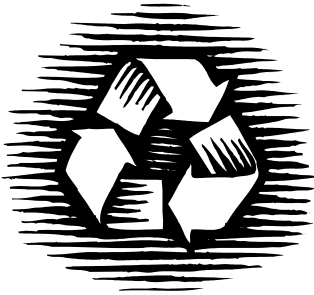




# Recycling Toolkit for Oklahoma Communities

October, 2008





# RECYCLING TOOLKIT FOR OKLAHOMA COMMUNITIES

There is more public support and interest in recycling than ever before. Citizens all across the state are encouraging their communities to develop programs. Community leaders are asking how to design cost effective recycling systems. Businesses are constantly seeking ways to reduce waste. Schools want to become recycling models for their communities.

This guide provides an overview of recycling programs from planning to operations. The people who provided information for it have a great deal of experience. However, no experience is as valuable as that gained by operating an ongoing recycling program. As readers encounter new operating realities or have new ideas about topics covered, please share them with DEQ so that this guide can be continually refined and improved.

Please watch the Oklahoma Recycling Association (OKRA) website for periodical updates and additions to this toolkit: [www.recycleok.org](http://www.recycleok.org).

***A big thank you to these toolkit contributors:***

Lindsay Briggs (DEQ)  
Fred Eilrich (OSU Cooperative Extension)  
Ilda Hershey (OSU Cooperative Extension)  
Mike Hixon (DEQ)  
Bryce Hulsey (DEQ)  
Kole Kennedy (DEQ)  
Margaret Meyer (DEQ)  
Michael Patton (The M.e.t)  
Traci Phillips (Natural Evolution, inc.)  
Fenton Rood (DEQ)  
Susie Shields (DEQ)  
U.S.E.P.A.

*Toolkit prepared for 2008 DEQ / OKRA Recycling Seminar.*

<b>TABLE OF CONTENTS</b>	
<b>TOPIC</b>	<b>PAGE NO.</b>
<b>Benefits of Recycling</b>	<b>4-5</b>
<b>Selecting the Best Type of Recycling Program</b>	<b>5-7</b>
<b>Recycling Equipment Needs</b>	<b>7-9</b>
<b>State Funding Opportunity</b>	<b>10</b>
<b>Recycling Measurement</b>	<b>10</b>
<b>Transportation Solutions</b>	<b>11</b>
<b>Setting Up A School Recycling/Waste Reduction Program</b>	<b>12</b>
<b>How to Set-up Recycling in Your Workplace</b>	<b>13-14</b>
<b>Basic Information about Recycling Materials</b>	<b>14-33</b>
<b>Paper</b>	<b>15-18</b>
<b>Yard Trimmings</b>	<b>18</b>
<b>Food Scraps</b>	<b>19-20</b>
<b>Plastics</b>	<b>20-22</b>
<b>Steel</b>	<b>22-23</b>
<b>Aluminum</b>	<b>2-23</b>
<b>Glass</b>	<b>25-27</b>
<b>Textiles</b>	<b>27-28</b>
<b>Wood Waste</b>	<b>22=29</b>
<b>Household Hazardous Waste</b>	<b>29-30</b>
<b>ECycling</b>	<b>30-33</b>
<b>Tires (See Oklahoma Waste Tire Program)</b>	<b>Appendix</b>
<b>Promoting Your Recycling Program</b>	<b>33-34</b>
<b>Conclusion</b>	<b>34</b>
<b>APPENDIX: Table of Contents (Information on CD)</b>	<b>35-36</b>

## **BENEFITS OF RECYCLING**

Recycling takes waste products out of the waste stream and places them back into use as feedstocks for new products. The environmental benefits of recycling are conservation of energy and natural resources and the reduction of pollution when recycled materials are used in manufacturing rather than raw materials. Recycling can also reduce risks to the environment and human health from improper disposal of some hazardous wastes. Although, the collection of recyclable materials is costly, economic benefits can be attained depending on the cost of alternatives such as landfilling or incineration and other factors such as volume of materials and proximity to processing facilities.

### **A Closer Look at the Benefits ...**

#### **Recycling Conserves Resources for Future Generations**

The earth's natural resources are not limitless. Ultimately, coal, oil, iron ore, bauxite, and other nonrenewable resources are available only in limited quantities. Even renewable resources, such as paper and other wood products, are available only up to a limited annual capacity.

#### **Recycling Saves Energy**

The extraction and processing of raw materials into manufacturing feedstocks are some of the most energy-intensive activities of industry. Reducing or nearly eliminating the need for these processes, therefore, achieves huge savings in energy. Recycling of aluminum cans, for example, saves 95 percent of the energy required to make the same amount of aluminum from its virgin source, bauxite. The amount of energy saved differs by material, but almost all recycling processes achieve significant energy savings compared to virgin material production.

#### **Recycling Supplies Valuable Raw Materials to Industry**

When cans, bottles, paper, and other products are recycled, they are processed into raw materials that can be used in the manufacture of new products. Much of the investment in the paper industry has been in mills and machines designed specifically to handle recovered paper. In the past 50 years, approximately 50 percent of the steel produced in the US has been recycled through the steelmaking process. Aluminum from recycled cans and other products account for about 50% of that industry's metal supply. Today, aluminum beverage cans contain an average of 41 percent recycled content.

#### **Recycling Reduces Emissions of Many Air and Water Pollutants**

Many pollutants are released by the extraction and processing of raw materials. Some of these pollutants are known to be carcinogenic or toxic to humans, and some have effects, such as creating acid rain, that are damaging to natural habitats. In addition, for many new and high volume usage chemicals, the long-term effects are unknown. Extensive life-cycle analyses find overall emissions to all environmental media to be lower when we use recovered rather than virgin materials. Recycling is a highly effective strategy for reducing all the categories of health risks and pollution resulting from virgin material extraction and processing.

#### **Recycling Reduces Greenhouse Gas Emissions**

Emissions of carbon dioxide, methane, and other greenhouse gases contribute to global climate change. Production with recovered materials generally results in much lower emissions of carbon dioxide because the energy used during the extraction and processing of virgin raw materials is reduced. Net carbon emissions from producing a ton of new material are 4 to 5 times higher than producing with recovered material in the steel, copper, glass, and paper industries, and 40 times higher for aluminum. When we recycle paper, that industry's need for virgin wood pulp is reduced, which leaves more trees standing over longer periods of time. More carbon is retained in forests through the natural process by which trees absorb carbon and generate oxygen, thereby, keeping the carbon out of the atmosphere and reducing the potential for climate change. Finally, if organic wastes, such as leaves, grass clippings, and paper, are recycled instead of landfilled, we reduce production of methane, another major greenhouse gas with even greater climate change potential than carbon dioxide. Second only to fossil fuel combustion, landfills are a leading source of greenhouse gas emissions in the US.

### **Recycling Creates Jobs and Revenue**

According to the U.S. Recycling Economic Information Study, commissioned by EPA, the recycling and reuse industry consists of approximately 56,000 establishments that employ over 1.1 million people, generate an annual payroll of nearly \$37 billion, and gross over \$236 billion in annual revenues. This represents a significant force in the U.S. economy and makes a vital contribution to job creation and economic development.

### **Recycling Stimulates the Development of Greener Technologies**

New technologies and industries are not created in a vacuum. Government incentives and regulations influence the direction in which private enterprise evolves. In the late 19th century, when America's natural resources appeared to be limitless, huge government grants of land to railroads, mining interests, and timber companies opened the West to transportation and industry. Prevailing attitudes encouraged the intensive use of virgin raw materials. Recycling, sets a similar context for today's industry. The vast supply of low-cost materials from community collection programs has spurred many businesses to develop new and innovative technologies and products. A good example is plastic lumber, which was developed to utilize low-cost materials such as plastic grocery bags and wood chips or sawdust. Plastic lumber is long lasting, requires limited upkeep, and resists warping and decay. Existing technologies can likewise be adapted to utilize collected recyclables to manufacture products. One example of this is a technology originally developed for food processing that is being used to remove additional glass, metal, plastic, and rubber from cars now being recycled for steel.

### **Recycling Reduces the Need for New Landfills**

No one wants more landfills in their community. And certainly no one wants to live near a landfill. Here the benefit from recycling is obvious: every cubic yard of material handled by a recycling or composting program is one fewer cubic yard of required landfill space. In 2006, Americans generated about 251 million tons of trash and recycled 82 million tons of materials, which is 32.5 percent.

*Sources: US Environmental Protection Agency, Oklahoma Department of Environmental Quality, Oklahoma Cooperative Extension Service, White House Task Force on Recycling, Stanford University Recycling Program, Steel Recycling Institute, and the Aluminum Association.*

## **SELECTING THE BEST TYPE OF RECYCLING PROGRAM**

### **Drop-off Centers**

The first alternative and typically the most cost efficient way of collecting in rural areas is a drop-off center as Ada is currently operating. Drop-off centers, or convenience centers, as they are frequently called are conveniently located sites where residents can voluntarily bring their recyclable materials. The centers will have containers and/or designated locations to dispose of various materials. A wide spectrum of center designs is possible, depending on type of accepted material, site location, number of residents using the facility, and funds available for construction and operation.

Drop-off or convenience centers can also serve communities that more strongly encourage recycling with volume restrictions for household waste pickup, but alternatives must be made available for those citizens that are unable to transport their materials to the center. An attendant should be onsite to insure that materials are not improperly commingled resulting in contamination of recyclables from other recyclables, and to protect against the inappropriate deposit of unwanted hazardous waste. *If the site is used for collection of hazardous waste, specific handling requirements are required for each item.* If a community elects to have curbside as its primary collection, then a convenience center provides residents an opportunity to dispose of specially designated recyclables such as appliances, tires and batteries. For a more complete and detailed discussion, a comprehensive guidebook entitled, "*A Guidebook for Community Convenience Centers: One Solution to Illegal Roadside Dumping,*" is available from the Oklahoma Cooperative Extension Service (Eilrich, et al, 1997).

**Curbside Collection**

Recyclables are now collected at curbsides of roughly one-third of all single family households in America (Powers, 1995). However, there are several communities in Oklahoma that offer curbside collection. These programs (i.e., OKC, Tulsa, Norman, Edmond, The Village as of 2008) are all in or near the larger metro centers. The primary differences between various curbside programs are the ways in which the materials are collected and the methods in which the materials are processed. With curbside collection the sorting can be done: (1) at the residence; (2) at curbside during pickup; or (3) at a materials recovery facility. Processing methods that focus on sorting at the residence are called source separation systems while those that focus on centralized separation are called commingled recovery systems. Although few systems are specifically one or the other, communities must decide which method will best serve as their primary approach.

**Collection is by far the largest cost component in a curbside recycling program, typically costing three or more times the cost of processing collected material.....much remains to be learned about how to minimize costs while maximizing the recovery of materials (Pferdehirt, et al., 1993)**

Recyclable materials are often collected with a separate route, but can also be co-collected (simultaneously with regular solid waste) in the same truck but in different compartments. Co-collection of separately bagged recyclables and garbage in the same one compartment truck is possible but the increased management challenges associated with processing, contamination of recyclables from garbage and the loss of materials from bag breakage often make this option less desirable.

Each strategy has its own inherent advantages and disadvantages. The best strategy or combination will depend on the unique needs of individual communities and the haulers.

**Table 2  
Estimated Capital Expense for  
Ada Recycling Program**

Capital Costs	Purchase Price	Purchase Date	Years Life	Annual Costs
Horizontal Baler	\$38,139	1997	10	\$3,814
Vertical Baler	\$6,452	1992	5	\$1,290
Forklift	\$14,500	1997	10	\$1,450
Trailer	\$1,430	1999	10	<u>\$143</u>
Total				\$6,697

**Estimated Revenue**

Revenue from the sale of processed goods can offset some of the costs associated with recycling. However, the market for recyclables can be highly volatile. Planners need to be conservative as to the projected revenue from recycling. With that in mind, estimated revenues from the two curbside collection alternatives were compared to the drop-off center given current prices of processed materials (Table 4). The increased recovery from a curbside collection program increased revenues 66 percent with 35 percent participation and approximately 84 percent with 40 percent participation. If the program was expanded to collect glass, the revenues could be increased even more. ***A word of caution is relative here as information from other recycling programs suggest that the addition of glass can have an impact on the quantity of other materials, but revenues from glass may not cover processing cost.***

**Table 3**  
**Estimated Processing Costs for Ada Recycling Program:**  
**Current Drop-Off and Curbside with 35 and 45**  
**Percent Set-Out Rate**

Processing Costs	Current Drop-Off	Curbside 35% Set-Out	Curbside 40% Set-Out
Wages	\$30,672	\$44,444	\$49,075
Utilities	756	1096	1210
Misc.	<u>240</u>	<u>348</u>	<u>384</u>
<b>Total</b>	<b>\$31,668</b>	<b>\$45,888</b>	<b>\$50,669</b>

The information in this report is designed to aid local decision makers in determining the most desirable system to serve the residents of Ada. The analysis suggests that based on other programs the quantity of recovered materials could increase with a curbside collection program. However, variation can be expected between communities and information should only be used to consider future action.

## RECYCLING EQUIPMENT NEEDS

All successful community recycling programs start with good planning and a program based on an existing recycling program that has worked somewhere. Avoid jumping into a poorly thought out recycling program on a shoestring budget. All recycling programs must have a community education outreach plan that spells out how the program works, what materials are accepted, how and when the collection will occur.

### **Small Community Program (less than 5,000 residents)**

The objective is to start small with basic equipment and a simple recycling collection program that is easy to implement and participate in. Curbside is expensive on a small scale (probably \$3.00 to \$4.00 per household per month). Drop-off programs with monitored collection sites are the best way to start a new recycling program. Choice of the drop-off site is important; place the recycling containers in a central area near a police or fire station, or existing transfer station. Use clearly marked bins or trailers to collect the recyclables, and have individual containers for plastics, tin or steel, aluminum, and paper (glass can also be collected but it is dangerous to handle and has virtually no resale value).

If the community supports a curbside program, start small and work your way into larger equipment. Use pickup trucks and curbside bins to collect the materials. Allow residents to put mixed recyclables into one bin and sort the material at a central collection point. When trucks fill up with recyclables, bring them back to a central point for sorting into plastics, steel, aluminum and paper (try to sort by the truck load instead of running many loads and sorting large quantities for half a day- rodents and other vermin like food waste left in tin cans and half full soda bottles). Aluminum and steel (must be separated) can be stored in large bins provided by a near-by metal recycler, paper can be stored in a roll-off box or empty trailer, and plastic needs to be baled in a small to medium vertical or down-stroke baler.

A recycling broker can help small communities sell or market their materials for a reasonable price without having to have truck load quantities (18- 20 tons of one type of material). Many small communities can put their materials on one trailer for sale to a buyer with the help of a broker. Avoid wasting time by trying to market the materials on your own; small communities do not generate enough material to effectively market their plastics, metals and paper.

All successful recycling programs constantly educate their community about recycling and how the local program works. Educate in the schools, and the kids will educate their parents and grandparents for you. Publish how much has been recycled, and how much the community has saved by recycling versus paying to landfill the recyclables.

### **Mid-Size Community Program (between 5,000 & 40,000 residents)**

The objective still is to start small with basic equipment and a simple recycling collection program that is easy to implement and participate in. Curbside is moderately expensive on this scale – probably \$3.00 to \$3.50 per household per month, but saleable quantities of recyclables can be generated with curbside recycling. Drop-off programs with monitored collection sites are a good way to collect recyclable from outlying communities, or individuals who prefer to drop-off their recyclables. Choice of the drop-off site is still important, but placing the recycling containers in an area on the outskirts of town near a retail center can work well for recyclable collection. Use clearly marked bins or trailers to collect the recyclables, and have individual containers for plastics, tin or steel, aluminum, and paper (collecting glass in an unmanned site is not recommended, since broken glass can accumulate around the collection containers).

Start all curbside programs on a small scale (maybe in one quadrant of town and add others over a few months); work out bugs in the program before you launch to a community wide program. Use pickup trucks and curbside bins to collect the materials in the beginning; after the program shows sustainability invest in a truck designed for collecting recyclables. If you do not have a material sorting facility, a compartmentalized truck is recommended (4 or 5 compartments is ideal). Still allow residents to put mixed recyclables into one bin and sort the material at the curb into the compartment truck.

When collection trucks fill up with recyclables, bring them back to a central point for sorting into plastics, steel, aluminum and paper (try to sort by the truck load instead of running many loads and sorting large quantities - rodents and other vermin like food waste left in tin cans and half full soda bottles). Aluminum and steel (must be separated) can be stored in large bins provided by a near-by metal recycler, paper can be stored in a roll-off box or empty trailer, and plastic needs to be baled. A vertical or down-stroke baler is recommended for a recycling effort in this size community. A recycling broker is still recommended for selling or marketing the materials for a reasonable price. In the first few years you will still want to move the materials before you have truck load quantities since it will most likely take several months to store-up 18- 20 tons of one type of material. Combining with another community is still recommended so materials can be loaded onto one trailer for sale with the help of a broker. Avoid wasting time by trying to market the materials on your own; small communities do not generate enough material to effectively market their plastics, metals and paper.

### **Large Community Program (over 40,000 residents)**

Most larger communities do not start with a brand new program from scratch. Many have had community drop-off programs, or a private company or maybe a sheltered workshop that has done some kind of community recycling program. A simple clearly defined recycling program with basic equipment and a simple recycling collection program is recommended. Still focus on an easy to implement program that has been promoted well to the community. Basic processing equipment includes: a down-stroke baler (multiple balers are recommended – one for each recyclable; #1 plastic, #2 plastic, steel or tin cans, and cardboard or OCC), a basic sorting line for separating the curbside collected recyclables; an indoor sorting facility or material recovery facility (MRF) with plenty of room indoors for storage of finished bales; loading docks for loading baled recyclables into tractor-trailers; an on-site scale to weigh trucks; and access to a railroad spur to load bales of recyclables onto railcars.

Curbside collection is definitely recommended for large communities, and is cost effective (probably \$2.25 to \$3.25 per household per month) if there is good community participation. Saleable quantities of recyclables should be generated with curbside recycling in a large community. A cardboard collection program for business and industry is another recycling effort that should be conducted in large communities. Front-load trucks are the recommended collection trucks for cardboard only collection programs at retailers and industry. Drop-off programs with monitored collection sites are a good way to collect recyclable from outlying communities, or individuals who prefer to drop-off their recyclables. Choice of the drop-off site is still important, but placing the recycling containers in an area on the outskirts of town near a retail center should still work well for recyclable collection. Use clearly marked bins or trailers to collect the recyclables, and have individual containers for plastics, tin



or steel, aluminum, and paper (collecting glass in an unmanned site is not recommended, since broken glass can accumulate around the collection containers).

Start all curbside programs on a manageable scale (maybe in one quadrant of town and add others over a few months); work out bugs in the program before you launch to a community wide program. Use compartmentalized trucks to collect the curbside programs if the community does not have a sorting line in the MRF, but a packer truck can be used if a good sorting system is operating at the MRF. Allow residents to put mixed recyclables into one bin and simply empty the unsorted recyclables into the collection truck for sorting of the material at the MRF after the truck has a full load (a packer truck can hold 2 to 4 tons of compacted recyclables).

A recycling broker is recommended for selling or marketing the materials if no one in the community has experience marketing recyclables (avoid wasting precious time by trying to market the materials on your own- spend your time and resources on promoting the new program in the community to boost participation rates). To get best pricing for the sorted and baled recyclables you will want to move the materials in truck load quantities since buyers want only full loads (18- 20 tons of one type of material). Combining with another community is still an option if you have limited storage space for baled recyclables.

### **COMMUNITY EDUCATION & OUTREACH**

Every successful recycling program is well planned, has local government buy-in, and has a funded recycling education and outreach program. Focus outreach events at local schools, educate the kids first and they will spread the work for you to moms, dads, cousins, grandparents, and neighbors. Work with the local newspaper to promote the recycling program on an ongoing basis. Get ads on the local news channel or public television/radio station. Send out notices about the recycling program with utility bills from the City. Focus on reaching different groups in your communities like banks, retail businesses, industry, etc. Structure your program so it can sustain after the initial launch of the recycling program – no program can sustain itself without constant education and feedback to the community.

### **ADDRESSING RURAL CONUNDRUMS**

Recycling processors and end users need volume in order to operate cost effectively. For example, manufacturers may only receive material in truck-load quantities, and may require that it be baled to a specified size. Rural areas and small towns may have trouble meeting these requirements. Even if sufficient quantities can be accumulated, small operations may have difficulty getting the collected material to a processing facility for proper sorting, packaging, and marketing. For example, until they are baled plastic bottles are primarily air. It can be cost prohibitive to move those bottles any significant distance until they are baled. It may well be that rural recycling programs must first obtain processing equipment such as a baler before collecting any recyclables.

If transportation is challenging and processing is not feasible, there may be other options. For example, scrap businesses that buy metals are available in virtually every region of Oklahoma. Even in the absence of such businesses, recyclers can arrange service from mobile baling companies who will also market the processed metals.

One material that can be recycled anywhere in Oklahoma is yard waste. It can be used as mulch, or composted into a soil amendment. Bulky items such as tree limbs may need to be chipped as they are received. No permit is required for yard waste composting sites, but a plan for the operation must be filed with DEQ's Land Protection Division.

## STATE FUNDING

Government agencies can obtain reimbursements for investments in recycling equipment from the DEQ. The funding support is for twenty-five per cent of the total investment, and is limited to \$20,000 per transaction. The funding can not be used for buildings or vehicles.

This program is continuous, with funding replenished each new fiscal year beginning on July 1. DEQ and the recipient enter into a contract that describes the project. DEQ uses the contract to issue a purchase order to the recipient. The recycling agency can then submit invoices to DEQ. The equipment purchase and invoice should both occur after the date of the purchase order.

Application information is available from:

R. Fenton Rood, Director  
Waste Systems Planning  
Oklahoma Department of Environmental Quality  
P.O. Box 1677  
Oklahoma City, Oklahoma 73101-1677  
405-974-0110  
fenton.rood@deq.ok.gov

## RECYCLING MEASUREMENT

It is important to utilize a recycling measurement tool that does all of the following:

- Ensures fair comparisons of recycling rates among states and local governments.
- Produces useful information for planning and decision-making.
- Provides accurate, up-to-date numbers for market development.
- Allows for easy data collection from the private sector.
- Saves you time and effort.

*"We see the standard measurement methodology as essential for our own governments within the state of Pennsylvania."*

--Carl Hursh  
Chief of Recycling Markets Section  
Pennsylvania Department of  
Environmental Protection

EPA developed a voluntary, standard methodology for measuring recycling rates. At present, few states or local governments define recycling in the same way, use the same approach for measuring recycling rates, or include the same materials in their rates. Many are not able to obtain complete information from data sources to calculate a reliable rate. As a result, the benefits of measuring recycling are often not fully realized. Utilizing this methodology can help you accurately evaluate the success of your program and ensure that your fiscal, administrative, and planning decisions are sound.

EPA developed this website: <http://www.epa.gov/osw/conserves/tools/recmeas/index.htm> to help state and local government officials learn more about the standard methodology. This site allow you to access a number of recycling measurement documents including detailed instructions, worksheets, sample survey forms, examples, helpful hints and tips, a recommended timeline for developing a measurement program, a glossary of more than 100 terms, and standard volume-to weight conversion factors (See Appendix for table).

You may download the entire 164-page guidance document, *"Measuring Recycling – A Guide for State and Local Government,"* here: <http://www.epa.gov/osw/conserves/tools/recmeas/docs/guide.pdf>.

## TRANSPORTATION SOLUTIONS

A marketing plan must be developed before collecting anything. People typically generate recyclables one at a time – one bottle, one can, one piece of paper. Recycling processors transform those individual recyclables into industrial raw materials. The process includes sorting to the specifications of the manufacturer, processing (typically baling) the material into a form that can be readily transported, and aggregating truck or train car loads for shipment to manufacturers. The recyclable material gains value at each step in the process.

Recycling processors known to DEQ are listed at: <http://www.deq.state.ok.us/lpdnew/Recyclingindex.htm>. Recycling collection programs close to these processors may be able to haul loose recyclables. For recycling to work in other locations baling is essential. Programs that bale materials may still work through processors who can pick up mixed loads of bales. Higher volume programs may be able to ship truck-load quantities of single commodities (baled) directly to consuming mills.

People in more remote locations can look for creative transportation solutions for their recyclables. Is there anyone in the community who routinely travels to one of the larger cities that is home to a processor? If so, do they regularly drive a truck or other vehicle that could haul the recyclables?

# SETTING UP A SCHOOL RECYCLING AND WASTE REDUCTION PROGRAM

## Tips for A Successful Program

1. Obtain top-level support from the school administration, your school district's operation and maintenance staff and your schools custodial staff. Discuss how the program can reduce costs for the school by lowering their disposal costs.
2. Appoint a recycling coordinator, teacher, class or club to implement your program. The best teams have students, teachers, principals, administration and parents who are willing to help.
3. Conduct a waste audit to determine waste composition and volume of materials, what portion can be recycled, re-used, reduced, or eliminated and what recyclable material could be substituted for non-recyclable materials currently in use. Ask your hauler if they will pickup your recycling. The DEQ's *Implementation Form for School Recycling* (in APPENDIX) may be of help with your initial planning efforts.
4. As a team, define your goals and ensure that each member has a role.
5. It is a good idea to choose one or two recyclables to start your new program (i.e. cardboard and mixed paper). Once your program is functioning smoothly, expand your program to include more recyclable materials. Focusing on recycling one commodity at a time allows you to work out the difficulties that may arise with contractual, collection, sorting and educational components.
  - a. Team members can choose the right type of collection container such as restricted openings or slots for paper to keep the garbage out of the recyclables. For more information on containers, see list of websites in the Appendix of this guide.
  - b. The team will need to determine where containers should be placed on your school sites based upon what the audit has determined. Recycling bins need to have trash receptacles next to them or your recycling containers may be used for garbage.
  - c. The recycle team will empty the collection containers bins into larger containers on site so the recycling company can pick them up. Develop this collection system with your school custodial staff. If this part of the program is not managed correctly, recyclables can find their way back into the garbage receptacles.
  - d. The team can create signs or contact local businesses as corporate sponsors and alert the local media of the program. Consider holding a kick-off event at your school site and perhaps tracking and graphing your recycling success to share with your students every month.
  - e. Based on the waste audit, the team may suggest revising existing procurement policies. They may request replacing non-recyclable items with ones that can be recycled or re-used. The team can educate students and staff through in class presentations or a school-wide assembly. Make sure to include school custodians in your education program
  - f. Some schools use the proceeds from collected recyclables (if rebates are available) to purchase recycling containers, fund field trips, and or have an end-of-the-year pizza party for the recycling team.

As a result of your new recycling program you will find that recyclables are being diverted from the waste stream and you are helping to keep valuable natural resources from ending up in a landfill. You may find that your school is now able to reduce the size or quantity of the waste collection dumpsters or to lower the frequency that garbage is picked-up at your school site. Not only will you save money for your school, you will be educating the next generation on the value of caring for our community and environment. See RecycleWorks website <http://www.recycleworks.org/schools/> for more information.

## HOW TO SET UP RECYCLING AT YOUR WORKPLACE

1. **Form a “green team”** – Approaching recycling as a team can help ensure the success of your recycling program. A “green team” is a group of employees interested in recycling and helping to set up a program.
2. **Determine materials you will recycle** – Performing a waste audit can help. A waste audit is an inventory of the amount and type of solid waste (trash) produced at a location. Commonly recycled business items:
  - Office paper
  - Magazines and catalogs
  - Newspaper
  - Cardboard
  - Aluminum cans
  - Plastic bottles
  - Toner and ink jet cartridges
3. **Contact your property manager** – Find out if there are any recycling programs in place. Ask them to provide office paper, cardboard, aluminum can and plastic bottle recycling as a service to building tenants. Remind them that recycling can reduce waste disposal costs.
4. **On your own** – If your property manager cannot provide recycling, or you are a small business, meet with your green team and decide what materials you want to recycle. Contact a recycling company – Interview multiple companies and get price estimates for providing a dumpster and pickup services. Most recycling companies provide rebates on materials collected. Check your local telephone directory listings for contact information.
5. **Drop-off Recycling** – If pickup services are not an option, another option is to take your recyclables to a drop-off recycling center.
6. **Coordinate collection** – with the recycling service provider, janitorial crew and/or staff. Think about:
  - Small bins – You can provide durable recycling containers to each staff person or ask them to use copy paper boxes or something similar at their work stations. Decide what type and size of bin to locate next to printers, fax machines and other machines that generate paper.
  - Central bins – Locate large recycling bins in copy rooms or break rooms.
  - Collection – Create a regular schedule and determine who will pick up recycling from the small and central bins. It may be staff, janitorial crew or a combination.
  - Drop-off recycling – If your staff is using a drop-off collection center, set up a team and schedule for taking recyclables to the center. You may also need to determine a place to store recyclables.Communicate all this information to your entire staff and janitorial crew.
7. **Educate staff**
  - Distribute fact sheets describing the new recycling program for employees and janitorial staff and post updates on your company's intranet site.
  - Provide bins and collection containers as mentioned above.
  - Mark containers with signs labeled by item. It is helpful to use the “chasing arrows” recycling symbol.
8. **Plan a fun kick-off event**
  - Send a memo from management to all employees encouraging participation.
  - Fun events, giveaways and refreshments could be provided.
  - Distribute fact sheets, signs and containers.
  - Schedule orientation sessions for each department.
9. **Let others know about your efforts**

Write articles for the employee newsletter, intranet, and building and industry newsletters. Acknowledge people for changing their habits and keep people informed of the results of their efforts. Seek staff's suggestions.

Send out press releases to the local media. You may also want to include information in customer or client mailings.

Include your recycling efforts in company promotional pieces.

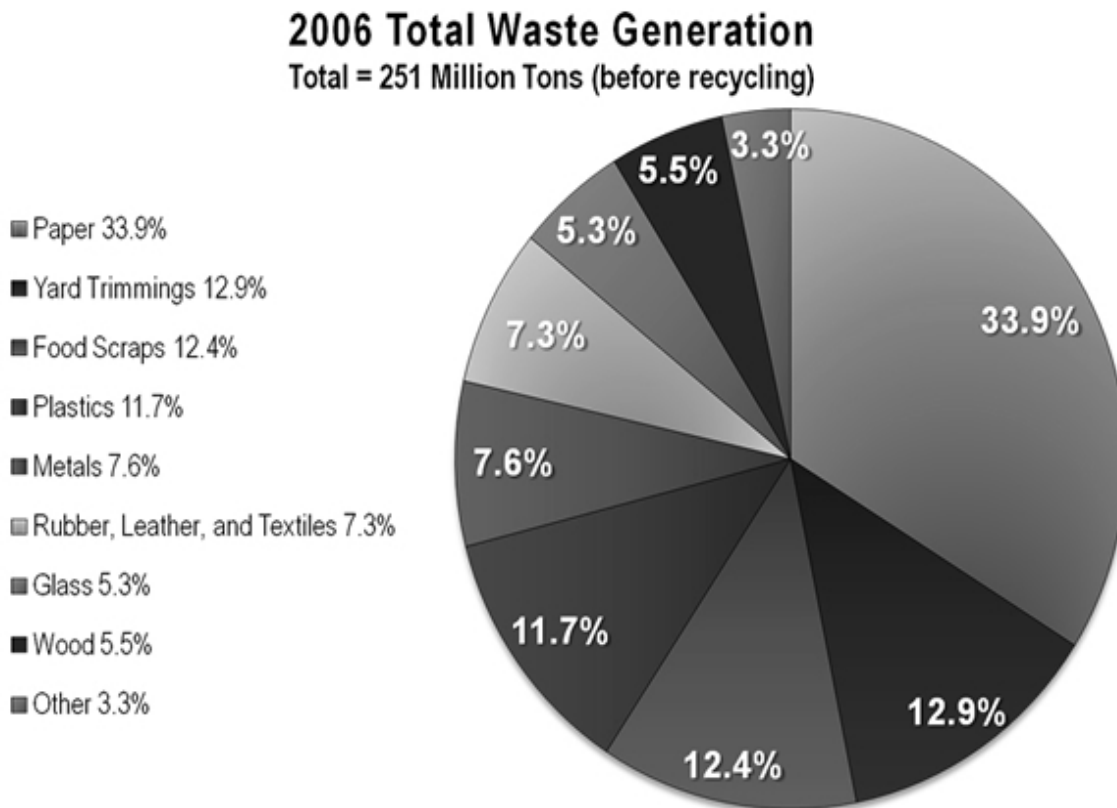
#### 10. Maintain your program

Have your green team meet regularly to evaluate your recycling program's progress. A successful program will continue to grow in volume recycled. The team can also address other green issues such as energy consumption and alternative transportation.

Stay in contact with staff. Update your staff regularly on the program's progress. Send out periodic recycling reminders. Train new employees about the recycling program.

Identify a recycling point person to handle tasks such as answering staff questions, managing the green team and program oversight.

**BASIC INFORMATION ABOUT RECYCLABLE MATERIALS**  
*Information in this section was reprinted from U.S.E.P.A.'s website:*  
<http://www.epa.gov/osw/consERVE/materials/index.htm>.  
*More details on these materials may be found there.*



## PAPER (33.9%)

Why recycle paper? Because paper and paperboard products represent the largest portion of our municipal waste stream (e.g., trash). In 2006, paper and paperboard products accounted for almost 85 million tons (or 34 percent) of all materials in the municipal waste stream. In that same year, we recycled more than half (51 percent or 44 million tons) of all the paper that Americans used.

### Paper Grades and Collection

Paper mills use "recipes" specifying the type of fiber and chemical requirements needed for the recycled-content paper or paperboard being produced. Mills seek to purchase bales of recovered paper that have the desired compositional quality and that meet specifications resulting in high quality recycled-content products. The different types of paper generally collected for recycling are categorized into different "paper grades." The grade of a particular bale of recovered paper depends on the type of paper that is actually in the bale, which is a direct result of the type of collection and processing used to recover the paper.

**Paper Grades** - There are five basic paper grade categories:

- (1) **Old Corrugated Containers (OCC)**, also known as corrugated cardboard: Mills use old corrugated containers to make new recycled-content shipping boxes, as well as recycled paperboard for product packaging (cereal boxes, shoe boxes, etc.).
- (2) **Mixed paper**: Mixed paper is a broad category that often includes items such as discarded mail, telephone books, paperboard, magazines, and catalogs. Mills use mixed paper to produce paperboard and tissue, as a secondary fiber in the production of new paper, or as a raw material in non-paper product such as gypsum wallboard, chipboard, roofing felt, cellulose insulation, and molded pulp products such as egg cartons.
- (3) **Old Newspapers(ONP)**: Mills primarily use old newspapers to make new recycled-content newsprint and in recycled paperboard and tissue, among other paper grades.
- (4) **High Grade Deinked Paper**: This grade is made of high grade paper such as letterhead, copier paper, envelopes, and printer and convertor scrap that has gone through the printing process. It must first be deinked before it can be reprocessed into high grade paper products such as printing and writing papers or tissue.
- (5) **Pulp substitutes**: A high grade paper, pulp substitutes are often shavings and clippings from converting operations at paper mills and print shops. Mills can use pulp substitutes in place of virgin materials to make back into high grade paper products.

**Note:** Although **shredded paper** is not a separate grade of paper, shredded paper can be recycled (usually as a mixed grade) as long as it is shredded to an appropriate size and does not contain an unacceptable level of contaminants, such as plastics. Collection program coordinators who want to recycle shredded paper should check with their contract hauler to determine appropriate shred size and level of contamination acceptable for recycling.

Statistics from the American Forest & Paper Association on the recovery of paper and paperboard, including information specific to individual grades, is available at [www.Paper Recycles.org](http://www.Paper Recycles.org).

**Collection and Processing** - Two basic collection methods for paper recovery are common:

- (1) **Single Stream Collection**: "Single stream" collection programs allow participants to put all recyclable materials (e.g., paper, bottles, cans, etc.) into one collection container. In the case of paper, all grades are mixed together. These materials are then collected and separated, usually at a central point such as a materials recovery facility (MRF). Paper collected in single stream systems may be further separated into various paper grades. For single stream recycling to work, the processing facility must sort the recyclable materials properly and thoroughly to meet market specifications.

Single stream collection has become popular because it:

- a. Is convenient which has been proven to increase participation rates;
- b. Makes it easy to add new materials to the collection system;

- c. Increases the amount of recyclables collected;
- d. Reduces the number of collection trucks needed.

(2) **Sorted Stream Collection:** Sorted-stream collection requires that participants place each recyclable material in the appropriate collection bin when they first discard the item. Recovered paper can be collected separately by grade (e.g., white office paper, newspapers, magazines, and corrugated cardboard boxes) or more commonly, collected as mixed paper separated from other recyclable materials.

Some of the benefits of sorted stream collection include:

- a. Lower levels of contamination at the source;
- b. Higher quality and more valuable recovered material;
- c. Lower costs to process the recovered paper.
- d.

(3) Paper recyclers are developing new technologies designed to handle, identify, and separate paper grades for recycling. One enhancement technology allows segregation of paper fibers during the recycling process according to fiber length, coarseness, and stiffness through a sequential centrifuging and screening process.

### Recovered Paper Quality

Recovered paper and paperboard needs to be clean, dry, and free of contaminants in order for industry to use it as a raw material for making new paper products. Although small amounts of contaminants may be acceptable in certain paper products, steps should be taken to limit contaminants as much as possible. Contaminants can severely injure workers and damage equipment, which can lead to expensive downtime at the paper mill. Broken glass, in particular, is a serious hazard. Contaminants include, though are not limited to:

- Plastic (e.g., report covers, spiral bindings)
- Glass
- Metal
- Most tapes, glues, and some adhesives (e.g., sticky notes, self stick labels, book binding)
- Food wastes
- Some coatings

Contaminants can enter the paper stream at any point in the paper recycling process, such as when individuals put their recyclables at the curb, custodians remove recyclables from office buildings and schools, or trucks haul bales of recovered paper to the mill. A mill may have to discard a bale of recovered paper that contains too many contaminants.

It is important for recovered paper to meet appropriate quality specifications. Consult your paper vendor for a list of their specs.

### Paper Recycling Markets

Markets affect how and which materials are collected for recycling, so it is important to consider the market for recovered paper before beginning a paper recycling program. Supply and demand for recovered paper influences the economics of paper recycling.

### Market Influence

Recovered paper is a global commodity. Supply and demand for recovered paper fluctuates, sometimes dramatically, with ever-changing economic conditions. How you choose to sort your paper will depend on the market for that paper. Currently, the market for recovered paper is very strong because of the demand from China and India.

### Types of Markets

A market can be intermediate (such as a materials recovery facility, processor, or packer that sorts, grades, bales, and sells recovered paper) or an end-use market such as paper recycling mills and manufacturers of other products made from recovered paper. Discuss market options with your hauler or paper recycler, who should already be familiar with markets for recovered paper in your area.



### **Export of Recovered Paper**

In recent years, dramatic economic growth in China has fueled very strong export demand for America's recovered paper. This has caused prices to skyrocket, making it more expensive to produce recycled paper here at home. One way we can help is to collect more recovered paper. Increasing supply will lower costs, which in turn, will enable mills to manufacture and sell more recycled-content paper.

In 2007, approximately 35 percent of recovered paper was exported to overseas markets. About 62 percent stayed in the US to be recycled into paper and paperboard products. The remainder was used to make other non-paper products like molded packaging, compost, and kitty litter.

### **Setting Up a Paper (or other) Recycling Program Details / Logistics**

Some important questions to ask when starting a paper recycling program include:

- Who will collect the recycled paper or other recyclables?
- What type of paper is generated?
- What collection system will be used?
- Where will the materials be stored and picked up for recycling?
- When will pick-ups be scheduled?
- How much of each type of paper will be generated?
- How will this program be paid for, promoted, and monitored?

### **Education and Outreach**

The best way to increase paper recycling is to educate people about:

- Why they should recycle.
- What they should recycle.
- How they should recycle.

There are several key elements to a successful education and outreach program:

- Keep it Simple:** Make the messages and directions clear, understandable, and concise.
- Say it Right:** Make sure program information is available in a multi-lingual format, as necessary, to ensure all citizens are informed.
- Make it Obvious:** Clearly label collection bins and advertise drop-off sites.
- Spell it Out:** Explain the reasons why recycling is important and the impact it makes on our environment.
- Keep it Going:** Give frequent updates on how much the program is progressing and how the effort is making a difference.
- Make it Count:** Set goals and publicly chart progress, with an incentive for reaching the goals.
- Shout it Out:** Get local media involved and publicize the program.

### **Monitoring**

Monitoring involves visually inspecting to make sure the program is running smoothly. Periodically inspect paper recycling and trash bins and observe:

- Contamination levels in recycling bins.
- Amount of recyclables thrown in the trash rather than collection containers.
- Conditions in the storage/staging area.
- Signage on recycling and trash bins.
- Level of material collected in trash cans and recycling bins

### **Evaluation and Metrics**

In order to measure progress, first establish a benchmark by trying to estimate the quantity and composition of paper and paperboard (by weight and grade) being generated. Your waste hauler might be able to provide this data. You can conduct a waste assessment - find out how at EPA's Waste Wise Web site.

Once your program starts, it is important to regularly monitor and evaluate participation and progress.

- Request monthly reports on the tonnage of paper collected from your recycling service provider. It helps to make this part of your waste/recycling collection and transport contract.

Compare the paper recycling data to the benchmark estimate to see the impact that the recycling program is making.

Determine your paper recycling rate by comparing the amount (by weight) of paper and paper products collected to the total amount of paper generated by the community (both recycled and discarded).

**You can calculate your recycling rate with this formula:** Paper Recycling Rate = Total paper recycled (by weight) divided by Total paper discarded (trashed + recycled) (by weight)

## **YARD TRIMMINGS (12.9%)**

In 2005, 245.7 million tons of municipal solid waste or MSW (more commonly known as trash or garbage) were generated in the United States. Organic materials—comprised of yard trimmings, food scraps, wood waste, and paper and paperboard products—are the largest component of our trash and make up more than two-thirds of the solid waste stream.

Reducing, reusing, recycling, and rebuying—the four "Rs"—is key to diverting organic materials from landfills or incinerators and protecting human health and our land, air, and water. Waste reduction and recycling prevents greenhouse gases (GHG) emissions, reduces pollutants, saves energy, conserves resources, and reduces the need for new disposal facilities.

Since these materials are relatively clean and biodegradable, disposal in landfills may be unnecessary and wastes space. In addition, as yard trimmings decompose in landfills, they generate methane gas and acidic leachate. Methane is a colorless, explosive greenhouse gas that is released as bacteria decompose organic materials in landfills. If methane is not controlled at a landfill, it can seep underground and into nearby buildings, where it has the potential to explode. Yard trimmings also contribute acidity that can make other waste constituents more mobile and therefore more toxic.

In large part, disposal of yard trimmings—such as grass clippings and trimmings from bushes, trees, and other yard vegetation—in landfills is generally not necessary, since backyard composting and yard trimmings collection and recovery programs have become quite popular. Composting yard trimmings saves landfill space and reduces methane production in landfills. Methane gas can contribute to global climate change.

Burning leaves and other yard trimmings pollutes the air and can lead to uncontrolled fires. Leaf smoke can make breathing difficult for people who suffer from asthma, emphysema, chronic bronchitis, or allergies. A number of states currently ban leaf burning, and some communities either ban leaf burning or restrict when and where it can take place. For more information, visit EPA's Backyard Burning site: <http://www.epa.gov/osw/nonhaz/municipal/backyard/health.htm>.

Many local governments offer drop-off and/or curbside collection of yard trimmings not composted by homeowners. Drop-off sites work best with residents accustomed to delivering their household discards to landfills or transfer stations to avoid the costs of a curbside collection program. Curbside collection is more expensive than drop-off but typically garners higher participation and diversion rates. The higher operational costs of curbside collection programs can be offset by decreased disposal costs (tipping fees), Increased landfill life; and Potential revenue from compost and/or mulch sales.

EPA's GreenScapes program provides cost-efficient and environmentally friendly solutions for managing yard trimmings from large-scale landscaping operations (e.g., golf courses, parks, roadsides); Find out more online: <http://www.epa.gov/epawaste/partnerships/greenscapes/>.

Although there is no permit required at this time, Oklahoma communities interested in large-scale composting must file a plan with the Oklahoma Department of Environmental Quality (DEQ) Land Protection Division. If sewage sludge or biosolids are included in the plan, communities must follow DEQ Water Quality Division rules. If manure is included in the plan, a permit must be obtained from the Oklahoma Department of Agriculture, Food and Forestry (ODAFF).

## FOOD SCRAPS (12.4%)

Food leftovers are the single-largest component of the waste stream by weight in the United States. Americans throw away more than 25 percent of the food we prepare, about 96 billion pounds of food waste each year. Food waste includes uneaten food and food preparation scraps from residences or households, commercial establishments like restaurants, institutional sources like school cafeterias, and industrial sources like factory lunchrooms. The nation spends about 1 billion dollars a year to dispose of food waste.

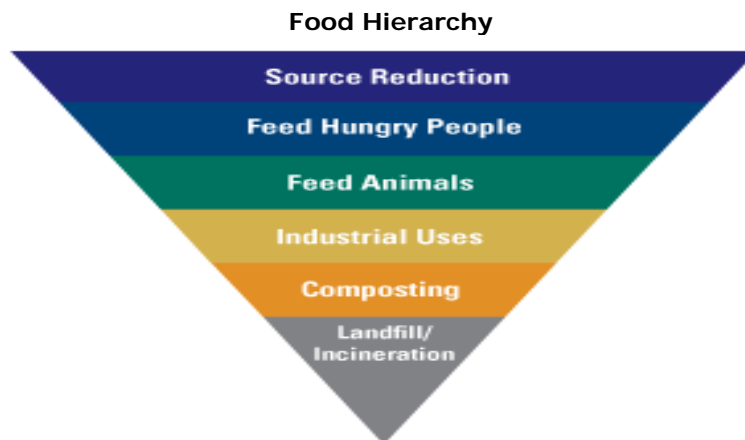
In 2005, almost 12 percent of the total municipal solid waste (MSW) generated in American households was food scraps and less than three percent was recovered. The rest was thrown away and disposed in landfills or combusted in incinerators.

The decomposition of food and other waste under anaerobic (without oxygen) conditions in landfills produces methane, a greenhouse gas (GHG) 21 times more potent than carbon dioxide. Landfills are the largest human-related source of methane in the United States, accounting for 34 percent of all methane emissions. Recover ((i.e. food donations) and recycling (i.e., composting) diverts organic materials from landfills and incinerators, thereby reducing GHG emissions from landfills and waste combustion.

Food waste recovery and recycling is already occurring across the country. State governments are encouraging businesses (e.g., supermarkets, restaurants, institutions) to separate excess, uneaten food for donations and to compost the remainder. Reusing and recycling excess food saves money by reducing disposal fees. By separating food waste, businesses can inventory the excess food they are creating and then implement source reduction practices to save money. Several local governments provide curbside collection of homeowner food waste for composting at municipal or commercial facilities. Many homeowners also are composting their kitchen waste in their own backyards and even in their kitchen using worm bins (known as "vermicomposting").

### Food Waste Recovery Hierarchy

Similar to its solid waste management hierarchy (e.g., source reduction and reuse, recycling and composting, disposal), EPA has suggested a food waste recovery hierarchy to show how productive use can be made of excess food. The food waste recovery hierarchy comprises the following activities, with disposal as the final option:



### Generators of Food Waste

Food waste is generated from many sources: food manufacturing and processing facilities; supermarkets; institutions such as schools, prisons, and hospitals; restaurants and food courts; and households. Food waste is categorized as either pre-consumer (i.e., preparatory food scraps) or post-consumer waste (e.g., leftover food or plate scrapings).

### Large-Scale Generators

Food service providers (e.g., supermarkets, institutions, restaurants) produce a significant amount of food waste each day. EPA is encouraging these large-scale food waste generators to manage their surplus food and to implement a food waste diversion program. Putting Surplus Food to Good Use: A How-To Guide for Food Service Providers: <http://epa.gov/osw/conserve/materials/organics/pubs/food-guide.pdf> uses the food waste recovery hierarchy to help these businesses find productive ways to use their surplus food. Separating and managing food scraps can result in both economic and environmental benefits.

For commercial and institutional food generators (e.g., food processors, grocery stores, restaurants, and institutions), composting food scraps onsite can greatly reduce waste collection and disposal costs, and provide a valuable compost product for use in landscaping.

Commercial food scraps can be managed by using in-vessel composting technology. In-vessel composting systems can compost waste volumes from a few pounds to more than 60 tons a day. Compostable materials are placed in the container and mixed, shredded, and aerated by the system. Some in-vessel systems are fully automated with sensors to monitor temperature, oxygen, and moisture. They use biofilters to reduce or eliminate odors. This is a good method for institutions with large amounts of compostable materials and limited space.

Visit the "Troubleshooting Composting Problems" table on CompostGuide.com for more tips on how to reduce common problems, including odors and pests. The California Integrated Waste Management Board also provides a Troubleshooting Guide to learn how to avoid pests and odors.

## PLASTICS

Plastics play an important role in almost every aspect of our lives. Plastics are used to manufacture everyday products such as beverage containers, household items, and furniture. The widespread use of this valuable material demands proper management of used plastics, as they have become a larger part of the municipal solid waste (MSW) stream in recent decades.

### How Plastics Are Made

Plastics are polymers. The most simple definition of a polymer is something made up of many units. Polymers are chains of molecules. Each link of the chain is usually made of carbon, hydrogen, oxygen, and/or silicon. To make the chain, many links, are hooked, or polymerized, together

To create polymers, petroleum and other products are heated under controlled conditions and broken down into smaller molecules called monomers. These monomers are the building blocks for polymers. Different combinations of monomers produce plastic resins with different characteristics, such as strength or molding capability.

Plastics can be divided into two major categories: thermosets and thermoplastics. A thermoset is a polymer that solidifies or "sets" irreversibly when heated. They are useful for their durability and

### Just the Facts

**In 2006, the United States generated about 14 million tons of plastics in the MSW stream as containers and packaging, over 6 million tons as nondurable goods, and almost 9 million tons as durable goods.**

**The total amount of plastics in MSW—almost 30 million tons—represented 11.7 percent of total MSW generation in 2006.**

**The amount of plastics generation in MSW has increased from less than 1 percent in 1960 to 11.7 percent in 2006.**

**Plastics are a rapidly growing segment of the MSW stream. The largest category of plastics are found in containers and packaging (e.g., soft drink bottles, lids, shampoo bottles), but they also are found in durable (e.g., appliances, furniture) and nondurable goods (e.g., diapers, trash bags, cups and utensils, medical devices).**

**Plastics also are found in automobiles, but recycling of these materials is counted separately from the MSW recycling rate.**

strength, and are therefore used primarily in automobiles and construction applications. Other uses are adhesives, inks, and coatings.

A thermoplastic is a polymer in which the molecules are held together by weak bonds, creating plastics that soften when exposed to heat and return to original condition at room temperature. Thermoplastics can easily be shaped and molded into products such as milk jugs, floor coverings, credit cards, and carpet fibers.

Plastic resins are processed in several ways, including extrusion, injection molding, blow molding, and rotational molding. All of these processes involve using heat and/or pressure to form plastic resin into useful products, such as containers or plastic film.

### **How Plastics Are Recycled**

According to the American Plastics Council (APC), more than 1,800 U.S. businesses handle or reclaim post-consumer plastics. Plastics from MSW are usually collected from curbside recycling bins or drop-off sites. Then, they go to a material recovery facility, where they are sorted either mechanically or manually from other recyclables. The resulting mixed plastics are sorted by plastic type, baled, and sent to a reclaimer. At the reclaiming facility, the scrap plastic is passed across a shaker screen to remove trash and dirt, and then washed and ground into small flakes. A flotation tank then further separates contaminants, based on their different densities. Flakes are then dried, melted, filtered, and formed into pellets. The pellets are shipped to product manufacturing plants, where they are made into new plastic products.

In 1997, APC estimated that roughly one-half of all U.S. communities—nearly 19,400—collected plastics for recycling, primarily PET and HDPE bottles, such as soda bottles. Roughly 7,400 communities collected plastics at the curb, and approximately 12,000 communities collected plastics through drop-off centers.

### **Resin Identification Code**

The Society of the Plastics Industries, Inc. (SPI) introduced its voluntary resin identification coding system in 1988. Municipal recycling programs traditionally target packaging containers, and the SPI coding system offered a way to identify the resin content of bottles and containers commonly found in the residential waste stream. Plastic household containers are usually marked with a number that indicates the type of plastic. Consumers can then use this information to determine whether or not certain plastic types are collected for recycling in their area.

#### **SPI Resin Identification Codes**

- |   |   |
|---|---|
| 1 | PET (Polyeththylene terephthalate - i.e., soda bottles) |
| 2 | HDPE (High-density polyethylene - i.e., milk jugs)      |
| 3 | VINYL (Polyvinyl chloride – i.e., pipes)                |
| 4 | LDPE (Low-density polyethelene)                         |
| 5 | PP (Polypropylene – i.e.s, long underwear)              |
| 6 | PS (Polystyrene (i.e., packaging peanuts)               |
| 7 | OTHER   |

### **Benefits of Plastics Recycling**

While overall recovery of plastics for recycling is relatively small—1.4 million tons, or 3.9 percent of plastics generation in 2003 - recovery of some plastic containers has reached higher levels. PET soft drink bottles were recovered at a rate of 31 percent in 2006. Recovery of HDPE milk and water bottles was estimated at about 31 percent in 2006.

Plastics are recycled for both economic and environmental reasons. Recycling and reuse of plastics have the obvious benefit of decreasing the amount of used plastics that end up in landfills. With increased plastics recycling, fewer natural resources need to be extracted to produce virgin plastic.

According to APC, plastics production accounts for 4 percent of U.S. energy consumption. Though they are derived from nonrenewable natural resources, plastics' adaptable characteristics often enable manufacturers to reduce the material used, energy consumed, and waste generated in making a variety of products.

### **Markets for Recovered Plastics**

Markets for some recycled plastic resins, such as PET and HDPE, are stable in most geographical areas in the United States and are expanding in many others. Currently, both the capacity to process post-consumer plastics and the market demand for recovered plastic resin exceed the amount of post-consumer plastics recovered from the waste stream. The primary market for recycled PET bottles continues to be fiber for carpet and textiles, while the primary market for recycled HDPE is bottles, according to APC.

In the future, new end uses for recycled PET bottles might include coating for corrugated paper and other natural fibers to make waterproof products like shipping containers. PET can even be recycled into clothing, such as fleece jackets. Recovered HDPE can be manufactured into recycled-content landscape and garden products, such as lawn chairs and garden edging.

The plastic lumber industry also is beginning to expand. New American Society for Testing and Materials (ASTM) standards and test methods are paving the way for use of these materials in decks, marinas, and other structural applications for both residential and commercial properties.

## **STEEL**

Steel is a versatile commodity that plays a major part in everyday life—it is used in applications ranging from food cans and household containers to automobiles and office buildings. Steel makes up the largest category of metals in the municipal solid waste (MSW) stream. For many years, steel has been a commonly recycled material in North America and throughout the world. Efficiently managing and recycling used steel products is important to maximize the utility of this commodity.

### **Just the Facts**

More than 1,000 facilities in the United States make and process steel, and most are located in the Great Lakes region and the South.

In 2006, the United States generated nearly 3 million tons of steel as containers and packaging in the MSW stream, as well as 11.5 million tons of ferrous metals, which include iron and steel, as durable goods.

The total amount of ferrous material generated in 2006 - 14.2 million tons - represented 5.7 percent of total MSW generation in 2006.

The amount of ferrous metals (iron and steel) generation in MSW has declined from 11.7 percent in 1960 to 5.7 percent in 2006.

Other sources of steel in the MSW stream are containers and packaging, such as food packaging and aerosol cans.

Large quantities of steel and other ferrous metals are found in construction materials and transportation products, such as automobiles, locomotives, and ships, but these are not included in calculations of MSW. These non-MSW products are, however, highly recycled. In 2006, the steel industry recovered and recycled more than 14 million tons of shredded steel scrap from automobiles—a recycling rate of 95 percent, according to the Steel Recycling Institute (SRI).

### **How Steel is Made**

Steel is an alloy of iron, produced by heating coke, iron ore, and limestone in a blast furnace. It is produced in one of two ways: the basic oxygen furnace (BOF) process and the electric arc furnace (EAF) process.

The BOF process uses 25 to 35 percent recovered steel to make new steel. It combines molten iron from blast furnaces with an injection of very pure oxygen, which causes a chemical reaction. Products such as automotive fenders, refrigerator encasements, soup cans, pails, and industrial drums are made with this type of steel. BOF steel is ideal for these applications because of its "drawability," or ability to be flattened into sheets.

The EAF process uses virtually 100 percent recovered steel to make new steel. Scrap steel is melted and refined by passing an electric current from electrodes through the material. Products such as structural beams, steel

plates, and reinforcement bars are made with this type of steel because it is so strong.

### **How Steel is Recycled**

Steel cans from MSW and other steel recyclables are usually collected from the curbside, drop-off sites, or multi-material buyback centers. The steel is then hauled to a material recovery facility, where workers separate it from other recyclables and crush it in to large bales. The bales are shipped to steel mills or foundries, where they are combined with other steel scrap and melted in a furnace to make new steel.

### **Benefits of Steel Recycling**

The steel industry in North America has been recycling steel scrap for more than 150 years. The steel industry needs scrap to produce new steel, which ensures that all steel products contain anywhere from 25 percent up to 100 percent recycled content. It also is cheaper to recycle steel than it is to mine virgin ore to manufacture new steel. New ore is still mined in order to supplement production of steel and steel products.

Recovering steel not only saves money, but also dramatically reduces energy consumption, compared to making steel from virgin materials. In turn, this reduces the amount of greenhouse gases released in to the air during processing and manufacturing steel from virgin ore.

### **Markets for Recovered Steel**

Because using recovered steel to manufacture new steel products saves money, manufacturers have an incentive to promote steel recovery, thus ensuring high recycling rates. Steel products, including the following, can contain between 25 and 100 percent recycled content:

Steel cans and containers comprise more than 90 percent of the food can market in the United States, according to the American Iron and Steel Institute (AISI). They contain up to 30 percent recycled steel.

By weight, typical large appliances (e.g., washing machines, refrigerators), consist of about 65 percent steel. The steel used in appliances, like all steel, is made with a minimum of 25 percent recycled steel. As of 2000, a total of 18 states had enacted landfill bans for appliances, meaning that they must be recycled, according to SRI.

Steel and iron components make up nearly 65 percent of the average automotive vehicle, according to SRI. The steel used in car bodies is made with a minimum of 25 percent recycled steel, and many internal automotive parts, such as engine blocks, are made using even higher percentages of recycled steel. Automotive vehicle recycling is calculated separately from the MSW recycling rate.

Because of its strength and durability, steel has long been the principal building material for commercial construction. Additionally, steel-framed residential homes are increasing in popularity, and by 2002, an estimated 25 percent of all new homes built in the United States will be totally or partially framed in recycled steel, according to SRI. Other construction products, such as roofs and bridges, also are made from recycled steel. Building and construction material recycling is generally calculated separately from the MSW recycling rate.

### **Case Studies**

The following case studies highlight successful steel recycling programs.

"Project Isaiah" brings the Los Angeles County Sheriff's Department together with TAMCO Steel to recycle confiscated firearms into steel rebar (reinforcing bars) used in local construction. In 1999, Project Isaiah recycled 35,600 pounds of metal from confiscated guns.

The City of Santa Fe Springs, New Mexico; Golden Springs Development; and the current owner of a nonoperational fuel storage tank farm and transfer station transformed it into a usable site for the community. Workers deconstructed and recycled steel equipment and tanks removed from the property. The development project diverted 8,250 tons of steel from old storage tanks and 6,275 tons of steel from equipment.

## **ALUMINUM**

Aluminum cans are lightweight, convenient, portable, and keep beverages cold. Cans are often used to package soda, beer, and other beverages, and account for nearly all of the beverage packaging

market for some products. When you throw your aluminum can into the recycling bin, you are contributing to a process that conserves natural resources and saves money compared to manufacturing cans from virgin materials.

### How Aluminum is Made

According to the [Aluminum Association's Aluminum: An American Industry In Profile](#), manufacturers make aluminum by mining deposits of bauxite ore and refining it into alumina—one of the base ingredients for aluminum metal. Alumina and electricity are combined with a molten electrolyte called cryolite. Direct current electricity is passed from a consumable carbon anode into the cryolite, splitting the aluminum oxide into molten aluminum metal and carbon dioxide. The molten aluminum collects at the bottom of the cell and is periodically "tapped" into a crucible and cast into ingots.

### The Aluminum Recycling Process

Individuals and haulers can deposit and collect aluminum used beverage containers (UBCs) at the curbside or community drop-off centers. From there, haulers take the cans to a material recovery facility (MRF), where workers separate aluminum cans from other food and beverage containers. Since most recovered UBCs are processed into new cans, it is important that processors generate only high-quality scrap. The recovered aluminum containers must be free from steel, lead, ferrous materials, bottle caps, plastics, glass, wood, dirt, grease, trash, and other foreign substances. The MRF or a scrap dealer then bales the cans, which brokers and can sheet manufacturers purchase.

Can sheet manufacturers typically have arrangements with toll processors to refine the metal and melt it into ingots. The can sheet manufacturers then melt the ingots into can sheet, make cans, produce lids separately, and then sell the cans back to the beverage industry.

### Benefits of Aluminum Recycling

The average aluminum can contains 40 percent postconsumer recycled aluminum. Recovering aluminum for recycling saves money and dramatically reduces energy consumption. The aluminum can recycling process saves 95 percent of the energy needed to produce aluminum from bauxite ore, as well as natural resources, according to the Aluminum Association. Making a ton of aluminum cans from virgin ore, or bauxite, uses 229 BTUs of energy. In contrast, producing cans from recycled aluminum uses only 8 BTUs of energy per can.

An aluminum can that is recovered for recycling is back in the consumer stream in a short period of time. It takes about 6 weeks total to manufacture, fill, sell, recycle, and then remanufacture a beverage can. Most of the aluminum recovered from the waste stream is used to manufacture new cans, "closing the loop" for can production.

### JUST THE FACTS

**In 2006, the United States generated nearly 2 million tons of aluminum as containers and packaging, and manufacturers used about 1.3 million tons of aluminum to make durable and nondurable goods.**

**The total amount of aluminum in the municipal solid waste (MSW) stream—3.3 million tons—represented 1.3 percent of total MSW generation in 2006. In 1960, aluminum in MSW was only 0.4 percent of MSW generation (340,000 tons).**

**The largest source of aluminum in the MSW stream is aluminum used beverage containers (UBCs) and other packaging containers. Other sources of aluminum are found in durable and nondurable goods, such as appliances and automobile parts.**

**Manufacturers make 99 percent of all beer cans and 97 percent of all soft drink cans from aluminum. Aluminum beer and soft drink containers were recovered at a rate of about 45 percent of generation (about 0.7 million tons) in 2006, and 36 percent of all aluminum in containers and packaging was recovered for recycling in 2006.**

**In 2006, Americans discarded about 2.6 million tons of aluminum in MSW after recovery—1.5 percent of total MSW discards.**

**Automobiles also contain aluminum, but this aluminum is generally not calculated in measures of MSW generation, recycling, or disposal.**



## Markets for Recovered Aluminum

UBCs are the largest component of processed aluminum scrap, with most UBC scrap manufactured back into aluminum cans. According to the North Carolina DENR, however, the demand for aluminum packaging is shrinking because of an increased use of plastics in soda bottles and other beverage packaging applications. To increase aluminum can recovery, the industry is assisting buy-back centers to attract more UBCs to their sites. Diecasts used by the automotive industry constitute the second largest portion of recovered aluminum. In the future, increased demand for fuel-efficient, lightweight cars is expected to make aluminum more popular in automobile manufacturing.

Demand for UBCs and other aluminum scrap depends on the supply and demand for primary aluminum derived from virgin material. The demand for primary aluminum is determined by the domestic and international demand for aluminum ingots and aluminum finished products.

The largest concentration of domestic aluminum consumption is in transportation, containers and packaging, and building and construction. Combined, these three markets account for almost two-thirds of industry consumption. The next largest grouping includes electrical, consumer durables, and machinery and equipment. Exports account for the remainder (about 13 percent), mostly to Canada, Japan, and Mexico. (The latest available data for the following market-specific information, provided by the Aluminum Association, comes from 1999.)

According to a study conducted by the North Carolina DENR, aluminum is a desirable material in the transportation industry because of its relative strength and lightweight properties. The average aluminum content per passenger car increased from 191 pounds in 1991 to 252 pounds in 1996, according to the North Carolina DENR. If the use of aluminum in automobiles continues to grow, then the prosperity of the transportation industry might determine the demand for aluminum.

## GLASS

For centuries, glass has served as a universal packaging container, holding precious commodities like wine and olive oil. Today, manufacturers use glass to hold everything from soda and peanut butter to champagne and perfume. Glass manufacturers and consumers continue to appreciate glass for its aesthetic value but also recognize its practicality. The glass in many items, from your beer bottle to your computer, can be recycled over and over while retaining its strength.

### Recycling Glass

The glass containing your soda today might be the glass containing your spaghetti sauce tomorrow. That's because glass, especially glass food and beverage containers, can be recycled over and over again. In fact, 90 percent of recycled glass is used to make new containers. Other uses for recycled glass include kitchen tiles, counter tops, and wall insulation. Glass makers have always known the material's recyclability, but glass recycling has grown considerably in recent years. This growth is due to both increased collection through curbside recycling programs and glass manufacturers' increased demand for recycled glass.

### Just the Facts

Americans generated 13.2 million tons of glass in the municipal solid waste (MSW) stream in 2006.

About 22 percent of the glass was recovered for recycling.

Recovery increased from 750,000 tons in 1980 to more than 2.9 million tons in 2006.

Soft drink, beer, food, wine, and liquor containers represent the largest source of glass generated and recovered for recycling.

Glass in durable goods, such as furniture, appliances, and especially consumer electronics, round out the sources of postconsumer glass.

Today, most glass manufacturers rely on a steady supply of recycled crushed glass, known as "cullet," to supplement raw materials. To make glass, manufacturers mix sand, soda ash, limestone, and cullet; heat the mixture to a temperature of 2,600 to 2,800 degrees F; and mold it into the desired shape. Sand is the only material used in greater volumes than cullet to manufacture glass.

Using cullet saves money and helps the environment, because:

- Cullet costs less than raw materials.

- Cullet prolongs furnace life since it melts at a lower temperature.

- Cullet demands less energy from power sources like electricity, natural gas, and coal.

- Less energy used means reduced emissions of nitrogen oxide and carbon dioxide, both greenhouse gases.

### **Collection and Processing**

Two common ways to collect glass are at the curbside and at drop-off locations. Glass collected at the curbside is usually commingled, meaning that different colors of glass, and sometimes different types of glass, are collected together. This glass might then be sorted by color, or other characteristics, at a materials recovery facility. Some municipal and commercial recycling programs require participants to separate clear, brown, and green glass. Often, glass collected at drop-off locations is separated by color. Generally local recycling offices or departments of public works instruct residents on the types of glass that the recycling program collects and how residents should set out materials at the curb or drop-off centers. Curbside collection requires less work on the part of residents, although contamination levels can be greater.

Although all glass is made of silica and soda, the type and quantity vary slightly with different types of glass. These differences frequently cause manufacturing problems due to different melting points and chemical incompatibility. In addition, since neither brown nor amber glass is used to manufacture clear glass, it is important to sort glass by color. Glass separated by color, whether this takes place at the curbside or drop-off facility or at a materials recovery facility, yield glass cullet of higher economic value.

Sorting also can help reduce common contaminants, such as ceramic cups, plates and pottery, clay garden pots, crystal and opaque drinking glasses, heat-resistant ovenware, lead collars from wine and champagne bottles, stones and dirt, light bulbs, metal caps, lids and neck rings, and mirrors. Finally, sorting can keep broken glass from contaminating other recyclables, like newspapers.

In the materials recovery facility, workers remove large contaminants by hand and sort the glass by color where possible. Then, glass is typically crushed and travels by conveyor belt through a series of refinements. Magnets pull out metal, and air currents remove lightweight material such as paper. Some cullet suppliers use sophisticated equipment such as lasers to sort colors of crushed glass and further remove small contaminants. Scientists continue to develop mechanisms to improve materials sorting, and, therefore, the quality of the cullet.

### **Markets for Recovered Glass**

Glass container manufacturers need a steady supply of quality cullet to make glass containers. Ninety percent of recycled glass is used to make new containers, and the demand for quality cullet is greater than the supply. Due to factors like contamination, cullet can be either high-quality or low-quality by the time it is sold. High-quality cullet is free of contaminants that can jeopardize the integrity of an entire batch of glass. The Glass Packaging Institute (GPI), a trade association representing glass and glass product manufacturers, lists a number of secondary uses of high-quality cullet: abrasives, aggregate substitute, bead manufacturing, decorative applications, fiberglass, frictionators (match tips), and fluxes in metal foundry work.

Lower-quality cullet—that is, mixed-color glass from container and non-container recycled glass—is increasingly used in secondary applications, such as in the manufacture of fiberglass insulation, roadbed aggregate, driving safety reflective beads, and decorative tile.

Unfortunately, Oklahoma has lost most of its traditional glass markets with only one plant remaining in Muskogee. (Anchor glass is still open in Henryetta, but accepts glass from only two suppliers.)

### **Case Studies**

Waste Management Recycle America (formerly Recycle America Alliance) constructed an automated, optical glass sorting line at its California facility that removes ceramic and metal contaminants from

color-separated clear, brown, and green glass. The new sorting technology also has the ability to convert three-color mixed glass into clean, usable cullet.

The goal of the Department of Defense (DOD)/Federal Facility/Ohio Pollution Prevention Partnership is to create a working relationship to promote and implement pollution prevention as the preferred strategy for protecting the environment. The partnership increased glass and plastic recycling by 99 percent, from 30 pounds to 27,000 pounds, by allowing DOD employees to recycle household materials on base.

More than 15 Minnesota counties have used reclaimed glass as aggregate. While many different applications have been demonstrated in Minnesota and other states, the use of 10 percent blend for road base is the most common, well proven, and safe.

## TEXTILES

Fleece, flannel, corduroy, cotton, nylon, denim, wool, and linen ... What can you do with these fibers when you're finished wearing them, sleeping on them, or draping them over your windows? One way to benefit both your community and the environment is to donate used textiles to charitable organizations. Most recovered household textiles end up at these organizations, who sell or donate the majority of these products. The remainder go to either a textile recovery facility or the landfill.

### Markets

Nearly half of textiles discarded are contributed to charities, according to an estimate from the Council for Textile Recycling. Charities either give away clothes or sell them at discounted prices in secondhand stores. About 61 percent of the clothes recovered for second-hand use are exported to foreign countries.

Regardless of their final destination, used textiles have a relatively stable and high price. According to EPA, revenue generated by sales is enough to cover processing costs. Unsalable clothing is sold to textile recovery facilities for processing.

### Collecting Textiles

A survey by Goodwill Industries, one of the largest textile collectors, found that half of the people making donations prefer door-to-door pickup, and more than half would not go more than 10 minutes out of their way to make a drop off. To help divert textiles that might otherwise end up in a landfill or incinerator, some counties collect used textiles with regular curbside recyclables pickup. Others offer less frequent quarterly or annual pickups. The Institute for Local Self-Reliance, a nonprofit organization that promotes waste reduction and recycling, reports that the most successful municipal or county programs have partnered with or otherwise involved local charities and nonprofit organizations.

Textiles typically are not sorted at the point of collection, but keeping them clean and free from moisture is important. Once clothes get wet, stained, or mildewed, they cannot be sold for reuse. To prevent contamination, many charities offer enclosed drop-off boxes for clothing or other fabrics. Communities with curbside collection for textiles should educate donors on how to properly bag clothing.

Textile recovery facilities separate overly worn or stained clothing into a variety of categories. Some recovered textiles become wiping and polishing cloths. Cotton can be made into rags or form a component for new high-quality paper. Knitted or woven woolens and similar materials are "pulled" into a fibrous state for reuse by the textile industry in low-grade applications, such as car insulation or seat stuffing. Other types of fabric can be reprocessed into fibers for upholstery, insulation, and even building materials. Buttons and zippers are stripped off for reuse. Very little is left over at the end of the recycling process. The remaining natural materials, such as various grades of cotton, can be composted. If all available means of reuse and recycling are utilized, the remaining solid waste that needs to be disposed of can be as low as 5 percent.

More than 500 textile recycling companies handle the stream of used textiles in the United States. As a whole, the industry employs approximately 10,000 semi-skilled workers at the primary processing level and creates an additional 7,000 jobs at the final processing stage. Primary and secondary processors account for annual gross sales of \$400 million and \$300 million, respectively.

### **Case Studies**

The Solid Waste Authority of Palm Beach County, Florida nearly tripled donations to charities during an innovative curbside textile collection program. In researching waste streams to divert from landfills, the county discovered that curbside textile collection inadvertently competed with charities, who rely on a steady stream of clothing. Rather than compete, the county and the charity groups decided to join forces. Together, they distributed more than 300,000 plastic bags as inserts to local newspapers. Each bag described the acceptable items and listed the location of charitable organizations for drop off.

Under a new program called Transitional Work Experience, Goodwill Industries agencies in the Washington, DC, area hire formerly homeless veterans in a wide variety of jobs, including truck drivers, inventory management, general office work, and production supervision. The jobs provide opportunities for these veterans to learn necessary job skills while earning a paycheck. Through programs like this, Goodwill helps people with potential employment barriers enter the workforce. In 2000 alone, Goodwill Industries International served more than 448,000 individuals. Goodwill funds its job-training programs primarily with revenues from collection and resale of clothes and other household goods.

## **WOOD WASTE**

Nearly six million tons of wood waste (e.g., urban wood waste, woody debris from suburban land clearing, and rural forestry residuals) were generated in 2003 according to the EPA. In fact, wood comprises the largest percentage of the residential construction and demolition materials (C&D) waste stream – approximately 40 to 50 percent of residential new construction materials – according to the National Association of Home Builders Research Center.

Prior to 1990, there was limited recycling of wood waste in the United States. Today, EPA estimates there are more than 500 wood processing facilities across the country.

Markets for recovered wood vary across the United States according to regional and local supply and demand. The current market, however, is dominated by mulch and fuel applications that pay between \$12 and \$24 per ton for processed wood. Wood waste from construction and demolition activities is attractive as a fuel because of its low moisture content. Processed or chipped wood is also used as a composting bulk agent and as animal bedding. Salvaged or reused wood products are the highest value items but typically require the highest costs for sorting and processing. In addition, recovered wood can be used to manufacture value-added products such as medium density fiberboard and particleboard; these manufacturers demand high-quality feed stocks, however, which can be difficult to achieve on a consistent basis.

The demolition industry is well established and is increasing its efforts to recover wood waste. In addition, the deconstruction industry continues to grow and salvage an increasing percentage of materials from old buildings. Deconstruction efforts recover and reuse wood for flooring, doors, windows, and other applications. A number of independent lumber mills have retooled their operations to process reclaimed timbers, as well.

Federal and local air and water regulations provide an incentive for wood recovery by discouraging inappropriate burning or discarding of woody debris. A major barrier to increased wood recovery, however, is the lack of grade standards for recovered wood. These standards include grading rules, engineering properties, and a grade stamp. There is also a need for technical performance testing to investigate the structural integrity of recovered wood.

In Oklahoma, wood pallets have found a recycling market in two locations for recycling in Oklahoma City: [IFCO](http://www.ifco.com), 2211 S. May Ave. and Midgard Corporation, 6300 S. Interstate 35 <http://www.midgardcorp.com/index.html>

Look for markets for your wood waste and other C&D Materials Exchange Web site: <http://www.zerowastenetwork.org/RENEWDEV/index.cfm>. Habitat for Humanity ReStores will accept old doors and other reusable wood products for resale.

## HOUSEHOLD HAZARDOUS WASTE

Leftover household products that contain corrosive, toxic, ignitable, or reactive ingredients are considered to be "household hazardous waste" or "HHW." Products, such as paints, cleaners, oils, batteries, and pesticides, that contain potentially hazardous ingredients require special care when you dispose of them.

Improper disposal of household hazardous wastes can include pouring them down the drain, on the ground, into storm sewers, or in some cases putting them out with the trash. The dangers of such disposal methods might not be immediately obvious, but improper disposal of these wastes can pollute the environment and pose a threat to human health. Many communities in the United States offer a variety of options for conveniently and safely managing HHW. In Oklahoma, permanent HHW collection facilities have been established in Oklahoma City and Midwest City.

### Benefits of Proper HHW Management

Reduction and recycling of HHW conserves resources and energy that would be expended in the production of more products.

Reuse of hazardous household products can save money and reduce the need for generating hazardous substances.

Proper disposal prevents pollution that could endanger human health and the environment.

### HHW Facts and Figures

Americans generate 1.6 million tons of HHW per year.

The average home can accumulate as much as 100 pounds of HHW in the basement and garage and in storage closets.

During the 1980s, many communities started special collection days or permanent collection sites for handling HHW. In 1997, there were more than 3,000 HHW permanent programs and collection events throughout the United States.

### Collection Options—Municipalities and Local Governments Facilitating Reuse, Recycling, and Proper Disposal

**Permanent collection or exchange.** See if your community has a facility that collects HHW year-round. Some of these facilities have exchange areas for unused or leftover paints, solvents, pesticides, cleaning and automotive products, and other materials. By taking advantage of these facilities, materials can be used by someone else, rather than being thrown away.

**Special collection days.** If your community doesn't have a year-round collection system for HHW, see if there are any designated days in your area for collecting solid waste at a central location to ensure safe management and disposal. (*See Toolkit Appendix for SWINO's Collection Day Procedures.*)

**Local business collection sites.** If your community has neither a permanent collection site nor a special collection day, you might be able to drop off certain products at local businesses for recycling or proper disposal. Some local garages, for example, may accept used motor oil for recycling.

### Disposal Options

Certain types of HHW have the potential to cause physical injury to sanitation workers, contaminate septic tanks or wastewater treatment systems if poured down drains or toilets, and present hazards to children and pets if left around the house. Federal law allows disposal of HHW in the trash. However,

many communities have collection programs for HHW to reduce the potential harm posed by these chemicals. EPA encourages participation in these HHW collection programs rather than discarding the HHW in the trash. Call your local environmental, health, or solid waste agency for the time and location of your HHW collection program. Also, read product labels for disposal directions to reduce the risk of products exploding, igniting, leaking, mixing with other chemicals, or posing other hazards on the way to a disposal facility. Even empty containers of HHW can pose hazards because of the residual chemicals that might remain.

## E-CYCLING

The use of electronic products has grown substantially over the past two decades, changing the way and the speed in which we communicate and how we get information and entertainment. Our growing reliance on electronics is illustrated by some remarkable figures. According to the Consumer Electronics Association (CEA), Americans own approximately 24 electronic products per household.<sup>1</sup>

EPA is working to educate consumers and others on why it is important to reuse and recycle electronics and what the options are for safe reuse and recycling of these products. State and local governments, manufacturers, and retailers, who are already aware of the pressing need to better manage these materials, are providing more opportunities to recycle and reuse this equipment. Many computer manufacturers, TV manufacturers, and electronics retailers offer some kind of take back program or sponsor recycling events. Many states, including Oklahoma, have passed some sort of legislation to manage end-of-life electronics, and more are expected to follow suit.

The most appropriate donation organization for computers can vary from area to area. In some cases, the most viable donation organization might be a charity, but in other areas, the appropriate donation organization might be the local school district or materials exchange. Visit Ten Tips for Donating a Computer: <http://www.techsoup.org/learningcenter/hardware/page5496.cfm> to learn more.

### Recycling Electronics

If donation for reuse or repair is not a viable option, households and businesses can send their used electronics for recycling. Recyclers recover more than 100 million pounds of materials from electronics each year. Recycling electronics helps reduce pollution that would be generated while manufacturing a new product and the need to extract valuable and limited virgin resources. It also reduces the energy used in new product manufacturing.

One thousand or more municipalities offer computer and electronics collections as part of household hazardous waste collections, special events, or other arrangements. In addition, public and private organizations have emerged that accept computers and other electronics for recycling. Depending on where you live and the amount of equipment you have, the best recycling option might be a county recycling drop-off center, TV repair shop, charitable organization, electronics recycling company, or even your local electronics retailer, which might collect used products and send them to a recycler. You can learn more about local electronics recyclers and collection events at EIA Environment - Consumer Education Initiative and at My Green Electronics.

Many electronics manufacturers are accepting used household electronics for recycling. In some cases, these services are provided free-of-charge. Asset management and recovery programs have been available to major corporations and large purchasers of electronic equipment for quite some time. Now, electronics manufacturers are beginning to offer similar services for households and small businesses. The consumer pays to mail the product back. Fees keep changing, but generally range from seven dollars up. Some manufacturers and retailers are offering free or for-a-fee events in communities.

### Recycle It!

If you can't repair, refurbish, or reuse your used electronic device, the next best thing is to recycle it!

Electronics consist of valuable resources, such as precious metals, copper, and engineered plastics, all of which require considerable energy to process and manufacture. Recycling electronics recovers

valuable materials, conserves virgin resources, and results in lower environmental emissions (including greenhouse gases) than making products from virgin materials. For example:

Recycling 1 million desktop computers prevents the release of greenhouse gases equivalent to the annual emissions of over 17,000 passenger cars.

Recycling 1 million cell phones saves enough energy to power more than 19,000 US households with electricity for an entire year.

Many communities offer computer and electronics collections as part of household hazardous waste collections, special events, or other arrangements. In addition, many public and private organizations accept computers and other electronics for recycling. More and more (but not yet all) electronics manufacturers and retailers are accepting used household electronics for recycling.

### **Recycling vs Disposal**

Of the 2.25 million tons of TVs, cell phones and computer products ready for end-of-life (EOL) management, 18% (414,000 tons) was collected for recycling and 82% (1.84 million tons) was disposed of, primarily in landfills.

From 1999 through 2005, recycling rate was relatively constant at about 15%. During these years, the amount of electronics recycled increased but the percentage did not because the amount of electronics sent for end of life management increased each year as well.

For 2006-2007, the recycling rate increased to 18%, possibly because several states have started mandatory collection and recycling programs for electronics. Details on the data sources, assumptions, and calculations underlying the information summarized above are available in two reports. Each report analyzes the management of electronics, but use different sets of data inputs and life span models. Looking at both of the reports together, it is evident that the results are quite similar. The fact sheet summarizes each approach and presents the joint results for 2003-2005.

### **Regulations Governing Management of Used Electronics**

Some electronics (such as color CRTs computer monitors, color CRT TV tubes, and smaller items such as cell phones and other "hand-helds") test "hazardous" under Federal law. If so, they are subject to special handling requirements under Federal law, subject to certain exemptions.

EPA encourages reuse and recycling of used electronics, including those that test "hazardous." To facilitate more reuse and recycling of these products, EPA has less stringent management requirements for products bound for reuse and recycling. Specifics follow:

The **Oklahoma Computer Equipment Recovery Act** (SB 1631 passed in 2008-see bill text in Appendix) targets desktop and laptop computers, as well as computer monitors. The Act requires computer manufacturers that do not have a mail-back recovery system to establish a state-approved recovery plan. Manufacturers are required to submit an annual report to the DEQ by March 1. The DEQ has a 30-day turn-around to analyze manufacturer's collection plans.

The DEQ shall educate consumers, which shall include hosting, or designating another person to host, a web site for consumers; maintain, and make available, a list of registered manufacturers who have adopted and implemented a recovery plan; maintain, and make available, a separate list of manufacturers whose recovery plan allows consumers to return other brands; file each recovery plan and annual report submitted by a manufacturer; produce a schedule of collection events, based on the manufacturers' submitted recovery plans; and by July 1 of each year, submit a summary of the manufacturers' annual reports, to the Governor, President Pro Tempore, and the Speaker of the House.

The DEQ may conduct audits and inspections to evaluate compliance and take enforcement action and assess penalties against a manufacturer, retailer or recoverer. The DEQ may promulgate rules and adopt fees as necessary to cover the costs of administering the program; The act will commence January 1, 2009 if an FTE is provided by the legislature.

**For a list of Oklahoma electronics recyclers, go to:**  
**<http://www.deq.state.ok.us/lpdnew/Recyclingindex.htm>**

**Resale or Donation:** Computer monitors and televisions sent for continued use (i.e., resale or donation) are not considered hazardous wastes.

### **What are the substances of potential concern in electronics?**

Lead, mercury, cadmium and brominated flame retardants are among the substances of concern in electronics. These substances are included in the products for important performance characteristics, but can cause problems if the products are not properly managed at end of life.

**Lead** is used in glass in TV and PC cathode ray tubes as well as solder and interconnects; older CRTs typically contain on average 4 lbs of lead (sometimes as much as 7 lbs in older CRTs), while newer CRTs contain closer to 2 lbs of lead.

**Mercury** is used in small amount in bulbs to light flat panel computer monitors and notebooks.

**Brominated flame retardants** are widely used in plastic cases and cables for fire retardancy; the more problematic ones have been phased out of newer products but remain in older products.

**Cadmium** was widely used in ni-cad rechargeable batteries for laptops and other portables.

Newer batteries (nickel-metal hydride and lithium ion) do not contain cadmium.

### **What products can be made from the materials recovered by recycling cell phones?**

Almost all of the materials used to manufacture a cell phone can be recovered to make new products. Metals, plastics, batteries and the packaging materials can be recycled and turned into new products.

Cell phones contain a number of different metals - gold, silver, platinum, palladium, rhodium, copper, tin, lead, brass and zinc - that can be extracted and recovered in the recycling process. The recovered metals can be used by a number of different industries such as jewelry, plating, electronics, plumbing, automotive, and art foundries. Products that can be manufactured from the recovered materials include automotive catalytic converters, plumbing faucets and piping, and gold or silver jewelry.

The cell phone packaging materials can also be recycled and made as a component of fiber board manufacture. When the rechargeable battery can no longer be reused, the battery can be recycled into other rechargeable battery products.

### **How to Recycle or Donate Used Electronics**

For organizations providing information on electronics donation and recycling opportunities in your area, please visit EPA's *"Where Can I Donate My Old Computer and Other Electronic Products?"* <http://www.epa.gov/osw/conserves/materials/ecycling/donate.htm>

### **Plug-In To eCycling Program?**

Plug-In To eCycling is a partnership between EPA and electronic manufacturers and retailers to offer consumers more opportunities to donate or recycle their used electronics. Plug-In To eCycling pilots innovative on-the-ground solutions that can be expanded to sustainable local, regional and national collection and recycling infrastructures. The program's initiatives are intended to reflect shared responsibility among manufacturers, retailers, governments and consumers. Such efforts demonstrate how voluntary industry-led models or public-private partnerships can complement existing state or municipality-led collection and recycling efforts.

Partners design and implement various approaches—either national or regional in scope—to give individuals recycling options. Partners might offer online takeback or trade-in programs, create partnerships with local organizations to facilitate collections, host collection events at retail locations, and support local recycling events with cities and municipalities.

### **What is the Plug-in to eCycling "Recycle Your Cell Phone. It's an Easy Call" Campaign?**

As cell phones, computers, and Personal Digital Assistants (PDAs) become more prominent in our everyday lives, the U.S. Environmental Protection Agency (EPA) is taking steps to encourage consumers to recycle these products instead of adding them to our nation's landfills. As part of this initiative, EPA's Plug-In To eCycling program has teamed up with leading cell phone makers, service providers, and retailers to launch a national campaign encouraging Americans to recycle or donate their unwanted cell phones. The "Recycle Your Cell Phone. It's An Easy Call" campaign aims to increase the public's awareness of cell phone recycling and donation opportunities, with the ultimate goal of increasing the nation's cell phone recycling rate. Plug-In To eCycling partners supporting this



campaign are: AT&T, Best Buy, LG Electronics, Motorola, Nokia, Office Depot, Palm, Samsung, Sony Ericsson, Sprint, Staples, T-Mobile, and Verizon Wireless.

EPA has targeted cell phone recycling because, despite the large number of programs, most consumers still do not know where or how they can recycle their cell phones. Consequently, less than 20 percent of unwanted cell phones are recycled each year. Recycling cell phones leads to significant environmental savings and can benefit communities.

The **Oklahoma Computer Equipment Recovery Act** (SB 1631 passed in 2008) targets desktop and laptop computers, as well as computer monitors. The Act requires computer manufacturers that do not have a mail-back recovery system to establish a state-approved recovery plan. Manufacturers are required to submit an annual report to the DEQ by March 1. The DEQ has a 30-day turn-around to analyze manufacturer's collection plans.

The DEQ shall educate consumers, which shall include hosting, or designating another person to host, a web site for consumers; maintain, and make available, a list of registered manufacturers who have adopted and implemented a recovery plan; maintain, and make available, a separate list of manufacturers whose recovery plan allows consumers to return other brands; file each recovery plan and annual report submitted by a manufacturer; produce a schedule of collection events, based on the manufacturers' submitted recovery plans; and by July 1 of each year, submit a summary of the manufacturers' annual reports, to the Governor, President Pro Tempore, and the Speaker of the House.

The DEQ may conduct audits and inspections to evaluate compliance and take enforcement action and assess penalties against a manufacturer, retailer or recoverer. The DEQ may promulgate rules and adopt fees as necessary to cover the costs of administering the program; The act will commence January 1, 2009 if an FTE is provided by the legislature.

**For a list of Oklahoma electronics recyclers, go to:**  
**<http://www.deq.state.ok.us/lpdnew/Recyclingindex.htm>**

## **PROMOTING YOUR RECYCLING PROGRAM**

Communities who wish to begin a recycling program should begin by locating area markets for recyclables before initiating their program. Create a committee of people comprised of business owners, city workers and the general public to serve as a task force. Once all logistics are handled and you're ready to start, get your citizenry involved in the launch! Below are several suggestions on educating your community through a variety of ways:

- Develop a slogan for marketing efforts, engage partners in a marketing campaign (block leaders, businesses, churches, environmental groups, ethnic groups, chambers of commerce, etc.)

- Set-up meetings with editorial boards to help get a story in your local newspaper

- Involve school kids by hosting a poster contest or creating of a trash band to make your program more visible at community activities or during an official "Launch Party"

- Create an insert to your monthly utility bill to advertise your program

- Create a publication to hand out at public events with detailed info on your community's program

- Print posters for display in local businesses and schools

- Include recycling info on your community's website and make it easy to find

- Participate in America Recycles day each year on November 15<sup>th</sup> - MAKE IT FUN!!!!!!!

- Establish a volunteer team to promote and allow for recycling at public events; invest in event recycling bins for check-out by local groups

- If utilizing a drop off center, create visible signage

Provide statistics and updates about the progress of your program – include the good and the bad to keep your citizens aware of issues

For curbside programs: Engage assistance for the Curbside Value Added Program; provide incentives for citizen participation; advertise and promote availability of extra recycling bins

Above all else, keep the messages simple

## CONCLUSION

The biggest benefit of recycling in Oklahoma is one that most recyclers never think about: economic development. Oklahoma is home to a number of major manufacturers that need recycled materials to make their products. A list of these companies are in the Appendix or may be found online here: <http://www.deq.state.ok.us/lpdnew/recyclers/reusers.htm>. Most of these plants are so large and need so much raw material that they must buy recyclables from all across the country. Oklahoma recyclables are their cheapest source of supply. For more details about the economic impact of these Oklahoma industries see "Oklahoma Reuse and Recycling Employment Study: An Analysis of the Economic Impact of the Oklahoma Recycling End Users and Selected Recycling Activity in the Tulsa Area," by Fred Eilrich of the Oklahoma State University Cooperative Extension Service.

While there is no gold in the garbage, there are increasing Oklahoma examples of situations where recycling costs less than paying to throw away trash. This is true not only in cities that use distant landfills, but also in major metropolitan areas. For example, McDonalds restaurants in the Oklahoma City area find it beneficial to pay recyclers for cardboard recycling services because they cost less than the dumpsters they use to throw away their garbage. In an office building like the Oklahoma DEQ where most of the waste generated is recyclable paper, the value of the savings for trash service not needed far exceeds the value of the recycled paper.

Most people focus on the environmental benefit of recycling. That benefit begins when recyclables are diverted away from landfills so pollution from the materials' degradation is never created. Using recyclables to manufacture new products significantly reduces air and water emissions and generally requires less energy. The biggest benefit of recycling may be citizen satisfaction. In a time when people generally want to do the right thing, many Oklahoma communities report that recycling is one of their most popular programs.

# APPENDIX

## RECYCLING TOOLKIT FOR OKLAHOMA COMMUNITIES TABLE OF CONTENTS

### GENERAL RESOURCES

1. List of OK Manufacturers Using Recycled Feedstock
2. Recycling on the Go (Event Recycling)
3. Snapshot of DEQ Recycling Information Website
4. Volume-to-Weight Recyclables Conversion Chart
5. Procedures for Holding Special Recycling Collection Days (Solid Waste Institute of Northeast Oklahoma)
6. School Recycling Program Implementation Worksheet (DEQ)
7. How to Start or Expand A Recycling Program (AF&PA)
8. A Guide to Recycling in Your Community
9. OKRA (Oklahoma Recycling Association) Membership Form
10. Oklahoma Recycling Legislation Overview
  - a. DCS - Oklahoma State Recycling Procurement Act (summary and 2 forms)
  - b. DEQ - Oklahoma State Recycling Goal (press release and SB 498)
  - c. DEQ - Oklahoma Computer Recycling Act (SB 1631; summary in body of toolkit)
10. List of recycling websites (including recycling container vendors)

### EDUCATION AND PROMOTION

1. Reasons to Recycle
2. Samples of Promotional PSAs from The M.e.t.
3. List of Oklahoma Educational Solid Waste Resources (including a list of those on OKRA's website)
4. List of Additional Informational Recycling Websites
5. World's Shortest and Most Comprehensive Recycling Web site
6. Stillwater Recycling Guide (example)
7. Oklahoma Star Program Flyer (DEQ Pollution Prevention)

8. **America Recycles Day**
  - a. 2008 press release
  - b. 2008 pledge card
  - c. National ARD banner / bookmark / flyer
  - d. DEQ Printable Packet (ARD project ideas / resources / general recycling information)

#### **REPORTS**

1. Nestor Research, Inc.: "Creating Change at the Municipal Level"
2. Curbside Value Partnership Reports: "Best Practices in Curbside Recycling" and "Lessons Learned about Improving Curbside Recycling"
3. Eureka Recycling: "Best Practices for Recycling in Multi-Family Housing"
4. NRC (National Recycling Coalition) Defends Recycling
5. "The Truth about Recycling" (Economist 2007)
6. Michael Patton's Presentation Materials
  - a. Price swing graphs for materials (last 3 years)
  - b. List of all Oklahoma buyers of glass, paper, plastics and metals
  - c. 10-page bidding contract to sell recyclables (with sample contracts and bidding forms)

#### **DEQ FACT SHEETS**

1. CFLs
2. E-Cycling
3. Oklahoma Waste Tire Program
4. Proper Handling of Vehicle Waste