

Unit IV : Environmental Pollution

(Weightage : 20marks)

Unit– IV Environmental Pollution	4a. Define pollution. 4b. State the sources of pollution. 4c. State the effects of land pollution on environment and lives. 4d. State various units and their functions of water treatment plant. 4e. State the needs of water conservation.	4.1 Definition of pollution, types- Natural & Artificial (Man- made). 4.2 Soil / Land Pollution – Causes and effects on environment and lives , preventive measures. 4.3 Water Pollution - Sources of water (surface and sub surface), sources of water pollution, effects on environment and lives, preventive measures, BIS water quality
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Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	4f. State the impacts of sewage. 4g. State various units and their functions of sewage treatment plant. 4h. State sources and effects of air pollution. 4i. Describe various methods to prevent air pollution. 4j. State sources and effects of noise pollution. 4k. Describe preventive measures for noise pollution. 4l. State characteristics of solid waste. 4m. State the impacts of solid waste. 4n. Describe incineration, RDF and sanitary landfilling. 4o. State the standards limiting/controlling values of various types of pollution.	standards, flow diagram of water treatment plant, Water conservation. 4.4 Wastewater - Generation(domestic and industrial), Impacts, flow diagram of sewage treatment plant, CPCB norms of sewage discharge. 4.5 Air pollution - Causes, effects, prevention, Ambient air quality standards. 4.6 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city. 4.7 Municipal Solid Waste, Bio-medical waste and E-waste - Sources, generation, characteristics, effects, and methods to manage.

4.1

DEFINITION OF POLLUTION:

Pollution is the undesirable changes in environment due to contamination of harmful materials that have adverse effects on living things and natural quality of environment. These harmful

materials are called **pollutants**.

Pollutions are two types.

The natural: The natural pollution is caused and produced naturally and will not affect our environment because of its regeneration ability.

e.g. Thunder, Volcano eruption, Forest fire, sand storms etc.

Man Made: The Man made pollution is being made by humans and have huge affect on our environment and definitely ourselves.

e.g. Automobiles, Industrialization, sewage, solid waste etc.

4.2

Land / Soil Pollution

- The fertility and structure of the land are harmed by contamination with harmful materials; this is called land pollution.
- Land pollution means damaging Earth's land surfaces, usually because of human activities and improper use of land resources.
- It happens when waste is not disposed of correctly.
- Soil cannot be made again. It is an irreplaceable resource.

Causes of Land Pollution

1. Industrialization

Plastics factories, chemical plants, oil refineries, large animal farms, coal-fired power plants, metals production factories and other industries all contribute to land pollution.

2. Mining Activities

The mining process can lead to the creation of large open spaces beneath the surface of the earth. Heavy minerals, sulfuric acid and other toxic materials leak from mining waste into soil.

3.Agricultural Activities:

As the population grows, the demand for food increases, leading to forests being cleared and converted into farmland.

Chemicals like herbicides, pesticides, artificial fertilizers, and synthetic manure seep into the soil, causing pollution.

4.Sewage Treatment:

After treating sewage, a large amount of solid waste remains.

This leftover waste is sent to landfill sites, which can pollute the environment.

5.Overcrowded Landfills:

Household waste creates tons of garbage every year.

Non-recyclable items end up in landfills, damaging soil quality and causing land pollution.

Construction Activities:

Urbanization has led to increased construction, generating waste like wood, metal, bricks, and plastic.

Deforestation:

Forests are cleared for industries, agriculture, and housing.

Once land becomes barren, it cannot be made fertile again.

Urbanization:

Urbanization is the shift of people from rural to urban areas.

It adds pressure on land for housing and food production.

The Negative Impact Of Land Pollution

1. **Groundwater Poisoning:**

Agricultural runoff, industrial waste, and landfill seepage pollute groundwater as they percolate through the soil.

2. **Water Nutrient Enrichment:**

Excess chemicals like nitrogen from farms flow into water bodies, depleting oxygen levels and harming fish, algae, and other aquatic life.

3. **Soil Erosion:**

Deforestation exposes soil to wind and rain, washing away the topsoil and reducing land fertility.

4. **Shifting Habitat:**

Deforestation and soil erosion force animals to relocate for food and shelter, increasing the risk of extinction for some species.

5. **Increased Risk of Forest Fires/Wildfires:**

Pollutants and dry soil create ideal conditions for forest fires and wildfires.

Effects of Land Pollution on Humans

- Humans can also experience negative consequences that can influence quality of life and health.
- The potential consequences include birth defects, the development of breathing disorders, skin diseases, and cancer.
- Land pollution has also been linked to development of children. The e - waste Chemicals that are commonly found in contaminated soil and water, such as lead, chromium, cadmium, arsenic etc. can impact a child's cognitive development even if the exposure is very low.

Prevention For Land Pollution

1. Proper waste disposal Focuses on treating waste and disposing it in the safest possible manner.
2. Reduce, Reuse, Recycle and Recover Reduce the usage of non-biodegradable materials, such as plastic shopping bags. Recycle the waste that can be recycled and Reuse the materials that can still be used to reduce the need for harvesting of resources.

4.3: Water Pollution

- Water: A Precious Gift of Nature
- Water carries nutrients to all cells in our body and oxygen to our brain.
- Water allows the body to absorb minerals, vitamins etc.
- Water flushes out toxins and waste. Water helps to regulate body temperature.
- Drinking water, also known as potable water. It must be free from all types of impurities.

Types of Impurities in water:

1. Suspended Impurities

The visible and floating impurities.

2. Dissolved Impurities

The soluble salts of Ca and Mg, minerals etc

3. Colloidal Impurities

The impurities of fine silt and clay

4. Biological Impurities

The invisible disease causing germs, bacteria etc.

Water treatment Process

- Need of water treatment:
- To remove the unpleasant and objectionable taste and odors from the water.
- To remove dissolved gases and color of water.
- To remove all types of impurities present in water.
- To kill all pathogenic germs, which are harmful to human health.
- To make water fit for domestic, industrial, and commercial uses.

Flow Chart Of Water Treatment Process



Water Treatment Process: Initial Stages

1. Raw Water Collection:

Water is collected from sources like rainwater, groundwater, lakes, and rivers.

2. Screening:

Floating objects such as leaves, branches, fish, and weeds are removed using bar or mechanical screening.

3. Aeration:

Water is exposed to atmospheric air to dissolve oxygen, eliminate gases, odors, and tastes, and precipitate metals like

iron and manganese. This is done using cascade and spray aerators.

4. Sedimentation:

Suspended particles with higher specific gravity than water are removed by letting water stand still for 2-3 hours.

Water Treatment Process: Major Clean-Up Stages

5. Coagulation:

A coagulating agent (e.g., aluminum sulfate or ferrous sulfate) is added to remove colloidal impurities by forming flocs.

6. Flocculation:

Colloidal particles are gathered into larger, heavier particles (flocs) for easy removal through sedimentation or flotation.

7. Filtration:

Water is passed through a granular material bed, such as gravity sand filters, to produce potable water.

8. Water Softening:

Impurities like calcium and magnesium are removed through methods such as the lime soda process, zeolite process, or ion exchange process, making water suitable for domestic and industrial use.

9. Disinfection:

Disease-causing germs are eliminated by chlorination, using chlorine gas, bleaching powder, or chloramines. This process also prevents algae growth that could clog filters.

10. Distribution of Water:

Treated water is supplied continuously to consumers through water distribution systems.

Standard for Safe Drinking Water

The **Bureau of Indian Standards (BIS)**, as per **IS 10500:1991**, has set quality standards for drinking water in India to ensure it is safe for consumption.

BIS Standards for Drinking Water Quality:

The standards include two limits:

- **Acceptable Limits:** The ideal levels for water quality.
- **Permissible Limits:** The maximum levels allowed in the absence of an alternate source.

If any parameter exceeds these limits, the water is considered **unfit for human consumption**.

BIS Standards for Drinking Water Quality (IS 10500:1991)

Parameter	Acceptable Limit	Permissible Limit
pH value	6.5 - 8.5	No relaxation
Turbidity (NTU)	1	5
Total Dissolved Solids (TDS, mg/l)	500	2000
Total Hardness as CaCO₃ (mg/l, Max)	200	600
E. coli presence/absence	Shall not be detectable in any 100ml sample	Shall not be detectable in any 100ml sample
Total Iron as Fe (mg/l, Max)	0.3	No relaxation
Fluoride (mg/l)	1	1.50

Parameter	Acceptable Limit	Permissible Limit
Residual Chlorine (mg/l)	0.20	1
Chloride (mg/l)	250	1000
Taste	Agreeable	Agreeable
Odour	Agreeable	Agreeable

Sources Of Water

Surface water: Water on the surface of the planet such as in a river, lake, wetland, or ocean.

Ground water: Water present beneath Earth's surface in soil pore spaces and in the fractures of rocks open well, tube well, bore well.

Sources of Water Pollution

1. Domestic Waste:

Residential waste, including disposable materials, food waste, detergents, soap water, and flushes from sinks and bathrooms, contains pathogens and disease-causing microbes, making it harmful.

2. Industrial Waste:

Waste produced by industries during manufacturing processes, often containing toxic chemicals and pollutants that can severely impact water quality.

3. Accidental Oil Leakage:

Oil spills from ships in the sea harm marine wildlife, such as fish

and birds, because oil does not dissolve in water, causing long-lasting environmental damage.

4. **Marine Dumping:**

Garbage such as plastic, paper, aluminum, food, glass, and rubber is dumped into the sea. These items take a long time to decompose (from weeks to hundreds of years), contributing significantly to water pollution.

5. **Agriculture:**

Chemicals used in farming, such as fertilizers, pesticides, fungicides, herbicides, and insecticides, run off with water and pollute nearby water bodies.

6. **Radioactive Waste:**

Waste from power plants and uranium mining can pollute water sources and the environment for thousands of years, causing long-term damage.

Effects of Water Pollution

on the Environment

- Water pollution harms **biodiversity** and **aquatic ecosystems** by disrupting the natural balance.
- **Thermal pollution**, which involves the rise in water temperature, contributes to **global warming**.
- The primary issue caused by water pollution is the **death** of aquatic life, including **fish, crabs, birds, seagulls, dolphins**, and many other animals that depend on these water bodies.

On Human Health

- Water pollution has severe negative effects on public health.
- Diseases such as **diarrhea, cholera, typhoid, dysentery**, and **skin infections** result from drinking or being in contact with contaminated water.

- In areas with no access to clean drinking water, people face a high risk of **dehydration**.

Prevention of Water Pollution

1. Wastewater Treatment:

Wastewater treatment involves removing pollutants from wastewater through physical, chemical, or biological processes.

2. Green Agriculture:

Agriculture should adopt climate-friendly crops, efficient irrigation practices to reduce water usage, and energy-efficient food production methods to minimize water pollution.

3. Air Pollution Prevention:

Human-induced CO₂ emissions, absorbed by oceans, cause acidification, threatening marine life and corals. Reducing air pollution helps prevent further water contamination.

4. Plastic Waste Reduction:

Since 80% of ocean plastic comes from land sources, reducing global plastic use and improving plastic waste management are essential to reduce plastic pollution in oceans.

Water Conservation

Rapid population growth and increasing water consumption for agriculture, industry, and domestic purposes have strained the world's freshwater resources, making water conservation urgent.

1. Domestic Conservation:

- Ensure taps at home are leak-free.
- Use wastewater for flushing toilets.
- Keep the overflow valve in the overhead tank in check.

- Use sprinkler irrigation in gardens to minimize water wastage.

2. Industrial Conservation:

- Install wastewater treatment plants in factories.
- Reuse cooling water for gardening or irrigation.
- Develop new techniques that require less water.

3. Agricultural Conservation:

- Use improved irrigation methods such as drip and sprinkler irrigation.
- Reduce water losses from canals.
- Construct water conservation structures like check dams, khet talawadi, pala, and gully plugging to retain water.

44: Wastewater

Generation of wastewater

Wastewater refers to the liquid waste produced by domestic and industrial activities.

Pollution of Water Bodies

Water can be contaminated by various substances, including:

- Pathogenic microorganisms
- Organic waste
- Toxic chemicals
- Sediments
- Oil and grease
- Solid waste

This polluted water is known as wastewater or sewage.

Generation of Wastewater

Types of Sewage

- 1. Domestic Sewage**
- 2. Industrial Sewage**
- 3. Sanitary Sewage**
- 4. Storm Sewage**

Types of Sewage:

1. Domestic sewage

- It carries used water from houses and apartments. It is the primary source of pathogens (disease causing microorganisms)
- A lot of diseases result from being in contact with sewage water, such as diarrhea, cholera, typhoid, dysentery or skin infections.
- Domestic sewage contains excess of nitrates and phosphates which promote the growth of algae.

2. Industrial sewage

- It is the used water from various processes in the industries.
- Industrial waste include dirt and gravel, masonry and concrete, scrap metal, oil, solvents, chemicals, scrap lumber, even vegetable matter from restaurants etc.
- The biomedical waste and e - waste when enters in waste water its effects becomes more dangerous.

3. Sanitary sewage:

Sanitary sewage includes liquidwaste from domestic and Industrial places. This sewage is extremely foul and requires to be disposed off very carefully.

4. Storm sewage:

The surface runoff developed during and immediately after rainfall over the connected area which is collected in the form of sewage is called as storm sewage.

Impacts of waste water

Impacts of waste water on the environment

- Creates nuisance- Bad smell.
- Pollutes water resources.
- Air pollution.
- Land / soil pollution.

The most immediate effect of wastewater on the environment is destruction of natural habitats of aquatic wildlife like fishes, crabs, birds, tortoise etc. due to exposure to harmful Chemicals

Impacts of waste water on Human Health

- Pathogens in waste water spreads water-borne diseases like Typhoid,
- Cholera, Paratyphoid Fever, Dysentery, Jaundice and Amoebiasis.
- Chemicals in the water also have negative effects on our health. Pesticides can damage the nervous system and cause cancer.

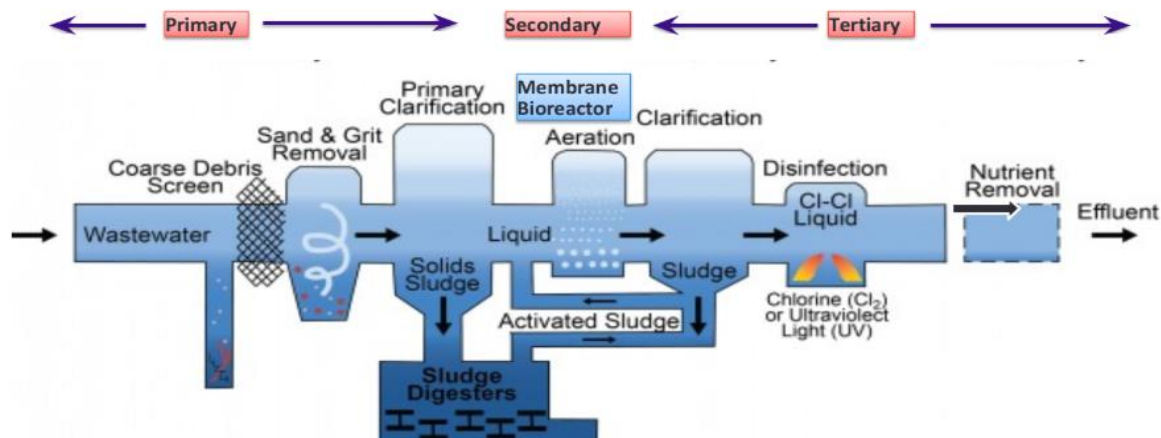
Sewage Treatment Process

- Sewage treatment is the process of removing pollutants from both domestic and industrial waste water.
- The objective of sewage treatment is to produce a safe disposable effluent without polluting the surrounding environment.

Steps in Sewage Treatment

1. Primary Treatment
2. Secondary Treatment
3. Tertiary Treatment

Flow chart of Sewage Treatment Process



<https://www.google.com/url?sa=i&url=http%3A%2F%2Fcass.umich.edu%2Ffactsheets%2Fus-wastewater-treatment>

CPCB Norms of sewage discharge

Central Pollution Control Board (CPCB) have issued the following standards for treated sewage discharge in accordance with provision of section 17(1)(g) of the Water (Prevention and Control of Pollution) Act, 1974.

No	Substance / characteristics	Spec. mg/l (max)	Amount in the effluent before treatment (mg/l)	Amount after treatment (mg/l)
1.	Total dissolved solids (TDS)	2100	729±3	798±8*
2.	BOD – 3 days at 27 ⁰ C	30	51±1	17±1
3.	Free ammonia	5	229±2	109±2
4.	Sulphides as S	2.0	4.56±0.14	0.82±0.04
5.	Cyanides as CN	0.2	0.68±0.02	NIL
6.	Dissolved Phosphates (PO ₄)	5.0	5.6±0.05	1.81±0.03
7.	Phenols as C ₆ H ₅ OH	1.0	3.41±0.09	0.40±0.02

4.5 Air Pollution

Definition:

Presence or addition of harmful substances to the air which causes negative impacts to the health of living organisms is

called as Air Pollution .

Causes of Air Pollution:

Natural – Volcanic eruptions, Natural fires, Pollens, Dust etc.

Manmade- Automobiles, Industries, Incineration, farming etc.

Types of Air Pollutants:

1. Primary Pollutants (Released directly in air)

Ex: ash, salts, pollen, spores, smoke, dust etc

2. Secondary Pollutants (Formed by chemical reaction between air and primary pollutants)

Ex: smog, acid rain, ozone etc.

Causes of Air Pollution



Primary Pollutants (Released directly in air)

Natural Sources



Pollens



Volcanoes



Dust



Bacteria & Viruses



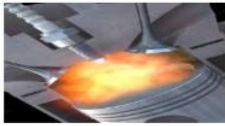
Fire

Causes of Air Pollution

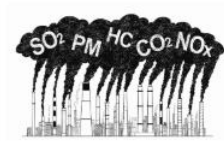


Primary Pollutants (Released directly in air)

Man made Sources



Combustion Processes



Chemical Processes



Nuclear or Atomic Processes



Mining Processes



Oil Refinery Processes



Farming Activities

Causes of Air Pollution

Secondary Pollutants

(Formed by chemical reaction between air and primary pollutants)

1) **Acid Rain**: The primary pollutants released from chemical industries like CO_2 , SO_2 , NO_2 , Cl_2 reacts with atmospheric moisture to form acids resulting in acid rain.

2) **Photochemical Smog**: The primary pollutants like NO and Hydrocarbons released from automobiles or on burning fossil fuels reacts with each other in presence of Sunlight and ozone Forming a toxic brown haze called as photochemical smog.

Among the photochemical products the most potent pollutants are:

1. Benzpyrene
2. peroxyacetyl nitrate (PAN)
3. peroxybenzoil nitrate (PB2N)

Effects of air pollution

- Air pollution occurs when harmful or excessive quantities of substances are introduced into Earth's atmosphere
- Air pollution not only causes hazardous health effects on humans, plants and animals but also contributes to climate change.

Effects of Air Pollution on Human Health

Air pollution impacts our physical and psychological well-being, affecting various organs and bodily functions. The consequences include:

- Respiratory diseases
- Cardiovascular damage
- Fatigue, headaches, and anxiety
- Irritation of the eyes, nose, and throat
- Damage to reproductive organs
- Harm to the liver, spleen, and blood
- Nervous system damage

Effects of Air Pollution on Vegetation

Air pollution negatively affects plants, either directly through toxic exposure or indirectly by altering soil pH. Pollutants can also coat leaf surfaces, reducing light penetration and hindering photosynthesis.

Specific Effects of Pollutants:

1. **Necrosis:** Damage to leaves caused by increased ozone levels.
2. **Abscission:** Premature leaf fall due to elevated nitrogen dioxide (NO₂).
3. **Chlorosis:** Yellowing of leaves resulting from higher sulfur dioxide (SO₂) levels.

On Animals

- Air pollutants disrupt endocrine functions, cause organ injury, and increase vulnerability to stress and diseases.
- They lower reproductive success and can result in death.
- Feeding pets fodder containing insecticide and pesticide residues severely affects their digestive system.

On Materials

- Major pollutants: sulfur dioxide, sulfates, nitrogen oxides, nitrates, chlorides, carbon dioxide, and ozone.
- Sensitive materials: calcareous building stones and metallic structures.
- Damages include:
 - Loss of mass
 - Changes in porosity
 - Discoloration
 - Corrosion of metals

On Climate

- **Global Warming:**
 - Carbon dioxide traps heat in the atmosphere, causing the greenhouse effect.
- **Acid Rain:**
 - Excess CO₂, SO₂, and NO₂ react with moisture in the air to form acid rain.
- **Ozone Depletion:**
 - Release of CFC gases damages the ozone layer, allowing harmful UV radiation to reach Earth's surface.

Prevention of Air Pollution

Air Pollution: Causes and Control

Since the Industrial Revolution, pollution has reached almost every corner of the Earth. To lead healthier lives, it is crucial to reduce air pollution, as everyone has a role in creating a healthier environment.

Ways to Control Air Pollution

1. Control at Source

- Minimize emissions from factories, vehicles, and other sources.

2. Particulate Pollution Control

- Use filters, scrubbers, and electrostatic precipitators to trap particles in the air.

3. Gaseous Pollution Control

- Employ techniques like absorption, adsorption, and combustion to reduce harmful gases.

1. Controlling Air Pollution at Source

- **Source Relocation:** Move industrial areas away from residential zones.
- **Source Shutdown:** Ban sources causing hazardous pollution.
- **Fuel or Energy Substitution:** Use eco-friendly fuels like CNG, biofuels, and biogas.
- **Good Operating Practices:**
 - Ensure proper maintenance.
 - Maintain controlled driving speeds to reduce emissions.
- **Vehicular Emission Control:**
 - Conduct regular PUC (Pollution Under Control) checks.
 - Use high-quality fuel with oil additives to lower emissions

2. Controlling Particulate Pollution

Particulate matter consists of solid and liquid particles suspended in air, such as dust, pollen, soot, smoke, and liquid droplets. These can be hazardous to health and the environment.

Methods to Control Particulate Matter

1. Settling Chambers:

- Use gravity to settle heavier particles at the bottom.

2. Inertial Separators or Cyclones:

- Use centrifugal force to separate particles from the air.

3. Electrostatic Precipitators:

- Use electric charges to capture and remove particles.

4. Bag Houses and Filters:

- Trap particles using fabric or other filtering materials.

5. Wet Scrubbers:

- Use water or other liquids to capture and wash away particles.

3. Controlling Gaseous Pollution

Gaseous pollutants are managed using three primary techniques:

1. Absorption:

- Pollutants are dissolved and concentrated in a liquid.

2. Adsorption:

- Pollutants adhere to the surface of a solid material.

3. Combustion:

- Pollutants are directly incinerated to break them down.

Ambient Air Quality Standards

The **Air (Prevention and Control of Pollution) Act, 1981** was established by the Central Government to prevent the deterioration of air quality.

Functions of the Central Pollution Control Board (CPCB):

1. Advisory Role:

- Advises the Central Government on air quality improvement and pollution prevention, control, and abatement.

2. Nationwide Programs:

- Plans and oversees the execution of programs for air pollution prevention and control across the country.

3. Support to State Boards:

- Provides technical assistance and guidance to State Pollution Control Boards.

4. Research and Investigation:

- Conducts and sponsors research on air pollution prevention and control.

5. Data Collection and Publication:

- Collects, compiles, and publishes technical and statistical data on air pollution.

6. Setting Air Quality Standards:

- Establishes and revises standards for ambient air quality.

Ambient Air Quality Standards in India

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO ₂), µg/m ³	Annual* 24 hours**	50 - 80	20 - 80
Nitrogen Dioxide (NO ₂), µg/m ³	Annual* 24 hours**	40 - 80	30 - 80
Particulate Matter (size less than 10 µm) or PM ₁₀ µg/m ³	Annual* 24 hours**	60 - 100	60 - 100
Particulate Matter (size less than 2.5 µm) or PM _{2.5} µg/m ³	Annual* 24 hours**	40 - 60	40 - 60
Ozone (O ₃) µg/m ³	8 hours* 1 hour**	100 - 80	100 - 180
Lead (Pb) µg/m ³	Annual* 24 hours**	0.50 - 1.0	0.50 - 1.0
Carbon Monoxide (CO) mg/m ³	8 hours* 1 hour**	02 - 04	02 - 04
Ammonia (NH ₃) µg/m ³	Annual* 24 hours**	100 - 400	100 - 400
Benzene (C ₆ H ₆) µg/m ³	Annual*	5	5
Benzo(a)Pyrene (BaP)- particulate phase only, ng/m ³	Annual*	1	1
Arsenic(As), ng/m ³	Annual*	6	60
Nickel (Ni), ng/m ³	Annual*	20	20

* Source: National Ambient Air Quality Standards, Central Pollution Control Board Notification in the Gazette of India, Extraordinary, New Delhi, 18th November, 2009
[http://www.arthapedia.in/index.php?title=Ambient_Air_Quality_Standards_in_India#:~:text=National%20Ambient%20Air%20Quality%20Standards,of%20Pollution\)%20Act%2C%201981](http://www.arthapedia.in/index.php?title=Ambient_Air_Quality_Standards_in_India#:~:text=National%20Ambient%20Air%20Quality%20Standards,of%20Pollution)%20Act%2C%201981)



4.6 Noise Pollution

Definition:

- Unpleasant and unwanted sound that disturbs human and animal life.
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Sources of Noise Pollution:**1. Industrial Sources:**

- Caused by industries such as textile mills, printing presses, and metal works.
- Common in cities like Kolkata, Ludhiana, and Kanpur where residential and industrial areas are not well separated.
- Modern planned cities like Chandigarh use green belts to reduce this issue.

2. Transport Vehicles:

- Urban centers face heavy noise from vehicles, horns, and air traffic.
- Cities like Delhi and Mumbai suffer from traffic jams and airport noises.

3. Household Sources:

- Noises from household appliances like record players, air conditioners, and mixers.

4. Public Address Systems:

- Loudspeakers used in public events and rallies.

5. Agriculture and Defense:

- Noise from machinery and weapons used in farming and defense activities.

6. Miscellaneous:

- Repair shops, construction, and demolition activities.
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Effects of Noise Pollution:**1. Physical Effects:**

- Temporary or permanent hearing loss.
- Headaches, high blood pressure, and fatigue.

2. Psychological Effects:

- Stress, sleep disturbances, and decreased productivity.

3. Other Effects:

- Discomfort to animals and harm to the environment.

Prevention of Noise Pollution:

1. Turn off noisy appliances when not in use.
2. Use earplugs to reduce exposure.
3. Plan urban areas with green belts.
4. Enforce strict noise level regulations

4.6.3 Prevention of Noise Pollution

- Turn off Appliances at Home and offices.
- Shut the Door when using noisy Machines.
- Use Earplugs.
- Lower the volume.
- Stay away from Noisy area.
- Follow the Limits of Noise level.
- Control Noise level near sensitive areas.
- Go Green by planning trees.

4.6.4 Noise Levels at Various Zones of City

Sr.No	Type of Area	Environmental Noise Standards (Leq) in d B (A).	
		Day time	Night time
1	Industrial area	75	65
2	Commercial area	65	55
3	Residential area	55	45
4	Silence zone	50	40

Level (in db)	Effects
up to 23	No disturbance
30-60	Stress, tension, psychological (illness, heart attack) effects especially at upper range.
60-90	Damage to health, psychological and vegetative (disturbance in stomach-gall function, pains in muscles, high blood pressure, disturbance in sleeping)
60-120	Damages to health and ontological (ear diseases) effects
Above 120	Painful effects in long run.

Table 4.6.1 : Noise pollution level and its harmful effects

4.7 Municipal Solid Waste, Bio-Medical Waste & E-Waste

4.7.1 Solid Waste Characteristics

1. Physical and Chemical Composition:

- **Physical Characteristics:**
 - Density/Specific weight
 - Color, Moisture content
 - Particle size, Void percentage
 - Shape and size distribution
 - Optical properties, Magnetic properties
 - Field capacity, Porosity, Electrical conductivity
- **Chemical Characteristics:**
 - Proximate analysis
 - Fusing point of ash
 - Ultimate analysis, Energy content

2. Field Determination:

- Solid wastes are heterogeneous.
- Sampling involves reducing waste to 100 kg and conducting further tests.

4.7.2 Solid Waste Management

- **Definition:** Systematic approach to collecting, treating, and disposing of discarded solid material.
- **Impacts of Improper Management:**
 - Unsanitary conditions
 - Environmental pollution
 - Outbreak of diseases

Treatment Methods

1. **Incineration:**
 - Combustion of organic substances.
 - Converts waste into ash, gas, and heat.
 - Can generate power.
 2. **Refuse-Derived Fuel (RDF):**
 - Processing combustible waste into energy-efficient fuel.
 3. **Sanitary Landfills:**
 - Isolate waste from the environment through systematic burial and layering.
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4.7.3 Bio-Medical Waste

1. **Definition:**
 - Waste generated during diagnosis, treatment, or immunization of humans or animals.
 - Includes sharp objects, gloves, body parts, and infected equipment.
 2. **Management Guidelines:**
 - **Segregation & Color Coding:**
 - **Red Bag:** Syringes, IV sets, etc.
 - **Yellow Bag:** Dressings, body fluids, and anatomical waste.
 - **White Puncture-Proof Containers:** Needles, blades, etc.
 - **Black Bags:** Non-infectious general waste.
 - **Blue Marked Cardboard:** Glass materials, ampules.
 3. **Disposal Methods:**
 - **Autoclaving:** Steam-based sterilization.
 - **Incineration:** High-temperature combustion.
 - **Chemical Disinfection:** Treats liquid infectious waste.
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4.7.4 E-Waste

1. **Sources:**
 - Discarded electronic devices: TVs, refrigerators, computers, etc.
2. **Environmental Hazards:**
 - **Components:**
 - CRT tubes, PCBs, chips, plastics, etc.
 - **Hazards:**
 - Lead, mercury, cadmium, and other toxic materials.
 - Air and water pollution during disposal.
3. **Statistics:**
 - India contributes 70% of the total e-waste globally.
 - Growth rate: 10% annually.

Recycling of E-waste

- **E-waste:** Contains valuable metals like gold, silver, platinum, etc.
- **Recycling Methods:**
 1. **Conventional:** Mechanical shredding and separation for extracting precious metals.
 2. **Alternative:** Use of acid-free systems for recycling printed circuit boards.
- **Benefits:**
 - Prevents health hazards and environmental damage.
 - Promotes reuse, refurbishing, and sustainability.

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