



Research Paper

Hazardous Waste & Its Management

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ABSTRACT

Any sort of material which has served its purpose over the course of time and is no longer useful to people is termed as waste. There are different categories of wastes but in this article our prime focus is on hazardous waste and also its management, hazardous in simpler terms means toxic. These wastes may cause damage during inadequate storage, transportation, treatment, or disposal operations; therefore they need to be properly treated. Although there are several options available for treatment of these wastes but the most prominent is to reduce the quantity of waste at its source or to recycle the materials for some other productive use. But we all are aware of the fact that waste can't be avoided so there will always be a need for proper treatment of these wastes as they can prove fatal to both human health and environment. All the steps involved in the management of these wastes must be followed in sequence. Also in India there are few well established transport, storage and disposal facilities (TSDF). Furthermore, sources, characteristics, effects and treatment methods are within the scope of this paper. The current status in India pertaining to generation of Hazardous Waste and the TSDF sites is also addressed.

KEY WORDS: Hazardous waste, fatal, toxic, management, prominent, TSDF

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I. INTRODUCTION

Hazardous wastes are those that contain toxic substances generated from industrial, hospital and some types of household wastes. The process of the hazardous waste management involves the collection, storage, recycling, treatment, transportation and disposal. All the steps must be followed in the systematic manner. Disposal of hazardous wastes is a worldwide challenge. Currently, in most of the developing countries hazardous wastes are often disposed off carelessly without being aware of the fact that these wastes have adverse effects on human health as well as on the environment. The potential health effects of these substances range from minor, short term discomforts, such as headaches and nausea to serious health problems, such as cancers and birth defects (that may not manifest themselves over years), to major accidents that cause immediate injury or death. . Therefore, to decrease the effects of these wastes proper attention is required during dumping, as it cannot be dumped of by common means like other by products of our daily lives. Dumping sites should be far from residential areas. The sources of hazardous waste are basically mines and mineral processing sites, agricultural and agro industries, medical amenities, household etc. Rapidly growing industries in the country have majorly contributed in the production of hazardous waste material. For the proper management of these wastes we need to prioritize certain things which include reduction in waste production from the source and also proper awareness among the people. The three R's reduce; reuse and recycle must be taken into account. In India although there are certain rules and regulation cited by the central government for treatment of these wastes but in practical world implementation of these laws is too little.

SOURCES OF HAZARDOUS WASTES

The different sources of hazardous wastes are given below:

- Inorganic chemicals
- Organic chemicals
- Petroleum refineries
- Iron and steel
- Non ferrous metals
- Metal finishing

- Leather tanning

II. CHARACTERISTICS OF HAZARDOUS WASTES

There are four basic characteristics of these wastes which include ignitability, corrosivity, reactivity, and toxicity.

Ignitability: According to the EPA, Ignitable wastes can create fires under certain condition and are spontaneously combustible, or have a flash point less than 60 °C (140 °F). Examples: fuel, diesel gasoline etc.

Corrosivity: According to the EPA, Corrosive wastes are acids or bases that are capable of corroding metal containers, such as storage tanks, drums, and barrels. Examples: waste from rust remover, battery acid etc.

Reactivity: According to EPA, Reactive wastes are those, “wastes [which] are unstable under normal conditions. They can cause explosions. Examples: lithium-sulfur batteries etc.

Toxicity: According to EPA, Toxic wastes are those that are “harmful or fatal when ingested or absorbed. Examples: mercury, lead etc.

Data about Hazardous Wastes....

- 7.90 million Tones of HW are produced in India annually.
- Quantity increases to 2-5% per year.
- 10 – 15 percent of hazardous wastes is produced by industries.
- In J&K there are 342 hazardous wastes generating units.
- It produces 20000 MT of hazardous wastes per year.
- The highest hazardous waste producing states are Gujarat, Andhra Pradesh, Rajasthan, Tamil Nadu etc
- There are total 141 dumpsites identified and 88 critically polluted areas.
- In India, 77% of waste is disposed of in open dumps, 18% is composted and just 5% is recycled. A significant 34% of all waste is generated by just 16% percent of the world's population, largely from high-income countries, but more than one-third of this waste is recovered through recycling and composting.
- Gujarat is the highest Hazardous Waste producing state and was the first state to address it ; also brought the concept of TSDF (Transport, Storage, Disposal, Facility)

Effects of Hazardous Wastes on humans

- Respiratory problems
- Nausea and vomiting
- Skin rashes
- Headache
- Birth defects
- Nervous system disorders

Effects of Hazardous Wastes on environment

- Water pollution
- Air pollution
- Global Warming

Examples of Hazardous Wastes:

- Chemicals for e.g. brake fluid or print toner
- Batteries
- Solvents
- Pesticides and Insecticides
- Wood Preservatives
- Oils except (edible ones) for e.g. car oil

Steps involved in Hazardous Waste Management

I. Analysis of hazardous wastes: We need to properly analyze how much quantity of the hazardous wastes is available and what further procedures need to be carried out for the treatment of these toxic wastes.

II. Collection and labeling: The waste is collected in a container that is sealed properly and also we have to leave a head space in that particular container. For the purpose of labeling, the words "Hazardous Waste", name and address of generator, date of initial accumulation, date that the 90-day period begins must be taken into account. Containers must be labeled and dated as soon as you begin accumulating the waste.

III. Transport and Storage: Hazardous waste is generally transported by truck over public highways. Only a very small amount is transported by rail, and almost none is moved by air or inland waterway. Highway

shipment is the most common. By proper storage of hazardous wastes we can help to protect our community's health. They should be stored up off the ground and in containers which are sealed properly for a period of 90 days.

IV. Treatments involved: The different processes include physical, chemical, biological and thermal.

Physical Treatment Methods: Various treatment methods adopted are given below:

- **Adsorption:** Adsorption on activated carbon occurs when a molecule is brought up to its surface and held there by physical and /or chemical forces. This process is reversible, thus allowing activated carbon to be regenerated and reused by proper application of heat and steam, or solvent
- **Distillation:** It is an expensive and energy intensive method and can probably be justified only in cases where valuable product recovery is feasible (e.g., solvent recovery). This technique has only limited application in the treatment of dilute aqueous hazardous wastes.
- **Evaporation:** Evaporation process is used for the treatment of hazardous waste such as radioactive liquids. It can be used to reduce waste volume prior to land.

Chemical Treatment Methods: Various treatment methods adopted are given below:

- **Solubility:** Hazardous waste may be organic and inorganic containing various chemical elements and with various structural configurations. Water, known as the universal solvent, will dissolve many of these substances, while others have only limited water solubility. Solubility of various salts inorganic and organic is utilized as a means of treatment of hazardous waste when waste water treatment facilities are available and land fill options are limited
- **Precipitation:** Often undesirable heavy metals are present in liquid and solid wastes which are in slurry form simple precipitation. The usual method of removal of inorganic heavy metals is chemical precipitation. Metals precipitate at varying pH levels depending on the metal ion, resulting in the formation of an insoluble salt. Hence neutralization of an acidic waste stream can cause precipitation of heavy metals.
- **Coagulation and flocculation:** Precipitation is greatly improved by adding coagulants. Most commonly used coagulant is alum. Many poly electrolytes are used as coagulants. These coagulants neutralize the charge of colloids in suspended condition thus by allowing them to settle rapidly

Biological Treatment Methods: Various treatment methods adopted are given below:

- **Land farming:** In this technique the waste is carefully mixed with surface soil on a suitable tract of land. Microbes that can metabolize the waste may be added, along with nutrients.
- **Composting:** It has typically been used to treat agricultural wastes, yard wastes and sewage sludges which most often contain negligible concentrations of hazardous organic substances.
- **Aerobic treatment:** This method uses oxygen to break down the effluent and remove the different pollutants such as phosphorus and nitrogen. In this process, oxygen is required to form air. This air is forced via blower or compressor to mix with the wastewater. It converts the sludge into new biomass.

Thermal treatment: Various treatment methods adopted are given below:

- **Incineration and Pyrolysis of Hazardous Waste:** They reduce the volume or toxicity of organic wastes by exposing them to high temperatures. When organic chemical wastes are subjected to temperatures of 800-3000°F (430-1700°C), they break down into simpler and less toxic forms. If the wastes are heated in the presence of oxygen, combustion occurs, and the process is known as incineration.

V. Disposal methods: Two basic methods of land disposal include land filling and underground injection. The thing that is to be taken into consideration in case of disposal method is site selection. It shouldn't be near any residential areas

- **Secure landfills:** Land filling of hazardous waste is regulated more efficiently than land filling of municipal solid waste. Hazardous wastes must be deposited in so-called secure landfills, which provide at least 3 meters (10 feet) of separation between the bottom of landfill and the underlying bedrock or groundwater table.
- **Underground Injection or Deep Well Injection:** Deep well injection is a disposal method for hazardous waste that was introduced in the 1930's and then it was mostly used by people. The first industrial disposal well was installed in Texas in the 1950's. In this period of time, injection wells began to be used for a much broader range of hazardous wastes, including chemicals, steel mill by-products, and pharmaceutical wastes. To this day, deep well injection remains one of the least expensive methods for disposing of large volumes hazardous wastes

III. CONCLUSION:

Our main motive should be waste minimization; this can be done at the individual level also. We need to give urgent attention for reducing the generation of waste at the source. Comprehensive environmental and social assessments of hazardous waste management operations are required to minimize the harmful effects of these wastes on human health and also on the environment.

We need to do the proper analysis of the quantity of hazardous wastes generated from industries as most harmful chemicals are produced by industries. Also we need to develop adequate infrastructure for proper treatment and disposal of hazardous wastes. We need to create more and more awareness among people so that they are aware about the harmful effects of these wastes. At present very little awareness exists among the stakeholders, it's necessary to educate people and convince them to adopt practices for reduce, reuse and recycle. Government should make strict rules to ask every household to keep two to three dustbins for the segregation of these wastes. Also we should try to use more and more recycled products.

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