Unit 1- Environment Pollution and Disaster management

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Environmental Pollution and its impacts

Pollution – Introduction

The term *pollution* can refer to both artificial and natural materials that are created, consumed, and discarded in an unsustainable manner.

Pollutants:

- Pollutant is defined as harmful material released into the environment that causes undesirable effects in the environment.
- **Pollutants** are the elements, molecules and particles involved in pollution - life can be harmed when exposed to these materials, and the effects of them on humans and plants are well known.
- Environmental pollution may destabilize development process and competitiveness of developing nations whose economies depends on natural resources.
- Industrialisation is the first fundamental cause of pollution.
- Among other things, industrialization set in motion the widespread use of fossil fuels (oil, gas and coal) which are now the main sources of pollution.
- Industrial pollution contribute majorly in emitting waste gases like carbon monoxide, sulphur oxides, and nitrogen oxides which are the waste products of industry and end up in the air as well as dumping of industrial waste into water, endangering human life
- The term "pollution" refers to any substance that negatively impacts the environment or organisms that live within the affected environment.

Types of pollution

- The five major types of pollution include:

- Air pollution,
- Water pollution,
- Soil pollution,
- Light pollution,
- Thermal Pollution
- Radioactive Pollution and
- Noise pollution.

Air pollution

- **Sources: Urbanization/ Manmade- Outdoor pollution sources and**
- **Indoor pollution sources**
- **Burning of fossil fuels** : The burning of fossil fuels contributes to the formation of smog, a dense layer of particulate matter that hangs like a cloud over many major cities and industrial zones.

- **Vehicle and factory emissions** : Carbon monoxide, sulfur dioxide and lead are typically released directly into the atmosphere from industrial activity and vehicles.
- Ozone, is usually created from the chemical decomposition of nitrogen oxides released from automobiles. Nitrogen dioxide is the product of the oxidation of nitrogen oxides.
- **Indoor** include carbon monoxide, methane, particulate matter (PM), polyaromatic hydrocarbons (PAH) and volatile organic compounds (VOC).
- SPM is usually caused by dust, combustion
- Air pollution is the introduction of harmful chemicals into the atmosphere.
- The exhaust from vehicles for instance, is polluting the air with toxic chemicals such as carbon monoxide and formaldehyde.

Sources:

- **Natural sources:** Volcanic eruption, dust storm, forest fire, Carbon dioxide from humans during respiration, Methane from cattle during digestion, Oxygen from plants during Photosynthesis

Major Pollutants of air:

- Ozone
- particulate matter
- carbon monoxide
- nitrogen dioxide
- sulfur dioxide and
- lead
- Volatile organic compounds (VOCs)
- Chlorofluorocarbons (CFCs)
- Mercury (Hg)
- Peroxyacyl nitrates (PANs)

Types of air pollutants:

- It can be further divided into **Primarily and Secondary air pollutants** if we go deep.
- **Primarily air pollutants** can be caused by primary sources or secondary sources. The pollutants that are a direct result of the process can be called Primary pollutants. Eg. sulfur-dioxide emitted from factories.
- **Secondary pollutants** are the ones that are caused by the intermingling and reactions of primary pollutants. Smog created by the interactions of several primary pollutants is known as a secondary pollutant.

Classification of Air Pollution

- Air pollution can be classified into two sections –
- **Visible air pollution**, like smog over a city is an example of visible pollution.
- **Invisible air pollutants** are less noticeable, but they can be more deadly. Good examples of invisible air pollutants are sulfur dioxide, carbon monoxide and nitrogen oxides

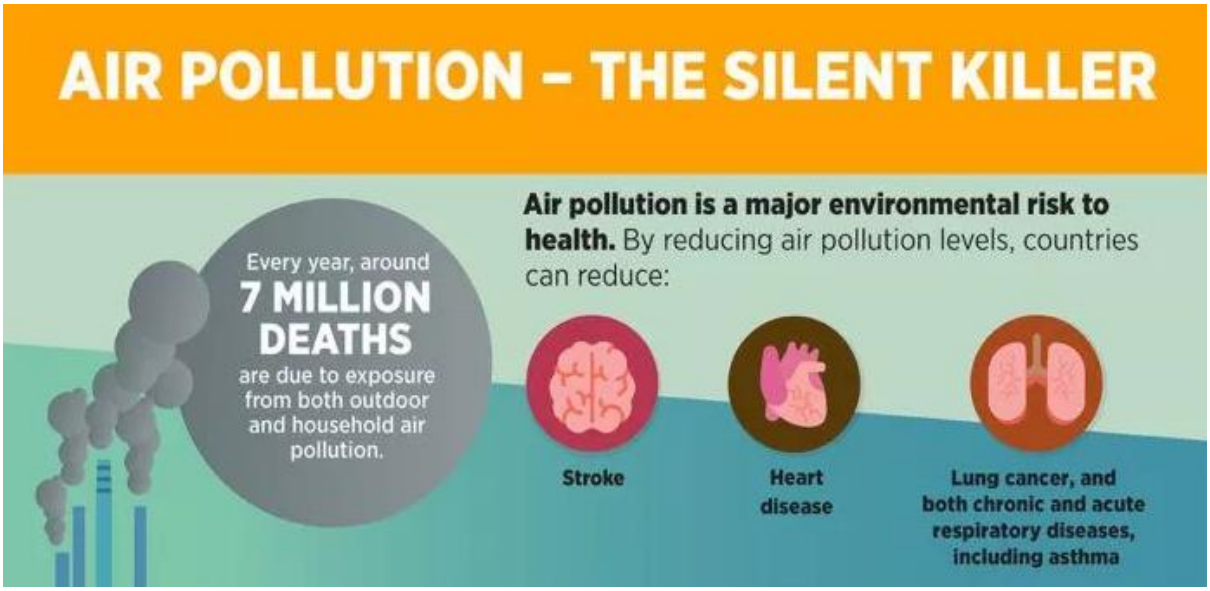
Effects of Air pollution

- **Respiratory and Heart Problems-** Asthma, chronic bronchitis, emphysema, heart attacks and strokes along with cancer
- **Child Health Problems-** Exposure to high air pollution levels during pregnancy causes miscarriages as well as premature birth, autism, asthma and spectrum disorder in young children. Brain development and pneumonia
- **Global Warming** - With increased temperatures worldwide, an increase in sea levels and melting of ice from colder regions and icebergs, displacement, and loss of habitat have already signaled an impending disaster if actions for preservation and normalization aren't undertaken soon.
- **Acid Rain**
- Harmful gases like nitrogen oxides and sulfur oxides are released into the atmosphere during the burning of fossil fuels. When it rains, the water droplets combine with these air pollutants, becomes acidic and then falls on the ground in the form of acid rain. Acid rain can cause great damage to humans, animals, and crops.
- **Depletion of the Ozone Layer**
- Ozone exists in the Earth's stratosphere and is responsible for protecting humans from harmful ultraviolet (UV) rays. Earth's ozone layer is depleting due to the presence of chlorofluorocarbons, hydrochlorofluorocarbons in the atmosphere.

Smog

- **Smog** is air pollution that reduces visibility.
- Ex: New Delhi 2019.
- Shanghai smog, The great smog of London (1952)
- Higher levels of smog are associated with a wide range of diseases such as chronic obstructive pulmonary disorder, heart disease, stroke and lung cancer

Health effect of air pollution



Water pollution

- Water pollution happens when toxic substances enter water bodies such as lakes, rivers, oceans and so on, getting dissolved in them, lying suspended in the water or depositing on the bed. This degrades the quality of water.
- Pollutants or contaminants which enter a body of water can be further divided into:
- **Degradable (non-conservative) pollutants:** impurities which eventually decompose into harmless substances or which may be removed by treatment methods; that is, certain organic materials and chemicals, domestic sewage, heat, plant nutrients, most bacteria and viruses, certain sediments
- **Non-degradable (conservative) pollutants:** impurities which persist in the water environment and do not reduce in concentration unless diluted or removed through treatment; that is, certain organic and inorganic chemicals, salts, colloidal suspensions
- **Hazardous waterborne pollutant**s: complex forms of deleterious wastes including toxic trace metals, certain inorganic and organic compounds
- **Radionuclide pollutants**: materials which have been subjected to a radioactive source.
- **Industrial Runoff**
- Stormwater and **industrial runoff** is a leading cause for water pollution.
- Industrial runoff typically contains high concentrations of pollutants such as heavy metals and petroleum hydrocarbons.
- **Oil Spill**
- An **oil spill** refers to any uncontrolled release of crude oil, gasoline, fuels, or other oil by-products into the environment.
- The **Deepwater Horizon oil spill** was an industrial disaster that began on April 20, 2010, in the Gulf of Mexico on the BP-operated Macondo Prospect, considered to be the largest marine **oil spill** in the history of the **petroleum** industry

Sources of Water Pollution

- Water pollution comes from point sources or non-point sources.
- **Point sources** include factories, sewage pipes and specific spills from pipelines or containers.
- **Non-point sources**, however, do not have a specific point of origin. Runoff from storms and melting snow carry fertilizers, pesticides, oil and gasoline, litter such as plastic bags and animal faeces into storm drains, creeks, rivers, lakes and, ultimately, the ocean.
- **Major water pollutants**
- Runoff from agricultural fields, industrial sites, or urban areas . Agricultural runoff typically includes fertilizer or toxic chemicals. Fertilizer can cause algal blooms .
- Raw sewage
- Trash such as plastic bags, fishing line, and other material oil spills

Effects of Water Contamination

- Diarrhea, skin diseases and other infections
- Bioaccumulation occurs as heavy metals like mercury move up through the food chain contaminate shellfish and fish like mackerel, tuna and sharks, exposing consumers to these toxic chemicals.
- Mercury poses higher health risks to children under 6 and to child-bearing women because it interferes with brain development.

Oil floats on water, cutting off oxygen for plankton. Oil causes tissue damage in coral and coral larvae, causes heart defects in bluefin tuna larvae and other fish and even small amounts of oil impairs the ability of seabirds to fly, swim and dive for food.

Types of Pollution-Land Pollution

- Land Pollution refers to the deterioration of the earth's land surfaces.
- It is a result of indirect and direct effects of human activities.
- It is a global issue that needs to be fixed immediately.
- **Soil pollution** as part of land degradation is caused by the presence of Xenobiotics (human-made) chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals or improper disposal of waste
- EPA (Environmental Protection Agency) estimates the pollution

Soil Pollution

The presence of substances in soil that are not naturally produced by biological species is of great public concern.

Xenobiotic

- Xenobiotics are defined as chemicals to which an organism is exposed that are extrinsic to the normal metabolism of that organism.
    - Ex: poly aromatic hydrocarbons (PAHs), persistent organic pollutants (POPs)

Recalcitrants:

- **Recalcitrants** are pollutants that persist in the environment, they are capable of long range transportation, bioaccumulation, in human and animals, and biomagnifications in food chain.
- The **term** "**long-range transport**" refers to the **transport** by the wind of air pollutants or their precursors from the areas where they were emitted to other locations at downwind distances of 100 km or more.

- Ex: most phenols (especially chloro- and nitro-derivatives) and fungicides.

Landfills

- Landfills are well-engineered facilities designed to receive specific kinds of waste, including municipal solid waste, construction and demolition debris and hazardous waste.

Causes of Land Pollution

- various substances that spill on the land cause land pollution.
- Similarly, these substances have different sources of origin.
- The most common ones are:
- Garbage
- Factories
- Farming
- Mining

Garbage: wet and dry waste , e waste generated at household gets dumped onto land which is referred to as a landfill. landfills release toxic gases that harm living beings as well as the ozone layer.
Factories: Factories produce toxic waste products and chemical which prove very damaging to land.
Farming : fulfil our food demands but may be harmful sometimes. Clearing of forests for land area in order to farm and use of insecticides and fertilizers sprayed on crops also damage the land.
Mining
Is done in order to obtain coal and minerals, we dig holes into the land. This results in land erosion and as well produces harmful gases and toxins which results in contaminated land as well as the air.

Effects of Land Pollution

- landfills also release methane gas which increases the effect of Global warming; Leachate contaminating ground water
- Cancer and skin infections.

Prevention of Land Pollution

- Reducing the usage of chemicals and pesticides
- Reforestation
- Recovering and Recycling Material
- Limit use of disposable products

Types of pollution : Noise pollution-

- Unpleasant sound is noise
- **Noise pollution** is generally defined as regular exposure to elevated sound levels that may lead to adverse effects in humans or other living organisms.
- According to the World Health Organization, sound levels less than 70 dB are not damaging to living organisms, regardless of how long or consistent the exposure is.

Effects of Noise pollution :

- **Noise pollution** is an invisible danger.
- It causes is **Noise** Induced Hearing Loss (NIHL).
- Exposure to loud **noise** can also cause high blood pressure, heart disease, sleep disturbances, and stress.
- These health problems can **affect** all age groups, especially children.
- **Prevention of Noise Pollution:**
- Upgrade Insulation.

- Noise Cancelling Headphones and Earplugs.
- Turn Off Electrical Appliances.
- Place Furniture Strategically in Your Property.

Types of Pollution - Thermal pollution

Thermal pollution is sudden increase or decrease in temperature of a natural body of water, that may be ocean, lake, river or pond by human influence.

Causes:

This normally occurs when a plant or facility takes in water from a natural resource and puts it back with an altered temperature.

It is from hot water or cold water being dumped into a body of water

Effects of thermal pollution

- It decrease the amount of dissolved oxygen in the water
- aquatic life like fishes, their larvae and eggs gets damaged .
- Kills some species of fish and macroinvertibrates that have a limited tolerance for temperature change, and migration of living entities
- Contributes to global warming

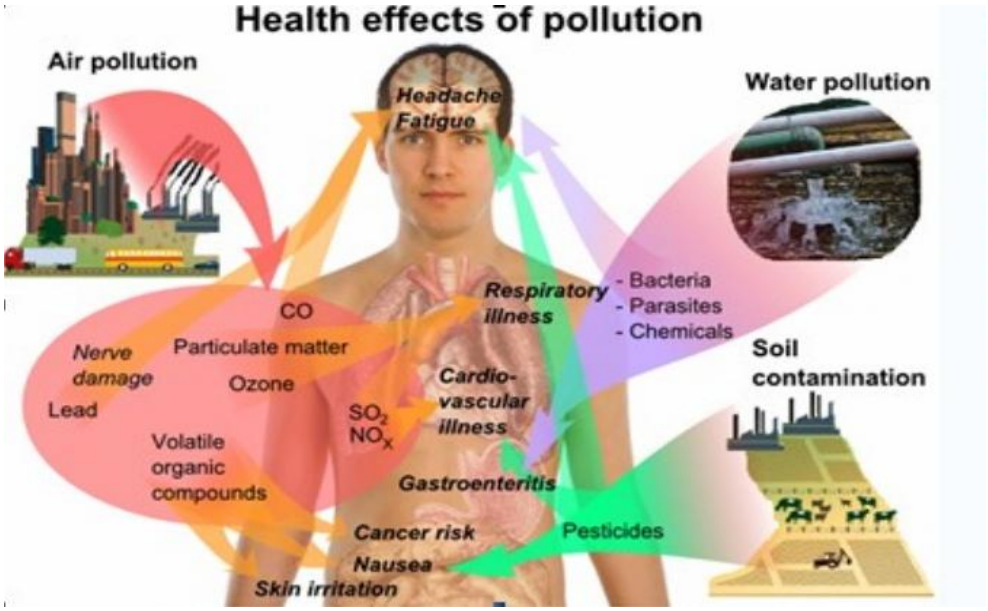
Types of Pollution- Radioactive pollution

- The radioactive pollution is the physical pollution resulting due to of release of radioactive substances into the environment during nuclear explosions and testing of nuclear weapons, nuclear weapon production and decommissioning, mining of radioactive ores

Effects of Radiation :

Exposure to very high levels of radiation, such as being close to an atomic blast, can cause acute health effects such as

- skin burns
- acute radiation syndrome (“radiation sickness").
- Skin cancer
- cardiovascular disease.
- chronic respiratory disease,
- lung cancer

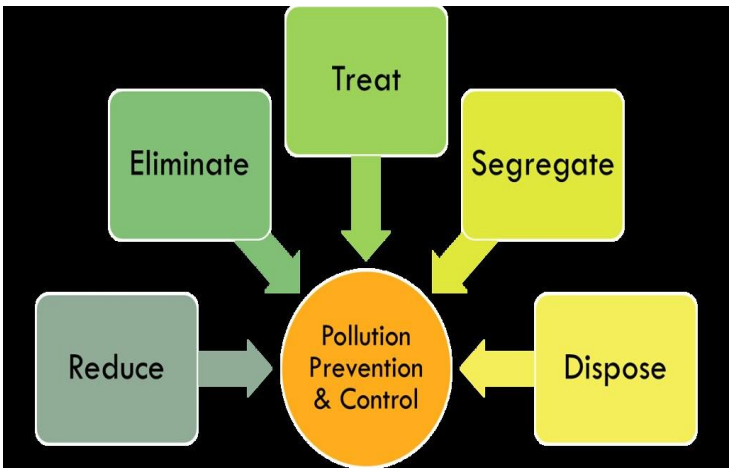


https://www.toppr.com/guides/chemistry/environmental-chemistry/land-pollution/

Environmental Pollution and management

INTRODUCTION

- Around the world, people and governments are making efforts to combat pollution.
- **Pollution** control is the process of reducing or eliminating the release of pollutants into the **environment** .
- It is regulated by various environmental agencies which establish pollutant **discharge** limits for air, water, and land.
- Recycling, for instance, is becoming more common.
- In recycling, trash is processed so its useful materials can be used again.
- Glass, aluminum cans, and many types of plastic can be melted and reused.
- Paper can be broken down and turned into new paper.



https://www.lanl.gov/environment/sustainability/pollution-prevention.php

International agencies

- World Health Organization (WHO),
- World Meteorological Organization (WMO) and
- United Nations Environment Programme (UNEP) have instituted monitoring and research projects in order to clarify the issues involved in air pollution and to promote measures to prevent further deterioration of public health and environmental and climatic conditions.
- The Global Environmental Monitoring System GEMS/Air (WHO/ UNEP 1993) is organized and sponsored by WHO and UNEP and has developed a comprehensive programme for providing the instruments of rational air pollution management
- **Pollution control** is the process of reducing or eliminating the release of pollutants into the environment . It is regulated by various environmental agencies which establish pollutant discharge limits for air, water, and land.
- Growing recognition of the environmental and public health impacts associated with anthropogenic activities has prompted the development and application of methods and technologies to reduce the effects of pollution.
- Governments have adopted regulatory and other policy measures to minimize negative effects and ensure that environmental quality standards are achieved.

Best Ways to Reduce Air Pollution

- Using public transports.
- Turn off the lights when not in use.
- Recycle and Reuse.
- No to plastic bags.
- Reduction of forest fires and smoking.
- Use of fans instead of Air Conditioner.
- Use filters for chimneys.
- Avoid usage of crackers.
- Avoid using of products with chemicals
- Implement Afforestation

Stages of the pollution management model:

Strategies for reducing these impacts can be directed at three different levels in the process:

1. Altering the human activity,

2. Regulating and reducing quantities of pollutant released at the point of emission, and

3. Cleaning up the pollutant and restoring ecosystems after pollution has occurred.

Control Measures

- Controls can be divided into two basic types of controls - technological and administrative.
- Technological:
- Gaseous- Condensation, adsorption, absorption, incinerator
- Particulate- wet scrubbers, electrostatic precipitators, Filters

WATER POLLUTION CONTROL

- Surface Water Pollution Control
- Groundwater Pollution Control

Pollution occurring within these drainage systems originates from the following sources:

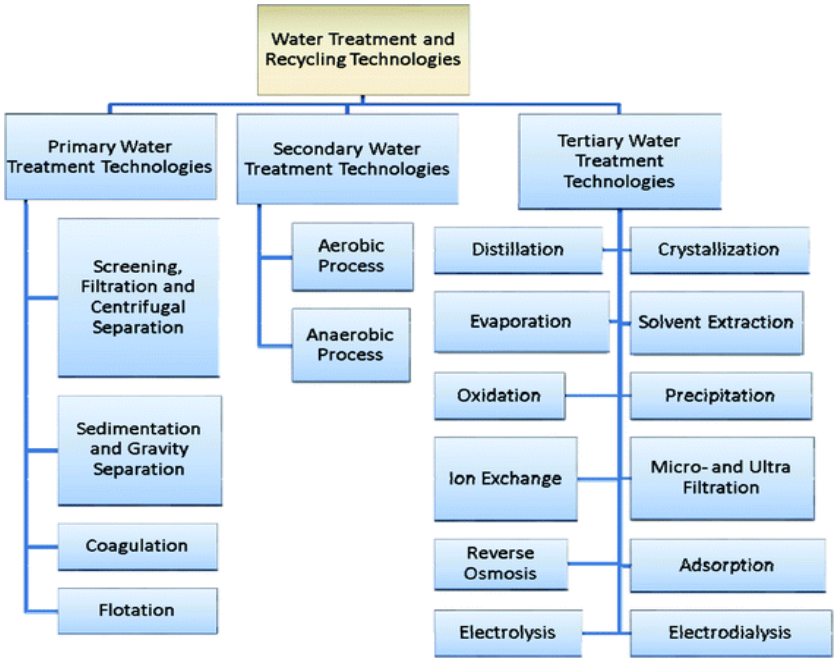
- **Point sources:** waste discharges into a receiving water body at a specific location, at a point such as a sewer pipe
- **Non-point (dispersed) sources**: pollution entering a receiving water body from dispersed sources in the watershed; uncollected rainfall runoff water drainage into a stream is typical. Non-point sources are also sometimes referred to as "diffuse" waters.
- **Intermittent sources:** from a point or source which discharges under certain circumstances, such as with overloaded conditions; combined sewer overflows during heavy rainfall runoff periods are typical.

Water supplies include:

- **Public water supply**: waters which with conventional treatment will be suitable for human consumption
- **Agricultural supply**: waters suitable for irrigation and livestock watering without treatment
- **Industrial/commercial supply:** waters suitable for industrial and commercial uses with or without treatment.

BIS GUIDELINES OF PARAMETERS

Parameters	UNITS	GUIDELINE VALUE
pH	-	4-12
Suspended solids	mg/l	24-5700
BOD5	mg/l	450-4,790
COD	mg/l	80 - 95000
Total nitrogen	mg/l	15-180
Total phosphorus	mg/l	11-160
Oil and grease	mg/l	10
Total coliform bacteria	Mpn/100ml	400
Magnesium	mg/l	25-49
Potassium	mg/l	11-160
Chloride	mg/l	48-469
Calcium	mg/l	57-112



https://pubs.rsc.org/en/content/articlelanding/2012/ra/c2ra20340e#!divAbstract

Waste Management Practices

- Waste may be grouped into three major categories, depending on its production:
- from the primary sector of production (mining, forestry, agriculture, animal breeding, fishery)
- from the production and transformation industry (foods, equipment, products of all types)
- from the consumption sector (households, enterprises, transportation, trade, construction, services, etc.).

Management of municipal and ordinary commercial waste:

- Collected by trucks, these wastes can be transported (directly or by road-to-road, road-to-rail or road-to-waterway transfer stations and long-distance transportation means) to a landfill, or to a treatment plant for material recovery (mechanical sorting, composting, biomethanization), or for energy recovery (grid or kiln incinerator, pyrolysis).

Solid wastes are traditionally described as residual products, which represent a cost when one has to resort to disposal.

- Management of waste encompasses a complex set of potential impacts on human health and safety, and the environment.
- The impacts, although the type of hazards may be similar, should be distinguished for three distinct types of operation:
- handling and storage at the waste producer
- collection and transportation
- sorting, processing and disposal.

Occupational health and safety authorities in the industrialized

countries are focusing on working conditions which, a few years ago, passed off unnoticed with unspoken acceptance, such as:

- improper heavy lifting and excessive amount of materials
- handled per working day
- inappropriate exposure to dust of unknown composition
- unnoticed impact by micro-organisms (bacteria, fungi) and endotoxins
- unnoticed exposure to toxic chemicals.

Recycling

- Recycling or salvaging is the word covering both reuse (use for the same purpose) and reclamation/recovery of materials or energy.
- The reasons for implementing recycling may change depending on national and local conditions, and the key ideas in the arguments for recycling may be:
- detoxification of hazardous waste when high environmental standards are set by the authorities
- resource recovery in low income areas
- reduction of volume in areas where landfilling is predominant
- energy recovery in areas where conversion of waste to energy can replace fossil fuel (coal, natural gas, crude oil and so on) for energy production.

Noise

Noise is an unwanted sound in wrong place at wrong time

Sources: Equipment usage in anthropogenic activities in industry.

Effects: Human- Rise in BP, stress levels and violent behavior.

- Hearing Damage- depends on intensity and duration of
- sound
- Physiological and psychological changes in various parts
- of body

Noise level tolerance: Unit is decibels- Silence zone- 40-50 dB

- Residential zone-45-50 dB
- Commercial Zone-55-65 dB
- Industrial Zone-70-75 dB

Solution: Sound proofing using fibre glass core, enclosures, acoustic lining

Thermal

- Presence of waste heat in water which can cause undesirable changes in the natural environment.
- **Sources:** processes like evaporation, convection, radiation, use of dryers and evaporators.

- **Effects**: decreases oxygen level in the atmosphere, leading to health effects of human beings.
- **Control:** cooling ponds, spray ponds, cooling towers-dry/ wet

Radioactive

Sources: Natural: cosmic rays,

- Anthropogenic: Nuclear power plants, X rays, nuclear
  - accidents.

Effects: Genetic damage affecting genes and chromosomes.

- Somatic damage- Burns, miscarriages, eye cataract,
- thyroid and cancer of bone, breast , lung, skin

Control: Proper siting, disposal of waste and maintenance