



# Chapter 16

## Waste Generation and Waste Disposal

# Municipal Solid Waste

- Refuse collected by municipalities from households, small businesses, and institutions such as schools, prisons, municipal buildings and hospitals.

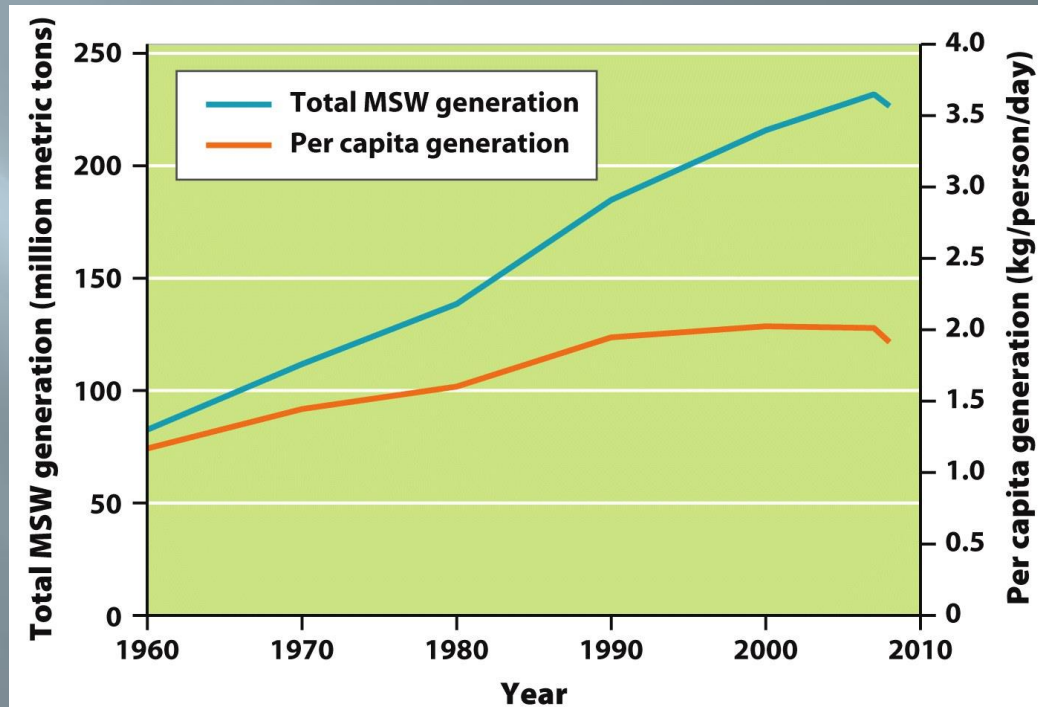
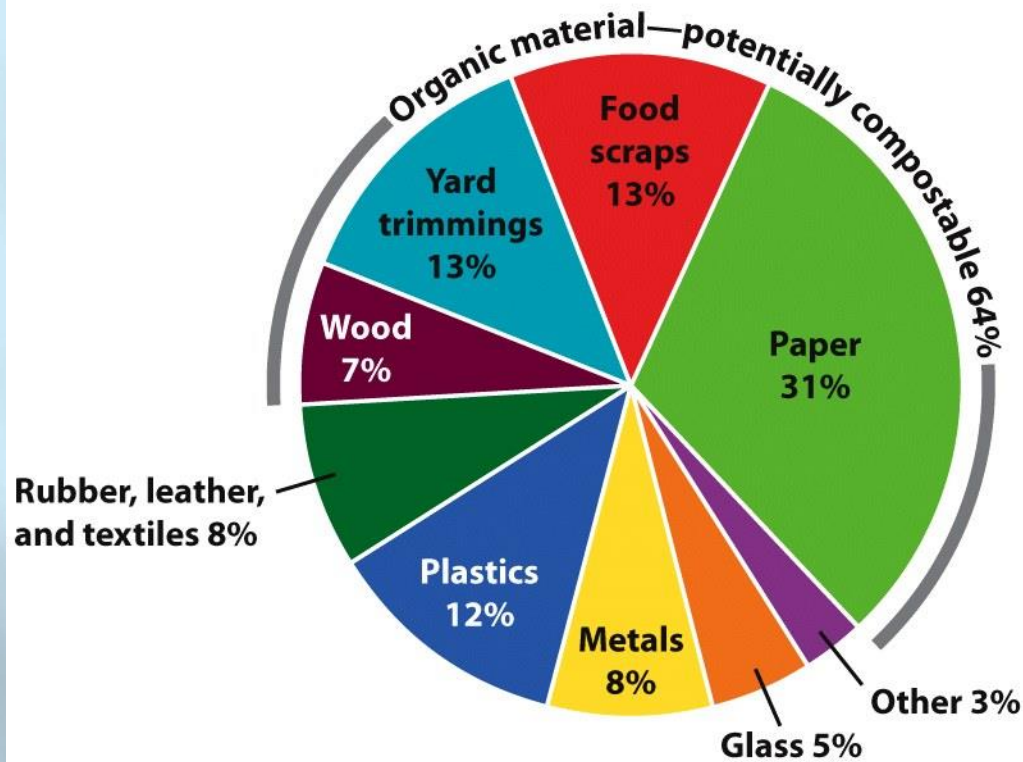
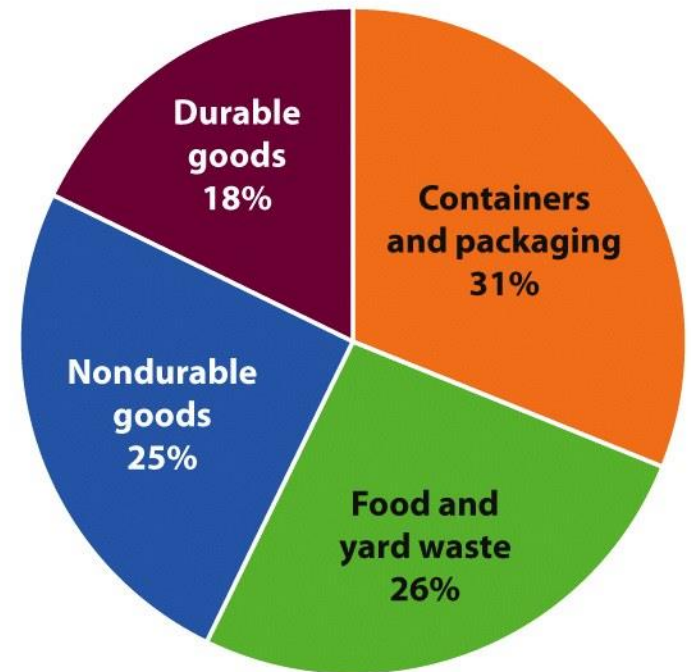


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**(a) Breakdown of MSW by composition**



**(b) Breakdown of MSW by source**

**Figure 16.5**

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# Composition of Municipal Solid Waste

- ▣ 31% - paper
- ▣ 33%- organic materials (yard waste, food scraps, wood)
- ▣ 12%- plastic
- ▣ 18%- durable goods (appliances, tires)

# E-Waste

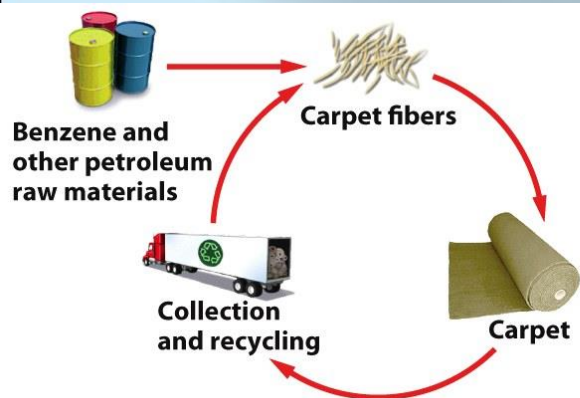
- ❑ Electronic waste (E-waste) televisions, computers, cell phones that contain toxic metals.



**Figure 16.6**  
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# Reduce, Reuse, Recycle

- ▣ Reduce- waste minimization or prevention
- ▣ Reuse- reusing something like a disposable cup more than once
- ▣ Recycle- materials are collected and converted into raw materials and then used to produce new objects

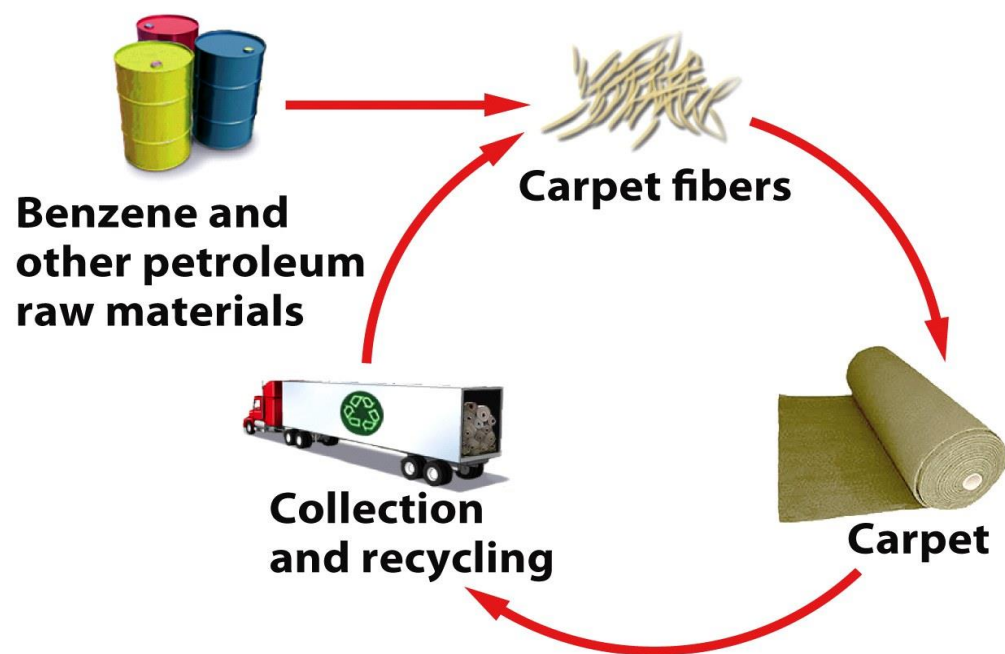


**(a) Closed-loop recycling**



**(b) Open-loop recycling**

**Figure 16.8**  
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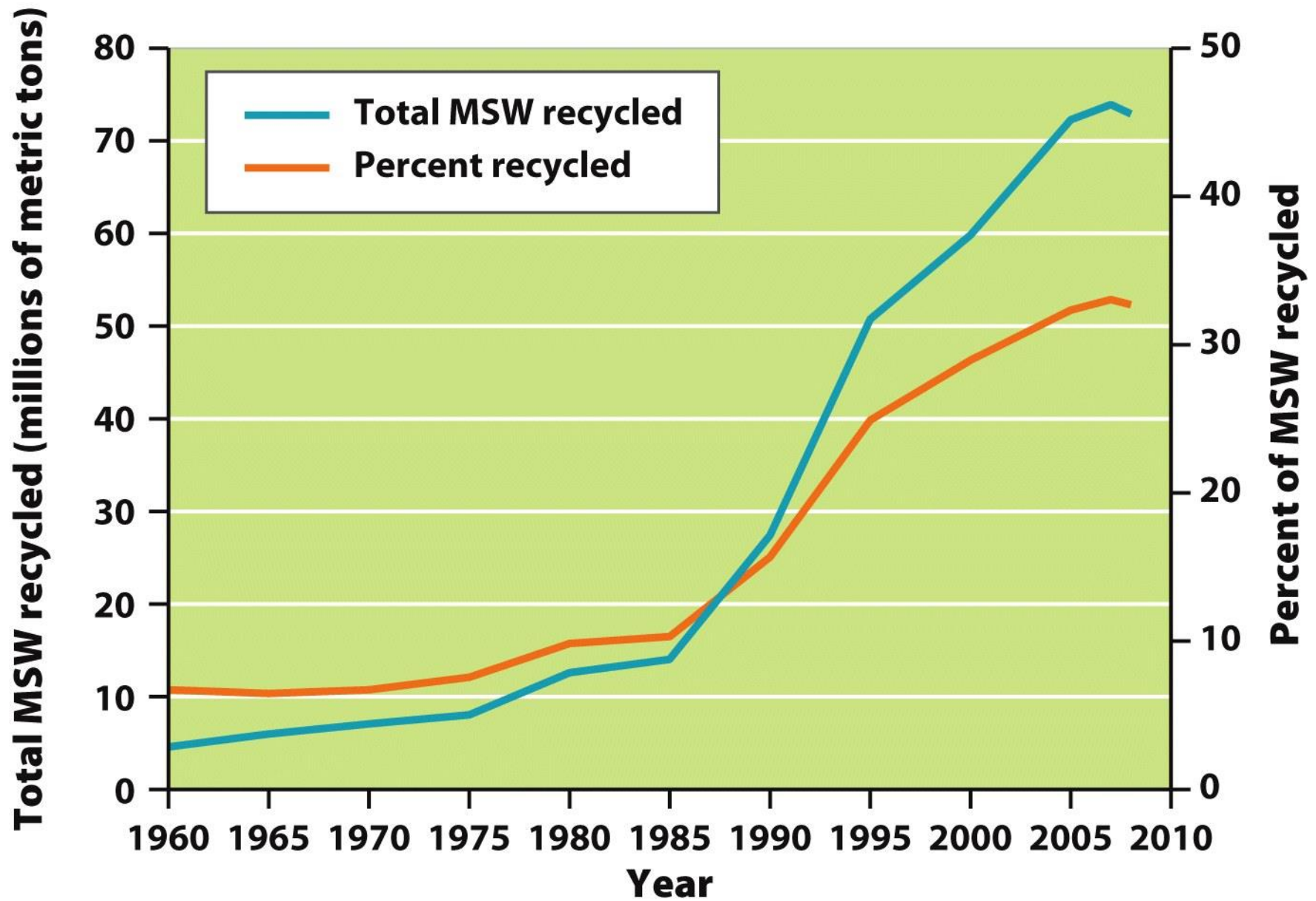
**Closed-loop recycling**



**Open-loop recycling**

**Figure 16.8b**  
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**Figure 16.9**

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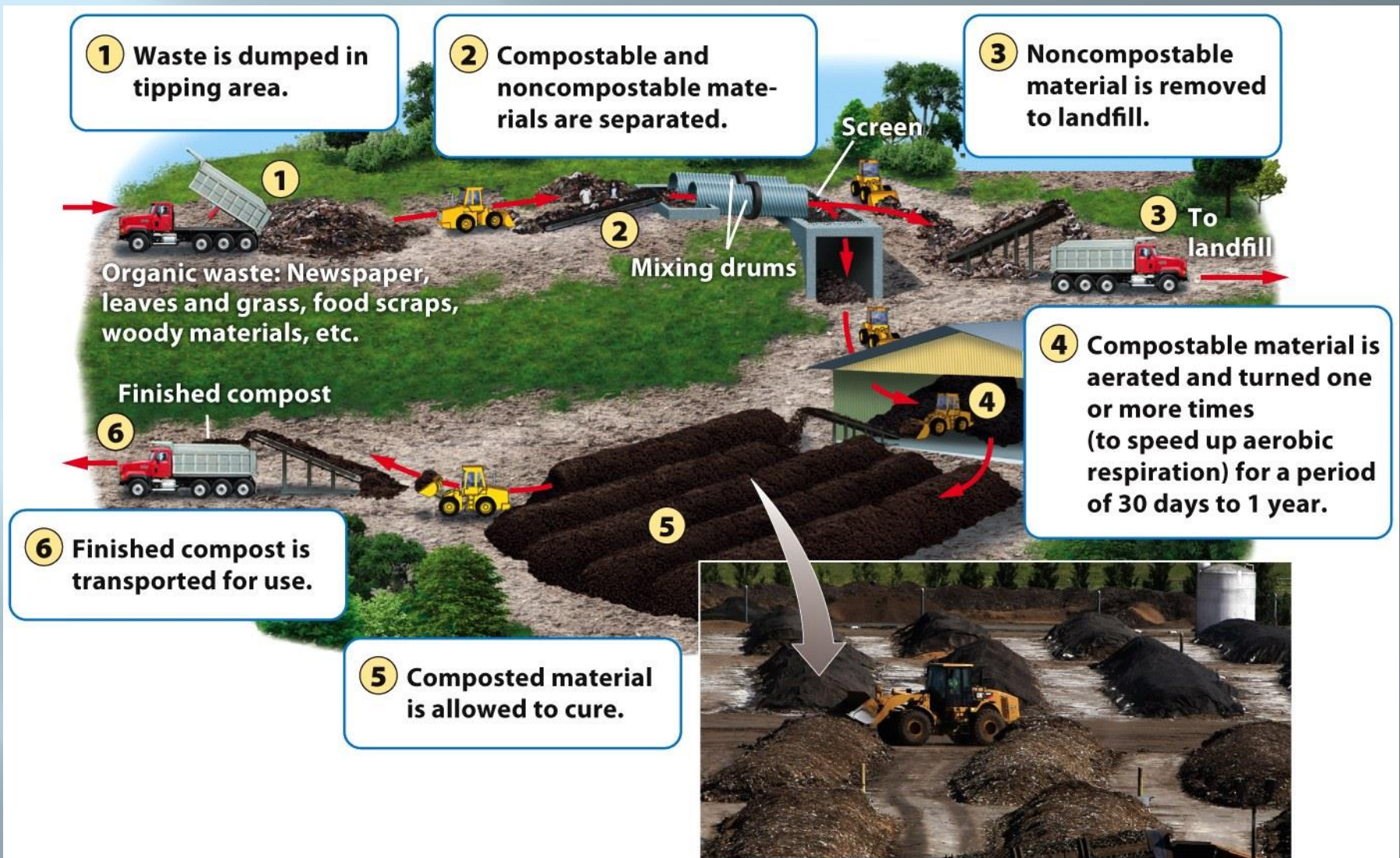


# Composting

- Compost- organic material that has decomposed under controlled conditions to produce an organic-rich material.



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**Figure 16.12**

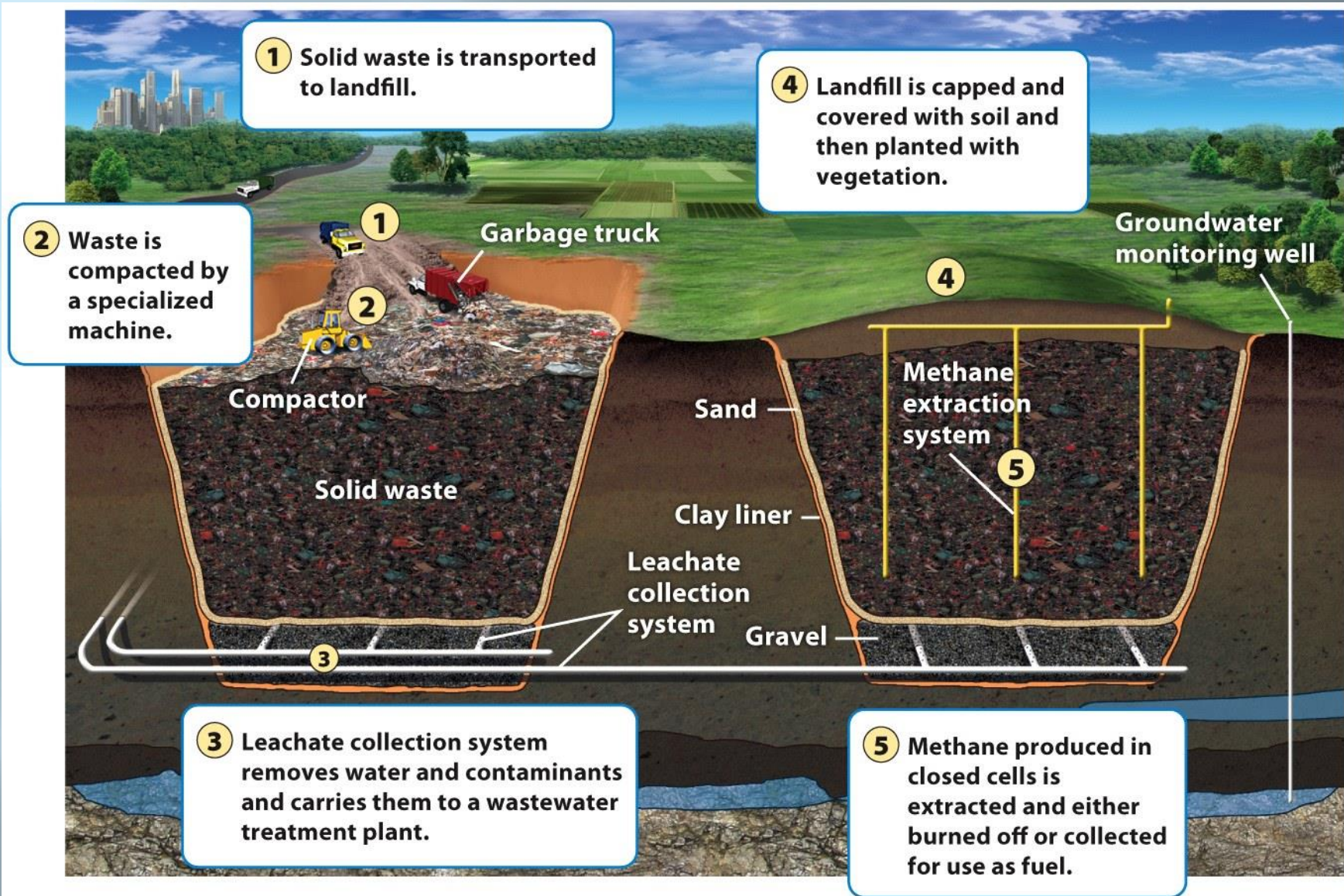
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# Landfills

- ▣ Sanitary landfills- engineered ground facilities designed to hold MSW with as little contamination of the surrounding environment as possible.
- ▣ Leachate- the water that leaches through the solid waste and removes various chemical compounds with which it comes into contact.





**Figure 16.14**

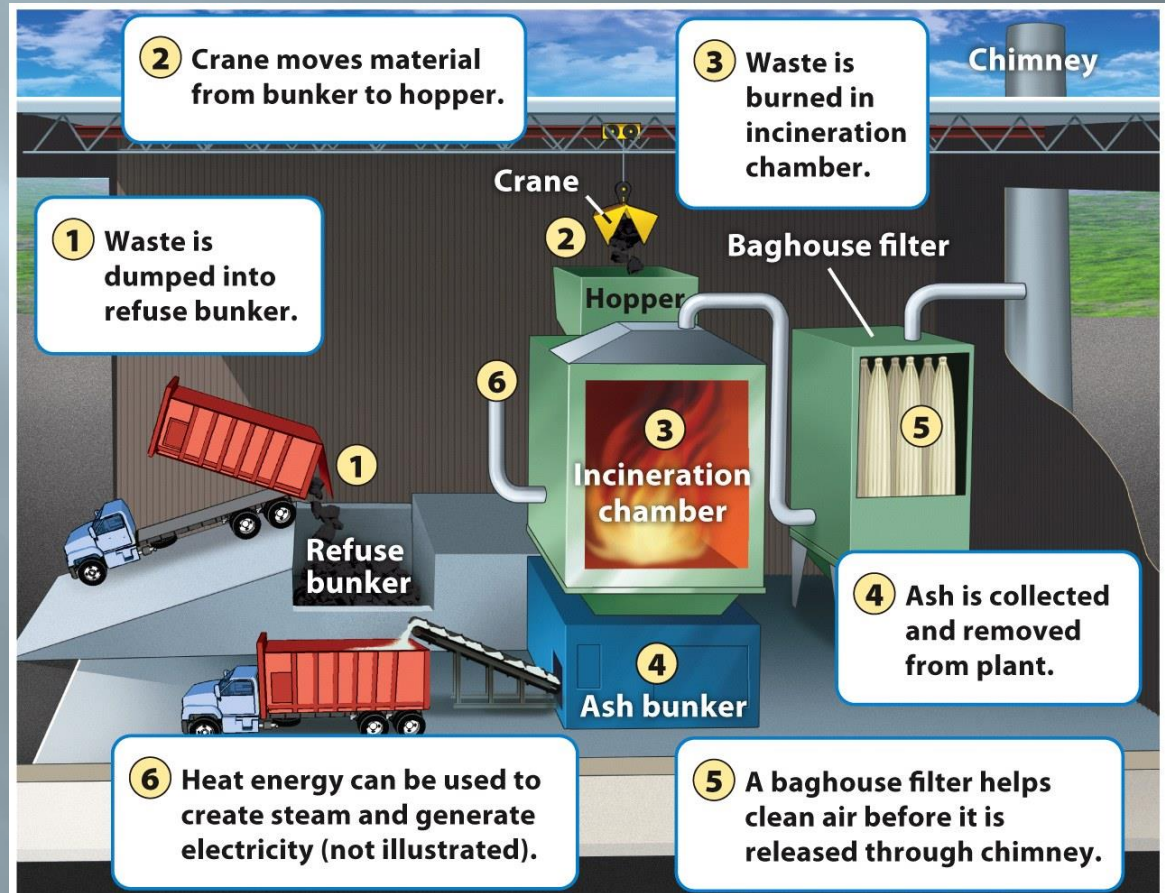
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# Incineration

- Incineration- the process of burning waste materials to reduce its volume and mass and sometimes to generate electricity and heat.



**Figure 16.16**  
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# Hazardous Waste

- ▣ Hazardous waste- liquid, solid, gaseous, or sludge waste material that is harmful to humans or ecosystems.
- ▣ Collection sites for hazardous waste must be staffed with specially trained personnel.
- ▣ Hazardous waste must be treated before disposal.

# Laws

- ▣ Resource Conservation and Recovery Act (RCRA)- designed to reduce or eliminate hazardous waste. Also know as “cradle-to-grave” tracking.
- ▣ RCRA ensures that hazardous waste is tracked and properly disposed of.

# Laws

- ▣ Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-also know as “Superfund”.
- ▣ Puts a tax on the chemical and petroleum industries. This revenue is used to cleanup abandoned and nonoperating hazardous waste sites where a responsible party cannot be found.
- ▣ Requires the federal government to respond directly to the release of substance that may pose a threat to human health or the environment



# Brownfields

- ▣ Contaminated industrial or commercial sites that may require environmental cleanup before they can be redeveloped or expanded.
- ▣ Old factories, industrial areas and waterfronts, dry cleaners, gas stations, landfills, and rail yards are some examples.

# Integrated Waste Management

- ▣ A method that seeks to develop as many options as possible, to reduce environmental harm and cost.
- ▣ Reduction, recycling, composting, landfills, and incineration are some ways IWM is utilized.