Q. How is hazardous waste classified. What are the various options for handling hazardous waste?

Introduction:

With the population explosion, there is an increase in demand of services that ultimately means consumption of more resource. This high consumption has resulted in production of more waste, a part of which is harmful for human health and environment that needs to be treated before its disposal. Many methods are used to treat the hazardous waste to reduce the adverse impacts which it likes to cause.

Hazardous Waste:

According to Pakistan Environmental Protection Act 1997, Hazardous Waste is:

> "any substance which is prescribed hazardous by Environmental Protection Agency which has adverse impacts on human health as well as on the environment."

Hazardous Waste include hospital waste and nuclear waste.

Types of Hazardous Waste:

Hazardous Waste is categorized into four different types which are as follows:

1. Listed Waste:

Listed Waste are those which EPA has determined as hazardous are are further scheduled in different lists: F-list, K-list, P-and U-list.

F-list includes the waste that is common in all manufacturing and industrial processes e.g. Dioxin bearing waste, petroleum refinery waste.
K-list includes the waste from specified industries e.g Iron and Steel industry, explosive industry, wood processing, ink-formation etc.
P and U-lists include waste from commercial chemical products e.g Cyanides, Acetones etc. P-list includes acute hazardous waste.

ii- Universal Waste:

This waste is universal in nature and is known as common generated waste. It include waste of pesticides, batteries, lamps, flourescent bulbs. Universal waste is further categorized into nine sub-classes i.e. explosives, gases, flammable liquids, oxidizing substances etc.

iii- Mixed Waste:

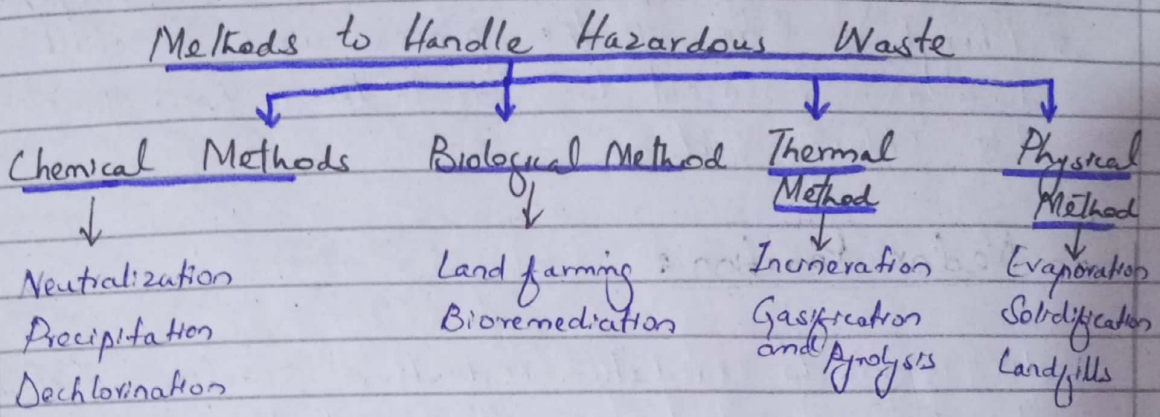
Mixed waste include waste of both radioactive and hazardous waste substances. So they possess the properties of both hazardous and radioactive waste. They are further divided into: high level mixed waste, low level mixed waste and mixed transuranic waste.

iv. Characteristic Waste:

This waste doesnot meet the part of any of the above listing, but it possess the characteristics of hazardous waste. Characteristics include toxicity, corrosiveness, ignitability, reactivity, persistence, bioaccumulation and biomagnification.

Methods for Handling Hazardous Waste:

Hazardous Waste is lethal to health and environment therefore, it is pertinent to treat those waste before their disposal. There are different methods which are used for mangement of hazardous waste and are given below:



1. Chemical Methods:

Chemical methods involve chemical processes that help in treating waste. Chemical methods which are widely used are as follow:

a. Neutralization:

Neutralization is a method to treat acidity or alkalinity of a toxic waste. It involves reaction of acid and base that neutralizes and form salt and water.

b. Precipitation:

It is used to remove soluble compounds from waste. A chemical is added to produce precipitant. This type of method is useful for streams that

carry heavy metals. The soluble part dissolves with precipitate and leave the unsoluble part to settle down.

c- Dechlorination :

De-chlorination is a process to remove Chlorine from chlorinated compounds such as PBP (Polychlorinated Bi-Phenyls). One of the process used metallic Sodium as a reagent to breach the bond of electronega-tive Chlorine atom.

d- Redox Reaction :

Redox refers to oxidation-reduction reactions. Oxidation involves loss of electrons while reduction involves gain of electrons. It is a process for detoxifying the toxic wastes in which chemical bonds are broken by passage of electrons from one reactant to other. It changes toxic waste into less hazardous waste.

2- Biological Methods :

It involves treatment of hazardous waste through microorganisms. Biological methods are used for organic waste such as from petroleum industry. It includes :

a- Farming :

Farming is a type of biological method where hazardous waste is mixed with suitable layer of soil. Microbes present in soil will act on waste and metabolize the waste.

b- Bioremediation :

In this method, microbes are used on a pre-existing contaminated site and generally genetically modified species of bacteria are used. This process is helpful in making the hazardous waste less hazardous.

3. Thermal Methods :

Thermal processes involve treatment of waste under high temperature and other suitable conditions. It is done in following ways:

a- Incineration :

Incineration is the burning of waste in the large incinerators in the presence of oxygen. It is commonly used to recover heat or electricity.

b- Gasification and Pyrolysis :

Both involves breaking or decomposition of organic waste. Gasification allows a low dose of oxygen for burning while pyrolysis is done in the absence of oxygen. Both processes are used to recover heat without causing air pollution.

c- Open- Burning :

In open-burning, waste is burned openly and this method though reduce the volume of hazardous waste, but contributes to air pollution. It emits CO, CO_2, VOC (Volatile Organic Compounds), PM (Particulate

matter) and polycyclic aromatic compounds.

4- Physical Methods:

Physical methods involve management and treatment of waste physically. Physical methods solidifies or reduces the volume of the waste. On the contrary, biological, chemical and thermal methods change the molecular form of waste material. Some of the common physical methods are as follows:

1- Solidification:

Solidification involves mixing the waste with a binding agent that is a substance which stick lose materials together. Common binding agents include cement, asphalt, fly ash and clay. Water must be added to assist the mixture for binding to occur; then the mixture is allowed to dry and harden to form a solid block.

2- Sedimentation:

A process for removing suspended solids particles from a waste stream. Sedimentation is usually accomplished by providing a sufficient time and space in special tanks and ponds for setting. Usually coagulating agents are used.

3- Flotating:

Process for removing solids from liquids by floating the particles to the surface through air bubbles.

Floating is used for removing particles too small to be removed by sedimentation.

4. Landfills:

Landfills are mostly used to treat solid hazardous waste. Landfill is a large piece of land, which is used for dumping waste. Before the hazardous waste is dumped in the landfills, a two-layered water resistant covering is coated at the base to prevent the leachate from contamination of soil and under-water.

Conclusion:

Hazardous waste has significant adverse impacts on human health as well as on environment. Therefore, it needs meticulous treatment to lessen the impacts. Through different methods, the concentration of hazardous waste could be minimized.

x —— x —— x —— x.