

Types of Hazardous and Toxic Waste Disposal Methods

USA makes 33% world's waste

- 2/3 ton/yr/person which comes to 4.5 lbs/person a day!
- That's twice the amt of Europe and Japan, 10 x more than other developed countries
- most common method of disposal= least desirable
 - all waste is mixed together- food, paper, hazardous, plastics (decompose to PCB and dioxins)

OLD SCHOOL WASTE MANAGEMENT

Ocean Dumps

- Illegal in US (hooray!), but common in most countries (boo!)
 - Until recently, NYC dumped its sewage, municipal and industrial waste, in the ocean off Long Island.
- 55 million lbs/yr of packaging are dumped into ocean
- 330 million lbs/yr of fishing gear lost or discarded
- Deadly to marine life (ex. seals get entangled in fishing nets) :(
- Ocean Dumping Ban Act of 1988- includes sewage sludge, industrial waste.

LANDFILLS

- Fate of most municipal solid waste (60%)
- Percentage of waste by weight in US
 - #1. Paper- 42% (2 million trees/day used)
 - #2. Yard/ Food- 27%
 - #3. Metal- 10%
 - #4. Glass- 9%
 - #5. Plastic- 7% (One million years to decompose)
- Past method- trash buried with an "impermeable" lining (clay)
 - prevents pollution of aquifer by leaching of rainwater through oil, chemical compounds, and toxic metals. It's *supposed* to anyway.
 - Many aquifers already toxic from leachate from batteries, pesticides, paint cans, smoke detectors (radioactive)
 - covered with 6"soil/day to prevent rodents and toxins leaching downward
- New "Sanitary" landfills are engineered to avoid water contamination

- fabulous setting: must now be set on stable, impermeable bedrock, away from streams, rivers, lakes etc.
- bottom liner: double lined with plastic liners made of high density polyethylene will only be degraded by household chemicals (like moth balls, margarine, vinegar and booze) so it lasts longer.
- Leachate Collection System: toxic fluids seep to bottom of landfill where they are collected by complex drainage pipes
- Methane gas, a by product of decomposing waste, is burned for electrical energy
- Once very effective, landfills are now costly landhogs- \$10 billion/year to bury trash
- Running out of space

Exporting

- Is there an "away"?
- "Garbage imperialism" and NIMBY
 - Hazardous and toxic waste often sent to poor, un-educated communities or countries
 - ex. American Indians, Africa
 - Bet Trang incinerator waste calamity- \$3 million bribe for dumping toxic incinerator waste in Cambodia. Caused nerve damage and deaths.
- Trashy life in Manila, Phillipines- Smoky Mountain, 20,000 people live off the trash
- A solution- make asphalt or concrete filler for highways filled with "recycled" toxic waste. Excellent... er, until it breaks down...

Incineration

- Fate of 15% of our municipal waste

Good

- Volume of waste reduced once burned 90%
- 45,000 tons/day burned in US
- Energy produced as by product of burning refuse- steam makes electrical energy
 - Called Waste-to-Energy

Bad

- Mass burn- throw everything in smaller than Volkswagon.
 - Many toxins are put into atmosphere
 - ex. dioxins (#1 source of dioxin in world), mercury, lead, cadmium, PVC (polyvinyl chloride)

- Residual ash is highly toxic too- sent to a landfill
- Expensive to build (\$100-\$300 million) and operate

Alternative

- Refuse-derived fuel- some incinerators remove batteries and plastics first for cleaner burn. Expensive.
 - Called Refuse Derived Fuel because trash burns hotter when pure
 - Rest of trash is sent to landfill.

THE THREE R'S: REDUCE, REUSE, RECYCLE

Reduction and Reuse

- Reduce- make less stuff to begin with
 - packaging unnecessary (mostly advertising not protecting product)
 - less junk mail- oh please!
 - use the internet
- Reuse is simply re-using an item
 - Shop at Sals!
 - Compose kitchen wastes
 - Fleece jackets out of plastic soft drink bottles. Hold the PVC's

Recycling - ITS A GOOD THING

- Recycling is re-processing discarded materials (ex. aluminum, plastic, tires, glass and newspapers)
 - 2/3 aluminum is now being recycled- cuts bauxite ore by 95%
 - bottles may be reformed as bottles
 - tires may be turned into roadways or sandals!
- Benefits include more efficient use of non-renewable resources
 - cheaper method of waste disposal- \$35/ton versus \$80/ton to bury it
 - less air and water pollution
 - cuts waste volume in landfill

EPA ranks best strategy for Municipal Solid Waste (MSW):

1. Source reduction (including reuse)
2. Recycling and composting (food waste)
3. Incineration

4. Landfilling

Intergrated Waste Management!

Reducing, reusing and recycling waste as much as possible. The management plan attempts to reduce landfill contributions.

HAZARDOUS WASTE

Anything that is fatal in low doses, flammable, reactive, corrosive or toxic when in the environment.

- 60 million tons of hazardous waste created a year in US.
 - 70% from chemical and petroleum industries
- *One gallon of gas can contaminate 1 million gallons of fresh water!*

The fate of hazardous waste

- Recycled
- Converted to less hazardous form
- Bioremediated
 - ex. Brassica absorbs Fe
- Placed in permanent storage in secure landfill or injected deep into earth
- Burned at high temperature
- "Temporarily" located in Brownfields- polluted properties that have been abandoned because of contamination

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Superfund Act of 1980- highly polluted waste site that is (supposed to be) undergoing rapid containment, cleanup and remediation. Presently this act is expired. Our tax money is paying for clean up now.

There are 36,000 sites in US

Case studies:

Hudson River- GE dumped PCB's in river

Love Canal- 1970s. Hooker Chemical dumped 20,000 tons of toxic waste in ditch. Sold to school. Cancer and birth defects common.

Resource Conservation and Recovery Act (RCRA) of 1976. Requires all hazardous waste to be tracked from CRADLE to GRAVE- shippers, generators and disposers.

Long Term Storage

- It has to go somewhere other than ocean or regular landfill
 - permanent retrievable storage- place in storage containers in building or cavern to be inspected and retrieved if necessary.
 - non-retrievable storage- a SECURE landfill. Place on thick bottom layer of clay, gravel, and plastic. I feel much better about that, don't you?

Long-term storage of nuclear waste at Yucca Mountain is a controversial topic because of NIMBY and that fact that the mountain has two active fault lines and is above a huge aquifer. So the short-term storage of the nuclear waste is at the nuclear power plants in huge pools or giant land "coffins". High-level nuclear waste is the high level of ionizing radiation that is created at uranium mines, manufacture of nuclear weapons, and the waste from spent nuclear fuel. Low-level waste is waste from industrial or research industries like clothing, needles, animal carcasses and stuff.

LAWS TO KNOW

1. Ocean Dumping Ban Act: bans ocean dumping of sewage sludge & industrial waste
2. Comprehensive Environmental Response, Compensation & Liability Act (CERCLA): Otherwise known as the Superfund Act- calls for a rapid cleanup of abandoned dumpsites containing toxic waste.
3. National Priorities List (NPL)- lists sites most in need of immediate cleanup. but many have yet to be contained
4. Surface Mining Control & Reclamation Act (SMCRA): requires coal strip mines to reclaim the land after they are finished mining. Money is put aside in escrow for clean up BEFORE mining begins.
5. Resource Conservation & Recovery Act (RCRA): requires generators, shippers and disposers of hazardous waste to keep accurate accounts of the management of the waste from the "cradle to grave".