AN OVERVIEW ON HAZARDOUS WASTE

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ABSTRACT

The problems posed by hazardous waste are beginning to be a priority concern of all governments in the world, due to the increasing number of companies that are generating wastes considered hazardous to health and the environment. The Health-care services in rural or urban settings inevitably generate waste that may be dangerous to health or have harmful environmental effects. The global impact of hazardous waste affects lives of not only humans but also of animals, birds and marine animals. Scenario in hazardous waste represents the total production and its effects upon the wildlife and environment. Scenario in hazardous waste generally refers with its amount of production, classification of waste and its impact on the nation. The hazardous waste issue impacts nation's growth since last 40-50 years. Hazardous waste is now become important factor for all countries worldwide.

KEYWORDS: Hazardous waste, scenario, global impact, health care, potential risk.

INTRODUCTION

The materials left behind every process may be either beneficial to the mankind through their therapeutic use or may damage or people and wildlife due to their exposure effect. These dangerous materials are called as Hazardous waste. Hazardous waste is defined as the dangerous waste or harmful to our environment or health. In general, Hazardous waste can be solids, liquids, gases or sludges. Legally Hazardous wastes are the wastes that cause chronic or adverse effects on health or environment when it is not properly controlled. The main
reason behind generation of hazardous waste is that some harmless materials have converted into hazardous waste during processes or the natural materials that are hazardous to begin with have been concentrated and released into the environment. About 90% of them are liquids or semi liquid. Some of these are non-degradable and may persist in nature.\footnote{1}

Although growing scientific research on chemical contamination exposes a pensive picture, we still do know the long term effects of these hazardous waste. Hazardous waste can be defined on the basis of their characteristics of its ignitability, corrosivity, reactivity, or toxicity. Additionally Hazardous waste can also be the by-products of manufacturing processes, discarded used materials, or discarded unused commercial products, such as cleaning fluids (solvents) or pesticides. In general hazardous waste is a waste that appears on one of the four RCRA hazardous wastes lists (the F-list, K-list, P-list, or U-list). However, materials can be hazardous wastes even if they are not specifically listed or don't exhibit any characteristic of a hazardous waste. For example, "used oil," products which contain materials on California's M-list, materials regulated pursuant to the mixture or derived-from rules, and contaminated soil generated from a "clean up" can also be hazardous wastes. The hazardous waste contain chemicals, heavy metals, radiation, dangerous pathogens, or other toxins. The waste can harm humans, animals, and plants if they encounter these waste buried in the ground, in stream runoff, in groundwater that supplies drinking water, or in floodwaters. Some wastes, such as mercury, persist in the environment and accumulate. Humans or animals often absorb them when they eat fish. During their manufacture and use, chemicals are released into the environment. They can travel vast distances by air or water and are also absorbed by wildlife and humans through the skin or ingested in food and water. Hazardous man-made chemicals have contaminated every environment, and wildlife - including birds, polar bears, frogs, alligators and panthers - is known to be suffering.
Historical Background

Wastes that referred as hazardous have been around for the long time. It is estimated that 264 million metric tons of hazardous waste was generated in 1981, a quantity equal to more than 70 billion gallons. Since 1981, the amount of hazardous waste produced annually has increased. About 14,000 installations regulates hazardous waste, while 4800 companies manage these wastes by treatment, storage and disposal (TSD) techniques. From these values, 96% of hazardous waste was managed on-site and approx 14.7 billion gallons have been disposed in the land each year and 500 million gallons are incinerated. The manufacturing industries introduced hazardous waste generators and management facilities. Approximately
85% of all generators and 72% of all treatment, storage and disposal facilities are connected with manufacturing operations in industry.\cite{2}

Fig. 1 Flow of material in industrial society.
Fig. 2 RCRA hazardous waste identification schematic. The "mixture" and "derived-from" rules are currently under revision.
Types of Hazardous waste.\textsuperscript{[3]}
Hazardous waste is regulated under the Resource Conservation and Recovery Act (RCRA).\textsuperscript{[4]} Hazardous wastes are defined under RCRA in 40 CFR 261 where they are divided into two major categories: characteristic wastes and listed wastes. The other hazardous wastes are Used Oil, Mixture & Derived-From Rules and Contained-In Policy.

I. Listed Wastes
By regulation, some specific wastes are hazardous wastes. These wastes are incorporated into five lists.

These five lists are organized into four categories:

• The F-list (non-specific source wastes)
This list identifies wastes from many common manufacturing and industrial processes, such as solvents that have been used for cleaning or degreasing. Since the processes producing these wastes occur in many different industry sectors, the F-listed wastes are known as wastes from non-specific sources. (Non-specific meaning they don't come from one specific industry or one specific industrial or manufacturing process.)

• The K-list (source-specific wastes)
This list includes certain wastes from specific industries, such as petroleum refining or pesticide manufacturing. Also, certain sludges and wastewaters from treatment and production processes in these specific industries are examples of source-specific wastes.

• The P-list and the U-list (discarded commercial chemical products)
These lists include specific commercial chemical products that have not been used, but that will be (or have been) discarded. Industrial chemicals, pesticides, and pharmaceuticals are example of commercial chemical products that appear on these lists and become hazardous waste when discarded.

• M-listed Wastes (discarded mercury-containing products)
This list includes certain wastes known to contain mercury, such as fluorescent lamps, mercury switches and the products that house these switches, and mercury-containing novelties.
II. Characteristic Hazardous Wastes

Wastes may be hazardous wastes if they exhibit any of the four characteristics of a hazardous waste like ignitability, corrosivity, reactivity and toxicity.

These four characteristics are:

**Ignitability**
Ignitible wastes can create fires under certain conditions, undergo spontaneous combustion, or have a flash point less than 60°C (140°F). Examples include waste oil and used. Test methods that may be used to determine if a waste exhibits the characteristic of ignitability include the Pensky-Martens Closed-Cup Method for Determining Ignitability, the Setaflash Closed-Cup Method for Determining Ignitability, and the Ignitability of solids.

**Corrosivity**
Corrosive wastes are materials, including solids, that are acids or bases, or that produce acidic or alkaline solutions. Aqueous wastes with a pH less than or equal to 2.0 or greater than or equal to 12.5 are corrosive. A liquid waste may also be corrosive if it is able to corrode metal containers, such as storage tanks, drums and barrels. Spent battery acid is an example. Test methods that may be used to determine if a waste exhibits the characteristic of corrosivity are pH Electronic Measurement and Corrosivitytowards Steel.

**Reactivity**
Reactive wastes are unstable under normal conditions. They can cause explosions or release toxic fumes, gases, or vapours when heated, compressed, or mixed with water. Examples include lithium-sulphur batteries and unused explosives. The characteristic of reactivity is defined in section 66261.23 of the hazardous waste regulations. There are currently no test methods available for reactivity. Instead wastes are evaluated for reactivity using the narrative criteria set forth in the hazardous waste regulations.

**Toxicity**
Toxic wastes are harmful or fatal when ingested or absorbed (e.g., wastes containing mercury, lead, DDT, PCBs, etc.). When toxic wastes are disposed, the toxic constituents may leach from the waste and pollute ground water. The characteristic of toxicity is defined in section 66261.24 of the hazardous waste regulations. It contains eight subsections, as
described below. A waste is a toxic hazardous waste if it is identified as being toxic by any one (or more) of the eight subsections of this characteristic.

1. **TCLP**
   Toxic as defined through application of a laboratory test procedure called the Toxicity Characteristic Leaching Procedure (TCLP - U.S. EPA Test Method 1311). The TCLP identifies wastes as hazardous that may leach hazardous concentrations of toxic substances into the environment. The result of the TCLP test is compared to the Regulatory Level (RL) in the table in subsection 66261.24 (a) (1) of the hazardous waste regulations. This criterion does not apply to wastes that are excluded from regulation under the Resource Conservation and Recovery Act.

2. **Totals and WET**
   Toxic as defined through application of laboratory test procedures called the "total digestion" and the "Waste Extraction Test" (commonly called the "WET"). The results of each of these laboratory tests are compared to their respective regulatory limits, the Total Threshold Limit Concentrations (TTLCs) and the Soluble Threshold Limit Concentrations (STLCs).

3. **Acute Oral Toxicity**
   Toxic because the waste either is an acutely toxic substance or contains an acutely toxic substance, if ingested. As per this criteria, a waste is identified as being toxic if it has an acute oral LD50 less than 2,500 mg/kg. A calculated oral LD50 may be used.

4. **Acute Dermal Toxicity**
   Toxic because the waste either is an acutely toxic substance or contains an acutely toxic substance, if dermal exposure occurs. As stated in Regulatory Level, a waste is identified as being toxic if it has a dermal LC50 less than 4,300 mg/kg. A calculated dermal LD50 may be used.

5. **Acute Inhalation Toxicity**
   Toxic because the waste either is an acutely toxic substance or contains an acutely toxic substance, if inhaled. As stated in regulator section, a waste is identified as being toxic if it has a dermal LC50 less than 10,000 mg/kg. U.S. EPA Test Method, SW-846 Methods: 3810, Headspace (formerly Method 5020) may be used to "test out" (for volatile organic substances).
6. **Acute Aquatic Toxicity**
Toxic because the waste is toxic to fish. A waste is aquatically toxic if it produces an LC50 less than 500 mg/L when tested using the "Static Acute Bioassay Procedures for Hazardous Waste Samples".

7. **Carcinogenicity**
Toxic because it contains one or more carcinogenic substances. Waste is identified as being toxic if it contains any of the specified carcinogens at a concentration of greater than or equal to 0.001 percent by weight.

8. **Experience or Testing**
Pursuant to the Regulatory Level (RL), a waste may be hazardous waste even if it is not identified as toxic by any of these seven criteria above. At the present time, only wastes containing ethylene glycol (e.g., spent antifreeze solutions) have been identified as hazardous.

The other hazardous waste are like **Used Oil**; a waste oil and materials that contain or are contaminated with waste oil are usually regulated as hazardous wastes if they meet the definition of "Used Oil" even if they do not exhibit any of the characteristics of hazardous waste. The term "used oil" is a legal term which means any oil that has been refined from crude oil, or any synthetic oil that has been used and, as a result of use, is contaminated with physical or chemical impurities. The other one is **Mixture & Derived-From Rules**; When evaluating materials that are mixtures or that are residuals resulting from processing other materials, you should check to see if the hazardous waste mixture-rule or derived-from rule applies. There are also additional mixture rules specifically for mining wastes and for used oil. These rules are intended to ensure that mixtures and residuals containing hazardous wastes are regulated in a manner that is protective of human health and the environment. The another yet is **Contained-In Policy**; Environmental media like soil, groundwater and surface water are not normally considered wastes. However, when environmental media are excavated or stored or transported for disposal at another location, the environmental media may be regulated as hazardous waste if it contains hazardous waste, including both listed and characteristic hazardous wastes. For example, soil contaminated with lead is often a hazardous waste because the lead "contained-in" the soil is a hazardous waste.
<table>
<thead>
<tr>
<th>Waste Class</th>
<th>Elemental Composition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C, H and/or C, H, O</td>
<td>Tars from production of styrene Off-specification phenol</td>
</tr>
<tr>
<td>2</td>
<td>C, H, N and/or C, H, N, O</td>
<td>Solid residues waste</td>
</tr>
<tr>
<td>3</td>
<td>C, H, Cl and/or C, H, Cl, O</td>
<td>Vinyl chloride waste</td>
</tr>
<tr>
<td>4</td>
<td>C, H, Cl and/or C, H, Cl, N, O</td>
<td>Nitrochlorobenzene waste</td>
</tr>
<tr>
<td></td>
<td>C, H, S and/or C, H, S, O</td>
<td>Petroleum refining sour waste</td>
</tr>
<tr>
<td></td>
<td>C, H, F and/or C, H, F, O</td>
<td>Fluorinated herbicide waste</td>
</tr>
<tr>
<td></td>
<td>C, H, Br and/or C, H, Br, O</td>
<td>Ethylene bromide waste</td>
</tr>
<tr>
<td></td>
<td>C, H, P and/or C, H, P, O</td>
<td>Malathion</td>
</tr>
<tr>
<td></td>
<td>C, H, Si and/or C, H, Si, O</td>
<td>Tetraethyl orthosilicate waste</td>
</tr>
<tr>
<td></td>
<td>C, H, Na and/or C, H, Na, O</td>
<td>Refinery spent caustic</td>
</tr>
</tbody>
</table>

**Global impact of Hazardous waste**

Worldwide, The United Nations Environmental Programme (UNEP) estimated that more than 400 million tons of hazardous wastes are produced universally each year, mostly by industrialized countries. About 1- percent of this total is shipped across international boundaries, with the majority of the transfers occurring between countries in the Organization for the Economic Cooperation and Development (OECD).[5] Some of the reasons for industrialized countries to ship the hazardous waste to industrializing countries for disposal are the rising cost of disposing hazardous waste in the home country. In India, the quantity of waste generated till 24 March 2000, for recyclable, incinerable and disposable waste types. In total, at present, around 7.2 million tonnes of hazardous waste is generated in the country of which 1.4 million tonnes is recyclable, 0.1 million tonnes is incinerable and 5.2 million tonnes is destined for disposal on land (MoEF 2000). As per the information provided by the MoEF, there are 323 hazardous waste recycling units in India and of these 303 recycling units use indigenous raw material while 20 depend on imported recyclable wastes. there are about 41,523 industries in the country generating about 7.90 million tonnes of hazardous waste annually, out of which landfill able waste is about 3.32 million tonnes (42.02%), incinerable waste is about 0.60 million tonnes (7.60%) and recyclable hazardous waste is about 3.98 million tonnes (50.38%).[6] Whereas in Europe (EU-28), the total waste generated by all economic activities and households amounted to 2.515 million tonnes; this was slightly higher than in 2010band 2008 (2.460 million tonnes and 2.427 million tonnes respectively) but lower than in 2004 which was 2.565 million tonnes; the relatively low figures for 2008 and 2010 may, at least in part, reflect the downturn in economic activity as a result of the financial and economic crisis.[7] A majority (63%) of the total waste generated in the EU-28 was mineral waste. The relative share of mineral waste in the total waste generated varied considerably between EU Member States, which may reflect, at least to some degree,
different economic structures. In general, those Member States that had higher shares of mineral waste were those that were characterised as having sizeable mining and quarrying activities.

CONCLUSION

A continuing rise in the rate of Hazardous waste is no longer acceptable as hazardous waste affects the health of millions of people and poisons large areas of our planet. In many places people live surrounded by garbage and landfills. It is essential that governments and corporations face up to waste, using what we know about reduction, recycling and reuse but also developing new technologies that eliminate waste. Therefore, a number of international and national regulations now state that producers have to be held accountable for the amount and toxicity of waste they produce. This includes the intelligent use of raw materials and steering production towards the use of durable non-toxic components that are easy to reuse, remanufacture, or recycle.

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