

Chapter 16: Waste Generation and Waste Disposal

Summary

The key objective of this chapter is to understand what constitutes waste and how we deal with the problems associated with it. The 3 R's- reduce, reuse and recycle-are explained and discussed in terms of solid waste.

Module 51. Only Humans Generate Waste

- Explain why we generate waste & describe recent waste disposal trends.
- Describe the content of the solid waste stream in the US. State the percentage of the world's solid wastes that is produced by the United States. State the percentage of solid waste produced in the United States that is municipal solid waste.
- Compare waste management and pollution prevention approaches to solid and hazardous waste

Humans generate waste that other organisms cannot use

- ✓ The United States is the leader of what came to be known as the "throw-away society."
- ✓ The flow of solid waste that is recycled, incinerated, placed in a solid waste landfill, or disposed of in another way is called the waste stream.
- ✓ E-waste (electronic waste) is one component of waste that is small in terms of weight, but very important in terms of environmental effect and is rapidly increasing.

1. ____ Waste	a. The flow of solid waste that is recycled, incinerated, placed in a solid waste landfill, or disposed of in another way
2. ____ Municipal solid waste (MSW)	b. Refuse collected by municipalities from households, small businesses, and institutions such as schools, prisons, municipal buildings, and hospitals
3. ____ Waste stream	c. Material outputs from a system that are not useful or consumed

Module 52. The Three R's and Composting

- Describe the three R's.
- Define *compost*. Understand the process & benefits of composting.
- List reuse strategies for refillable containers, grocery bags, and tires.

The three R's and composting divert materials from the waste stream

- ✓ Three easy ways of diverting materials from the waste stream are commonly referred to as "the 3 R's": reduce, reuse, and recycle.
- ✓ Another way to reduce materials from the waste stream is to compost.

1. ____ Reduce, Reuse, Recycle	a. Organic matter that has decomposed under controlled conditions to produce an organic-rich material that enhances soil structure, cation exchange capacity, and fertility.
2. ____ Source reduction	b. Recycling a product into the same product.
3. ____ Reuse	c. A popular phrase promoting the idea of diverting materials from the waste stream.
4. ____ Recycling	d. The reduction of waste through minimizing the use of materials destined to become municipal solid waste from the early stages of design and manufacture.
5. ____ Closed-loop recycling	e. Using a product or material that was intended to be discarded.
6. ____ Open-loop recycling	f. Recycling one product into a different product.
7. ____ Compost	g. The process by which materials destined to become municipal solid waste are collected and converted into raw material that is then used to produce new objects.

Module 53. Landfills & Incineration

- Describe the goals, design, & function of a solid waste landfill. Describe a modern sanitary landfill. Summarize the benefits and drawbacks of burying solid wastes in sanitary landfills.
- Explain the design & purpose of a solid waste incinerator.
- Assess the pros and cons of incineration of hazardous and solid wastes.

Currently, most solid waste is buried in landfills or incinerated

- ✓ The U.S. used to put waste in open dumps.
- ✓ Sanitary landfills are designed to hold the waste with as little contamination of the surrounding environment as possible.
- ✓ Incineration is the act of burning waste to reduce volume and mass. It is sometimes used to generate electricity or heat.

1. ____ Leachate	a. The residual nonorganic material that does not combust during incineration.
2. ____ Sanitary landfills	b. Residue collected at the bottom of the combustion chamber in a furnace.
3. ____ Tipping fee	c. The residue collected from the chimney or exhaust pipe of a furnace.
4. ____ Siting	d. Liquid that contains elevated levels of pollutants as a result of having passed through municipal solid waste or contaminated soil.
5. ____ Incineration	e. The process of burning waste materials to reduce volume and mass, sometimes to generate electricity or heat.
6. ____ Ash	f. Engineered ground facilities designed to hold municipal solid waste with as little contamination of the surrounding environment as possible.
7. ____ Bottom ash	g. The designation of a landfill location, typically through a regulatory process involving studies, written reports, and public hearings.
8. ____ Flyash	h. A fee charged for disposing of material in a landfill or incinerator.

Module 54. Hazardous Waste

- Define hazardous waste & discuss the issues involved in handling it.
- Describe the laws/regulations/legislation regarding hazardous waste.
- Describe how Superfund (CERCLA) has been subverted and how its enforcement can be improved.

Hazardous waste requires special means of disposal

- ✓ The majority of hazardous waste comes from industry.
- ✓ In the U.S., hazardous waste must be treated before disposal.
- ✓ The Superfund (CERCLA) law authorized the federal government to respond to any substance that may pose a threat to human health or the environment.
- ✓ Brownfields are sites that are not as hazardous as Superfund sites but are still contaminated.

1. ____ Hazardous waste	a. CERCLA, a 1980 U.S. federal act that imposes a tax on the chemical and petroleum industries, funds the cleanup of abandoned and non-operating hazardous waste sites, and authorizes the federal government to respond directly to the release or threatened release of substances that may pose a threat to human health or the environment.
2. ____ Superfund	b. Waste material that is dangerous or potentially harmful to humans or ecosystems.
3. ____ Brownfields	c. Contaminated industrial or commercial sites that may require environmental cleanup before they can be redeveloped or expanded.

Module 55. New Ways to Think About Solid Waste

- Explain the purpose of life-cycle analysis.
- Describe alternative ways to handle waste & waste generation. Discuss the variety of environmental management methods to deal with solid waste and describe the attributes and drawbacks of each of these methods.
- Integrated Waste Management. Describe each of the elements and priorities in an Integrated Waste Management system.

There are newer ways of thinking about solid waste

- ✓ Every method of waste disposal will have adverse environmental effects.
- ✓ It is important to analyze the life-cycle of any material.
- ✓ Integrated Waste Management uses the ideas of reduce, reuse, recycle.

1. Life-cycle analysis is an important systems _____ that looks at the materials _____ and throughout the lifetime of a product.
2. Integrated Waste Management, which employs several management, and _____ in order to reduce the environmental of MSW.

Chapter Review

This chapter is about building an awareness of our throwaway society and how we deal with all of the trash we create. Waste goes into landfills, is recycled or is incinerated. This chapter gives the positives and negatives of each solution to the problem of trash disposal and reviews the laws that have been written to protect us from both household waste and hazardous waste.

1. Summarize the composition of municipal solid waste in the U.S.
2. Draw a diagram and identify the 5 parts of a sanitary landfill.

3. What are some problems with landfills and how can these problems be prevented?

4. What are some problems with incineration of waste?

5. Summarize the RCRA and CERCLA laws.

6. Explain Integrated Waste Management.

Do The Math

1. The annual precipitation at a landfill is 250mm per year, and 50% of this water runs off the landfill.

If the landfill has a surface area of 10,000 m² and the leachate collection system is 80% effective, calculate the volume of water in cubic meters that infiltrates the landfill per year.

2. How much volume of leachate in m³ is treated per year?