A look into the historical and social context of the management of solid and hazardous waste in the U.S.
Types of Waste

- Solid Waste
- Liquid Waste
- Gaseous Waste
- Chemical Waste
- Commercial Waste
- Industrial Waste
- Biomedical Waste
- Compost Waste
What is Non-Hazardous Waste?

• In a nutshell, non-hazardous wastes are:
  • Any discarded or abandoned materials
  • Can be solid, liquid, semi-solid or containerized gaseous material
  • Waste that is safe to use and/or dispose of commercially, industrially, agriculturally or economically

• Examples of non-hazardous solid wastes include the following materials when discarded:
  • Waste tires
  • Scrap metal
  • Latex paints
  • Construction & demolition debris, etc.
  • Garbage
  • Furniture and toys
  • Construction & demolition
What is Hazardous Waste?

- Waste that is reactive, toxic, corrosive or otherwise dangerous to humans and/or the environment
  - Due to quantity and/or physical, chemical or infectious characteristics
- Generated from many sources ranging from industrial manufacturing process wastes to batteries
- May come in many forms, including:
  - Liquids
  - Solids
  - Gases
  - Sludges
Waste Management Issues

- Mid-1900s solid and hazardous waste management issues rose to new heights of public concern in the U.S. due to:
  - Increasing generation of waste
  - Shrinking of disposal capacity
  - Rising disposal costs
  - Public opposition to the siting of new disposal facilities
- Led to the passing of federal regulations by the Environmental Protection Agency (EPA)
Landmark Hazardous Waste Episodes
Love Canal, NY - Superfund Site

• Love Canal constructed to link the Niagara River to Lake Ontario (1894)
• Hooker Chemicals and Plastic Corporation took over site (1947) and buried thousands of tons of toxic chemicals
• Love Canal sold to the Board of Education of Niagara Falls (1953)
Love Canal, NY - Superfund Site

- October 1976: Niagara Gazette reports materials from a chemical landfill have been seeping into basements in the area; people falling ill
- November 1976: Gazette reports chemical analyses of residues near Love Canal indicating the presence of 15 organic chemicals, including toxic chlorinated hydrocarbons (PCBs)
- May 1980: President Carter declares the site a national emergency
Dichlorodiphenyltrichloroethane – DDT

• Widely used chlorinated organic pesticide originally developed in 1873
• 1939: Paul Muller of Geigy Pharmaceutical in Switzerland discovered the effectiveness of DDT as an insecticide
• 1948: Muller awarded the Nobel Prize in medicine and physiology
• Use of DDT increased enormously after WWII, primarily due to effectiveness against mosquitos (malaria) and lice (typhus)
  • However, indicated to cause lack of fertility in birds
  • First chemical to be associated with causing cancer in humans
Mercury - Hg

- Elemental mercury (oxidation state = 0) relatively non-toxic
- Mercuric cation (oxidation state = +2) toxic
- If dumped into the environment, Hg can be converted to methylmercury by microorganisms
- Methylmercury (oxidation state = +1) VERY toxic
  - 100-fold more toxic than mercuric cation
- “Mad as a Hatter” = Mercury salts used in curing felt for hats caused mercury poisoning
Environmental Protection Efforts

• Common Environmental Values:
  • No adverse effect on our personal health
  • Minimal or no affect on public health
  • Worthwhile to protect species and natural environments
  • Minimize the constraints placed on individual liberties
  • Consider both the costs and benefits of environmental protection efforts
Historical Stages of U.S. Environmental Protection Efforts

• pre-1945: Common Law/Conservation Era
• 1945-1962: Public Works Era
• 1962-1972: Environmental Movement
• 1972-1980: Federal Regulatory Era
• 1980-1990: Refining Regulatory Strategies
• 1990-?: Regulatory Recoil
• post-?: Unknown
Growth of Environmental Laws
Regulation of Waste Disposal

• RCRA – Resource Conservation and Recovery Act of 1976
  • Public law that creates the framework for the proper management of both non-hazardous and hazardous solid waste
  • Guidelines and policies set to ensure the safe management and cleanup of non-hazardous and hazardous waste
    • Subtitle D – Non-hazardous solid waste
    • Subtitle C – Hazardous solid waste
• Bans open dumping of waste and sets minimum federal criteria for the operation of municipal and industrial waste landfills
Regulation of Waste Disposal

- RCRA’s “Cradle to Grave” concept for hazardous waste management
  - Ensures safe management of hazardous waste from the moment it is generated to its final disposal
- Safe management of hazardous waste, includes:
  - When it is created
  - While it is transported, treated and stored
  - When it is disposed
“Cradle-to-Grave” System

Hazardous Waste Generation

Hazardous Waste Transportation

Recycling

Treatment

Disposal

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RCRA & Medical Waste

- MWTA – Medical Waste Tracking Act of 1988
  - Added medical waste to RCRA
  - After NY and NJ beach closures in 1987-1988 due to washed-up medical waste
- Required “Red Bag” (potentially infectious) waste
- Regulated waste per MWTA:
  1. Cultures and stocks
  2. Pathological wastes
  3. Human blood and blood products
  4. Used and unused sharps
  5. Isolation waste
Regulation of Waste Disposal

- CERCLA – Comprehensive Environmental Response, Compensation and Liabilities Act of 1980
  - Also known as the “Superfund Act”
- Identifies sites where hazardous waste threatens the environment and/or public health as a result of leakage, spillage or general mismanagement
- Identifies the responsible party and holds the responsible party accountable for clean-up of contaminated site
  - Referred to as Potentially Responsible Parties (PRPs)
“Superfund” Cleanup

- CERCLA authorizes Superfund cleanup responses in two ways:
  1. Emergency Response or Short-Term Removal
     - For sites with contamination that poses an immediate threat to human health and/or the environment
  2. Long-Term Remedial Action
- EPA’s National Priorities List (NPL)
  - List of contaminated sites of national priority
  - Intended to guide EPA in determining which sites warrant further investigation
  - As of 2014, there are more than 1,300 Superfund sites in the U.S.
Waste Management & Disposal
Classification of Wastes

- Biodegradable
  - Can be degraded (e.g., paper, wood, fruits) or composted
  - Biological decomposition of solid organic materials by bacteria, fungi and other organisms into a soil-like product

- Non-biodegradable
  - Cannot be degraded (e.g., plastics, bottles, old machines, cans, containers)
Management of Waste

• Waste Disposal
  • Final handling of solid waste, following collection, processing or incineration
  • Most often means placement of wastes in a dump or landfill

• Landfilling
  • Final disposal of solid waste by placing it in a controlled fashion in a place intended to be permanent
Waste Management Hierarchy

- Source Reduction
- Reuse
- Recycling
- Resource Recovery
- Incineration
- Landfilling

Most Preferred
Least Preferred

Waste Disposal