Course Learning Outcomes for Unit IV

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

2. Describe the major categories of waste.
   2.1 Describe the components of nonhazardous industrial waste.
   2.2 Identify the factors that contribute to the amount of construction waste produced.

4. Characterize the components and chemical and physical properties of municipal solid waste (MSW).
   4.1 Describe the chemical and physical properties of incinerator ash.
   4.2 Identify the contribution of plastic waste to the MSW stream.

6. Discuss waste disposal techniques and technologies.
   6.1 Explain the concept of industrial symbiosis and how it can reduce the amount of nonhazardous industrial waste.
   6.2 Describe how a cyclic rather than a linear approach to design and construction can reduce construction waste.
   6.3 Analyze the pros and cons of thermal waste treatment.
   6.4 Discuss the four main categories of plastic solid waste recycling techniques.

Reading Assignment

Chapter 14:
Reusing Nonhazardous Industrial Waste Across Business Clusters

Chapter 15:
Construction Waste

Chapter 16:
Thermal Waste Treatment

Chapter 17:
Thermochemical Treatment of Plastic Solid Waste

Unit Lesson

When we, as human, use materials in our everyday life (eating, drinking, building, buying, selling) we produce a variety of waste products. Think about it. There are billions of us on this earth. We produce waste in astronomical amounts. What happens to this waste? Does it magically disappear once we are done with it? Not hardly. Depending on the type of waste, it must be disposed of somehow, in ways that do not endanger us.

Non-hazardous Industrial Waste (NHIW)

According to the Environmental Protection Agency (EPA), 7.6 billion tons of industrial solid waste are generated by American industrial facilities each year. This waste consists of “organic chemicals, inorganic chemicals, primary iron and steel, plastics and resin manufacturing, stone, clay, glass and concrete, pulp and paper, food and kindred products (U.S. EPA, 2012).
The first step in managing such a large and varied waste stream is to encourage more efficient production of goods. As you learned in Unit I, tools such as life cycle assessment help to reduce the amount of waste generated in the first place. Another way we can reduce the non-hazardous industrial waste (NHIW) stream is through industrial symbiosis.

Industrial symbiosis occurs when one manufacturer’s waste becomes another manufacturer’s raw material. Industrial symbiosis is part of the study of industrial ecology that examines the flow of materials and energy through systems at different scales: from products to factories, all the way up to national and global levels (Osmani, 2011). We can use the concepts of industrial ecology and symbiosis to create more efficient and sustainable industries and reduce the amount of NHIW that is sent to landfills and incinerators each year.

Construction Waste

One estimate of construction waste states that 30% of what is brought to a construction site to be used as building materials ends up as waste (Fishbein, 1998). Not only does this waste create environmental issues but also it adds unnecessary costs to the project.

A significant percentage of this waste (33%) is a result of architects not taking waste minimization into account during the design process (Osmani, 2011). Programs such as Leadership in Energy & Environmental Design (LEED) are encouraging construction project teams to take a construction project’s environmental impact into consideration.

John Deere, an agricultural care company, constructed a marketing and sales center that was awarded a LEED Gold rating in June 2012. To achieve such a status, many recycling and reuse projects were incorporated into the construction process. For example, the team used waste from the construction site to provide energy for the cement manufacturing process. Metal went to scrapyards for recycling, and sheetrock went to a plant that recycles wallboard (Cox, 2013).

Thermal Waste Treatment

An alternative to landfilling waste, incineration involves burning waste materials to oxidize organic compounds. As a result of this burning, the ash from incinerators can contain heavy metals, and the flue gases can contain harmful organic and inorganic compounds.

The chemical and physical characteristics of a waste determine how it should be treated. The goal of the treatment is to make the chemical compounds in the waste less mobile and less toxic (Vallero, 2011). A testing procedure called the toxicity characteristic leaching procedure (TCLP) is performed on the incinerator ash to assess the level of leachability of the metals. If the ash does not pass the TCLP test, it must be disposed of in a hazardous waste landfill. Therefore, although incineration reduces the total volume of the waste, contaminants can be concentrated in the ash.

Thermochemical Treatment of Plastic Solid Waste

Plastic is ubiquitous in our everyday lives; therefore, so is plastic waste. According to the EPA in 2010, approximately 12% of municipal solid waste (MSW), or 31 million tons, was plastic waste (ACC, Gershman, Brickner & Bratton, Inc. 2013).

Plastic has a high energy value. The plastic can be either recycled or the stored energy in the plastic can be recovered. In re-extrusion and mechanical recycling, scrap plastic is used to manufacture plastic products of similar material. Thermochemical treatments such as gasification and pyrolysis produce fuels. Gasification produces syngas, which can be used to create synthetic natural gas, and pyrolysis produces a synthetic liquid fuel that is comparable to crude oil (ACC, Gershman, Brickner, & Bratton, 2013).
References


