

## CHAPTER-3

### Introduction to solid waste

Solid Waste / In solid ~~low~~ material in the material flow pattern that is rejected by society is called solid waste.

All Human Activities viz domestic, Commercial Industrial, healthcare and agriculture generate solid waste. The quantity and nature of the waste vary with the activity and the level of technological development in a country. If solid waste not managed properly, these wastes can have an adverse impact on the environment and public health from the contamination of solid waste and pollution of air and through spread of diseases.

### Solid waste management →

Management of solid waste may be defined as the discipline associated with the control of generation, storage, collection, transport and disposal of solid waste that they will not have impact on public health and environment.

### Solid waste management in India

India, as an other developing country, is currently facing an acute problem in the management of solid waste. Open dumping of waste is wide spread throughout the country. This is because of the mistaken belief that it is the most easiest and cheapest disposal method. That is why



we pollute our land, air and water by deposition of waste along the sides of roads and riverbanks.

Solid waste management has become a major environmental issue in India. The per capita of MSW generated daily in India ranges from 100g in small and 500g in large towns.

In modern cities MSW is collected by respective municipalities and transported to designated disposal sites.

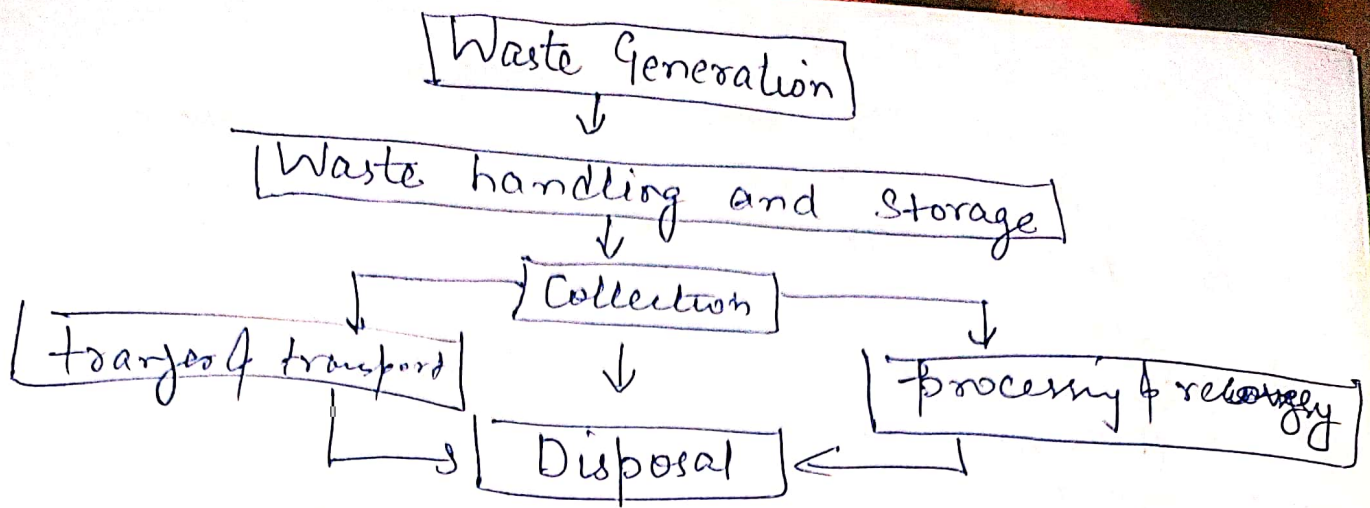
But now a days, the concern about SWM has increased and government has taken steps and create a lot of awareness programs in it.

There are innumerable potential hazards due to the mismanagement of solid waste. These are:

- Air pollution by burning of SW.
- Generation of noxious odour
- Promotion of micro-organisms that cause diseases
- Health effect to waste workers and pickers through direct contact with waste.

Function of elements of solid waste management system





- (i) Waste Generation It comprises of solid waste which are rejected or non-usable for human or society. It is either thrown or gathered for disposal.
- (ii) Waste handling and storage It involves the activities which are involved with the management of waste until they are placed in storage container. Handling involves the movement of container to collection point.
- (iii) Collection It includes not only gathering of solid waste but also the transport of these material to the location where the collection vehicle is employed.
- (iv) Processing and recovery The recovery of sorted materials, processing of solid waste and transformation of SW that occur primarily in location away from the source of solid waste generation. Waste processing is undertaken to recover conversion products and energy.



## Transfer and Transport

It involves two steps:

- (i) the transfer of waste from the smaller collection vehicle to the large transport equipment
- (ii) the subsequent transport of waste over distances to disposal sites.

## Disposal

The final functional element in solid waste management system is disposal. Today the disposal of wastes by landfilling or uncontrolled dumping.

## Quantity of solid Waste

The quantity of solid waste depends on a number of factors such as

- food habits
- standards of living
- degree of commercial activities
- seasons.

The quantity of solid waste can be expressed in unit of volume or in unit of weights. The total waste can be estimated by following equation

$$W = T(w/T)$$

W - total weight

T - total no of trucks

w = weight of truck

t → no of trucks that were weighed



## Solid Waste Characteristics

### (i) Characterize by source

- (a) Residential waste
- (b) Commercial waste
- (c) Industrial waste
- (d) Agricultural waste

### Physical Characteristics

Solid waste require frequent conversion between mass & volume, that is not constant.

### Parameters of solid waste

#### (i) Density

$$D = \frac{\text{mass}}{\text{Volume}}$$

#### Dry density

$$P_{\text{dry}} = \frac{\text{mass of solid}}{\text{Total Volume}}$$

Solid waste

$$D_s = \frac{M_s}{V_s}$$

⇒ Specific weight / is weight per volume.

→ It is important to design the landfill, storage and transport vehicle.



### (2) Moisture Content

- $\frac{\text{weight of Water}}{\text{Total wet weight of Waste}}$
- moisture increases the weight of solid waste.
  - Cost of Collection & transport increases.

### (3) Size of Waste Constituent

It helps in design of mechanical separators and waste treatment plants.

### (4) Calorific Value

amt of heat generated from the combustion of unit weight of a substance expressed in kcal/kg.

### (5) Field Capacity, total amount of moisture which can be retained in a waste sample its gravitational pull.

### (6) Compressibility, degree of physical change of solid when pressure applied on it.

### Chemical characteristics

- (i) Chemical characteristics includes P, nitrogen, Phosphorus, potassium etc.
- (ii) Bio chemical Carbohydrates, proteins, natural fibres etc.
- (iii) toxic pesticides, insecticides, heavy metal.
- (iv) lipids / lipids fats, oils & greases.  
- high Calorific Value  
- biodegradable.



plaster

## Solid waste disposal in rural and urban areas →

### (i) Methods of solid waste disposal

#### (1) open dumping

- It is an illegal process
- It includes solid waste of household trash, construction waste etc.
- It is dumped in location like roadside, vacant lots or private property.
- Threat to human health and can pollute the environment

#### (II) Compositing

- It is a natural biological process that carried out under controlled aerobic and anaerobic conditions.
- It is an efficient method to break down material to an end product which is beneficial for soil and plants.

#### (III) Land fills

- It is the area of land in which we made a pit in land where waste is deposited.
- its aim is to avoid waste contact to underground water & surrounding environment.



→ it is done for following type of waste

(i) ~~Mixed waste~~ ~~not~~

(ii) Non-Hazardous Waste

(iii) Pre-post processing waste.

#### (4) Incineration

→ involve the combustion of organic matter & other substance.

→ It is controlled burning of waste at a high temperature ( $1200-1500^{\circ}\text{C}$ ) which sterilises and slashes the waste in addition to reduce its volume.

#### (5) Gaseification

→ Partial Combustion of Carbon material)

→ It convert organic matter at high temperature ( $>700$ ) into gases composed mainly  $\text{CO}_2$ ,  $\text{CO}$ ,  $\text{N}$ ,  $\text{H}$ , methane which used as a fuel.

#### (6) RDF (Refuse Derived fuel)

- The fuel produced from combustible component that the industry calls municipal solid waste.

- The waste usually taken from industries or commerce ~~is~~ ~~unshred~~ ~~unshred~~ dried ~~and~~ ~~and~~ it finally burnt to produce electricity.



## Introduction to air pollution

Air pollution is the presence of substance in the atmosphere that are harmful to the health of human and other living beings.

It is caused by both human and natural contributors, Industries, factories, Vehicles, mining, agriculture, forest fires, Volcanic eruption, & wind erosion all cause air pollution.

## Issues to air pollution

Global Warming / It is long term heating of earth increases temperature on earth due to the depletion of ozone layer and releases UV rays from sun on earth.

## Reasons

- (i) Due to human Activities
  - 1) Fossil fuel burning
  - 2) Smoking
- (ii) Cutting of trees decreases and of oxygen. Global warming occurs when  $\text{CO}_2$  and other pollutants and greenhouse gases collect in the atmosphere and absorb sunlight and solar radiation that have bounced on earth surface.



~~effects~~ (i) Skin Cancer

(ii) Other diseases, like, Breast cancer, suffocation.

(iii) Leaf corrosion etc.

## Acid Rain

- Acid rain describes any form of precipitation that contains high levels of nitric and sulphuric acids.
- Normal rain is slightly acid, with a pH of 5.6 while acid rain generally has a pH between 4.2 and 4.4.

## Cause

- The biggest sources are coal-burning power plants, factories and automobiles.
- When humans burn fossil fuel, sulphur dioxide and nitrogen oxides are released into the atmosphere.
- These air pollutants react with water, oxygen and other substances to form airborne sulphuric and nitric acid.
- The rain from these clouds then falls as weak acid which is why it is known as acid rain.

## Effect

effect on plant

effect on river & lakes

effect on human.



## Photochemical Smog

→ is a unique type of air pollution which is caused by reaction between sunlight and pollutants like hydrocarbon and nitrogen dioxide. Although photochemical smog is often invisible it can be extremely harmful, leading to irritation of the respiratory tract and eyes. If concentration is high, elevated rates of death and respiratory illness can be observed.

## Ozone layer depletion

Ozone layer is the earth's atmosphere that contains high concentration of ozone and protect the earth from the harmful UV rays.

Ozone layer depletion → is the reduction in the concentration of ozone particle in ozone layer

### Cause

When chlorine and bromine atoms in the atmosphere come in contact with ozone and destroy the ozone molecules.

### Ozone depleting substance

CFC, Halon, Methylbromide,  
Bromo chloromethane, Methyl chloroform.

~~CFC~~





Effect  
- Skin Cancer

- eye Cancer

- Destroy development process in plants

### Types of air pollution

Person of It refers to exposure to dust, fumes, and gases to which an individual is exposed when he indulges in his

Occupation of

Community

### Source of air pollution

stationary sources (i) line (ii) point

mobile sources



## Primary Air pollutant and their effect on living being

### (i) Sulphur dioxide

- is an irritant gas, effect mucous membrane.
- increases breathing rate, causes oxygen deficit in body.
- Patients of asthma are badly affected by this pollutants.
- Corrosion to bulky and metal objects

### (ii) Carbon monoxide

- it affects the central nervous system and even responsible for heart attacks.
- it originates from automobile exhaust and by incomplete combustion of organic matter.

### (iii) Oxides of Nitrogen

- $\text{NO}_2$  and  $\text{NO}$  are found to be injurious to human health.
- $\text{NO}_2$  is more dangerous than  $\text{NO}$ .
- it can cause eye and nose irritation.

### (iv) Hydrogen sulphide

- it is a foul smelling gas with typical odour of rotten egg.
- it can cause headaches, sleepiness and pain in the eyes.

v) Lead is mainly injected by the atmosphere through the exhaust of automobiles gradually during on petrol.

- Cause in normality to pregnancy and fertility
- Cause irritation in mucous membrane.







## Secondary air Pollutant

Sulphuric acid | It is formed by simple chemical reaction between sulphur dioxide with water vapour.

- it is more toxic than sulphur dioxide.
- it cause acid rain.

## Ozone

→ Ozone has been generally found to occur in the highly moistened area. During day time it is produced with the photochemical reaction of hydrocarbon and nitrogen oxide.

- it can cause irritation in the respiratory tracts.

## Formaldehyde

it is a colorless gas with pungent odor from a family of gases called aldehydes.

- Commonly known as preservatives in medical laboratories and mortuaries.

## Peroxy-acetyl nitrate

- is an oxidant more stable than ozone. Hence it is better capable of long range transport than ozone.

- it irritates the eyes resulting in blurred vision and eye fatigue.



# BIS Standards for Air Pollutants

Pollutants	Time weighted Average	Concentration in ambient air	
		Industrial areas Residential and Rural areas	Green area
Sulphur dioxide	Annual Average	50	20
	24 hr	80	20
Nitrogen oxide	Annual Average	40	30
	24 hr	80	80
Particulate matter size $< 10 \mu m$	"	60	60
	"	100	100
Particulate matter size $< 2.5 \mu m$	"	40	40
	"	60	60
Ozone	8 hr	100	100
	1 hr	180	180
Lead	Annual Average	0.5	0.5
	24 hr	1.0	1.0
Carbon monoxide	8 hr	2	2
	1 hr	4	4
Ammonia	Annual Average	100	100
	24 hr	400	400
Benzene	Annual Avg	5	5
Benzopyrene	Annual Avg	1	1
Arsenic	4	6	6
Nickel	4	20	20

May 1st



## Abatement of air pollution $\Rightarrow$

The air pollution and resultant air quality can be attributed to emission from Vehicular, industrial and domestic activities. For control of air pollution, with the view to intimate policy measures and to prepare ambient air quality management plan 321 Air quality monitoring stations are optional covering twenty five states and four union territories.

The CPCB has prepared a action plans which has been circulated to all the state pollution control boards.

The action plans emphasize identification of source of air pollution, assessment of pollution load and adoption of abatement measure for identified sources.

In order to control Vehicular pollution, a road map has been proposed in auto fuel policy which includes uses of cleaner fuels and enforcement measures for all vehicles through Pollution under control Certification system. ~~It~~ a for more control, government is taken steps includes Bharat stage II ~~which~~ will be improved now a level of Bharat stage IV