can be reused. Deconstruction takes more time than hitting a building with a wrecking ball or pushing it down with a bulldozer, but if the salvaged materials are either donated to a non-profit or resold, the price can be comparable. There is a steady market for reused material like framing, siding, cabinets, light fixtures, and some plumbing fixtures. Reusing these items saves natural resources and preserves much of their embedded energy.

This study also compared the environment impacts of smaller and medium-sized homes. As we saw in Thoughtful Consumption, the size of a building directly influences its environmental impact, so consider how much space you really need to be happy. Find a good designer, builder, or remodeler and talk about your needs. The Cascadia Green Building Council[193] provides training for builders in our region and the Green Building Certification Institute[194] certifies builders in green building practices and the Leadership in Energy and Environmental Design (LEED) Program standards. LEED maintains a rating system for certifying resource efficient commercial buildings and homes.

Dealing with Construction and Demolition (C&D) Waste

What goes up must come down and that applies to buildings, too. Whether you are tearing out walls for a remodel or building from scratch, you'll have construction waste. Not all construction waste is created equal; some items can be resold or donated and others can be recycled. You'll need to take extra care while taking apart the building to preserve the value of its materials.

If you live in the Portland/Metro area, your builder will have access to a variety of tools to help reduce, reuse, and recycle construction and demolition waste. Metro has become a trusted source for information for the construction industry. Its construction salvage and recycling website[195] contains a variety of useful tools for how to deconstruct buildings and incorporate salvaged materials into new buildings. These guides focus on resources in the Portland/Metro region, but much of the information is transferable to other parts of the state.

Fortunately for us, we also have an active initial C&D diversion program beginning in Tillamook County.

Contractors can donate usable items to CARTM for resale through their reuse store or the rebuilding center. Both the Manzanita and Tillamook Transfer Stations accept conforming asphalt roofing waste and clean wood at preferential disposal rates, since those materials can be recycled, either into road material or used as hog fuel. Since both processes involve local solutions, the benefits are compounded.

Design with Nature

Ian McHarg's landmark 1969 book, *Design With Nature*,[196] introduced the idea of including ecological concerns when planning and designing buildings and communities. This book had a profound impact on urban planning and architecture. Until then, planners and architects had only looked at socio-economic factors when making their decisions. McHarg urged them to look at the physical systems their structures would inhabit and then to try to make their designs complement those systems. Due to the influence of this book architects now work to understand the soil, hydrology, and climate of an area before planning a new development. To view an example of this principle in action, watch a TED talk by Bill McDonough [197] about cradle-to-cradle design and his design for a city in China.

Janine Benyus's 1997 book, *Biomimicry: Innovation Inspired by Nature*[198] is another seminal work. It gave a name to and defined a methodology for the practice of studying how nature's solutions can help us devise some of our own. Biomimicry analyzes the natural world to discover how to design things we can use. For example, spider silk is the inspiration for a new thread that is stronger than Kevlar or steel, very flexible, and stretches up to 40% before it breaks.

Imitating nature's models allows us to create useful things that are not separate from natural systems (like Styrofoam) but are part of them. Oregon State University professor Kaichang Le has created a very strong wood adhesive modeled on the protein that allows mussels to attach to rocks. This non-toxic glue can replace formaldehyde, a human carcinogen, in plywood and particleboard. Since formaldehyde fumes from these products are released into the air, replacing it with the new adhesive can improve indoor air quality and reduce eye and lung irritation.

Permaculture uses an ecological perspective to integrate human agricultural practices into the natural world. Its goal is to make humans more self-reliant yet more integral to the natural biological cycles of an area. This goal is achieved through a careful study of nature as a system, observing its patterns, and then using that knowledge to design site-specific agricultural systems. Permaculture values careful observation, biological diversity, integration of biological elements, natural abundance, and slow progress. An ideal permaculture installation requires little maintenance because the elements are mutually supportive.

For many years, people who were concerned about waste focused on what happened to the things we consume when we were done with them. Was there a better thing to do with used products than send them to a landfill? Can we get more value from our discards? Who should pay for disposal? How do we manage toxic waste? These are still important questions, but as we have become more aware of the issues surrounding climate change, the

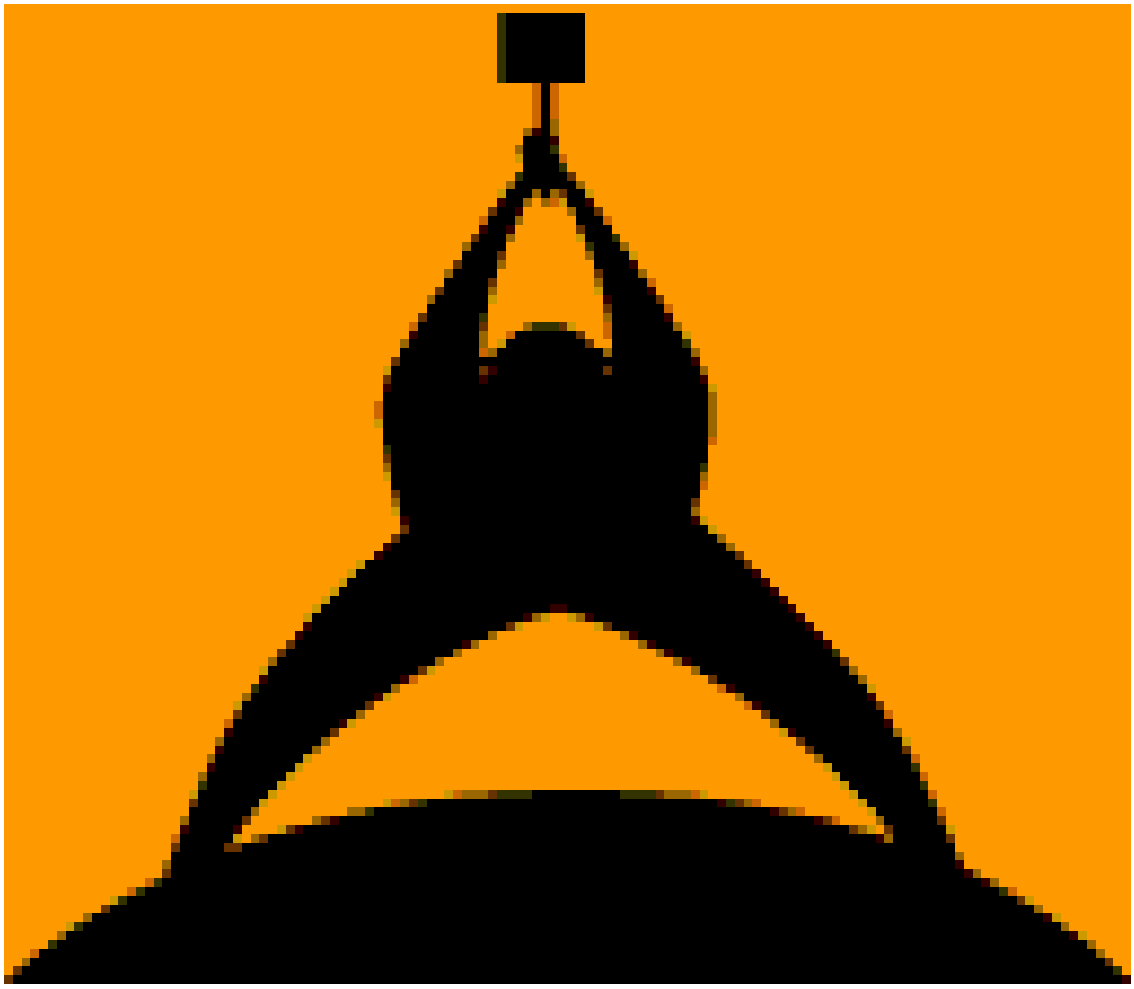
focus of those questions has broadened to encompass the total life cycle of our products, not just their final resting place. What we've learned is that most of the environmental and health

impacts of producing and using our products happen upstream, well before they enter a landfill or recycling facility.

Sustainable Materials Management is a perspective that helps us understand the total environmental and health impacts of the products we design, make, and use. It helps us focus on the upstream costs of the items we consume. Life Cycle Analysis lets us evaluate the environmental costs and benefits of the goods we produce and helps us make informed comparisons between different products and processes. This is important because some of our assumptions about what is best for the environment may be wrong: a cardboard box may not be best choice for sending a scarf to a customer, but a non-recyclable plastic envelope might be.

But a Sustainable Materials Management perspective is not enough. It gives us data but doesn't tell us what to do with it. The Natural Step, Cradle-To-Cradle Design, and other philosophical frameworks can help us prioritize our decisions. And there are tools that can help us make our ideas into reality: supply chain management, environmentally preferable purchasing policies, green-building techniques, and of course, recycling. We'll need to use all of these perspectives, tools, and techniques to face the challenges of resource depletion and climate change that loom on the horizon.

Chapter 8: Taking Action



The importance of taking action

As you've progressed through this manual, you've been introduced to ways to reduce waste and save money and resources. You may even have started making those changes at home or work. But old habits are hard to break. Studies consistently find that there is a big gap between what people know and what they actually do to protect the environment.

The Taking Action module will explore how to help bridge that gap between what we know and what we do. We'll first review why waste prevention is important; then we'll look at the gap between attitudes and action. Next we'll explore how we might change our own behavior and how we can influence the behavior of others, including governments and corporations. Since how we talk about these issues is as important as the information we share, we'll also learn about effective communication.

Why Reduce, Reuse and Recycle?

As we saw in previous modules, there are many reasons to reduce, reuse and recycle the items we use every day:

- Create jobs and increase U.S. competitiveness
- Help us have enough clean water
- Control pollution
- Protect nature for future generations
- Conserve forests, streams and landscapes
- Save energy and reduce our dependence on foreign energy sources
- Reduce greenhouse gas emissions that fuel global warming
- Save money
- Be part of the solution

Most of the environmental impacts of our consumption happen when we turn raw materials into products, not when we dispose of them. This means that preventing waste by reducing the quantity of goods that we consume is a particularly powerful way to save money and resources.

The Gap Between Attitudes and Action

Protecting the environment is an American value. In a George Mason study done in June of 2010—the middle of the economic downturn—56% of those surveyed agreed that protecting the environment improved economic growth and provided new jobs.65% agreed that protecting the environment was important, even if it reduced economic growth.

But there is a gap in what people believe and what they do.

This gap is apparent in Mainstream Green, a study conducted between September 2010 and February 2011. Participants were asked how important taking public transportation & walking or biking to work; purchasing locally grown food; using eco-friendly cleaning products and recycling bottles/cans/paper were to a sustainable lifestyle.

80% of respondents said these activities were important to living a sustainable lifestyle, but only 50% regularly did those activities. This leaves a 30% gap between what people believe and what they do. Other surveys show similar results. Clearly, people want to take action and protect the environment. The key for us—for you—is to make that happen.

Moving From Ideas to Action

So how do we get people to move from knowing to doing? Information is not enough. Research into recycling behavior shows that four other factors are important in motivating people to recycle and reduce waste.

1. Awareness of the consequences of action or inaction
2. Personal responsibility
3. Community norms
4. Knowing specific actions that make a difference

These concepts are explored in this module's discussion about changing behavior.

Of course, one of the best ways to learn about changing behavior is to change your own. As you've been taking the Master Recycler class, you may have come across some ideas that you'd like to integrate into your life, but haven't yet. What's stopping you?

Identifying and Overcoming Your Barriers

Take a minute or two and make a list of three ideas you have to save money and resources. Next to each, write specific reasons why you haven't taken action. For example, if you want to start using green cleaners are you concerned about how well they work? Or do you keep forgetting to buy vinegar to make your own cleaner? Maybe you bought the ingredients but don't have spray containers to put the mixture into. Be specific about what has stopped you.

List all the reasons you haven't followed through on the thing you'd like to change and focus on just the ones that quickly come to mind. Then think about easy ways to overcome those barriers. For example, you can check out Consumer Reports or other product rating sources to see which eco-friendly cleaners work best. Put vinegar and containers with spray tops on your shopping list, or put a post-it-note on the door you go out when you head for the market to remind you to buy that vinegar. If you have everything you need except the time, you might want to treat green-cleaner-making as a scheduled activity - perhaps it would be a fun project to do with a child or to share with a friend. The solutions, just like the barriers will be your own.

Understanding and overcoming your own barriers to action will help you understand why others may not be taking action. Sometimes the solution is easy. Other times there may be no easy solution. If you live in a rural area, for example, you may not have access to public transit or curbside recycling. But you may be able to carpool with a co-worker or to take your home recycling to a recycling depot or into your workplace recycling program.

When you can, include your friends, neighbors, or co-workers in your thinking about the topic. Ask them how they are dealing with the issue. It's very possible someone has already solved your challenge. So ask around. Talking with others can help you think of new options

as well as start them thinking about how they would deal with your issue—and perhaps make it their own!

Once you've identified your solution, put it into effect. If your solution is complex, you may want to develop a step-by-step plan to get it done. If it's simple, you may want to jump right into it. But be patient with yourself and others: according to a 2009 study, it takes an average of sixty-six days of practice before a new habit becomes automatic[199]. Some habits are much easier to adopt than others and some people can adopt new habits more rapidly. The point is to stay with it. Because when you're done, the new habit will be just as hard to break as the old one!

Action is Empowerment

When you take the time to identify and jump over the hurdles that are keeping you from implementing the changes you'd like to make, you'll feel good. Taking the time to do the things that are important to us is enriching and empowering. It's easy to look at the issues we've been discussing in this class and feel overwhelmed. Our environmental challenges are great, and it is easy to get bogged down in lists of things that are wrong with the world — and easier still to feel guilty about how our habits are contributing to them.

But what we do matters. Taking action is empowering. We can't wait for government or business to make the world a better place; individuals will have to lead the way. We can use our spending power and our voting power to send messages about what is important to us and what we value.

Stay positive by focusing on solutions instead of problems. Trade publications like Resource Recycling[200] and BioCycle[201] can keep you up-to-date on technical solutions to specific environmental challenges. Reading about the efforts and successes of others can be inspirational and open the door to new possibilities[202- 204],.

We can all learn to live well while using less. And we can help others learn how to do it, too! The majority of Americans say they'd like to live a greener life, but they don't know how. The class will help you learn how to do that. While learning how to live well and waste less, you may become a role model for your friends, family, and co-workers. By making changes in your own life, you'll be showing that green living is not just for hippies or fanatics: it's for everyone. And you'll become a great resource for your community[205-213].

The Value of Small Steps

Think of someone you admire. Then think about how long it took them to become who they are. It's easy to become impatient and feel like where we want to be is long way away from where we are. But small steps matter[214]. Each time we put our recycling bin at the curb, take our reusable coffee cup to a meeting, or don't print an email, we are saving resources. Our efforts may sometimes seem small, but when multiplied by millions of others, their impact is great.

It's Not Just the Environment

There are lots of good reasons to buy and use less stuff:

- You'll save money on things you don't need.
- You'll spend less time in stores.
- You'll have less clutter.
- Saving money will lower your stress level.
- You'll worry less about what others are buying.
- You can create new challenges for yourself.
- You'll be able to spend time and money on the things that really matter to you.

Greens and Browns

Not everyone is on the same page when it comes to reducing, reusing, and recycling. Folks who take action to save money and conserve resources by recycling, buying smart, fixing, and maintaining what they own and borrowing and sharing items are sometimes called Greens. Folks who think conserving resources is foolish or unnecessary are sometimes referred to as Browns. The green/brown spectrum is wide. It ranges from people who never buy anything new to those who drive gas guzzling vehicles a half-block to buy a piece of gum. Most of us are nearer the middle. This is good news because the people on the extreme ends of the spectrum are not likely to rethink their choices. They have made their decisions and they live their lives based on their extreme worldview.

The good news is that there are many people in the middle of the green/brown spectrum who would like to live a simpler, less wasteful life, but they don't know how to do it. These folks want hands-on information or examples they can use to help their actions match their values. They don't want to spend their time creating their own strategies to use less and live more; they're busy people. These are the people who may be ready to take action, but aren't sure where to begin. You might even be one of these people! So forget about influencing the strong browns, and spend your time helping the folks in the middle live closer to their values.

Use Social Norms

Social norms are a powerful motivator. This is because most people are comfortable when they know they are doing the same thing others are doing. Since many folks don't want to feel left out, social norms are a favorite motivator used by advertisers. But marketers aren't the only ones who can use norms to motivate others — you can too!

One of the most effective ways to influence others is by modeling desirable behavior. Taking your recycling to the curb, carrying your reusable mug to meetings and your own bag to the store, or helping your workplace or community center start reducing paper waste shows others that saving resources is something everyone can do. When your neighbor sees your bin at the curb or your groceries in reusable bags, he is reminded that he could be doing the same thing. These reminders are sometimes referred to as prompts because they prompt others to think about, and sometimes alter, their behavior.

The increasing use of reusable shopping bags is an example of how social norms and prompts can work. If you've been standing in a check-out line and the person behind you has commented that she keeps forgetting her bags in the trunk of her car, you've experienced the

power of norms and prompts. Your bags prompted her to remember her bags were still in the car. Forgetting bags in the car is a common barrier to their use. That's why several grocery store chains have posted signs in their parking lots reminding customers to bring their bags inside.

Social norms and prompts can help motivate others to change their behavior, but sometimes all they need is to solve a simple problem like remembering to bring their bags into the store. Since your check-out neighbor's comment indicated a barrier she'd like to overcome, you might share how you remember your bags. Perhaps you place them behind a front seat instead of in the trunk or maybe you add them to your shopping list. Some organizations distribute Got Bag? window stickers to serve as prompts. Why not carry a couple of those in your reusable bag to share?

You will influence others when you model desirable behavior and are friendly and helpful when others ask questions; acknowledge their challenges and help them problem solve. But don't nag! While it can be frustrating to see others be wasteful, try to be content with making the changes in your own life that you value. This doesn't mean that you can't take recyclable containers out of the garbage container at your local park. It just means you shouldn't shame the person who put them there.

Make the Best Choice the Easiest Choice

People have a lot on their minds, so when you can, make saving resources the easiest thing to do. If your co-workers always have to remember to set the printer to double-sided, they'll forget most of the time (and you will too!) So set the printer to default to double-sided printing. Place recycling bins where paper waste is generated: where you sort your mail, next to the copier, and not across the room or down the hall. Put recycling containers next to garbage cans, so folks have an easy choice to make. Don't buy paper towels or cups; have cloth rags and ceramic cups within easy reach. Ask your family, friends, or co-workers how you can make reducing waste easier for them and then figure out how to make that happen.

Each of us has challenges and priorities and even those we love may not be able to follow our lead, so be aware of potential barriers and try to overcome them. By living in a way that reflects our values, we are creating the world we want to live in. Remember the value of small steps. And you never know when you are influencing others. Maybe the next time you see the woman who was next to you in that checkout line she'll have her reusable bags with her!

Give People a Reason to Care

Research shows that Americans no longer need a long list of reasons to care about waste. They want information about specific steps they can take to help them make a difference. But as we noted earlier, what we know and what we do are sometimes at odds. Changing behavior takes work. If you're going to motivate people to change, you'll need to give them a reason to care. Place the wasteful or non-wasteful behavior of an individual within the larger scheme of things. Deal with the emotional as well as the factual side of the individual. Appeal to their feelings of fairness, their responsibility to future generations, or to their dislike of waste.

We seldom find just one thing that motivates people. A person's primary concern may be to provide a healthier world for their children. Other concerns, however, may be to save money on the garbage bill, have more time with the family and less toxic waste in the environment. The concept of the Green Triangle provides a handy way to think about how changes in one area of our lives may affect other areas[215]. Ernest Callenbach, the author of Ecotopia, created this term to express the interrelationship between the environment, personal finance, and personal wellbeing. Callenbach says that making a decision that is beneficial for one of these areas is almost always good for the other two. For example, if you decide to get healthier by riding your bike to work, you'll also save money on gasoline and car maintenance and reduce greenhouse gas emissions. If we choose to save resources by buying fresh, whole food in minimal packaging, we'll likely save money by buying items in bulk and get healthier because we're eating less processed food. If we decide to save money by spending less time in front of our computer, we'll probably get more exercise and be less tempted to buy items online. You can use this concept to spark discussion in almost any setting; just ask for stories of personal change.

Use Concrete Examples

Abstract facts like the number of tons of garbage Americans produce each year are hard for listeners to grasp. People relate best to stories of an individual, not of a large group. So visualize or personalize the facts. Set the stage with images your audience can see, feel, or imagine. Folks want to know about specific actions they can take to make a difference, so use real-life examples to demonstrate changes they could make in their own lives. Avoid technical overload. Abstract information does not motivate people.

Address the Concerns of Your Listeners

We have all felt trapped by a speaker who talked on and on about interesting topics that were not useful to us. If you are actively listening, your partners in conversation will let you know what is important. When you find out, zero in on the information that matters. Acknowledge that you can learn from other people's experiences.

Active listening is a way of communicating that lets the speaker and you know that you have accurately heard what he is saying. This technique requires the listener to paraphrase what the speaker has said. If the paraphrase is not accurate, the speaker can restate her point. The listener can also reflect back what they believe is the emotional content of the statement, for example, "You're feeling frustrated that your employer has not started a recycling program in your office." Active listening requires that you actually listen to the speaker instead of thinking about how you're going to reply to him. It will also help you address the specific interests and concerns of your audience.

In a larger group, you may be able to make a guess about interest areas by knowing the membership of your audience. Parents who attend elementary school PTA meetings will have different interests than those attending a discussion at a senior center. You may want to talk about reducing lunchroom waste or how to become involved in the Oregon Green Schools Program with the parents and about effective food storage with the seniors.

Tailor Your Information to the Level of Your Audience

You will find a wide variety in your audience's level of awareness. Some people will already be

working on recycling projects in their homes and offices, and others will think that recycling is something that can only be done to newspapers. Be flexible in your approach, and present information tailored to your audience in an understandable way. Plan to involve your audience, but don't depend too heavily on their cooperation. If your audience is shy, you may have a hard time finding volunteers. Don't use technical terms or other jargon. Your goal is to communicate, not to impress them with your knowledge.

Empower Your Listeners

After you provide background information, empower your listeners by letting them know that they can make a difference. Stress that the choices they make as consumers are like votes that have a direct impact on the producers. Consumer power in the marketplace is an important tool to change the use of resources, whether we are spending five cents, five dollars, or five hundred dollars. Consumer power is available every time people shop, reuse, or recycle.

Promote Active Involvement

Promote involvement in problem solving or information exchange. Help people generate and share ideas about actions they presently take or might take to affect their area of interest. Encourage whatever positive steps they are taking. If they have an objection to a line of activity, help them think of alternatives. Encourage creativity.

Suggest Specific Actions

Suggest Actions to reduce waste, lower costs or influence manufacturers - whatever the area of interest may be. Stress simple, low-cost and immediate actions.

Take Time to Answer Questions

If you're giving a presentation, you can choose whether to take questions during or after your talk. Just let your audience know when they can ask. If you don't know the answer, that's fine. You are not expected to be an expert on every issue. Simply respond, "I don't know, but I will be happy to find out and get back to you if you'd like to share your contact information with me afterwards."[216]

What we say is important. How we say it can be just as important. Chances are that at some point you'll be talking or writing about recycling or using less stuff. It may be a flyer about recycling at work or a sign about avoiding pesticides at the community garden, maybe an announcement about an Earth Institute Class in your area. Whether you are communicating with your neighbor, a small group or planning a PowerPoint presentation, following a few simple guidelines will help you communicate your message more effectively[217].

Master Recyclers As Educators and Resources

As a Master Recycler, part of your job is to spread the word about the personal and social benefits of recycling, composting and earth-wise shopping. You will help people find out what steps they can take to increase recycling and reduce the amount of waste they put in the trash. You will provide information based on your own experience and on what you learn in the training.

When you volunteered to become a master recycler, you made an active commitment to make the world a better place. It is our responsibility as your training and support team to provide you with the resources to help you fulfill your commitment.
We will make the following resources available to you for ideas, information and support:

A. Marion County Public Works - Environmental Services Department and Metro brochures dealing with a variety of waste reduction and recycling topics

B. This training manual, which is yours and is ready reference for a variety of ideas and data. The appendix has a guide to specific recycling and waste reduction resources.

C. The Deepwood Gardens Compost Demonstration Site

D. Materials and information for doing presentations to the public. Examples include PowerPoint presentations, videos, clip art and more.

E. Portable recycling display

F. Demonstration kits for precycling, alternatives to disposables, and buying recycled products

G. Regular meetings with other Master Recyclers and program staff to share information, build skills and provide feedback

H. Marion County Public Works - Environmental Services staff who are available to answer difficult questions or to provide feedback

I. Marion County Public Works - Environmental Services (503-588-5169) is also a good resource for waste reduction, recycling and hazardous products information

J. Monthly newsletters to keep you current on recycling issues and volunteer opportunities.

K. As you become an active Master Recycler you also will discover that the people you meet at demonstrations, booths and speaking engagements will provide an invaluable source of ideas and information. Pay particular attention to the experience of others because they are discussing what worked for them.

Master Recyclers as Motivators

Many of you will be called upon to speak to groups as part of your outreach commitment[219]. Others will talk with people at outreach events or while organizing and carrying out special projects. As a Master Recycler, part of your job is to motivate people to change their ideas and behavior relating to waste. This is a big job. To do it effectively, it is helpful to keep certain ideas in mind.

An in-depth article on communication and fostering sustainable behavior, which includes valuable tips and examples, follows this chapter[218]. The following communication guidelines are particularly useful for planning a presentation, but they are basics that also can be used effectively in one-to-one communication.

A. Give People a Reason to Care. If you are going to motivate people to change you will need to give them a reason to care. When you talk about the results of our consumption- based lifestyle, appeal to their feelings of fairness, their responsibility to future generations, or to their dislike of waste. Place the wasteful (or non-wasteful) behavior of an individual within the larger scheme of things. Deal with the emotional as well as the factual side of the individual.

We seldom find just one thing that motivates people. A person's primary concern may be to save money on the garbage bill. Other concerns, however, may be to save Brazilian rain forests, have less toxic waste in the environment, and have fewer waste facilities to pay for.

B. Use Concrete Examples. When you talk about the consequences of our actions, don't talk about millions of tons of garbage and abstract facts. Set the stage with images they can see, feel or specifically imagine. Talk about the number of truck loads of garbage we send to the Brooks Waste to Energy plant daily. Get your listener to think about the resources involved. Avoid technical overload. Abstract information does not motivate people.

C. Address the Concerns of Your Listeners. We have all felt trapped by a speaker who talked on and on about interesting things that were not useful to us. If you are actively listening, your partners in conversation will let you know what is important. When you find out, zero in on the information that matters. Also, acknowledge that you can learn from other people's experiences.

In a larger group you may be able to make a guess about interest areas by knowing the membership of the group. Parents who attend elementary school PTA meetings will have different interests than people attending a discussion at a Senior Center. You might want to talk about packaging school lunches with the parents and about effective food storage with the seniors.

D. Tailor Your Information to the Level of Your Audience. In a day of outreach you will find varied levels of awareness and action. Some people will already be working on recycling projects in their homes and offices, and others will think that recycling is something that can only be done to newspapers (and only then by fanatics!). Be flexible in your approach, and present the information in an understandable way.

E. Empower Your Listeners. After you provide background information, empower your listeners by letting them know that they can make a difference. Stress that the choices they make as consumers and voters have a direct impact on the producers. Consumer power in the marketplace is an important tool to change the use of resources. That tool is available every time people shop, reuse or recycle.

F. Promote Active Involvement in problem solving or information exchange. Help people generate and share ideas about actions they

presently take or might take to affect their area of interest. Encourage whatever positive steps they are taking. If they have an objection to a line of activity, help them think of alternatives. Encourage creativity.

G. Suggest Specific Actions to reduce waste, lower costs or influence manufacturers-- whatever the area of interest may be. Stress simple, low-cost and immediate actions.

Communication Guidelines

Public speaking trainer Dale Carnegie said, "The way you say it is as important as what you are saying." Be aware of how you are communicating with people when doing outreach. Some general guidelines for effective outreach communications include:

A. Take initiative to start conversations with people at events. It is hard for some people to break the ice, but a simple lead-in such as, "Do you want any information about recycling or composting?" can get people started.

B. Be aware of body language. People often make assumptions from non-verbal clues. For example:

Looking people in the eyes tells them that you are interested in what they are saying.

Open, upright posture signals that you are confident in your knowledge. Slouching indicates that you are bored. Arms folded across your chest signals that you are defensive.

Attentiveness to people and activities around you shows that you are eager to talk. Reading a book or otherwise ignoring people at an outreach event signals that you don't have anything to share.

C. Show an interest. Even if it's the hundredth time you've been asked that question today, it's the first time for the person asking it.

D. Be honest and sincere. Don't "wing it" if you don't know the answer to a question. Guessing the answer can do more harm than good. Remember, it's okay to say, "I don't have the answer to that one, but I'll find out," or refer them to where they can find it. If appropriate, take the person's phone number and call back with the information as quickly as possible.

Outreach Plans

You have committed to payback 30 hours of outreach. Activities can include:

- Giving waste reduction presentations to small groups;
- Setting up a recycling program at your place of work;
- Staffing display booths at events or fairs; or
- Devise a totally new activity. You can work individually or with a group of other Master Recyclers who have similar interests or complementary skills. The choice is yours!

You may have a special project already in mind. If not, the Master Recycler Program Coordinator will be able to help you generate some ideas or can schedule you for activities that are already in process. Please remember that the activities you choose should be things you feel comfortable doing. It is always good to stretch and try new things, but if speaking in front of a group terrifies you, don't tie yourself to a schedule of speaking engagements. We want you to be successful in your outreach and to enjoy doing it.

To be happiest with your participation, it is important that you develop a plan to clarify your goals and help you reach them. During the internship phase of your training, we will help you develop your own outreach plan. It will be tailored to your interests and level of energy. It will state the who, what, how, when and where of your 30 hours of community activity. This plan will act as your guide, but don't allow it to limit you.

Outreach Plan will include:

- Goal Statement - What you would like to accomplish.
- Activities - What specific things you would like to do.
- Work Plan (if applicable) - A plan with timelines and activities that will help you reach your goal.
- All Outreach Plans must help the Master Recycler Program accomplish the following:
    - Provide community outreach and education.
    - Enhance the waste reduction knowledge and action of Master Recyclers.
    - Provide Master Recyclers with skill-building outreach activities.
      Provide opportunities for staff and Master Recyclers to work for greater program effectiveness.
    - Collect feedback from Master Recyclers and others about program effectiveness.
    - Provide a rewarding, effective and informative program.

Payback Guidelines

To help us fulfill our goal, payback activities must meet the following criteria:

1) Must implement a system or program that diverts materials from the waste stream, OR
2) Provide one-on-one educational contact, AND,
3) Provide a meaningful educational and/or skill enhancing experience for the volunteer. AND
4) Be a sustainable program. Should you no longer be able to fulfill the program, it must be able to be passed to another willing person without becoming a burden on staff.

Payback activities can be self-generated in the form of an individual project created by the volunteer and approved by the Coordinator, or they may be generated by the Coordinator working in conjunction with other volunteers and with local educational and solid waste programs.

Prep/infrastructure hours contribute significantly to the quality and effectiveness of the

program, but to not meet either #1 or #2 above. Prep time includes the creation or gathering of materials for presentations, workshops, or general distribution and training for specific outreach activities. Infrastructure time includes activities that serve to enhance the Master Recycler or any other existing solid waste programs: grant writing, developing an educational activity, working on the Master Recycler Newsletter, or coordinating volunteers, for example. The amount of time for these activities that will count toward payback will be determined on a case bases by the Coordinator.

Reporting

Reporting is essential to evaluate the effectiveness of the program. Information required includes:

Number of outreach hours
Description of activity

The coordinator will track your hours, but you are responsible for verifying your hours and information after each of your outreach activities.

Certificates

To receive the Master Recycler certification, each volunteer must attend training sessions and contribute 30 hours of community outreach over a twelve-month period. During this time you will be responsible for staying in close contact with the Program Coordinator. We will do all we can to provide you with necessary resources, materials and supplies for your use, but you must discuss your needs/requests in advance with the Program Coordinator.

This formal training is just the beginning. Your outreach efforts will determine the impact of this educational program. In the end, you are the one who will make a difference - and shape a better world for us all.

Glossary

3rd Party Certification – Independent companies that have set up criteria to assess the environmental claims of various products. Products that have been certified by a third party (such as Green Seal, EcoLogo, or Design for the Environment) normally have the 3rd party's seal of approval on the product packaging. Household and commercial cleaners are a common product that is certified by 3rd parties.

Aerosol Products - A substance packed under pressure in a container with a spraying device.

Anaerobic – An environment devoid of free oxygen, which allows for the proliferation of anaerobic bacteria in a compost pile.

Aerobic bacteria – Bacteria that thrive in an environment with oxygen. Most commercial and home compost systems rely on aerobic bacteria to break down organic matter and turn it into compost.

Aerated Static Pile - Composting system that uses a series of perforated pipes (or equivalent) as an air distribution system running underneath a compost pile and connected to a blower that either draws or blows air through the piles. Little or no pile turning is performed.

Aseptic Packaging – Type of packaging commonly used for soy milk products and juice boxes. It is a composite packaging material made from paper, plastic and aluminum layers.

Automotive Products - A hazardous product category including waste motor oil, antifreeze, brake fluid, etc.

Bacteria - Group of single-cell micro-organisms, the smallest of the living organisms. Bacteria are found everywhere, in the soil, water and air.

Bale – Once separated, recyclable materials are compressed into rectangular bales which vary in size but are approximately one cubic yard in size. Bales weights vary, depending on what type of material they are made from but can range from a few hundred pounds to 1,500 lbs. or more. Garbage is sometimes baled to make it more efficient to transport to distant landfills.

Biodegrade - To decompose under natural conditions—the breakdown of a compound to simpler chemicals by microorganisms.

Biomimicry - Biomimicry or is the examination of nature, its models, systems, processes, and elements to emulate or take inspiration from in order to solve human problems. The term biomimicry comes from the Greek words bios, meaning life, and mimesis, meaning to imitate.

Bio-plastics - A growing amount of plastics is made from feedstocks that are grown, such as sugar cane or corn. In fact, the first plastics including cellophane were made from bio-based materials—these plastics were largely eclipsed by more efficient plastics. Bioplastics are reemerging today as scientists develop more efficient ways to produce them, as well as in response to concern over the use of finite resources, primarily natural gas and oil. Although bioplastics represent an important area of innovation, attention should be paid to their sustainability considerations (environmental, economic and social), such as water use, recyclability, the effects of farming, greenhouse gas emissions, food supply, and the cost of food.
There are common misconceptions regarding bioplastics. Many people believe—incorrectly—that all bioplastics are biodegradable; however, the use of plant feedstocks does not necessarily lead to biodegradable plastics. For example, PET plastic made from plant feedstocks has the same chemical formula as PET made from natural gas and oil feedstocks. Bio-based PET plastic is not biodegradable, but it is recyclable. The bioplastic PLA, on the other hand, can biodegrade in a commercial composting facility—but it likely will not be accepted in many of today's recycling programs.

Blister-Pack Product Packaging - Blister pack is a term for several types of pre-formed plastic packaging used for small consumer goods, foods, and for pharmaceuticals.

Bulk Buying – The practice of purchasing food and other products in loose form, without packaging.

Bulking Agent - Material, usually high in carbon such as sawdust, wood chips, or shredded yard trimmings added to a compost system to maintain airflow by preventing settling and compaction of waste.

Carbon:Nitrogen Ratio – The balance of carbon and nitrogen in an organic material. This ratio is an important factor in creating an environment that maximizes bacterial decomposition of organic waste.

Caution – As used on a product warning label. Indicates that the contents are toxic but level of toxicity is low. Ingesting products that contain more than an ounce can harm or produce a toxic effect in an adult.

Chasing Arrows - The "chasing arrows" symbol is the recognizable recycling symbol. Its intended use by manufacturers is to indicate that a product and/or its packaging is recyclable although it is often incorrectly used.

Closed Loop – A product that is continually recycled into the same product, for example glass bottles into glass bottles.

Commingling – A collection method where recyclable materials are collected together and separated manually or by special machinery.

Composite Material Packaging – Product packaging that is made from mixed-materials that are inseparable, such as milk cartons made of plastic-coated paper. Separating the paper from the plastic makes recycling such composites expensive.

Compost – Material formed from the decomposition of various forms of plant debris. Sometimes the word is used as a verb, to compost a material is to place it into environment that will cause it to decompose. Also, crumbly, earthy, sweet-smelling mixture of decomposing organic matter (e.g., leaves and food scraps) that is often used to improve the texture, water-retaining capacity, and aeration of soil.

Composting – A process that allows for the controlled biological decomposition of organic material.

Consumable Products – Products such as food and fuel that, when used, are permanently transformed into energy and/or waste product.

Consumerism - A doctrine advocating a continual increase in the consumption of goods as a basis for a sound economy.

Contaminant - A substance that contaminates (to make impure or unsuitable by contact or mixture with something unclean, bad, etc.). In the recycling and composting industries, contaminants are materials that should not have been placed in the recycling bin or yard debris carts.

Cullet – Broken or crushed glass suitable for remelting.

Curbside Collection – Garbage haulers pick up recyclables from residents same day as garbage. Containers are provided.

Curing - The last stage of composting that occurs after much of the readily metabolized material has been decomposed. Provides for additional stabilization, reduction of pathogens, and allows further decomposition of cellulose and lignin.

Danger – As used on a product warning label. Indicates the contents are highly toxic (less than a teaspoon can harm or kill an adult), corrosive (can burn the skin or the eyes), or flammable.

Degradable - Relating to a compound that breaks down into simpler compounds by stages.

Deposit System – The generic term for any recycling program that involves a deposit that is recouped (all or part) through participation in a qualified recycling program, e.g., beverage containers in Oregon or auto batteries

Dirty MRFs – A term for a material recovery facility that processes garbage to remove recyclable or compostable materials.

Disposable Products – Products such as paper and plastic dishware and utensils, batteries, etc., which are designed and produced for a one-time use and then become part of the waste stream.

Downstream Impacts - Energy and pollution associated with collection and transportation of waste and recyclables, leachate from MSW and ash landfills, methane and other air emissions from landfills, air emissions from waste incinerators, land, air, and water quality impacts of burning, stockpiling, and illegal dumping of garbage. While downstream impacts have negative environmental impacts as described above, upstream impacts are normally more environmentally destructive.

Dual Stream Sort – A collection method for recycling whereby most materials are mixed together but one or more items (i.e. glass or motor oil) are collected separately from the commingled (mixed) recycling.

Durable Products – Products such as clothing, furniture and tools that are designed to be used over and over again and can be maintained and repaired to insure longer life.

Environmentally Preferable Purchasing – Green procurement is the purchase of environmentally friendly products and services, the selection of contractors and the setting of environmental requirements in a contract. Green procurement steams from pollution prevention principles and activities. Also known as green or environmental purchasing, green procurement compares price, technology, quality and the environmental impact of the product, service or contract. Green procurement policies are applicable to all organizations, regardless of size. Green procurement programs may be as simple as purchasing renewable energy or recycled office paper or more involved such as setting environmental requirements for suppliers and contractors.

E-waste – Electronics that are collected for recycling are considered e-waste.

Extended Producer Responsibility - Extended Producer Responsibility (EPR) is a mandatory type of product stewardship that includes, at a minimum, the requirement that the producer's responsibility for their product extends to post-consumer management of that product and its packaging. There are two related features of EPR policy: (1) shifting financial and management responsibility, with government oversight, upstream to the producer and away from the public sector; and (2) providing incentives to producers to incorporate environmental considerations into the design of their products and packaging.

Externalized Benefits - An external benefit is a benefit that someone gains because of someone else's action, outside of any market transaction between them. Immunizations give external benefits. When you get a vaccine for a certain disease, you make it less likely that you will contract the disease. That is the internal

benefit. What you also do is make is less likely that other people will get the disease, because they probably will not catch it from you. That is the external benefit.

Externalized Costs - Externalized costs are negative impacts associated with economic transactions which concern people outside of those transactions, meaning that neither the buyer nor the seller bears the brunt of the costs. An example is factory pollution, which can have a negative influence on the surrounding community.

Flammables – Products that are easily set on fire; combustible.

Generation Rate – This is a measurement of everything that is disposed, recycled or composted. It is a measure of how much society consumes.

Grasscycling – Leaving cut clippings on the lawn as a natural way to return nutrients to the lawn. It is a source reduction activity in which grass clippings are left on the lawn after mowing. The practice consists of mowing grass so it is never more than two to three inches tall. The grass clippings are left where they fall and allowed to decompose, returning nutrients to the lawn.

Green Building - Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high performance building.

Green Marketing – A style of marketing that makes packages and products look "green" or environmentally friendly to the consumer.

Green Team - Green teams are dedicated groups of employees, regardless of discipline or organizational level, which facilitate the pragmatic implementation of sustainable operations principles at their organization. Schools, businesses and places of worship can all have green teams. Green teams range from the informal - a few employees working together to increase recycling opportunities for themselves and their community, to the formal - a group specifically chartered by leadership to promote and foster sustainable operations that reduce a unit's environmental footprint. Green teams are often "place-based", meaning that the issues they choose to work on are meaningful to their specific community and geographic location.

Green Washing - Greenwashing (a compound word modeled on "whitewash"), is a form of spin in which green PR or green marketing is deceptively used to promote the perception that an organization's aims and policies are environmentally friendly. Whether it is to increase profits or gain political support, greenwashing may be used to manipulate popular opinion to support otherwise questionable aims.

Hazardous Products – A term applied to those products that because of their chemical reactivity, toxic, explosive, corrosive, radioactive or other characteristics, cause danger, or are likely to cause danger, to health or the environment.

Herbicide - A hazardous product category that describes products intended to kill unwanted plants. Includes Weed and Feed lawn products, Diazanon, Moss killers, Round up and other weed killers.

Holding Unit – A simple container used to store yard and garden waste in an organized way until these materials break down or are needed in an active compost pile.

Household hazardous waste (HHW) - Small quantities of unused or leftover hazardous products used in the home that become waste. Paints, pesticides, and some cleaners are examples of household hazardous waste. Caution must be taken when handling, storing, or disposing of these products.

Household Hazardous Waste Site – A collection facility that accepts hazardous materials from the public and then disposes of the waste safely. There are approximately 8 hazardous waste facilities in Oregon. In rural areas that do not have easy access to a hazardous waste facility, periodic collection events are scheduled to safely manage these materials.

Humus - The dark-brown or black substance resulting from the slow decomposition and oxidization of organic matter on or near the surface of the earth, which, with the products of the decomposition of various rocks, forms the soil in which plants grow.

Incineration – The process of burning solid waste under controlled conditions to reduce its weight and volume, and often to produce energy. Facilities that use the heat to generate energy are called waste-to-energy facilities.

Inorganic - Substance in which carbon-to-carbon bonds are absent; mineral matter.

Integrated Waste Management – A system combining several alternatives for solid waste management, including recycling, composting and disposal options such as landfilling.

KRAFT - A strong, usually brown paper processed from wood pulp, used chiefly for grocery bags and as wrapping paper. Usually it is recycled with the similarly made corrugated cardboard fibers.

Landfill - A waste disposal site for the deposit of solid waste (or ashes that result from incineration). Also, an engineered disposal site where solid wastes are deposited, compacted to the smallest practical volume, and covered by soil or other material applied at the end of each operating day. Hazardous wastes are taken to special disposal sites selected and designed to minimize the chance of releasing hazardous substances into the environment. Many larger landfills have methane capture systems

to reduce the amount of methane (a powerful greenhouse gas) from entering the atmosphere. The methane is burned to generate electricity and to eliminate the methane gas.

Leachate - Liquid that has seeped through solid waste in a landfill and has extracted soluble, dissolved or suspended materials in the process.

Life-Cycle Analysis – Analyzes the total environmental impacts of a specific product or product category, including energy use, air pollution and water pollution. This analysis tracks every stage of the products life, including mining, manufacturing, transportation, use and disposal.

Material Recovery Facility (MRF) – A facility that manually and/or mechanically separates recyclable materials out of mixed waste. The remainder of the waste is sent to the landfill.

Mixed Waste Processing - Central facility for inspecting and sorting commingled waste materials generally for the purpose of recovering materials of value for recycling. Same as a material recovery facility (MRF).

Mobius Loop – This "chasing arrows" symbol inside a circle is supposed to be used by manufacturers to indicate that a product and/or its packaging is made from recycled content.

Mulch – Organic material (wood chips, sawdust, etc.) placed on the soil surface to control weeds, lessen evaporation and stop soil erosion.

Municipal Solid Waste - Wastes such as durable goods, disposable goods, containers and packaging, food scraps, yard trimmings, and miscellaneous inorganic wastes from households, certain commercial establishments (e.g., businesses or restaurants), institutions (e.g., schools or hospitals), and some industrial sources. It does not include nonhazardous industrial wastes, sewage, agricultural waste, hazardous waste, or construction and demolition waste. Also known as garbage, trash, refuse, or debris.

NIMBY – An acronym for the "Not in My Back Yard" syndrome when neighborhoods fight against the placement of unwanted facilities near their homes, like landfills or waste processing facilities.

Nonpoint-Source Pollution – Undefined sources of water pollution, such as street runoff, erosion from construction and agricultural areas, etc.

Nonrenewable Resources – Resources not capable of being naturally restored or replenished or that are replaced more slowly than they are used such as oil, iron ore or uranium.

Organic Matter – Plant and animal residue that decomposes and becomes a part of the soil.

Pesticides – A hazardous product category that describes products intended to kill a pest. Includes insecticides, mothballs, fungicides etc.

Planned Obsolescence – Designing a product to become obsolete because of fashion or function with other elements, not because it is worn out. This practice is most common in computers and software, clothing, sporting equipment, home interiors and automobiles.

Point-Source Pollution – Water pollution sources that may be traced to a specific source, such as sewer line or a discharge pipe of an industrial facility.

Polishes and Waxes - A hazardous product category including floor wax, furniture and shoe polish, auto wax, nail polish, etc.

Post-Consumer Material – Material generated by a consumer or business that has served its intended use and has been separated or diverted from solid waste for the purpose of recycling, collection or disposal. Post-consumer does not include manufacturing waste. Recycling done at home is considered post-consumer material.

Pre-Consumer Material – Material such as factory trimmings, damaged or obsolete products, and overruns, which are generated by manufacturers. Such materials have been recycled for years.

Precycling – The practice of reducing or avoiding waste before it enters the home by prethinking your purchase based on packaging waste; one of the most effective ways to decrease household garbage.

Product Stewardship - Product Stewardship is the act of minimizing health, safety, environmental and social impacts, and maximizing economic benefits of a product and its packaging throughout all lifecycle stages. The producer of the product has the greatest ability to minimize adverse impacts, but other stakeholders, such as suppliers, retailers, and consumers, also play a role. Stewardship can be either voluntary or required by law.

Recovered Material – Materials and byproducts that have been recovered from solid waste. Industrial scrap is not considered recovered because the materials and byproducts are commonly reused within the industrial system. This is a broad term, which covers both pre-consumer and post-consumer materials.

Recyclable – A product or package that can be collected, separated or recovered from the waste stream for use as a raw material in the manufacture or assembly of a new package or product. Also, material that still has useful physical or chemical properties after serving its original purpose and can be reused or remanufactured to make new products. Plastic, paper, glass, steel and aluminum cans, and used oil are examples of recyclable materials.

Refurbish - To repair, clean, and make useful again. Some electronic manufacturing companies and other businesses take back used equipment, refurbish it, and sell it again.

Recovery Rates – A measurement of everything that is recycled and composted as a percentage of everything that was generated (garbage + recycling + composting). In recent years, Oregon's recovery rate has hovered around 50%, meaning that approximately half of all of Oregonian's waste was composted or recycled and half was landfilled or incinerated.

Recycled Content – The portion of a product or package that contains materials that have been recovered or otherwise diverted from the solid waste stream either during the manufacturing process or after consumer use.

Recycled Material – Material that has been separated from the waste stream, reprocessed into a new product, often taking the place of virgin material.

Recycled Products – (as defined by the State of Oregon for internal purchasing definitions) Materials, goods or supplies in which at least 50% of the total weight of the item is made out of secondary and post-consumer waste. Also 10% of the item's total weight must be made from post-consumer waste. Recycled products include remanufactured products. A less prescriptive definition is any product that contains any recycled content.

Recycling – Systems that collect, process and market individual materials from the waste stream to be manufactured into new products, such as paper, glass, metals, or motor oil. Also, collecting, sorting, processing, and converting materials that would have been thrown away into raw materials used to make the same or new products.

Renewable Resources – Capable of being naturally restored or replentished.

Reuse – Methods by which existing materials can be put back to their intended use.

Selective Shopping – When buying something new, selecting the product and package carefully in order to minimize waste.

Sewage Treatment Plant - Facility that uses physical, chemical and biological processes to remove organic matter, bacteria, viruses and solids from residential, commercial and industrial wastewaters before they are discharged in rivers, lakes and seas.

Soil Amendment - A substance added to the soil to improve its physical properties as a growing medium (e.g. compost).

Source Reduction - Any change in the design, manufacture, purchase, or use of materials or products (including packaging) to reduce their volume or amount or toxicity

before they become municipal solid waste. Source reduction also refers to the reuse of products or materials.

Source Separation – Recyclables are segregated from other wastes at the point of generation – at home or at work – and are collected separately. Often used to refer to the systems that sort recycling by material type as opposed to the common co-mingling systems.

Superfund - The federal government's program to locate, investigate and clean up the worst uncontrolled and abandoned toxic waste sites nationwide; administered by the Environmental Protection Agency.

Sustainable – The ability to support, endure or keep up economically and socially without depleting or damaging resources.

Tipping Fee – The amount that the public and garbage haulers pay to dump garbage and compost at transfer stations, landfills, waste-to-energy facilities, or composting facilities. Occasionally if market prices are low, garbage haulers have to pay tipping fees to drop off recyclables.

Top Dressing – Using compost to mulch around flower and vegetable plants, shrubs and trees.

Toxic/Poison – A chemical or mixture of chemicals that presents a high risk of injury to human health, safety or to the environment.

Transfer Station - A place where garbage, yard debris and/or recycling are collected and compressed, baled, and loaded onto vehicles for more efficient transport to disposal or recycling sites.

Trash - Items that are discarded because they no longer work and are uneconomical or impossible to reuse, repair, recycle or compost.

Turning Unit – Typically a series of bins or a horizontally mounted rotation barrel used for building and turning hot compost piles.

Upstream Impacts - The environmental costs associated with the production and distribution of products before the consumer purchases them. Environmentally, most products have much larger upstream costs than downstreamcosts. Examples include extraction and harvesting of raw materials, energy and water used for manufacturing of primary materials and fabrication of products/packages, pollution released as a consequence of off-site energy consumption, pollution released from manufacturing processes and energy and pollution associated with transportation of raw materials and products.

Upstream Processes - Extracting raw materials and converting them to products.

Vermi-compost – High quality "castings" left behind in worm composting bins.

Warning – As used on a product warning label. Indicates the contents are moderately toxic (a teaspoon to an ounce can harm or kill an adult).

Waste Audit – A way to assist individuals and businesses in determining how they can reduce waste, both that they generate and receive from other sources, to help protect the environment and save money. Sometimes called a waste assessment.

Waste Exchange – A system where one person or company's waste becomes a resource for another person or business.

Waste Generation Rate - The weight and proportion of materials and products as they enter the waste management system from residential, commercial, institutional, and industrial sources and before materials recovery or combustion takes place. This includes everything that is composted, recycled and discarded as garbage.

Waste Prevention - The reduction of the quantity and harmfulness for the environment of materials and substances at the marketing, distribution, utilization and elimination stages, in particular by developing 'clean' products and technology.

Waste Reduction - Methods used by the generator of waste to reduce the amount of solid waste requiring recycling, composting, incineration or disposal. "Reduce" is the first and most important of the 3 R's.

Waste Stream - The total flow of solid waste from homes, businesses, institutions and manufacturing plants that is recycled, burned, or disposed of in landfills, or segments thereof such as the 'residential waste stream' or the 'recyclable waste stream.'

Waste to Energy Facility – A facility that burns mixed solid waste to reduce its volume and extract energy as heat and/or electricity.

Windrow System - Composting mixture is placed in elongated piles, called windrows. These windrows are aerated naturally by a chimney effect, by mechanically turning the piles with a machine such as a front-end loader or specially designed equipment, and/or by forced aeration.

Worm Castings - Earthworm excrement. Worm castings appear dark and granular like soil, and are rich in soil nutrients.

Yard Debris - Grass clippings, leaves and weeds, and shrub and tree prunings six inches or less in diameter, from residences and businesses.

List of links:

Chapter 1: Overview

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25. http://www.epa.gov/methane/sources.html
26. http://www.epa.gov/nitrousoxide/sources.html
27. http://www.epa.gov/ozone/
28. http://www.epa.gov/highgwp/sources.html
29. http://www.theresourceinnovationgroup.org/climate-masters-at-home/
30. http://www.theresourceinnovationgroup.org/climate-masters-at-work/
31. http://www.epa.gov/climatechange/science/index.html
32. http://occri.net/
33. http://www.storyofstuff.com/
34. http://www.ericweinerbooks.com/books/the-geography-of-bliss/description/
35. http://www.theeconomicsofhappiness.org/
36. http://en.wikipedia.org/wiki/Gross_national_happiness
37. http://ul.com/newsroom/pressreleases/ulc-standards-acquires-environmental-certification-and-advisory-firm-terrachoice/
38. http://www.greenwashingindex.com/
39. http://www.greenseal.org
40. http://www.epa.gov/dfe/
41. http://www.ecologo.org/en/
42. http://us.fsc.org/

43. http://www.ewg.org/
44. http://www.ewg.org/skindeep/
45. http://www.goodguide.com/
46. http://www.epa.gov/greenerproducts/?utm_source=AOR+Contact+List
47. http://www.realdiaperassociation.org/diaperfacts.php
48. http://www.svdp.us/assets/sitefiles/svdp_styrofoam_recycling_for_businesses.pdf
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86. http://oregonstate.edu/dept/mcarec/sites/default/files/master-gardeners/ecolawnbrochurefeb13.pdf
87. http://www.culinate.com/articles/features/wasted_food
88. http://organizedhome.com/kitchen-tips/menu-planning-save-time-kitchen
89. http://grist.org/food/2011-11-18-use-by-dates-a-myth-that-needs-busting/
90. http://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/food-labeling/food-product-dating/food-product-dating
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