Types of Solid Waste Facilities: What Options Exist for Materials Management?

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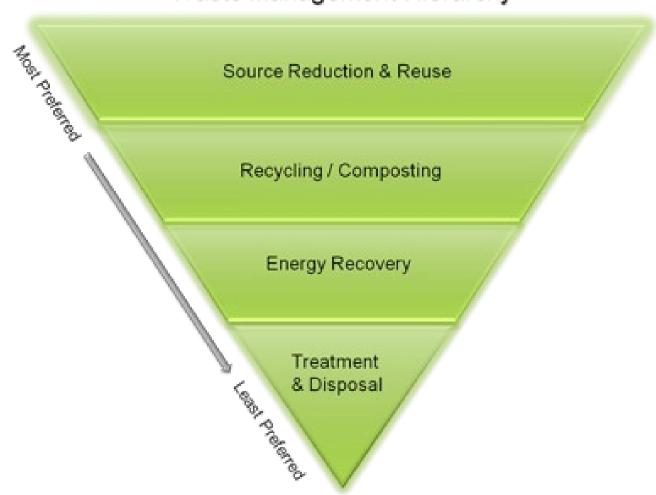


- Solid Waste Management Over Time
- Original Dumps
- Transfer Stations
- Waste Haulers
- Landfills
- Incinerators/ WtE Facilities
- Compost Facilities
- Anaerobic Digesters
- Recycling and Processing Facilities
- What's Next?



Waste Management Hierarchy

Waste Management Hierarchy



Waste Management Timeline

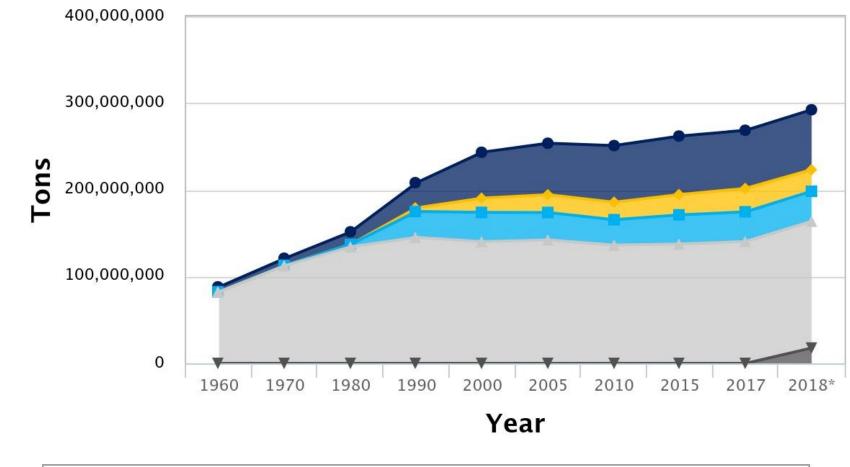
- 1953: Joint committee of US Public Health Service and American Public Works Association published guidelines for collection and disposal
- 1961: US Public Health Service developed recommended standards for sanitary landfill operations
- 1965: Solid Waste Disposal Act (first federal regulation) to assist state and local governments develop guidelines for collection and disposal
- 1970: Resource Recovery Act calls for increased government involvement in waste management and promotes recycling and WTE.
- 1970: Creation of EPA
- 1976: Resource Conservation and Recovery Act (RCRA), end of open dumps
- 1989: EPA issues a report advocating for recycling
- 1990: EPA recognizes MSW power as a renewable fuel requires use of Best Available Control Technology (BACT) for emissions
- 1991: EPA Finalizes Subtitle D with minimum criteria for MSW landfills. States develop rules and regulations or adopt federal criteria. Leads to more closures of unsecure facilities.



Waste
Management
Timeline
Continued

- 1992: President Bush Executive Order 12780, waste reduction and recycling in all federal agencies
- 1994: President Clinton Executive Order 12873, requires
 Federal agencies to establish waste prevention and recycling programs
- 1996: EPA set recycling goal of 35%
- 2000: EPA links global climate change to solid waste management, waste reduction to reduce greenhouse gas production
- 2011: EPA launched Food Recovery Challenge
- 2016: EPA establishes Food Recovery Hierarchy
- 2020: EPA announces national recycling goal increases to 50%
 - by 2030 and developed National Recycling Strategy
- 2023: EPA updating Food Recovery Hierarchy

Municipal Solid Waste Management: 1960-2018



Changes in

Disposal

Options Over

Time



Original
Dumps/
Unlined
Disposal
Sites

- Many municipalities had open, unlined dumps used by local residents for waste disposal
- Waste was not covered or compacted
- Waste was often burned in open pits to reduce the volume
- Liquids were not managed
- Most dumps were closed in the late 80's and early 90's with the establishment of

solid waste regulations

 Transfer Stations were developed with the closure of local dumps and permitted by State Regulatory Agencies

 Waste is collected for transfer to other permitted disposal/ treatment facilities

 Transfer Stations were often sited at the location of the closed dump

Transfer Stations



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Transfer Stations

- Wastes are stored on constructed pads to protect groundwater
- Wastes are stored in separate clearly marked areas to limit contamination of recyclables
- Waste areas are managed to ensure regular complete removal/transfer of materials
- Putrescible waste is stored under cover to limit leachate production
- Facilities are designed to allow for safe access by waste haulers and residents

- Providing adequate storage for the number of users or newly regulated materials
- Management of household hazardous waste and e-waste
- Stormwater management and diversion
- Management of "Bargain Barns"
- Odors
- Traffic flow





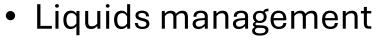
- Collect waste and recyclables from residents
- Can be both private or public
- May focus on a single material type (organics, single stream recyclables)
- Require licensing
- May require documenting (manifesting) certain materials
 - Type of material
 - Generator
 - Receiving Facility











- Waste/ recyclables separation
- Safety of employees
- Record keeping

Innovations

Automated equipment



Waste Haulers

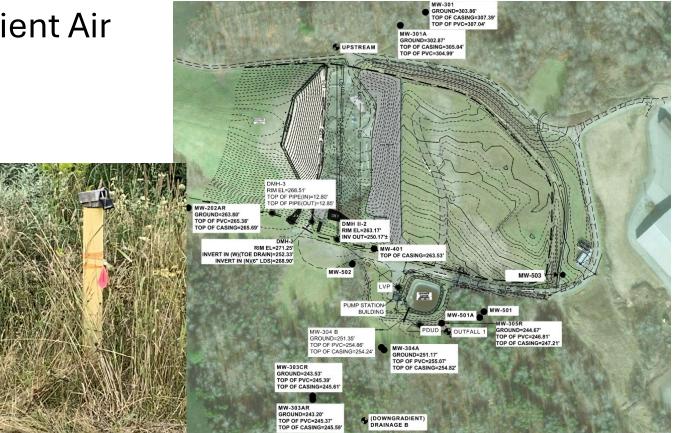


- Permitted by state regulatory agencies
- Designed for safe/ environmentally secure disposal of solid waste
 - Composite Liner Systems
 - Leachate Collection
 - Gas Collection
 - Waste placement practices
 - Cover system placement





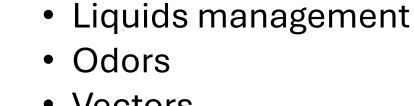
- Extensive environmental monitoring network
 - Groundwater
 - Surface water
 - Gas
 - Ambient Air





- May be limited to single waste types (monofils)
 - Ash
 - Industrial waste (sludges)
 - Construction and Demolition Debris (CDD)





- Vectors
- Public relations/ Being a good neighbor
- Record keeping

Innovations

- Gas-to-Energy
- Post-closure re-use

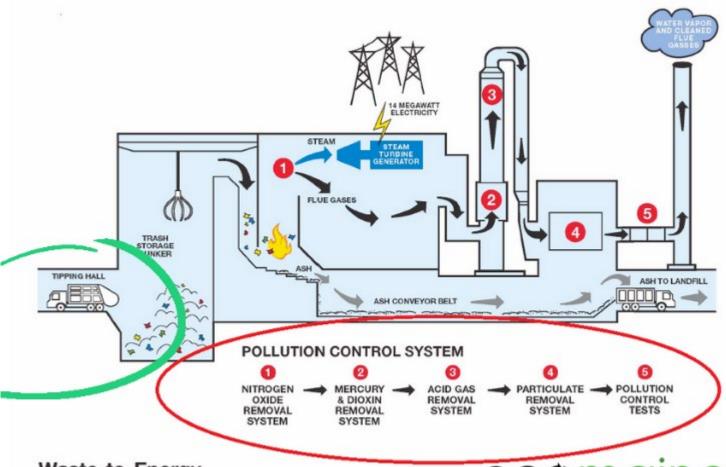




Incinerators

- Permitted by state regulatory agencies
- Designed for safe/ environmentally secure destruction of solid waste
- Produces electricity
- Reduces volume of waste requiring landfill disposal





Waste-to-Energy

- 90% reduction of trash volume
- · Power generation
- Pollution control

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 Alternate disposal for shutdown, maintenance, and malfunction

- Regulatory updates
- Waste contamination (Li-ion batteries, propane tanks)
- Characterization of ash for disposal

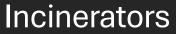














- Require licensing
- Designed to be protective of human health and the environment
- Collect organic waste materials
 - Food waste
 - Leaf and yard waste
 - Animal manure
 - Biosolids



Compost Facilities Operated to biologically decompose waste material aerobically

Require controlled temperatures

Must have an end-use for produced

materials



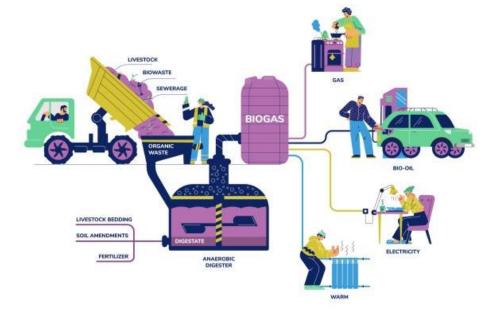


- Waste contamination
- Liquids management
- Odors
- Vectors
- Temperatures/ Fires
- Record keeping
- Scalability





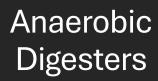
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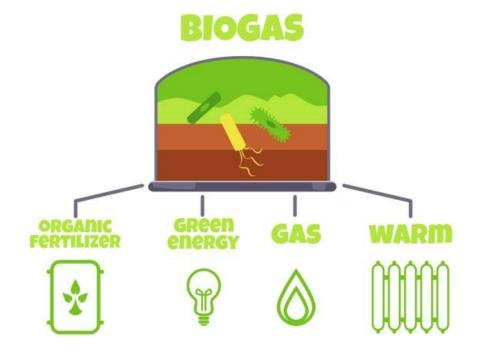
Anaerobic Digesters

- Operated to biologically decompose waste material anaerobically
- Can be co-located with agricultural facilities
- Produce biogas and digestate
 - Animal bedding (solids)
 - Fertilizer (solids and liquids)





- Waste contamination
- Biogas use/ electrical interconnect
- Digestate re-use



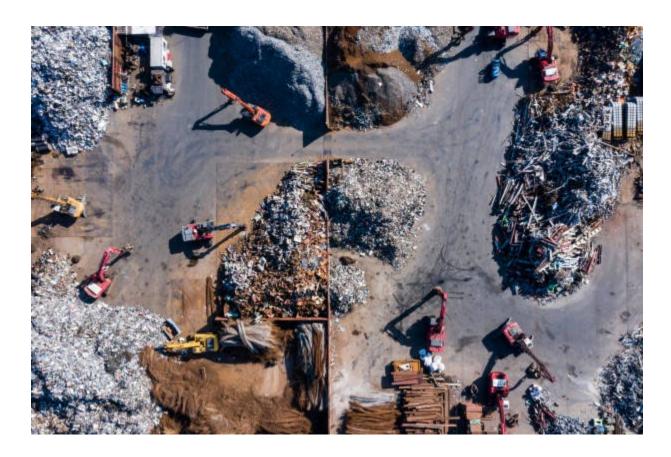
Recycling and Processing Facilities

- Require licensing
- Designed to be protective of human health and the environment
- Collect waste materials for processing, recycling, or re-use



Recycling and Processing Facilities

- May be designed for single material type
 - Metals (replace junkyards)
 - CDD



Recycling and Processing Facilities

MRFS

(Materials Recovery Facility, Materials Reclamation Facility, Materials Recycling Facility, Multi Re-use Facility)

- Designed to collect, sort, and prepare materials for recycling markets
- May be the first step at other waste handling facilities (incinerators, anaerobic digesters)
- Materials include:
 - Metals
 - Plastics
 - Paper

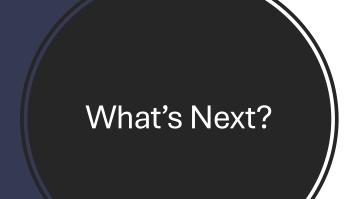
Recycling and Processing Facilities

- Waste contamination
- Materials movement (first in/first out)
- End market stability
- Changing regulations
- Hazardous materials





- Converts MSW to syngas
- High temperature/ low oxygen
- Optical/ Automated waste sorting
 - Uses cameras and sensors
- Automated collection equipment







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