APES- **Chapter #23 Guided Reading**
Botkin & Keller- *Materials Management*

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Chapter Objectives:

- *The importance of resources to society*
- *The differences between mineral resources and reserves*
- *The factors that control the environmental impact of mineral exploitation*
- *How wastes generated from the use of mineral resources affect the environment*
- *The social impacts of mineral exploitation*
- *How sustainability may be linked to the way we use nonrenewable resources*
- *The emerging concepts of materials management and how to achieve it*
- *The advantages and disadvantages of each of the major methods that constitute integrated waste management*
- *The various methods of managing hazardous chemical waste*
- *The problems related to ocean dumping and why they will likely persist for some time*

Pg. 520: Treasures of the Cell Phone
1: *What are the reasons why **e-waste** is not recycled more?*
-There is a lack of disposal methods that are simple, effective, small-scale, and inexpensive; not enough education

23.1: The Importance of Resources to Society
1: *Define the following:*
*** Renewable Resources**
-Resources that are regularly replenished as long as the processes that renew them operate normally (air, surface water, some groundwater, plants, animals, some energy sources)
*** Non-Renewable Resources**
-Resources that are replenished in too long of a time frame to be useful (soil, some groundwater, oil, coal, most minerals)

What **differentiates** renewable and non-renewable resources?
-The time frame; renewable resources take a relatively short time to replenish, while non-renewable resources take far longer

2: How many tons of non-fuel minerals does the typical American use per year?
-10 tons

23.2: Materials Management: What is it? 1: Define **Materials Management:**
-Methods consistent with the ideal of industrial ecology, making better use of materials and leading to more sustainable use of resources.

2: What are *5 ways* that this can be pursued?
-1: Eliminating subsidies for virgin material extraction; 2: Establishing green building incentives to encourage the use of recycled materials in construction; 3: Assessing financial penalties for poor production practices; 4: Providing financial incentives for beneficial industrial practices; 5: Providing incentives for people, industry, and agriculture to develop programs that reduce waste

3: How does the idea of materials management and recycling changing where paper mills are located?
-Paper mills now use recycled paper rather than new paper from forests, so paper mills are being established in cities with more recycled paper.

23.3: Mineral Resources
1: When **metals are concentrated** in such high amounts by geologic processes, **Ore Deposits** are formed.

2: In the **Earth's crust**, which element makes up the most % by composition? What is 2nd?
-Oxygen; Silicon

3: How are ***sedimentary processes and weathering*** involved in mineral deposits?
-Sedimentary processes weather rocks and carry small particles of minerals to deposits that accumulate over time and are sorted by wind and water.

23.4: Figuring Out How Much is Left
1: What is the difference between a **mineral resource** and a **mineral reserve**?
-Mineral resources are known concentrations of elements that aren't factored by industry. Mineral reserves are concentrations that can be legally and economically extracted for profit.

2: Earth's mineral resources can be divided into which broad categories?
-Elements for metal production and technology, building materials, minerals for the chemical industry, and minerals for agriculture.

3: When the availability of a particular mineral becomes limited, there are four possible solutions:
1: Find more sources
2: Recycle and reuse what has already been obtained
3: Reduce consumption
4: Find a substitute

23.5: Impact of Mineral Development
1: What are some of the **environmental impacts** of surface mining (open-pit mines)?
-Severe topography changes, dust affecting air quality, trace element releases

2: What are some of the **social impacts** of large scale mining operations?
-Stress on areas unprepared for growth (water supply, waste disposal, schools, housing, recreation), urbanization, pollution

3: What can be done to *minimize* the environmental effects of mining?
-1: Reclaiming areas disturbed by mining; 2: Stabilizing soils that contain metals to minimize release; 3: Controlling air emissions of mined materials; 4: Treating contaminated water; 5: Treating waste on and offsite; 6: Practicing reduce, reuse, and recycle

4: What are the 3 R's of waste management?
-Reduce waste production, Reuse waste, Recycle opportunities

23.6: Materials Management and Our Waste
1: Compare *"dilute and disperse"* to the contemporary method of *"concentrate and contain".*
-Dilute and disperse involves dumping waste into a river, diluting it. Concentrate and contain is disposing waste by concentrating the waste and putting it into containers such as trenches or ditches.

2: In the next few years, how many U.S. cities will run out of landfill space?
-1/2 of all U.S. cities

3: What is **"NIMBY"?**
-"Not In My Backyard", the attitude that waste disposal sites should not be situated near residential areas

4: Describe the concept of *"industrial ecology"* and how it will be *essential in the future.*
-Industrial ecology is the study of relationships among industrial systems and their links to natural systems. Industrial ecology believes that our industrial society should behave as a natural ecosystem, and zero waste is emphasized.

5: What is your opinion of *"pay as you throw"*? **Defend your opinion**
-I believe that the "pay as you throw" method of taxation on waste would be very ineffective, because lower-income citizens face even more taxation due to the decreased availability of cleaner fuels and appliances.

23.7: Integrated Waste Management
1: Define **Integrated Waste Management (IWM):**
-A set of management alternatives that includes reuse, source reduction, recycling, composting, landfill, and incineration.

2: What is *waste stream?*
-The waste produced in an area

3: What is *single-stream recycling?*
-Recycling where materials are not separated before collection; they are commingled and separated later

4: What are some creative ways that industry are encouraging recycling?
-Increased availability of recycling bins, offering reusable alternatives to a product, making goods easier to disassemble, and coding parts for easier recycling

5: How can **human waste (night soil)** be re-used and recycled? What are some drawbacks?
-Human waste can be used as fertilizer; disease and parasites

23.8: Municipal Solid-Waste Management
1: *Which product* comprises the largest percentage of waste dumped in the United States? *Is this surprising?*
-Paper; no (we throw away tons of paper every day in school)

2: Define **Composting:** *(What are the pros and cons?)*
-Composting is a biochemical process in which organic materials decompose to a rich, soil-like material. Although it is organic and harmless, separating organic material from waste is expensive, and pesticide treated material may make compost toxic.

3: What are the *pros and cons* of **incineration**?
-Very efficient and can generate power; pollution from emissions and ash

4: What is a **sanitary landfill** and *how is it accomplished*? How is a **sanitary landfill** selected? *What things need to be considered*?
-A landfill designed to concentrate and contain refuse without creating hazards; by confining waste to a small area in as small of a volume as possible and reducing groundwater pollution; by topography, location of groundwater table, precipitation levels,

type of soil and rock, and location of ground and surface water dispersal zone; groundwater movement and pollution entering

5: What is environmental justice?
-The study of social issues in siting waste facilities, chemical plants, and other such facilities

6: What is *leachate?*
-Noxious, mineralized liquid capable of transporting bacterial pollutants

7: How can pollutants enter the environment from sanitary landfills?
-Gas emissions, metal saturating soil, soluble materials in groundwater, runoff and leacheate, metal in plants, toxic plant residue, contaminated water and groundwater, and wind dispersal

8: What are the *federal mandates* for sanitary landfills?
-Landfills cannot be sited on floodplains, wetlands, eq zones, unstable land, or near airports; landfills must have liners and a lecheate collection system; Landfill operators must monitor groundwater for chemicals; Landfill operators must meet financial assurance criteria to ensure monitor continues for 30 years after the landfill closes

9: What are some actions you can take to reduce the waste you generate?
-Reduce, reuse, recycle; turn waste into energy or reduce waste buildup

23.9: Hazardous Waste
1: Where is most of the hazardous waste generated in the U.S.? *What are the sources* of hazardous waste in the United States?
-East of the Mississippi River; The electronics industry, coal and petrol industry, damaged buildings

2: Summarize (in 3-4 sentences) the story of **Love Canal.**
-William love constructed a canal in 1892 to develop an industrial park. When it was found out that this canal was no longer needed, waste was dumped into the canal until its purchase by the city of Niagara Falls for $1.00. After the purchase, people started to settle in the area that was used to dump 20,000 tons of waste. Problems arose when rain evidenced that the area was more dangerous than perceived.

23.2: A Closer Look: "e-waste: A Growing Environmental Problem"
1: Summarize the problem with e-waste in the United States.
-Since e-waste is expensive to process and obsolete electronics are considered useless, e-waste is deceptively transported to other countries to make recycling profitable. This disposal, however, poses a risk to the population in these countries, since e-waste contains many chemicals and heavy metals that people are exposed to when dealing with

waste.

23.10: Hazardous-Waste Legislation

1: What is the purpose of RCRA (Resource Conservation and Recovery Act)?
-The RCRA emphasized the identification and life cycle determination of hazardous wastes. The RCRA issued guidelines pertaining to manufacturing, transporting, and disposing of hazardous waste.

2: What is the purpose of CERCLA (Comprehensive Environmental Response, Compensation and Liability Act)?
-CERCLA improved hazardous waste disposal standards, banned land disposal of certain chemicals, initiated a limited timetable for disposal of waste, and increased the superfund.

23.11: Hazardous-Waste Management: Land Disposal

1: Look at the chart on pg. 541- List the PROS/CONS of each of the Hazard Reduction Technologies:
-Landfills and impoundments are good for disposing solid waste cheaply, but surface water and groundwater is affected, construction is time consuming, and it is highly toxic.
-Injection wells are very effective towards compounds that can break down easily in the environment, and it is cheap. However, this method can be extremely toxic to surface water and groundwater, and siting may be difficult.
-Incineration is very effective for most waste products, but the cost, air pollution, hauling risks, and price are very unattractive factors.
-High-temp decomposition is very effective towards chemicals, but prices may be high, operation may present risks, and air pollution is critical.
-Chemical stabilization is very effective in metal disposal, but it may produce undeterminable amounts of leacheate, and some inorganics may still be soluble.
-Microbial breakdown can dispose of metals and some organic compounds such as oil. It is, however, hard to monitor uncertainties in construction, and soil and groundwater may be contaminated.

23.13: Ocean Dumping

1: What are some of the ways that ocean pollution has affected ocean life?
-It has killed off organisms and inhibits growth, reduces dissolved oxygen in water, causes eutrophication, and habitat change.

2: Why are the marine waters of Europe in trouble?
-Because urban and agricultural pollutants are causing eutrophication in the ocean.

3: Why is the microlayer of the ocean considered to be so important?
-Because it consists of the base of the food chain (small organisms) and young fish and shellfish develop there.

23.14: Pollution Prevention
1: What are the steps of ocean pollution prevention?

23.15: Sustainable Resource Management
1: What is the R to C Ratio- What does it tell us?
-The R-to-C ratio is used to determine the amount of time we have to find solutions to the depletion of nonrenewable resources. R is the known reserves, and C is the rate of consumption.

Read: ***Can We Make Recycling a Financially Viable Industry?*** Answer the following:

1*: What can be done about the global problem of e-waste? Could more be recycled safely?*
-E-Waste could be made the industry's problem, so the industry must dispose of the waste itself instead of shipping it to other countries. If the waste is disposed of domestically, then more complex and effective recycling can be used to recover more parts and materials than shipping the waste to other countries to be dealt with.

2: What can be done to assist recycling industries to become more cost-effective?
-Putting subsidies towards recycling and developing cheaper ways to recycle could make recycling more cost-effective.

3: What are some of the indirect benefits to society and the environment from recycling?
-People may have more jobs available to them (recycling jobs) and the environment will be cleaner, and resources will become more sustainable.

4: Define or criticize the contention that if we really want to do something to improve the environment through reduction of waste, we have to move beyond evaluating benefits of recycling based simply on the fact that it may cost more than dumping waste in a landfill.
-This contention states that the health of the planet should be brought before the economic risks that are present in recycling, and other related processes. In my opinion, I think that this statement is true, and that the Earth is a better investment. If waste is dumped and the environment is neglected, then we might need to pay more to restore the planet than deal with problems now.

5: What are the recycling efforts in your community and university, and how could improvements be made?
-My community emphasizes recycling by paying for each plastic bottle recycled, and my having recycling bins available to the public. Improvements could be made by making recycling absolutely mandatory (like Japan).

Summary: *Suppose you found that the home you had been living in for 15 years was located over a buried waste disposal site. What would you do? What kinds of studies could be done to evaluate the potential problems?*

-If I found out that my home has been situated over a waste disposal site, then I would try to determine what kind of substances or items were dumped in my area by referring to documents that have recorded the sites activity. I could measure the area's toxicity using help from toxicologists or other experts as well. If I find that the area is toxic, then I will move immediately.