Definition of Hazardous Wastes

The term hazardous waste does not have an exact scientific definition because of the wide range of properties that can make a chemical a threat to public health or the environment.

Some of the hazardous effects of chemicals include short term toxicity to humans, long term toxicity to humans, Ecotoxicity, flammability, explosivity, and corrosivity.

Furthermore, each of the thousands of chemicals used by industry is characterized by a different degree of hazard for any of these characteristics.

For example, exposure for few milligram of one of chemicals may cause death to the average adult. On the other hand, adults may survive after ingesting kilogram of a different chemical. Between these two extremes lies a gradient of toxicities for each of the thousands of different chemicals.

Hazardous waste is a waste that due to its chemical activity or flammable, explosive, toxic, or corrosive properties is likely to pose a substantial threat to human health or the environment in the present or future.

For a more effective definition, the EPA relies on the specifications set by the Resources Conservation and Recovery Act (RCRA) in 1976. According to the RCRA, a waste first must be considered a 'solid waste.' This term is confusing in that the RCRA defines 'solid waste' as any discarded material, including solids, liquids, and contained gases.

Characteristic Hazardous Waste

1- Ignitability, is based on a number of criteria involving the material's tendency to burst into flame (spontaneously or under certain conditions), or a material's flash point, if less than 60 C through friction, moisture absorption, or spontaneous chemical changes. Tests listed in regulations, such as the Pensky-Martens Closed-Cup Method for Determining Ignitability and it can also be employed to determine the degree of ignitability. Waste oils and used solvents are two examples of hazardous waste that fulfill the ignitability criterion.

2- Corrosivity; If an aqueous waste-solution is a strong acid ($pH \leq 2$) or a strong base ($pH \geq 12.5$) capable of corroding metal containers, then it fulfills the

corrosivity criterion. If a liquid dissolves metal at a rate greater than 6.35 mm (0.250 inch) per year at test temperature of 55 C, it too is considered corrosive and hazardous. Hazardous waste that exhibit corrosive properties include sulfuric acid and hydrochloric acid. The testing method known as the Corrosivity Towards Steel (Method 1110A) is the only method to determine corrosivity.

3- Reactivity; Wastes that are unstable, i.e. those that can cause explosions, release toxic fumes/gases/vapors upon heating, and react upon compression or mixing with water, are considered reactively hazardous. There are no existing tests to determine reactivity. Examples of reactive chemicals include lithium sulfur batteries, ammunition, aerosols, and explosives.

4- Toxicity is determined by an analysis of the waste's leachate using a testing procedure known as the Toxicity Characteristic Leaching Procedure (EPA Method 1311). If toxins (listed in federal regulations) such as arsenic, trichloroethylene, or mercury are found at levels that surpass regulatory levels, then the material in question is designated as toxic and therefore hazardous.

Listed Hazardous Waste

Hazardous wastes are added to the RCRA list if the EPA determines they fulfill one of four requirements:

a) The waste typically contains harmful chemicals, and other factors indicate that it could pose a threat to human health and the environment in the absence of special regulation. Such wastes are known as toxic listed wastes.
b) The waste contains such dangerous chemicals that it could pose a threat to human health and the environment even when properly managed. Such wastes are known as acutely hazardous wastes.
c) The waste typically exhibits one of four characteristics of hazardous waste.
d) When EPA has cause to believe that for some other reason, the waste typically fits within the legislative definition of hazardous waste.

There are four lists maintained by the RCRA in US for identifying listed hazardous wastes, known individually as F, K, P, and U lists. The F-list is reserved for non-specific source wastes. In English this designation refers to wastes that are produced

in general manufacturing and industrial processes that are common throughout industry. Examples of waste generated from these processes include solvents used in the cleaning (degreasing) of machine parts, or wood preserving. As of publication date there are 39 non- specific source waste definitions. The K-list, or source-specific waste list, describes wastes that are produced in specific manufacturing sectors only, such as pesticide manufacturing or petroleum refining. Within the list, categories pertaining to industry are as specific as 'ink formulation,' or 'veterinary pharmaceuticals,' or 'organic chemical.' The K-list to date contains 148 hazardous waste categories, 111 more than the F-list. This discrepancy is because the K-list deals with wastes in more specificity than its counterpart F-list. The U and P lists are frequently described in unison, given their similarities. Both refer to discarded chemical products (e.g. pesticides and pharmaceuticals) as opposed to mixed wastes, but differ in designation as either 'toxic' or 'acutely hazardous' waste, respectively. Toxic chemicals, which are less dangerous, present a threat to the public/environment and require regulation and management to reduce the threat. Acutely hazardous chemicals present a threat despite regulation and effective management. In the RCRA, 959 toxic and 487 acutely hazardous wastes are listed.

History of hazardous waste

The manufacture of product that we use in everyday life results in the generation of waste some of which may be persistent, toxic, flammable, corrosive, or explosive. For example, the production of computer and semiconductor components requires halogenated solvents, Aircraft construction and maintenance activities generate petroleum, solvent, and heavy metal waste. The synthesis of plastics, paints, and pesticides produces organic solvents, by product, and sludge. Every industry that has produced manufactured goods has also generated waste. The annual rate of hazardous waste generated in the United States at 1 ton per person.

The quantity and diversity of hazardous waste have grown with the progression of technology. Until the 1800s, most materials used in home and industries were natural product s such as lard or plant extracts. As the world entered the petroleum age in the

nineteenth century, kerosene and other petroleum distillates were used as solvents and fuels.From the 1930s through the 1950s, chemists discovered that the industrial properties of petroleum products could be improved by a variety of synthetic techniques. One of the processes developed was halogenation(i.e., adding halogens, chlorine, fluorine, or bromine- to petroleum based chemical). Halogenated aliphatic solvents were found to be more effective degreasing agents than petroleum distillates and had an additional benefit of nonflammability. Halogenated pesticides were found to have properties that enhance their toxicity and corresponding control of insects plants and fugi. However, Many of these halogenated organic compounds persist for long period of time and are harmful to public health and to the environment

Past Disposal Practices

Before strict regulatory measures were broadcasted in 1980, quick and dirty disposal techniques were used, some of the more past common disposal practices are below;

1-Soil spreading; Waste liquids, especially lubricating oils and other petroleum residues, were commonly spread on soils and unpaved roads. The practice not only provided a means of disposing of the waste, but also mitigated blowing dust. However, one of the problems with placing petroleum on soils is the presence of cancer-causing polycyclic aromatic hydrocarbons (PAHs).

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2- Pesticide Rinse and Formulation Area; Agricultural chemicals have been used widely in the United States and throughout the world. In almost all cases, pesticides have been received by farmers and aerial applicators in concentrated form and then diluted on site for application. The area where the pesticides have been formulated which may be next to a barn or near the landing strips used by aerial applicators, are usually open spaces containing little or no vegetation. Large polyethylene vats have been used to mix the concentrated pesticides with water. Because of the remote nature of many of these sites and lack of regulatory control, spillage and improper disposal of the rinsate have become commonplace. These areas have become contaminated from both past

and present disposal practices because many of the pesticides especially those used in the 1940s through 1970s are resistant to natural degradation processes.

3- Underground Storage Tank;

Throughout the twentieth century, approximately 5 million underground storage tanks (USTs) were installed to hold gasoline, jet fuel, solvents, heating oil, and other industrial compounds.

Unfortunately, soils are a corrosive environment and, after a relatively short period of time, the tank rust, corrode, and leak. Recent studies have shown that only 1.8% of tank less than 5 yrs old leak but the most common tank age range for leakage is 11to25 years. A few resistant tanks (11.8%) last longer than 25 years.

4-Pits, Ponds, Lagoon;

Before the regulated management of hazardous waste, many industries disposed of their chemicals on site by placing them in unlined pits, ponds, and lagoons. Workers simply dug a pit into which wastes were poured. The waste then disappeared by seeping through the soil. In the least permeable soil, the wastes were held at the surface, so these areas were called ponds or lagoons.

5- Sanitary Landfills; Every sanitary landfill that was designed to accept newspapers, cans, bottles, and other household wastes also received waste petroleum products, solvents, pesticides, and transformer oils. Liquid hazardous wastes were often disposed of in drums or in some cases were poured directly into landfills. These sanitary landfills were unlined, so the wastes have often migrated to surface and groundwater. Some regulators believed that all the sanitary landfills should be considered hazardous waste sites because they received hazardous waste particularly, before 1980.

6-Drum Storage Area; waste chemicals stored in 55 –gallon drums were often placed on the loading docks, concrete pads, or other temporary storage area until they could be disposed of. Because of lack of money or administrative action, the drums often accumulated , sometimes to the point where the

thousands were stored and stacked. Drums stored in the manner eventually corroded and leaked, with chemical released to the underlying soil and ground water.

8- Unlined Hazardous Waste Landfill; Many large industries constructed their own land fill that were used primarily for the land disposal of industrial by-products, such as building materials or out of date equipment. Unfortunately, chemical wastes were also disposed of in these landfills along with the nonhazardous solid materials. Leakage to the soil and groundwater was commonplace because these systems were not designed to contain hazardous wastes.

9- Midnight dumping; Although hazardous wastes were easily disposed of before comprehensive hazardous waste regulations were enacted , the waste were sometimes surreptitiously transported and disposed of other's property or insolated locations, such as a wooden area of a desert canyon. These midnight dumping practices often resulted in pockets of contamination on

Private, federal and state land. Many sites have gone undiscovered and others have been found during excavation activities for new highways and buildings. Construction managers, who are often uneducated in hazardous waste management, have encountered buried drums and stained soils more often than what they would like. The cleanup of hazardous wastes at construction sites has delayed the completion of hundreds of new highways and buildings.

10- uncontrolled Incineration; Burning and incinerating some hazardous waste ,such as chlorophenols and poly chlorinated biphenyls, has sometimes resulted in incomplete combustion , with the formation of more toxic products in the ash and the emission of hazardous air pollutants. The safe incineration of many hazardous chemicals requires specific condition s of temperature, turbulence, and residence- conditions that are provided by permitting process under the dominated hazardous waste management law.