Course Learning Outcomes for Unit II

Upon completion of this unit, students should be able to:

2. Describe the major categories of waste.
   2.1 Differentiate between the composition, collection, and disposal of municipal solid waste in developed versus developing countries.
   2.2 Identify the three classes of nuclear waste.
   2.3 Summarize the physical and chemical characteristics of mine waste.

4. Characterize the components and chemical and physical properties of municipal solid waste (MSW).
   4.1 Apply the main management challenges of municipal solid waste to a local waste management issue.
   4.2 Identify the categories of management in municipal solid waste.

6. Discuss waste disposal techniques and technologies.
   6.1 Examine the potential dangers of mine waste disposal techniques.
   6.2 Describe the machinery employed in metals recycling.
   6.3 Identify the issues associated with nuclear waste disposal.

Reading Assignment

Chapter 5:
Mine Waste: A Brief Overview of Origins, Quantities, and Methods of Storage

Chapter 6:
Metal Waste

Chapter 7:
Radioactive Waste Management

Chapter 8:
Municipal Waste Management

Unit Lesson

Mine Waste

Our modern lifestyle depends on a constant supply of metals. Copper, gold, iron, aluminum, chrome, and silver are just some of the metals we come into contact with on a daily basis. From our coffee makers to our cell phones and alarm clocks, metals are essential to the functioning of our everyday lives.

However, the extraction of these metals comes with a price to our health and the environment. Mining requires the excavation of enormous volumes of rock, and the metals extraction process involves the use of toxic chemicals, such as cyanide. The environmental issues vary somewhat depending on the type of ore being extracted and the mining practices used, but mine waste generally contains toxic heavy metals, sulfuric acid, and radon gas (Blight, 2011). In fact, hard-rock mining is the highest toxic waste generator of all industries in the United States, according to the Environmental Protection Agency (“Behind Gold’s Glitter,” 2010).
Metal Waste

It takes a large amount of energy to extract metals from their ore and process them into the products that we use on a daily basis. Since metal can be recycled indefinitely, recycling metal is profitable.

In fact, the energy saved from using recycled steel scrap amounts to approximately 75% of the energy that would have been spent to generate steel from raw minerals, and the CO$_2$ emissions are reduced by 58%. Furthermore, the recycling process results in an 86% reduction in air pollutants and a 97% reduction in mining waste (Pretz & Julius, 2011). Given the environmental costs of mining waste, recycling metals is not only economically profitable but also environmentally friendly.

Nuclear Waste

Currently, about 15% of the world’s electricity is produced in nuclear power plants. The International Atomic Energy Agency (IAEA) classifies the waste from these plants as either exempt waste (EW), low- and intermediate-level waste (LILW), or high-level waste (HLW).

EW is excluded from regulation because its hazard is considered minimal. LILW is radioactive enough that precautions must be taken to protect the public and workers—generally for short time periods. Lastly, HLW is so radioactive that it must be isolated from people and the environment for long periods of time (Marra & Palmer, 2011).

Located in Nevada approximately 100 miles NW of Las Vegas, Yucca Mountain, left, is a proposed site for a national nuclear waste repository. Although cancelled, the plans for the repository are still being discussed, and the proposition may resurface. (Fastfission, 2006)

Because of high oil and gas prices, there is renewed interest in increasing the amount of power we obtain from nuclear energy, thus increasing the amount of nuclear waste that we must manage. In the U.S., HLW is currently stored in underground storage tanks at several sites: Hanford, Savannah River, and the West Valley Demonstration Project. A permanent storage plan involves solidifying the waste and storing it in an underground depository. However, the U.S. plan to dispose of its nuclear waste at Yucca Mountain has been cancelled (Marra & Palmer, 2011).

Municipal Solid Waste

Periathamby (2011) defines municipal solid waste (MSW) as all waste generated in a municipality. The types and relative amounts of waste vary from community to community and from country to country. Overall, the higher the income of the country the higher the amount of waste produced.

In developed countries, MSW can be disposed of in incinerators and sanitary landfills. However, in many developing countries, waste is dumped at unlined and uncontrolled sites, resulting in water and soil contamination (Periathamby, 2011). These uncontrolled sites contribute to global warming by releasing landfill gasses. In sanitary landfills, landfill gasses such as methane and carbon dioxide can be collected. However, nonsanitary landfills are not designed to collect landfill gasses, and these gasses are released into the atmosphere.
The proper management of MSW is not only an issue for our local communities. It is a global problem, and the United Nations Conference on Environment and Development adopted Agenda 21 in 1992. Chapter 21 of the agenda “emphasizes that MSW management must go beyond the mere safe disposal or recovery of wastes and seek to address the root cause of the problem by attempting to change unsustainable patterns of production and consumption” (Periathamby, 2011, p. 120).

The concept of changing our unsustainable patterns of production and consumption is tied to the life-cycle-assessment process we discussed in Unit I. Using LCA, we can make the products and processes we use more sustainable, thus reducing the amount of waste that must be accounted for in a waste management plan. Notice, however, that Agenda 21 mentions changing our unsustainable patterns of consumption, as well. As you read Chapter 8, think about how consumption patterns in developed and undeveloped countries contribute to MSW issues and what might be done to change those patterns.

References


