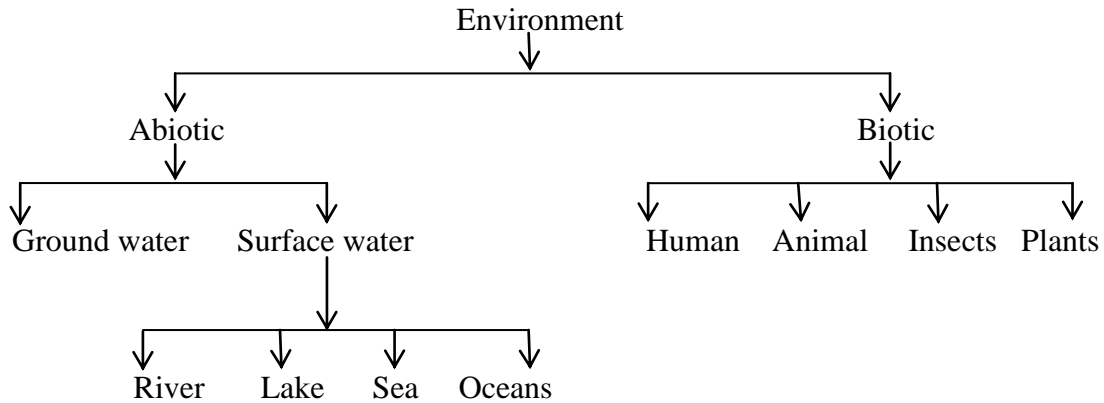


B.Sc. Course(Second Semester)
University of Babylon-College of Engineering
Environmental Engineering Department

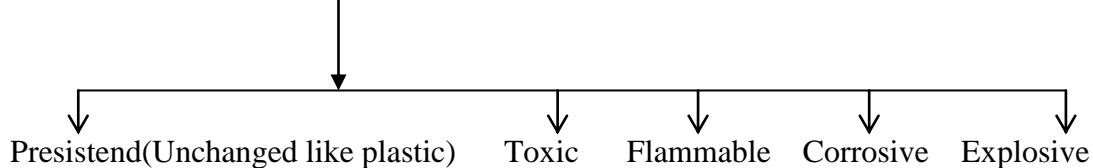
Hazard Waste Management



Introduction:

In past two decades, industry, government and the general public have become increasingly have attention to the need to respond to the hazardous waste problem which has grown steadily over the past 100 years, and this started from,

- ❖ High Standards
- ❖ Industrial Society
- ❖ Manufacture Of Products
- ❖ Generation Of Waste
- ❖ Some Of Waste are Hazardous waste



Hazardous Waste Definition:

H.W. came in all shapes and forms. They may be liquids solids, or sludge's (semisolids) and gases.

They may be products or manufacturing processes. Simple commercial products such as: housholding cleaning fluids or battery acid that have been discharged.

H.W. is a substance considered hazardous if it exhibits one or more of the following characteristics:

- 1) Ignitable \longrightarrow Substance cause or enhances fires.
- 2) Reactive \longrightarrow Substance reacts with other and may exploded.
- 3) Corrosive \longrightarrow Substance is a danger to health, water, food and air.

And it is likely to result in danger to human health or the environment.

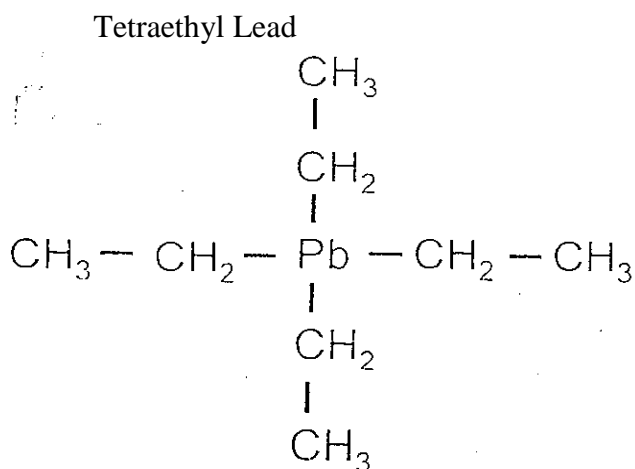
The General Hazardous Waste Characteristics are:

1. Short - term toxicity to humans.
2. Long – term toxicity to humans.
3. Eco toxicity \longrightarrow Ecology.
4. Flammability.
5. Explosivity.
6. Corrosivity.

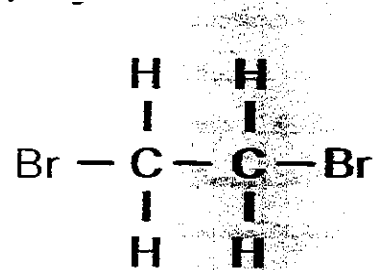
Units of Contaminant Measurement:

Part-per Concentration	Water Concentration	Soil Concentration
ppm (part per million)	mg/L	mg/kg
ppb (part per billion)	mg/L	mg/kg
ppt (part per trillion)	ng/L nanogram/liter	

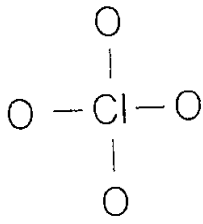
Fuel Additives:



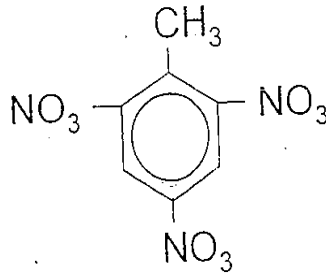
EDB (Ethylene Dibromide)



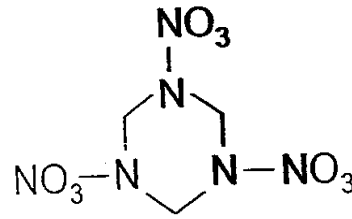
Explosives and Propellants:



Perchlorate(ClO_4^-)



TNT



RDX

Mixtures:

Aroclor – mixture of PCBs

Coal tar and creosote – PAHs, monoaromatic hydrocarbons, trace metals

Gasoline – mixture of aliphatic and aromatic hydrocarbons

(Plus Additives: Tetraethyl lead, EDB, EDC in leaded gasoline, MTBE, ethanol, other oxygenates in unleaded)

Environmental Legislation and Regulations Governing Hazardous Waste:

The Major Environmental Laws for Hazardous Waste Management:

A. The Solid Waste Disposal Act (1965):

Was the first federal government attempt to improve solid waste disposal practices. It provided funding for the development of state solid waste management programs and began the regulation of municipal waste management. SWDA was amended by the Resource Conservation and Recovery Act (RCRA) in 1976. RCRA greatly expanded the provisions pertaining to the management of hazardous waste.

B. Clean Air Act – 1970 (there have many amendments):

1. Purpose – to set definite goals for emissions reductions and ambient air quality improvement.
2. The states and local governments were given the responsibility for controlling air pollution.
3. National Ambient Air Quality Standards (NAAQS) were established to protect primary public health and secondary public welfare (materials and vegetation; crops; livestock; buildings).

- a. NAASQs were set for 6 "criteria pollutants" emitted from widespread sources – particulates, sulfur dioxide, ozone, carbon monoxide, lead and nitrogen dioxide.
 - b. For these, primary and secondary standards differ for only particulates and SO₂.
4. National emission standards were established for the following hazardous air pollutants:
- a. Asbestos, benzene, beryllium, mercury, vinyl chloride, arsenic, radionuclides.
5. Summary – Since 1970, impressive strides have been made in improving and protecting air quality (e.g. lead reduction)

C. Clean Water Act – 1972 (there have been many amendments)

1. Purpose – to regulate toxic and nontoxic pollutant discharges into surface waters from municipal, industrial, and other specific and nonspecific sources.
2. A goal is to return all surface waters of the U.S. to a water quality suitable for "fishing and swimming".
3. EPA has established limits on the quantities of pollutants that may be discharged into surface waters by industry and municipalities; the states have adopted water quality standards for every stream within their borders.
4. EPA has developed effluent standards for industry and sewage treatment plants. All industrial and municipal facilities that discharge wastewater directly into the Nations Rivers and streams must have an NPDES (National Pollution Discharge Elimination System).

Important fact: with the passage of CAA and the CWA in the early 1970s, the burden of hazardous waste disposal shifted to the land.

This was coupled with low initial land and disposal costs. This resulted in the creation of numerous contaminated land disposal sites within the U.S. and we are still paying to clean these up today.

D. Toxic Substances Control Act – 1976

1. Purpose – to regulate the introduction and use of new hazardous chemicals. There was a need for an evenhanded approach between Congress, EPA, chemical industry, public and special interest groups.
2. The toxic effects of new chemicals have to be evaluated.
3. EPA can require testing of existing chemicals by generators if sufficient evidence exists that the chemical poses a risk to human health and the environment.
4. EPA requires a 90 day advance notice of intent to manufacture or import new chemicals.
5. EPA has the authority to limit or prohibit the manufacture, processing or distribution of a chemical substance that poses an unreasonable risk to human health and the environment.

6. Using its authority under TSCA, Congress identified polychlorinated biphenyls (PCBs) for phased withdrawal from the market place. It directed EPA to prohibit the manufacture, processing and distribution of PCBs. Although not specifically identified under TSCA, EPA used its authority through TSCA to regulate asbestos.

7. EPA has the right to inspect any operator where chemicals are manufactured or stored.

E. Resource Conservation and Recovery Act – 1976

1. RCRA was enacted to close the environmental loop to prevent groundwater, surface water, land and air from the contamination of hazardous waste. It is the single most important legislative vehicle for the management of hazardous waste. It would be amended twice including the Hazardous and Solid Waste Amendments Act (1984).

2. Overview

- a. First regulatory program for controlling hazardous waste.
- b. Provides grants and technical assistance to the states for waste management activities.
- c. Creates standards for identifying hazardous wastes for generators, transporters and managers.
- d. Encourages waste minimization.
- e. Hazardous waste is to be handled in a cradle to grave framework that originates with the generation, through the transportation, and then ultimately to the treatment and disposal of the waste.

F. Hazardous and Solid Waste Amendments – HSWA (1984).

1. New technological standards for land disposal facilities that included double liners, collection systems, and groundwater monitoring.
2. New requirements that generate between 100 – 1000 kg of hazardous waste per month were now to be regulated.
3. New regulations for USTs.
4. New restrictions on the future land disposal of untreated hazardous waste. Restrictions prohibited the growing of food chain crops on land that had been previously treated with hazardous wastes that contained arsenic, lead, cadmium, mercury, nickel – land farming.
5. "As a matter of national policy, the generation of hazardous waste is to be reduced or eliminated whenever possible". Possible solutions include resource recovery, recycling, product substitution, waste minimization, pollution prevention.

G. Comprehensive Environmental Response, Compensation, and Liabilities Act – CERCLA (1980).

1. To respond to the "sins of the past" – to address the environmental and health problems caused by the uncontrolled handling and disposal of hazardous waste.
2. The heart of CERCLA is Superfund.

H. Superfund Amendments and Reauthorization Act – SARA (1986).

1. Title I and II – Response and Liability.
 - a. Find permanent remedies to the maximum extent possible.
 - b. Superfund replenishment - \$8.6 billion over 5 years.
 - c. Liability provisions were strengthened.
 - d. States were encouraged to participate as active partners with EPA in taking more responsibility in managing the cleanup activities.
 - e. Public participation – public interest groups can apply for technical assistance grants to enhance the public's understanding of Superfund site conditions and activities. This was to ensure citizen involvement in remedial action.
 - f. EPAs expertise in risk assessment was expanded.
 - g. Each federal department must comply with CERCLA in the same manner as the private sector.
2. Title III – Emergency Planning and Community Right to Know.
 - a. Emergency planning – each local community will develop an effective emergency response plan to the release of hazardous materials.
 - b. Emergency release – facilities are required to report spills and releases of hazardous chemicals to state and local emergency response officials.
 - c. Community right – to – know – facilities are required to submit MSDS sheets for each hazardous chemical to state and local authorities.
Facilities are required to submit an emergency hazardous chemical inventory to state and local authorities.
 - d. Toxic chemical releases – industries are required to report routine emissions of certain toxic chemicals to land, water and air.

Introduction:

- ❖ Every system in nature progresses towards disintegration and it contributes to creating waste.
- ❖ A modern hospital is a complex multidisciplinary system which consumes thousand of items for delivery of medical care and is part of physical environment. All products consumed in hospitals have some unusable left over i.e. **Hospital Waste**. This waste is great threat to ecological balance by polluting environment.

Definition:

- ❖ Any unwanted residual material which cannot be discharged directly, or after suitable treatment can be discharged in the atmosphere or to a receiving water source, or used for landfill is waste [Wilson, 1981].
- ❖ Infectious waste are all those substances which cannot be reesterilised or reused within or brought into patient care [Rearly, 1972].

Definition:

No standard universally accepted definition for the terms:

- ❖ Hospital Waste
- ❖ Medical Waste
- ❖ Regulated Medical Waste and
- ❖ Infectious Waste

Definition:

❖ **Hospital Waste:**

Refers to all waste, biological or non-biological, that is discarded and is not intended for further use.

❖ **Medical Waste:**

Refers to materials generated as a result of patient diagnoses, treatment, immunization of human beings or animals.

❖ **Infectious Waste:**

Are the portion of medical waste that could transmit an "infectious disease".

❖ **Medical Waste:**

Is a sub set of hospital waste and.

❖ **Regulated Medical Waste:**

Which is synonymous with "infections waste" from a regulatory perspective is a sub set of medical waste.

Why Hospital Waste is Hazardous:

- ❖ Infections waste is capable of producing an "infectious disease".
- ❖ Chances of this are higher with in hospitals than outside.
- ❖ This depends on factors like:
 1. Dose,
 2. Host susceptibility,
 3. The presence of a pathogen,
 4. The virulence of a pathogen and
 5. The portal of entry (most commonly absent factors)

Infections waste is also generated:

- ❖ Dental offices
- ❖ Nursing homes
- ❖ Laboratories
- ❖ Research centers

The work environments similar to hospital environment.

Most Common RCRA Violation in Healthcare:

Hazardous waste determinations
Improper disposal, including chemotherapy waste
Improper management of expired pharmaceuticals
Open containers
Unmarked / unlabeled containers
Satellite accumulation
Hazardous waste training
Contingency plan
Improper consolidation of waste from nearby facilities

Note: Don't forget contractors and consultants

Locations Where Wastes Can Be Found:

- ❖ Laboratories —————> Operating rooms
- ❖ Nursing units —————> Haz. Waste areas
- ❖ Construction —————> Satellite acc. Areas
- ❖ Laundry —————> Dental clinics
- ❖ Maintenance —————> X-rays units
- ❖ Pharmacy —————> Morgue