


Lesson 19. Solid & Haz. Waste



Solid Wastes

June 6, 2006

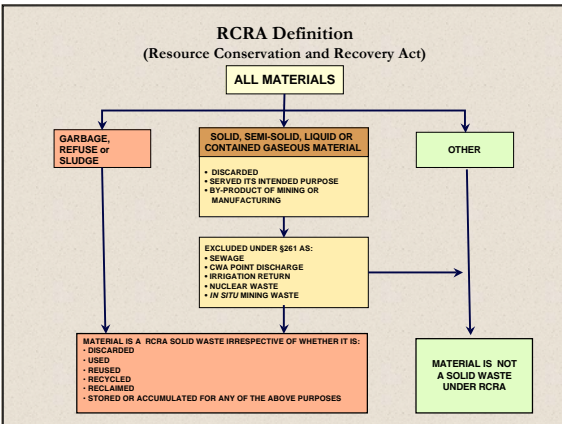
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Lesson Overview



- ❖ Solid Waste Disposal
 - Generation & Storage
 - Collection & Transport
 - Disposal Options
 - Landfills
 - Incineration
- ❖ Alternatives to Waste Disposal
 - Reduction
 - Reuse / Recycling
- ❖ Hazardous Wastes

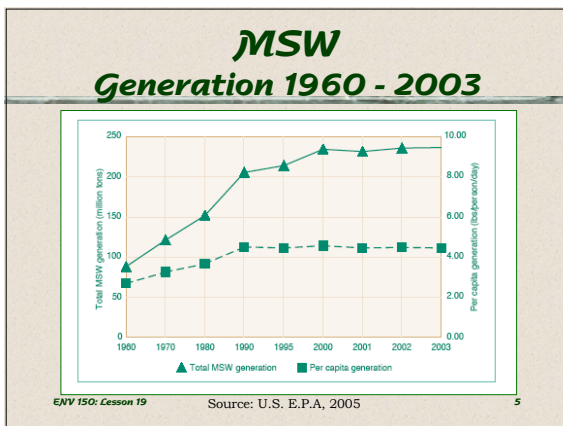


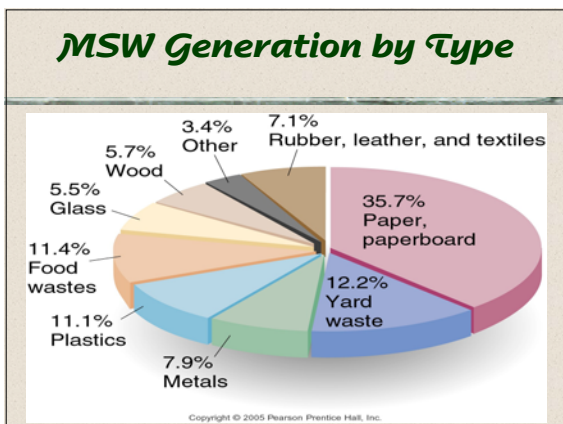
Garbage

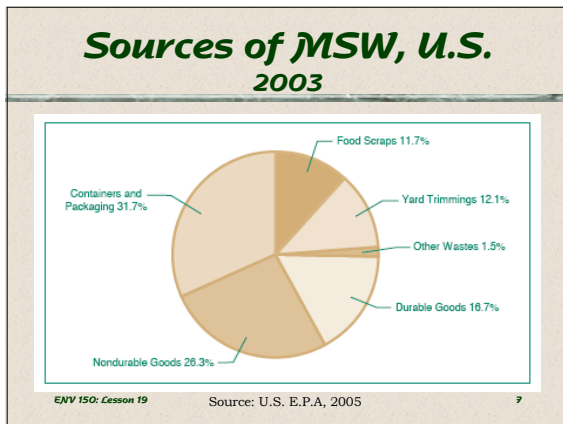
❖ Municipal Solid Waste (MSW)



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Storage



- ❖ Residential
- ❖ Commercial
- ❖ Compaction

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Residential Storage



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Commercial Storage



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Inadequate Capacity



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Compaction



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Collection & Transport



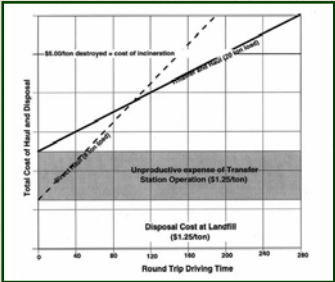
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Collection & Transport (Continued)




ENV 150: Lesson 19 14

Collection & Transport (Continued)




ENV 150: Lesson 19 15

Transfer Stations



ENV 150: Lesson 19 16

Transfer Stations (Continued)




ENV 150: Lesson 19 17

Transfer Stations (Continued)



ENV 150: Lesson 19 18

Transfer Stations (Continued)



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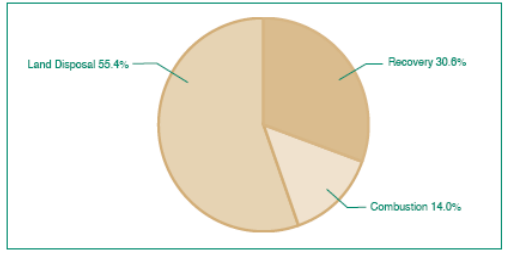
Disposal

Disposal Options:

- ❖ Sanitary Landfill
- ❖ Incineration
- ❖ Other
 - Composting
 - ~~Ocean Dumping~~

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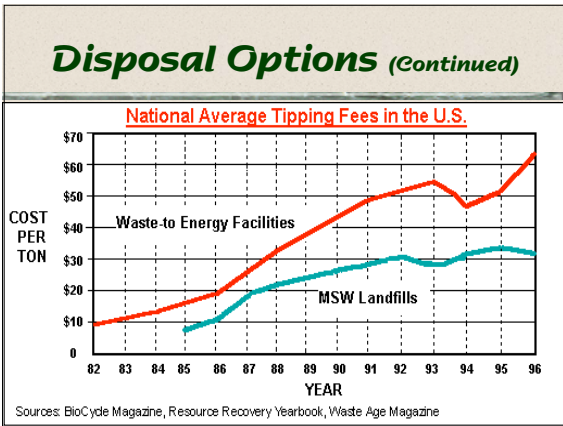
MSW Management, 2003

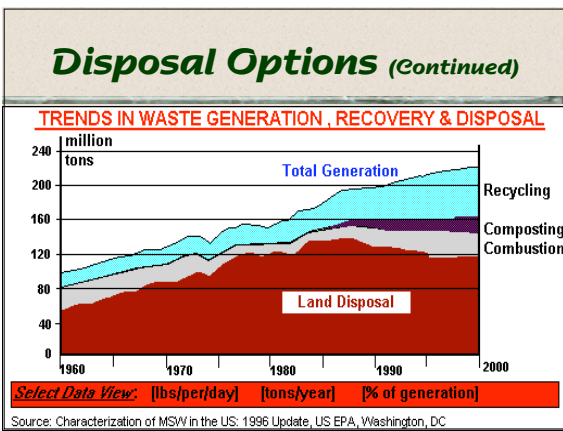


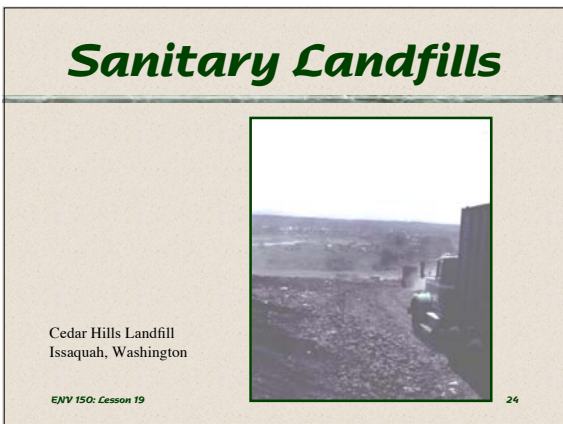
Management Method	Percentage
Land Disposal	55.4%
Recovery	30.0%
Combustion	14.0%

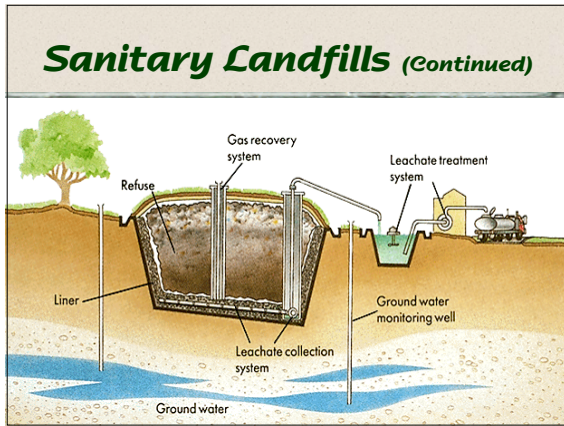
Source: U.S. E.P.A., 2005

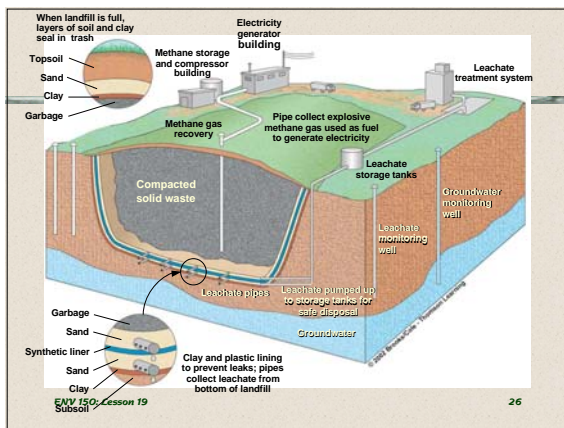
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Sanitary Landfills (Continued)



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Sanitary Landfills (Continued)



ENV 150: Lesson 19 29

Sanitary Landfills (Continued)




ENV 150: Lesson 19 30

Sanitary Landfills (Continued)



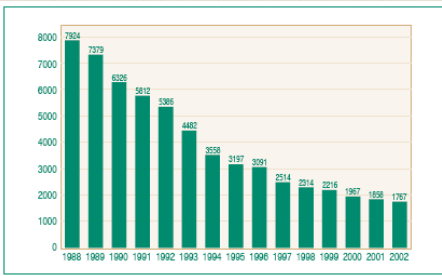
ENV 150: Lesson 19 31

Sanitary Landfills (Continued)



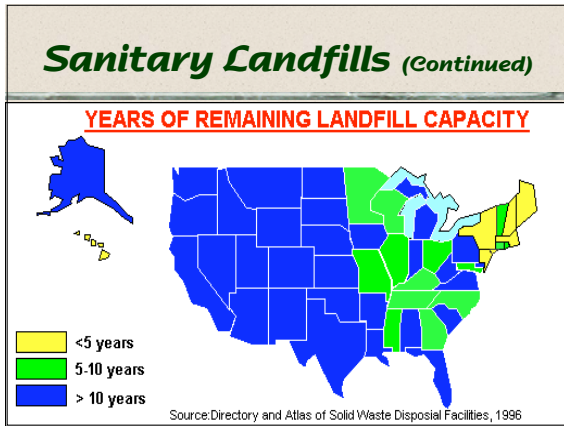
ENV 150: Lesson 19 32

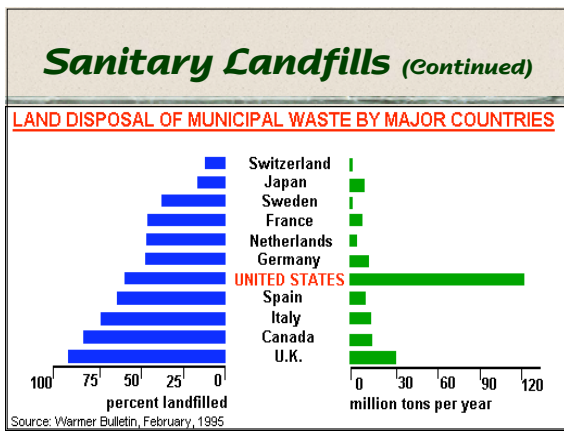
Number of Landfills

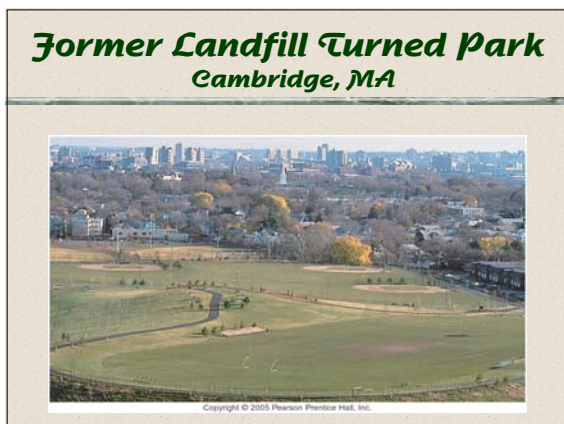


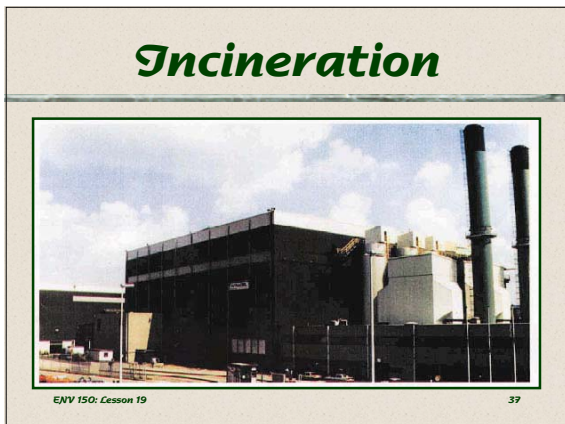
Year	Number of Landfills
1980	7854
1989	7379
1990	6326
1991	5912
1992	5386
1993	4482
1994	3558
1995	3187
1996	3091
1997	2514
1998	2314
1999	2216
2000	1967
2001	1838
2002	1767

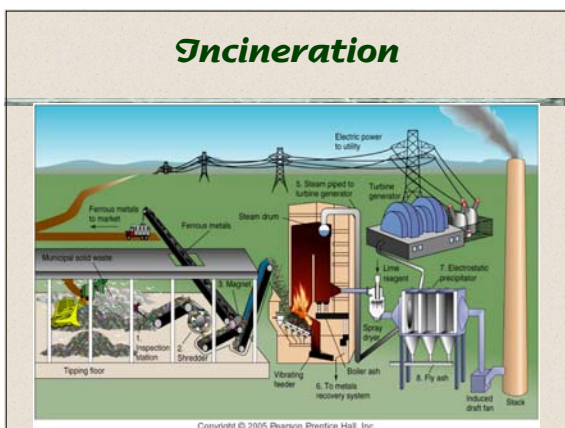
ENV 150: Lesson 19 Source: U.S. E.P.A., 2005 33

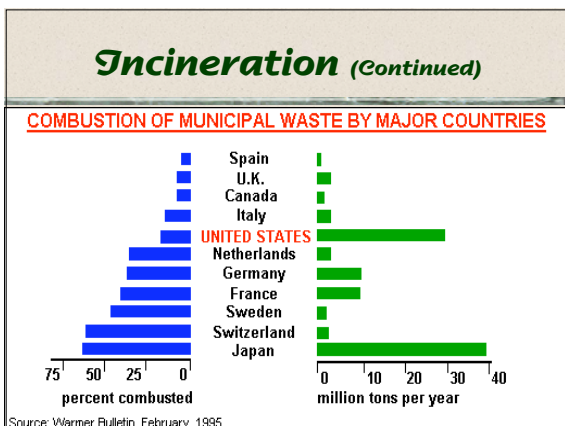












Regulation of MSW

- ❖ Resource Conservation & Recovery Act (RCRA)
 - Increasingly stringent requirements for MSW
 - Essentially equivalent to Hazardous Waste TSD
 - Subtitle C: Hazardous Wastes


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Questions



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Alternative Technologies

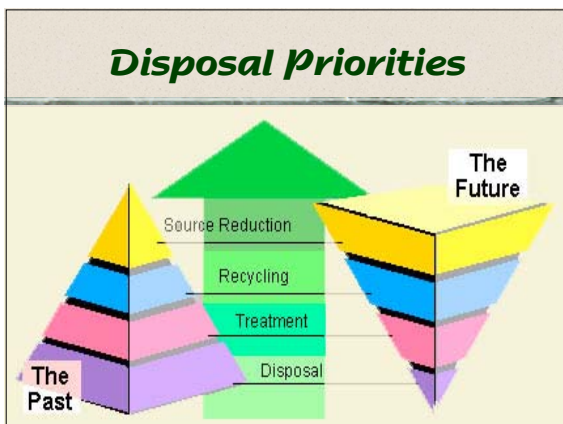
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Waste Reduction

- ➔ Use less
- ➔ Just in Time Inventory
- ➔ Reduced Packaging
- ➔ Household Hazardous Waste Collection

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Waste Reuse

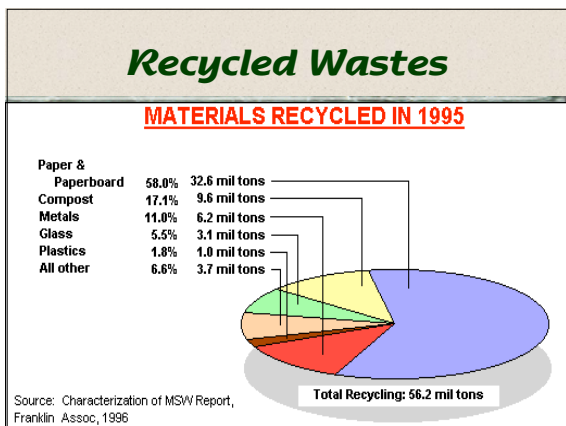
- ❖ Reuse of an item for the *same* purpose
 - ➔ Bottle Recycling
 - ➔ Shopping Bags
 - ➔ Repair consumer goods

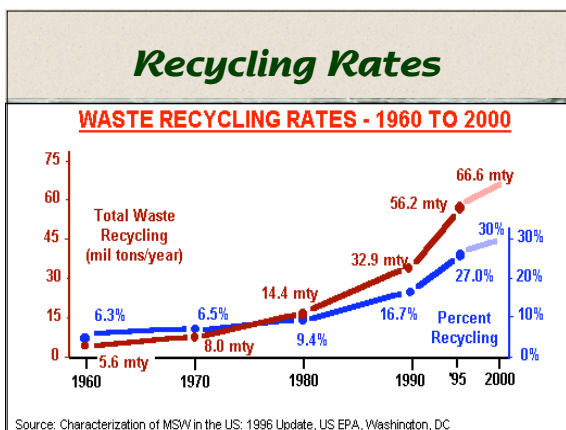
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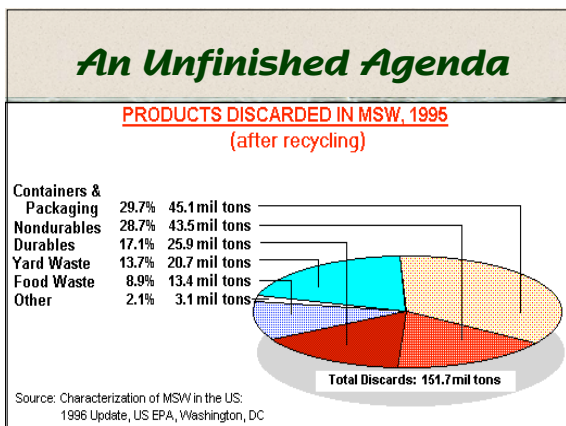
Waste Recycling

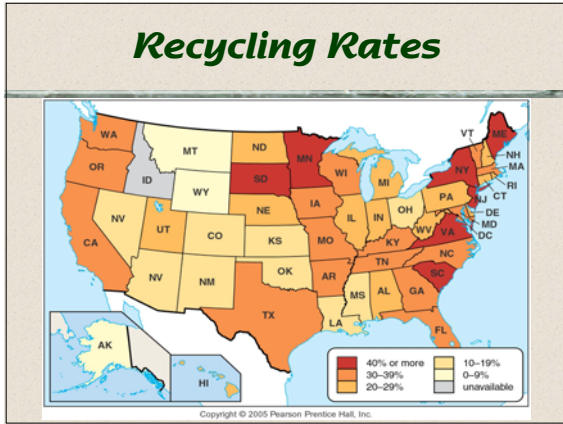
- ❖ Reuse or conversion of an item for a different purpose
 - Recycled products
 - Composting
 - Energy recovery

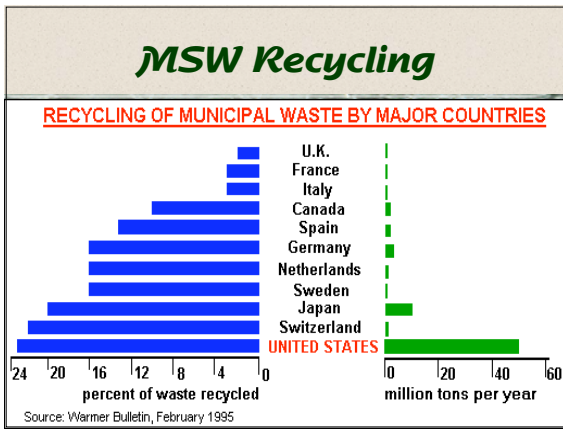
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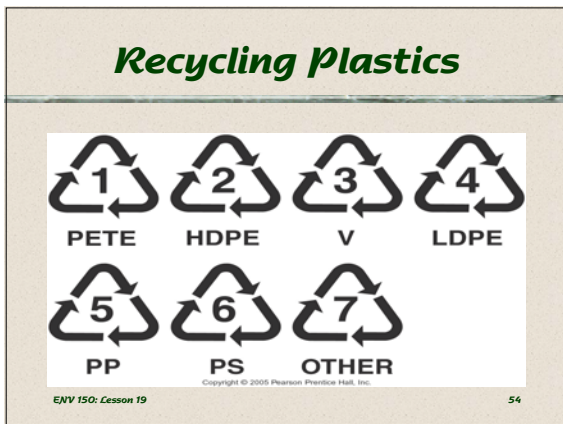




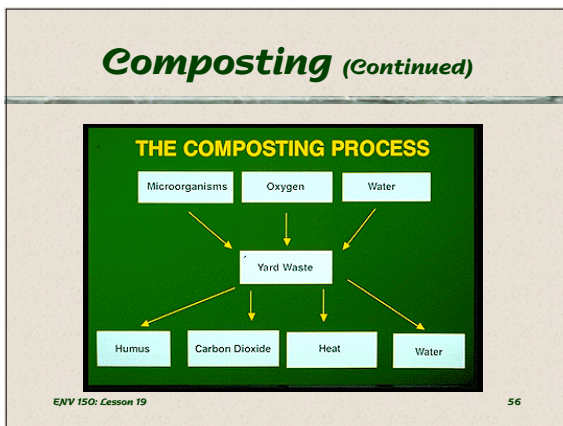




















Composting *(Continued)*




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Questions



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Hazardous Wastes

June 6, 2006

April Huff
North Seattle Community College

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What makes it hazardous?

EPA classifies hazardous and toxic waste in one or more of the following categories:

- ❖ Ignitability
- ❖ Corrosiveness
- ❖ Reactivity
- ❖ Toxicity

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A group of its own

- ❖ Radioactive: very hazardous material (nuclear power plants, nuclear weapons production)

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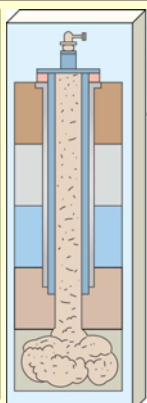
66

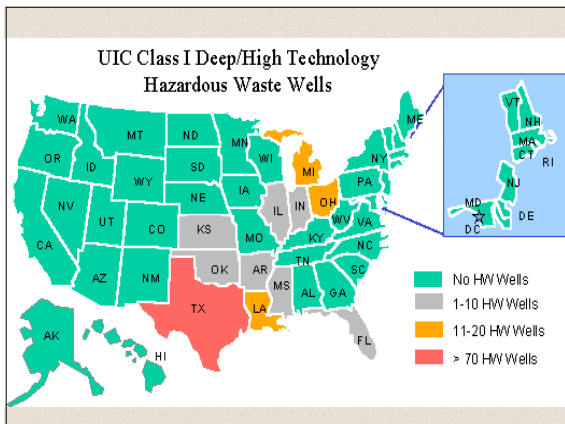
Dealing with Hazardous Wastes
Various Methods

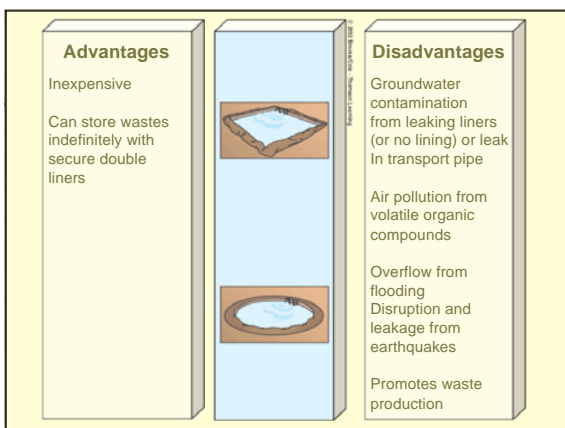
Out of sight – out of mind

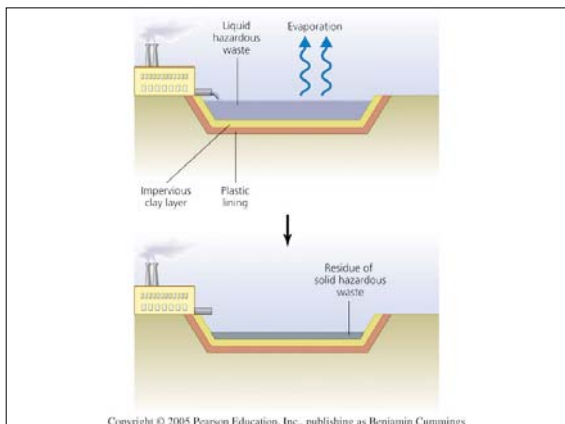
- ❖ Where it goes, nobody knows!
- ❖ Deep well injection
- ❖ Surface impoundments
- ❖ Hazardous waste landfills
- ❖ Incineration

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Advantages Safe method if sites are chosen carefully Wastes can be retrieved if problems develop Low cost		Disadvantages Leaks or spills at surface Leaks from corrosion of well casing Existing fractures or earth quakes can allow wastes to escape into groundwater Encourages waste production
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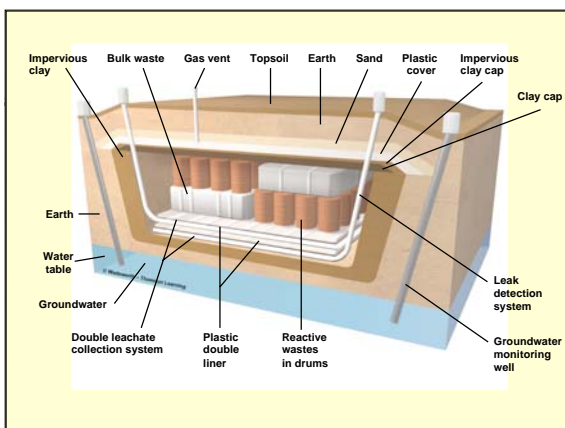






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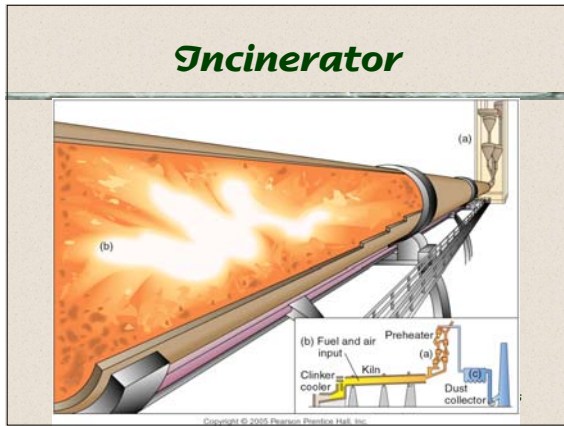


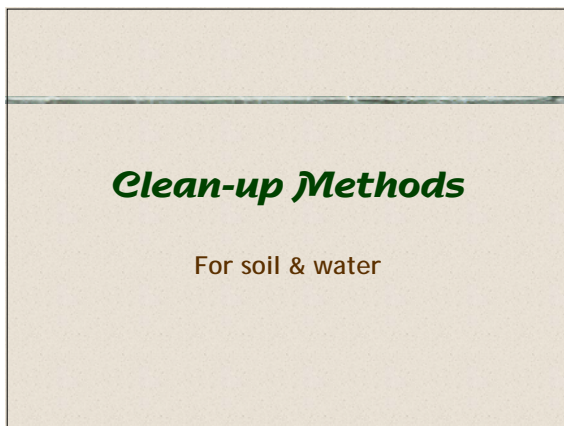


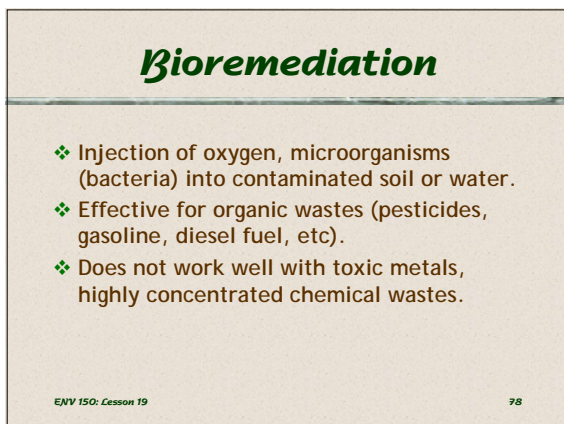
Mass burn Incinerators

- ❖ Commercial incinerators or cement kilns
- ❖ Burn around 750 - 3000 degrees F

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

Phytoremediation

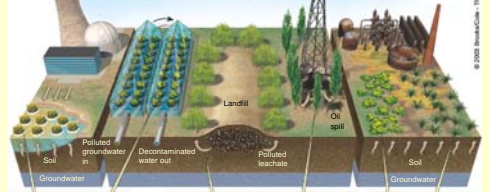
❖ Natural or genetically engineered plants that filter and remove contaminants from the soil

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Trade-Offs	
Phytoremediation	
Advantages	Disadvantages
<p>Easy to establish</p> 	<p>Slow (can take several growing seasons)</p>
<p>Inexpensive</p>	<p>Effective only at depth plant roots can reach</p>
<p>Can reduce material dumped into landfills</p> 	<p>Some toxic organic chemicals may evaporate from plant leaves</p>
<p>Produces little air pollution compared to incineration</p>	<p>Some plants can become toxic to animals</p>
<p>Low energy use</p> 	

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Radioactive contaminants	Organic contaminants	Inorganic metal contaminants
<p>Sunflower</p> 	<p>Willow tree</p> 	<p>Poplar tree</p> 
<p>Indian mustard</p> 	<p>Brake fern</p> 	



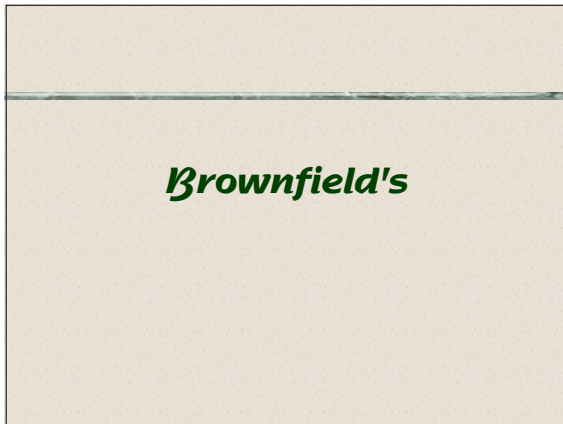
Rhizofiltration
Roots of plants such as sunflowers with dangling roots on ponds or in greenhouses can absorb pollutants such as radioactive strontium-90 and cesium-137 and various organic chemicals.

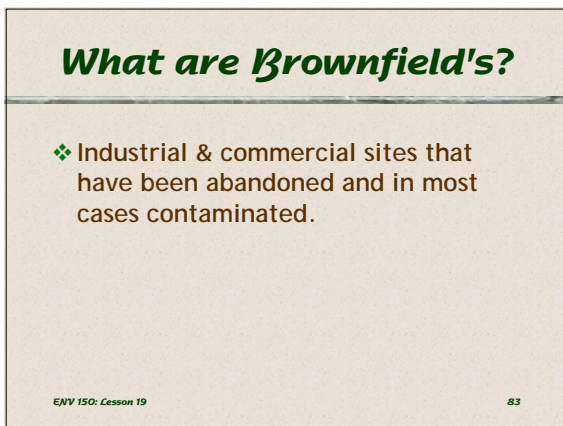
Phytostabilization
Plants such as willow trees and poplars can absorb chemicals and keep them from reaching groundwater or nearby surface water.

Phytodegradation
Plants such as poplars can absorb toxic organic chemicals and break them down into less harmful compounds which they store or release slowly into the air.

Phytoextraction
Roots of plants such as Indian mustard and brake ferns can absorb toxic metals such as lead, arsenic, and others and store them in their leaves. Plants can then be recycled or harvested and incinerated.

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RCEA

- ❖ Resource Conservation & Recovery Act
- ❖ Passed by US Congress in 1976
- ❖ Amended in 1984

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RCEA

This law requires:

- ❖ EPA to identify hazardous wastes & set standards. (States manage)
- ❖ Firms that store, treat, or dispose of more than 110 kg (220 lbs) per month must have permit.
- ❖ Permit holders to use a cradle-to-grave system for wastes.

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Superfund aka CERCLA

- ❖ Comprehensive Environmental Response Compensation & Liability Act
- ❖ Passed in 1980 by US Congress

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CERCLA

- ❖ Identify and clean up abandoned hazardous waste sites & underground tanks leaking toxic chemicals

- ❖ National Priorities List

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CERCLA

- ❖ To keep taxpayers from footing most of the bill clean ups are based on the polluter-pays principle

- ❖ The EPA is in charge of:
 - > Finding the parties responsible for each site.
 - > Ordering them to pay for the entire clean up.
 - > Suing them if they do not.

If no responsible found - money is drawn out of the "Superfund" for clean up.

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Hazardous Waste Nightmare
The story of Love Canal

Love Canal

- ❖ Late 1800's - early 1900's
- ❖ New dream community on the eastern edge of Niagara Falls, NY proposed by William T. Love.
- ❖ Love felt that digging a short canal between the upper and lower Niagara Rivers, power could be generated cheaply for this "model city."

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Niagara Falls



Love Canal

- ❖ Love's project was not really feasible due to economic times and newer technology (alternating current). He also ran out of money.
- ❖ 1910 - Love's dream shattered.
- ❖ Just a partial ditch (60 feet by 3000 feet long) remained where construction began for the canal.

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Love Canal

- ❖ 1910 - 1927 canal used by residents to fish and swim
- ❖ 1927 - land annexed by the city
- ❖ 1942 - 1952 Canal becomes municipal and industrial chemical dumpsite for Hooker Chemical Co. 21,000 tons total were dumped in this area.

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Love Canal

- ❖ 1953 - the Hooker Chemical Company, owners and operators of this property, covered the canal with soil and sold it to the Niagara Falls School Board for \$1.00.

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Love Canal

- ❖ 1955 - elementary school and playground constructed onsite.
- ❖ 1957 construction of homes were built on this property.
- ❖ By 1978 - 800 homes had been built.

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Love Canal

- ❖ Trees and gardens were turning black and dying.
- ❖ Noxious puddles in yards and basements.
- ❖ Children returned from play with burns on their hands and faces.
- ❖ Birth defect rates were rapidly increasing in this area.

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Love Canal

- ❖ August 1978 - News story broke about Love Canal containing hazardous chemicals, several of them carcinogens.

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Love Canal

- ❖ Lois Marie Gibbs - "Mother of Superfund" created Love Canal Homeowners Association (LCHA).
- ❖ Protested the situation to the government.
- ❖ President Carter approved emergency financial aid for the residents.
- ❖ By end of August, 98 families had been evacuated.

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ENV 150

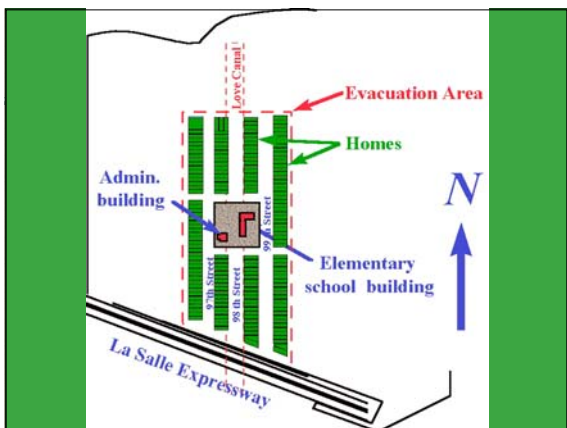
105



Love Canal

- ❖ Eventually all but 67 families were relocated by 1979.
- ❖ Superfund/CERCLA goes into effect 1980.
- ❖ 239 homes closest to the canal were demolished and the southern section of the neighborhood declared uninhabitable.
- ❖ Summer 1990 - 200 northern homes considered "habitable." Black Creek Village subdivision is established.

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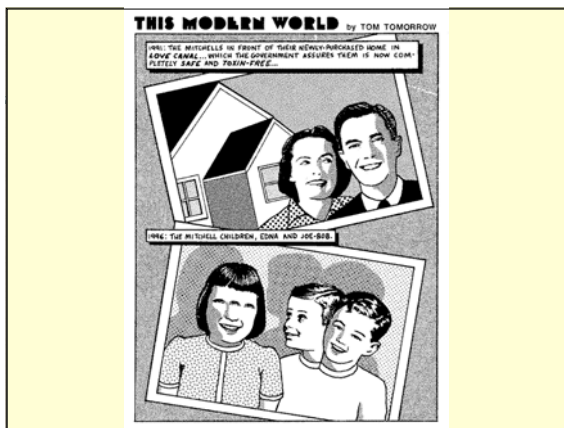


Love Canal

- ❖ Company has paid over \$98 million and then some for clean-up of site and lawsuits.

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Assurances

"The entire area is probably one of the most tested pieces of property on this planet. It's probably one of the safest places to live."

Mike Basile
(spokesman for the EPA)

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Doubts

"I haven't found a scientist yet who would say the landfill won't leak again. The logical flow of water in that community is from the landfill to the homes."

Lois Gibbs

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Love Canal


❖ September 2004 - area officially removed off of National Priorities List

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Superfund Closer to Home

Gas Works Park


Welcome to Gasworks!



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Gas Works Park

- ❖ 1900-1956 - Seattle Gas & Light company purchased this land for a gas processing plant.



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Gas Works Park

- ❖ 1900-1930 - plant used coal , leaving behind coal tar and underground plumes of a substance called naphthalene.
- ❖ Today that product remains underground, but is believed to be so deep it's actually below the bottom of Lake Union.
- ❖ City Officials plan to leave it untouched.

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Gas Works Park

- ❖ 1930-1956 - plant used oil to convert to manufactured gas, which created a benzene plume.
- ❖ Benzene is a by product of gasoline.
- ❖ Plant closed in 1956 when natural gas became the new way to heat homes.

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Gas Works Park

- ❖ 1961 - City of Seattle purchased land for \$1.3 million dollars for future park. The City was fully aware of the contaminants and agreed to clean them up.
- ❖ 1976 - After 3 years of hauling away contaminated soil, the park opens to the public.

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Gas Works Park

- ❖ 1984 - Park temporarily closed again due to heighten concern of health hazards.
- ❖ Park considered to be a Superfund site, but the state chose to clean it up instead.
- ❖ Politics and money delayed a thorough clean up until the 1990's.
- ❖ \$4 million dollars later, Gas Works Park was reopened.

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Another Sign



ENV 150

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Gas Works Park

- ❖ Site still remains contaminated.
- ❖ Clean up still in progress.

- ❖ Bottom line: don't eat the soil or drink the lake.

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Questions



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Web Resources

- ❖ U.S. Environmental Protection Agency
 - > <http://www.epa.gov/epaoswer/osw/hazwaste.htm>
- ❖ Household Hazardous Wastes
 - > <http://outreach.missouri.edu/owm/hhw.htm>
- ❖ King County Local Hazardous Waste Program
 - > <http://www.metrokc.gov/hazwaste/house/>

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Next Lesson

**Housing &
Urban
Development**

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