KATHRYN HILGENKAMP

ENVIRONMENTAL HEALTH

ECOLOGICAL PERSPECTIVES

Waste Management

Chapter 14

The Disposable Age

- We are a “throw away” society
- The United States accounts for 5% of the world’s population and 50% of the world’s solid waste
- The manage of waste is a public health problem

Sources of Waste

- Agricultural
  - Leftover crops, weeds, pesticides, herbicides, manure, animal carcasses
- Commercial
  - Materials left from service industries and food packaging
- Industrial
  - Waste from mining, power plants, and manufacturing
- Municipal solid waste
  - Trash, rubbish, and garbage from small businesses and homeowners

Problems with Waste

- The average person generates 4.5 lbs. of waste per day, a continuous source
- One of the biggest expenses of city budgets
- Improper disposal causes problems with vermin and insects
- Pollution of surface and groundwater
- Hazardous materials

Terminology

- Solid waste—trash, rubbish, and garbage
- Refuse—material that must be thrown away
- Garbage—discarded food or organic matter
- Rubbish—combustible and noncombustible material
- Trash—worthless, unnecessary, and offensive material

Terminology (continued)

- Biosolids—human and animal waste containing pathogens
- Sewage—waste matter flushed down toilets and drains
- Effluent—solid, liquid, or gas waste discharged into the environment
- Wastewater—water contaminated or used that must be cleaned before reusing

Laws Regulating Waste Disposal

- Solid Waste Disposal Act of 1976
- Resource Recovery Act of 1970
- Resource Conservation and Recovery Act of 1976

“Old” Ways of Managing Solid Waste

- 1800s threw garbage and sewage into the street or open pits
- 1874 incineration of municipal waste to reduce the volume
- Reuse of items
  - Food scraps fed to animals
  - Clothing passed generation to generation
  - Fabric scraps used to make quilts and rugs
  - Broken items repaired

Solid Waste Management Today

- 20th century garbage collection systems and landfills
- A major problem today because of
  - More disposable items
  - More convenience foods
  - More people in urban areas

Land Disposal

- The most common method for disposing of solid waste is land disposal
- Land fills are the most common
- Other techniques include:
  - Land application; the discharge of sludge for drying
  - Deep-well injection .25 to 1 mile below ground

Hazards Associated with Land Disposal

- Leaks in landfills contaminate water supplies
- Methane gas smell
- Debris
- Pests
- Increased traffic

Harmful Effects of Incineration

- Technique used for 15% of solid waste in the United States
- Ashes must be disposed
- Particulate matter becomes airborne
- Poisonous gases and heavy metals can be emitted into the atmosphere

Ways to Reduce Solid Waste

- “Green product design”
  - Lighter packaging that takes up less space
  - Biodegradable packaging and products
- Source reduction
- Recycling

Source Reduction Techniques

- Recycling of reusable products
  - Newspaper and cardboard
  - Bottle deposits for glass
  - Can collection
  - Reused oil, batteries, tires, printer cartridges
- Composting and vermicomposting of plant matter
- Mulching of grass clippings and trees

“Green Power”

- The use of waste materials as fuel to generate recovery
- Also known as waste heat recovery
- Methane gas is burned from decomposition of organic materials
- Waste-to-energy facilities burn as much as 250 tons of garbage per day
- It is costly
- Less than 2% of U.S. energy is generated from green power

Human Waste Disposal

- Rural areas
  - Pit privies
  - Cesspools
  - Septic tanks
- Urban areas
  - Sewage systems
  - Wastewater management

Pit Privies

- Known as “outhouses”
- Must be 100 feet from the home

Cesspool

- A large perforated tank surrounded by an absorption bed
- Solids are digested by bacteria
- Water is filtered through an open bottom and holes in the sides
- Cesspools function according to how many chemicals from the house are discharged into the cesspool.

Septic System

- A septic tank is made of concrete, plastic, or fiberglass with a capacity of 750–2000 gallons, depending on how many people use it

Septic System (continued)

- There is an inspection port for cleaning out
- The sewage is held for 24–72 hours
- The waste is discharged to an absorption field or drain field by trenches or ditches
- The effluent is absorbed into the soil
- It is not for the disposal of grease, oil, facial tissues, feminine hygiene products, condoms, or cigarette butts

Sewage in Municipalities

- Sewage contains debris, storm water runoff, and anything flushed or poured down the drain
- It is important to prevent the spread of disease
- The management of sewage in cities is referred to as municipal wastewater treatment

Six Stages of Wastewater Treatment

- Preliminary treatment
  - Removal of solids and replenishment of oxygen to suspend solids
- Primary treatment
  - Movement to sedimentation tanks for flocculation
  - Reduces bacteria, 40–60% of suspended solids, and 25–40% of the biochemical oxygen demand (BOD)

Six Stages of Wastewater Treatment (continued)

- Secondary treatment
  - Use of bacteria and microorganisms to consume the rest of the organic material
  - Trickling filters aerate the effluent and activate the sludge
- Tertiary treatment
  - Solids are removed and wastewater filters through sand, crushed anthracite coal, diatomaceous earth, or carbon particles

Six Stages of Wastewater Treatment (continued)

- Disinfection stage
  - Chlorine is added to reduce BOD and odor
  - Ozone, bromine, hydrogen peroxide, iodine, or UV light is used to kill pathogens
  - The chlorine residual should be between .25 and .70 ppm
- Final stage
  - The water is safely discharged into a pond, lake, or lagoon

Bulk Waste

- Scrap metal
  - Appliances
  - Bicycles
  - Furniture and mattresses
  - Televisions
  - Toys
- Automobile salvage yards

Regulating Waste Disposal

- Resource Conservation and Recovery Act of 1976
  - To protect human health and the environment from potential hazards associated with waste disposal
- Clean Air Act Amendments
- Clean Water Act
- Safe Drinking Water Act

Hazardous Waste

- A small portion of total waste generated
- 90% is generated by chemical manufacturers, petroleum refineries, and metal processing industries
- 10% is generated from small-quantity generators and households

Definition of Hazardous Waste

- Any waste that is
  - Ignitable
  - Corrosive
  - Reactive
  - Toxic
- Causes injury, illness, death, or destruction of the environment
- Can be solid, liquid, or gas

Types of Hazardous Waste

- Commercial
- Household
- Medical
- E-waste

Household Hazardous Waste

- Batteries
- Engine oil
- Paint
- Corrosive cleaning sprays
- Drain uncloggers
- Aerosol products

Medical Waste

- Any waste generated as a result of diagnosis, treatment, or immunization of human beings or animals
- About 16–20% is considered “infectious”
- Sometimes reduced by sterilizing or autoclaving surgical and other equipment
- The EPA does not regulate medical or infectious waste as a separate type of waste unless it is defined as hazardous waste

E-Waste

- Technologically obsolete equipment
- Some components contain radioactive products or harmful materials
  - Computer monitors contain brominated flame retardants
  - Monitors contain lead, cadmium, and/or mercury ad cadmium
- E-waste cannot be reused

Management of Hazardous Waste

- There are potential dangers associated with the handling, storage, transportation, and storage of hazardous waste
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA; a.k.a. “Superfund”) has funds for cleaning up abandoned hazardous sites
- There are over 1,200 sites on the National Priorities List

Hazardous Waste Compact

- An agreement between states to provide storage and disposal facilities for hazardous waste
- Moving hazardous waste from one site to another risks a “hazardous incident”

Nuclear Waste

- Also known as radioactive waste
- The biggest concern among hazardous waste disposal
- High-level and low-level waste

High-Level Radioactive Waste

- The most dangerous type is spent fuel rods
- A.k.a. irradiated reactor fuel
- Significant amounts of uranium and plutonium with penetrating and toxic levels
- Some can be reprocessed
- The rest must be stored until excessive heat generation has subsided
- Another source is from nuclear weapons that are disarmed or torn apart

Low-Level Radioactive Waste

- When the radioactive properties have discharged
- Includes protective clothing, rags, mops, filters, equipment, tools, and other items
- Can be disposed underground for 10–100 years before it is considered harmless
- The Low Level Waste Policy Act of 1980 established a national system for the storage of low-level radioactive waste
- Each state is responsible for the disposal of low-level radioactive waste within their state

Agencies That Monitor Hazardous Waste Disposal

- Atomic Energy Commission was established in 1954
- Nuclear Regulatory Commission (NRC)

Ways Individuals Can Manage Waste

- Reduce
- Precycle
- Reuse
- Recycle