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THE OHIO STATE UNIVERSITY EXTENSION

Extension FactSheet

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Integrated Solid Waste Management

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Based on data from the U.S. Environmental Protection Agency (U.S. EPA, 2001), each person in the United States generated 4.5 pounds of solid waste per day in 2000. In Ohio, nearly a ton of locally generated residential and commercial waste per resident is landfilled during a year. If industrial waste is included, almost 1.8 tons of locally generated waste is landfilled per resident per year. Throughout the country, solid waste management is a major issue. A few states have mandated up to a 50 percent reduction in waste going to landfills. Some communities are establishing mandatory recycling programs. Waste is no longer out-of-sight and out-of-mind. Waste is now visible as part of public policy.

Why Worry About Solid Waste?

Waste, garbage, trash, junk, debris, and refuse are all names given to that "stuff" that is no longer useful in its current form. In contemporary society, many of the items used daily are designed to be used and discarded. Single-use packaging and disposable items, from diapers to razors to cameras, define many of our consumer patterns. With the increased availability of disposables has come the added problem of how to get rid of all this waste.

The most predominant form of disposal is the permitted and licensed modern landfill, a relatively new system that has been around less than five decades. One of the very real problems facing society today is the management of old closed and abandoned dumps. Many of these are considered hazardous, even though, at the time of their use, they were considered the "proper" disposal method. While abandoned dumps pose a unique set of problems (Fact Sheet CDFS-140-05, *Abandoned Dumps: Yesterday and Tomorrow),* innovative strategies are needed to deal with the waste we produce today to prevent it from causing problems for future generations.

What Is Integrated Waste Management?

As waste management issues gain public awareness, concern has risen about the appropriateness of various disposal methods. Within our modern scheme of waste management, disposal is the last phase. Most people acknowledge that disposal will always be needed (the exception being those advocating zero-waste policies). The most widely used disposal method, the modern landfill, is discussed in Fact Sheets CDFS-137-05, *Landfills: Science and Engineering Aspects,* and CDFS-138-05, *Landfill Types and Liner Systems.* Solid waste professionals realize that the ideal way to reduce the stress on disposal systems is to reduce the amount of waste that is produced. The emphasis in modern solid waste management is on reduction, reuse, and recovery before disposal. These three words are at the center of the discussion of integrated waste management systems. *Reduction* is using fewer disposable goods. *Reuse* is using items again after their initial consumer use is past. *Recovery* is recapturing the material or energy value of the item at its highest point.

No single solution completely answers the question of what to do with our waste. Every community or region has its own unique profile of solid waste. The composition of

the waste varies, depending on such diverse variables as urbanization, commercial enterprises, manufacturing, and service sector activities. Similarly, the attitudes of people in different states and regions of the country vary regarding waste management practices. This is often referred to as the *waste management ethic* and includes the *recycling ethic* and *litter ethic* of a community as subcategories. Community diversity and waste diversity are two reasons why no single approach to waste management has been accepted as *the best* method.

Since there is no preferred method, every community must create its own best approach to dealing with its waste. However, all communities have the same alternatives. The general strategies are given in this fact sheet and explained further in other fact sheets. In addition, recycling goals are dictated by the state of Ohio and must be met by the 52 solid waste management districts in Ohio.

The strategy used to develop an integrated waste management system is to identify the level or levels at which the highest values of individual and collective materials can be recovered. For this reason, the list starts with reduction — using less and reusing more, thereby saving material production, resource cost, and energy. At the bottom of the list is ultimate disposal — the final resting place for waste (Figure 1).

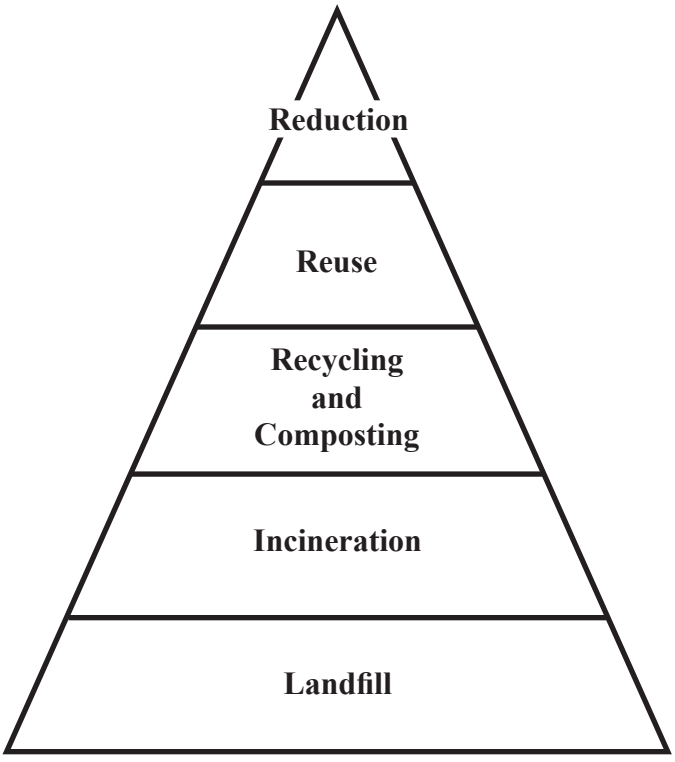

Figure 1: Hierarchy of integrated solid waste management.

Strategies for Change

Reduction Strategies

Reduction strategies are any approaches a community may use to lower the amount of waste being produced. Examples include a surcharge on excess bags, containers, or household refuse or an incentive program for commercial/industrial reduction efforts. Some simple reduction activities that individuals within a community can do are backyard composting (this reduces the amount of waste disposed of in landfills) and two-sided copying on paper. A waste exchange program also contributes to reduction. In any of the change strategies (reduction, reuse, and recovery), public education and involvement are crucial, and in the case of reduction, they are imperative. Reduction assumes the commitment and involvement of all citizens. Source reduction strategies have many favorable environmental impacts, including reducing greenhouse gas production, saving energy, and conserving resources, in addition to reducing the volume of the waste stream.

Reuse Strategies

Reuse is using a product more than once, either for the same purpose or for an alternate purpose. Reuse does not require reprocessing and, therefore, has lower energy requirements than recycling. Reuse strategies include making donations to charity, reusing packaging (including boxes and bags), using empty jars for food storage, and participating in a paint collection and reuse program.

Materials Recovery — Recycling and Composting

In recycling, waste materials are processed industrially and then reformed into new or similar products. Recycling includes preconsumer waste, such as factory cuttings or shavings, as well as post-consumer waste items, including cardboard, newspapers, plastic bottles, and aluminum cans. Although recycling is often viewed as a resource conservation activity, it may offer greater return for many products in terms of energy savings.

A second means of recapturing value is through the use of the natural biodegradation process. The predominant use of composting programs throughout the United States is in yard wastes. In urban areas, the composting of leaf and tree waste alone can reduce landfill dependency by up to 12 percent. The segregation of yard waste from other organic (biodegradable) wastes is necessary to avoid contamination of the compost which might render the mulch or end product less desirable.

In 2001, the combination of recycling and composting diverted 68 million tons of U.S. refuse from landfills and incinerators. In addition to reducing the necessity for siting and constructing new landfills and incinerators, recycling also helps to reduce greenhouse gas emissions and pollutants.

Resource Recovery — Incineration

The third approach to value recapture is to incinerate waste and use the heat for energy. Although many combustibles are recyclable, there is often a higher total value (due to processing costs) in burning the waste for energy than in recycling. Often, many combustible/recyclable materials are contaminated and rendered difficult and/or expensive to recycle. By developing an incineration program with a materials recovery component, furnace and processing equipment life is usually extended because glass and ferrous and non-ferrous metals are removed during material recovery. Incineration reduces the volume of refuse by up to 90 percent, leaving behind only ash, and resulting in less need for landfill space.

Ultimate Disposal — Landfill

The last option is disposal. Given current technology, there are residuals from the previous processes, and some materials are simply not recoverable and must go somewhere. In the year 2000, more than 50 percent of all waste generated nationally ended up in landfills. The continuing development of more stringent requirements for landfills is making this ultimate disposal option less environmentally offensive, but more costly. The increasing ability to recover methane from landfills is providing a positive use for what has historically been a non-valued disposal method. Bioreactor landfill technology has the potential to further reduce the environmental impact of landfills and maximize methane recovery from these systems (Fact Sheet CDFS-139-05, *Bioreactor Landfills)*.

As society moves waste to the forefront of public policy, it is more apparent that what we discard annually contains a multitude of valuable and recoverable materials. An integrated waste management system entails a careful analysis of what is in the waste stream and offers ideas on practices to recover the various materials at the point of highest value. The best strategy for a community is to match its unique position with the mix of activities that will best serve it now and far into the future.

For More Information

The sources listed here provide additional information on integrated solid waste management:

Tchobanoglous, G., Theisen, H., and Vigil, S. 1993. *Integrated Solid Waste Management: Engineering Principles and Management Issues.* McGraw-Hill, Boston, Mass.

U.S. Environmental Protection Agency. **http://www.epa.gov/epaoswer/non-hw/muncpl/reduce.htm.**

Vesilind, P. A., Worrell, W., and Reinhart, D. R. 2002. *Solid Waste Engineering.* Brooks/Cole, Pacific Grove, Calif.

Other related Ohio State University Extension publications and fact sheets are:

OSU Extension Fact Sheet CDFS-137-05, *Landfills: Science and Engineering Aspects.*

OSU Extension Fact Sheet CDFS-138-05, *Landfill Types and Liner Systems.*

OSU Extension Fact Sheet CDFS-139-05, *Bioreactor Landfills.*

OSU Extension Fact Sheet COM-0001-99, *Composting at Home.*

OSU Extension Bulletin 792-95, *The Composting Process.*

OSU Extension Fact Sheet CDFS 114-98, *The Consumer's Role in Plastic Recycling.*

OSU Extension Fact Sheet CDFS 112, *Community and Household Recycling Efforts.*

OSU Extension Fact Sheet CDFS 115-91, *Office Paper Recycling.*

OSU Extension Fact Sheet CDFS 121, *Recycling Newsprint in Ohio.*

OSU Extension Fact Sheet CDFS 108-98, *Recycling.*

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