

MODULE 2

ENVIRONMENTAL POLLUTION

AIR POLLUTION

‘Air pollution is the presence of foreign matter in the ambient atmosphere ,generally resulting from the activity of man, in sufficient concentration, present for a sufficient time and under circumstances which interfere significantly with the comfort, health or welfare of person or with the full use or enjoyment of property’.

There are several types of pollution and each of them has serious implication on our health as well as for our whole environment.

Types of Air Pollution

1. Natural and anthropogenic (manmade)

Some of the natural sources include:

- a. Volcanoes: Volcanic activity produces smoke, ash, CO₂, SO₂ etc
- b. Dust: Wind carries dust from areas with little or no vegetation such as desert areas
- c. Forest Fires: Releases smoke, ash, dust, CO₂, nitrogen oxides etc
- d. Wetlands: Microbial action in wetlands result in the formation of methane gas which will then release to the atmosphere

Some of the anthropogenic sources include:

- a. Stationary point sources: Single identifiable source of air pollutant emissions
eg: combustion furnace flue gas chimney
- b. Mobile sources: Exhaust emissions from vehicles
- c. Evaporative sources: Some volatile liquids evaporate and release vapours when not enclosed.

eg: paints ,solvents, perfumes etc

2. Outdoor and indoor

Outdoor air pollution is mainly due to automobile exhaust and industrial emissions.

The major outdoor air pollutants are nitrogen oxides, oxides of sulphur, ground level ozone, particulate matter, carbon monoxide and lead vapour

Indoor air pollution is mainly due to indoor activities such as cooking, painting etc

3. Primary and secondary

Primary air pollution is due to primary air pollutants, substances that are emitted directly into the atmosphere (CO, CO₂, SO₂, H₂S etc) and exist in the same form as in source emissions.

Secondary air pollution is due to secondary air pollutants, substances that are formed in the atmosphere by the interaction of two or more primary air pollutants or by the reaction of a primary air pollutant with other elements in the atmosphere with or without the presence of sunlight.

Examples: ozone, PAN(peroxy acetyl nitrate) etc.

4. Air pollution by hazardous air pollutants

Hazardous air pollutants are toxic pollutants that can cause serious health effects such as cancer, birth defects etc. Examples: heavy metals, asbestos, formaldehyde, vinyl chloride.

5. Particulate matter pollution and gaseous air pollution

Particulate matter (PM) consists of materials like dust, smoke etc. Size is very important to the behavior of PM in human body. Particles larger than 10micrometre are trapped in the nose. Particles between 5 micrometre and 10 micrometre are removed in the throat. Particles smaller than 5 micrometre reach the bronchial tubes, while particles 2.5 micrometre in diameter or smaller may reach into the deepest portions of the lungs, which is very dangerous.

Gaseous pollutants include CO, SO₂, oxides of the nitrogen, ground level ozone. Each of them may cause harm to human health and environment.

6. Air pollution by volatile organic compounds

These are organic compounds which easily evaporate at room temperature and enter the atmosphere. eg: acetone, benzene, toluene etc.

Effects of Air Pollution

Effects on human health

The effects of air pollution on human health mainly occur as a result of contact between the pollutants and the body. The effect depends on the concentration of contaminant present, time of exposure to the contaminant etc.

Some common health effects :

1. Eye irritation
2. Nose and throat irritation
3. High mortality and morbidity rate
4. Chronic pulmonary diseases like bronchitis and asthma
5. CO reacts with haemoglobin in blood and thus reduces the oxygen carrying capacity of the blood
6. Causes cancer

Effects on plants and animals

Some of the common effects on plants and animals:

1. Suppressed growth and premature ageing in plants
2. Leaf bleaching (Reduced efficiency of photosynthesis)
3. Acid deposition can damage aquatic life
4. Respiratory problems in animals
5. Migration of seasonal birds may hamper

Effects on environment and property

Some of the common effects on environment and property:

- Reduces visibility due to smog formation (smoke + fog)
- Acid deposition can corrode metals, eat away stone on statues and monuments
- Discolour buildings, cloths.

Specific Air Pollutants and their effects

Pollutants	Effects
SO ₂	Affects mucous membrane
CO	Carboxy- haemoglobin formation
Oxides of Nitrogen	Eye and nose irritation, pulmonary discomfort
H ₂ S and mercaptans	Odorous
Ozone	Irritation in respiratory tract
Fluorides	Cumulative poison
Lead	Gastro intestinal damage,liver and kidney damage etc.
Hydrocarbon vapours	Eye and respiratory irritation

Control Measures to Reduce Air Pollution

1. Afforestation programmes

2. Periodic air quality monitoring
3. Reduced use of fossil fuels
4. Promotion of renewable energy sources
5. Involve public in air quality management activities
6. Adoption of stringent pollution control measures
7. Incorporate control measures

WATER POLLUTION

Water pollution is defined as an undesirable change in physical, chemical or biological characteristics of water that will be or may be harmful to human and other life, industrial process, living conditions and cultural assets or cause wastage of our raw material resources.

Sources of Water Pollution

1. Point Source – sources which can be identified at a single location.

Eg industrial discharge, municipal sewage, combined sewerage

2. Non Point or Diffused Sources – They are diffused across a broad area and their contamination cannot be traced to a single discharge point.

Eg : runoff from agricultural lands, mining area etc.

3. Natural Sources of Water Pollution

- Rain water
- Atmosphere
- Surrounding Vegetation
- Underground rocks and volcanoes

- Natural runoff
- 4. Anthropogenic Sources –They include oil spills, atmospheric deposition, marine dumping, radioactive waste, global warming and eutrophication.
- Among these the most important are
 - Domestic Wastewater
 - Agricultural Runoff
 - Industrial Effluent

1. What are the sources of water pollution? Explain

The sources of water pollution are classified into two types: point source pollution and nonpoint source pollution. Point source pollution is discharged into the environment through pipes, sewers or ditches from specific sites such as factories or sewage treatment plants. Non-point source pollution is caused by pollutants that enter bodies of water over large areas. Such sources include contaminants that enter the water supply from soil/ground water systems and from the atmosphere via rain water. Soil erosion is a major source of nonpoint source pollution.

Point source discharges take on a variety of forms, but all are traceable to an identifiable end-of-pipe discharges. For municipal and industrial activities contributing to point source discharges, the polluted water is collected the sewer system and treated in a centralized waste water treatment plant (WWTP). This provide the advantage of economies of scale and reduces the regulatory effort required to monitor and permit the discharge. Industrial wastes undergo some level of pre-treatment at the facility that generate the waste. Ground water contamination remedial activities have adopted the pre-treatment strategy. In some cases the ground water is pumped to the surface, treated to reduce the concentrations of contaminants, and then discharge to sewer. One problem associated with this has been requirement to treat the groundwater to make it drinking water quality.

Non-point source discharge are much more difficult to identify and, consequently, to regulate and control. For example, non-point water pollution occurs when rain washes the pesticides or fertilizers from cropland into the surface water. Non-point source discharge control strategies

required improved management practices to reduce the potential for pollution from occurring. Over fertilization, improper pesticides application and residue disposal, employing sat as a road deicer all contribute to non-point source pollution, but could be controlled by better management practices

The specific contaminants leading to pollution in water include a wide spectrum of chemicals, pathogens, and physical changes such as elevated temperature and discoloration. While many of the chemicals and substances that are regulated may be naturally occurring (calcium, sodium, iron, manganese, etc.) the concentration is often the key in determining what is a natural component of water and what is a contaminant. High concentrations of naturally occurring substances can have negative impacts on aquatic flora and fauna.

Oxygen-depleting substances may be natural materials such as plant renatural and anthropogenic substances may cause turbidity (cloudiness) which blocks light and disrupts plant growth, and clogs the gills of some fish species.

Many of the chemical substances are toxic. Pathogens can produce waterborne diseases in either human or animal hosts. Alteration of water's physical chemistry includes acidity (change in pH), electrical conductivity, temperature, and eutrophication. Eutrophication is an increase in the concentration of chemical nutrients in an ecosystem to an extent that increases the primary productivity of the ecosystem. Depending on the degree of eutrophication, subsequent negative environmental effects such as anoxia (oxygen depletion) and severe reductions in water quality may occur, affecting fish and other animal populations.

- Resident fish species find it difficult to feed as they mostly rely on sight (although migratory fish may pass through un affected)
- Solids which settle on the bottom alter or destroy the vegetation on the river bed with corresponding changes in the animal community.
- Deposition of suspended solids can seriously damage spawning sites where fish bury their eggs, as the eggs are unable to breath because the small gaps in the river bed become blocked.

2. Differentiate between point and nonpoint sources of water pollution.

Point sources

Point source pollution refers to the pollution which occurs due to a single identifiable source. This type of pollution remains localized to the point of pollution. Hence, it is easy to identify the source and take actions to prevent pollution. Point source pollution is concentrated near the place of origin. It can be small scale to large scale.

Some examples of point source pollution include sewage pipes releasing sewage into water ways, chimneys of factories, oil spills, pipes leaking chemicals to rivers, etc. This type of pollution can happen accidentally or as a result of deliberate actions. Since the source is single and identifiable, small community actions are enough to prevent point source pollution.

Point Source of Water Pollution:

1. It is pollution caused by discharge of effluents at one point.
2. Due to large scale entry of pollutants at one point, the contamination and harmful effect on quality of water is maximum.
3. Treatment plant can be installed in the area of flow of effluents.
4. Other type of control measures are not required

Non-point sources

Nonpoint source pollution refers to a pollution where the source of the pollution cannot be traced back to a single source. This type of pollution is widely diffused and diluted. The pollution is not concentrated into a particular location or area. Hence, it is difficult to identify the origin and take seepage, atmospheric deposition, hydrologic modification, etc. The result of the nonpoint source pollution can be seen in water bodies, earth, sea, etc.

Non-point Source of Water Pollution:

1. It is pollution caused by discharge of pollutants over a wide area.
2. There is some dilution of the effect of pollutants due to large size of area.

3. Treatment plant is useless for this type of pollution.
4. Control measures are required on a large scale for non-liberation of pollutants

Commonly found Water Pollutants

1. Inorganic salts

causes hardness

Iron causes spots and stains in cloths

leads to Eutrophication

2. Acids/ Alkalis

pH change

Corrosion

Below 5 aquatic life disappears

Water treatment plant efficiency

3. Organic Matter

4. Suspended Solids

5. Floating Matter

6. Thermal Discharges

Stratification

DO reduction due to microbial activity

7. Colouring Materials - Sunlight transmission
8. Toxic Chemicals - Aquatic life
9. Micro organisms

Pathogenic

Degradation of organic matter

10. Radioactive materials
11. Foam producing matter

MODULE 2

ENVIRONMENTAL LEGISLATIONS IN INDIA

Laws that regulate the human interaction with environment are termed as Environmental laws. The environmental conservation is not a new concept to India, rather it is an inseparable part of Indian heritage and culture (Indians worship Panchabhootas – Earth, Water, Air, Fire, Space). Realizing the importance of environment, our country has made the following provisions in our Constitution.

1. Article 21 – Protection of life and personal liberty
2. Article 48 A – Protection and improvement of environment and safeguarding of forests and wildlife
3. Article 51 A – Fundamental duties of every citizen of India – To Protect and improve the natural environment including forests, rivers, lakes and wildlife

The following are the major environment legislations of India.

1. Water (Prevention & Control of Pollution) Act 1974
2. Air (Prevention & Control of Pollution) Act 1981
3. Environment Protection Act 1986 (May 1986)
4. Environment Protection Rules 1986 (Nov 1986)

WATER (PREVENTION AND CONTROL OF POLLUTION) ACT OF 1974

This is an act to provide measures for the prevention and control of water pollution and maintaining or restoring the wholesomeness of water. The act prohibits the disposal of any poisonous, noxious or polluting matter or any matter causing obstruction to proper flow of water in a stream. Some of the salient features of Water act are listed below:

- a. Establishment of pollution control board at Central (Central Pollution Control Board) and State level (State Pollution Control Board)
- b. Mandates prior approval of Pollution Control Board for operating, establishing and expanding industrial activities leading to discharge of industrial effluents
- c. Empowers Pollution Control Board to enter and inspect plant, factory etc

- d. Empowers Pollution Control Board to take samples of industrial effluents and do subsequent analysis
- e. Advise the Central/State Government on any matter concerning the prevention, control or abatement of water pollution.

AIR (PREVENTION AND CONTROL OF POLLUTION) ACT -1981

The Act was passed under the article 253 of the constitution of India which provide measures for the prevention, control and abatement of air pollution. Air pollution is defined as the presence of any liquid or gaseous substances in the atmosphere in such concentration as may be or tend to be injurious to human being or other living creatures or plants or property or environment.

Some of the salient features of Air act are listed below:-

- a. Empowers Pollution Control Board to take appropriate measures for the prevention, control and abatement of air pollution.
- b. Mandates prior approval of Pollution Control Board for operating, establishing and expanding industrial activities that lead to discharge of air pollutants to the atmosphere
- c. Empowers Pollution Control Board to enter and inspect plant, factory etc
- d. Empowers Pollution Control Board to take samples of ambient air, emissions and do subsequent analysis
- e. Advise the Central/State Government on any matter concerning the prevention, control or abatement of air pollution.

CARBON CREDIT

A carbon credit (often called a carbon offset) is a financial instrument or permit representing the right to emit one tonne of CO₂ (carbon dioxide) or CO₂ e (carbon dioxide equivalent gases) into the atmosphere. It represents the amount of GHG s removed or reduced from the atmosphere from an emission reduction project. This carbon credit can be used by governments, industry or private individuals to offset damaging carbon emissions that they are generating. Thus carbon credits are used as a permit to emit certain amount of CO₂ into the atmosphere. So, in a nutshell, carbon credit (often called carbon offset) is a credit for greenhouse emissions reduced or removed from the atmosphere from an emission reduction project, which can be used, by governments, industry or private individuals to compensate for

the emissions they are generating. One carbon credit corresponds to one tonne of CO₂. Carbon credits are acquired through :-

- Project based transactions--- credits are acquired as a result of successful implementation of carbon reduction projects. For eg:- If a private organization has successfully implemented afforestation project and if it is found to have reduced carbon dioxide from the atmosphere, then that private company can acquire carbon credits equivalent to their reduction levels.
- Allowance based transactions ---Regulatory authority issues allowances or permits to industries. If one carbon credit is issued to an industry, it means that they can emit one tonne of carbon dioxide or equivalent.

CARBON TRADING:

It refers to buying and selling of carbon credits that have been either distributed by a regulatory authority or generated by GHG emissions reduction projects. In cap & trade mechanism, a regulatory authority limits (cap) the amount of GHG to be released over a period of time.

Carbon credits are typically measured in tonnes of CO₂-equivalents (or CO₂e) and are bought and sold through number of international brokers, online retailers and trading platforms. Businesses that find it hard to comply with the carbon emissions, purchase carbon credits to offset their emissions by making finance readily available to renewable energy projects, forest protection and reforestation projects around the world. These renewable energy and energy efficiency projects replace fossil fuel and industrial processes. This all helps businesses in mitigating their emissions and comply with the global standards.

Offsetting one tonne of carbon means there will be one less tonne of carbon dioxide in the atmosphere than there would otherwise have been. For e.g.: when solar energy companies sell carbon offsets, this helps them as these projects become more viable. The buyers of the credits benefit as they can use these credits to overcome their greenhouse gas emissions. Many types of activities can generate carbon offsets. Projects which acquire carbon credits include wind, solar, geothermal, biomass projects which replace fossil fuel powered plants, low cost household device projects that can eliminate need for extra energy, methane capture from landfill gas and agriculture, different afforestation projects, forest protection from illegal logging, destruction of heat trapping greenhouse gases from the atmosphere and many more.

CARBON TAX

A carbon dioxide tax is a tax on businesses and industries that produce carbon dioxide through their operations. The tax is designed to reduce the output of greenhouse gases and carbon dioxide. The tax is imposed with the goal of environmental protection.

CARBON FOOTPRINT

It is a measure of the total amount of carbon dioxide emissions that is directly and indirectly caused by an activity, individual, organization etc. In other words:

When you drive a car, the engine burns fuel which creates a certain amount of CO₂, depending on its fuel consumption and the driving distance.

When you heat your house with oil, gas or coal, then you also generate CO₂.

Even if you use electricity, the generation of the electrical power may also have emitted a certain amount of CO₂ (thermal power plants).

When you buy food and goods, the production of the food and goods also emitted some quantities of CO₂

Your carbon footprint is the sum of all emissions of CO₂ (carbon dioxide), which were induced by your activities in a given time frame. Each of us contributes to the greenhouse gas emissions either by the way we travel, the food we eat, the amount of electricity we consume and many more. Every individual, organization, business unit etc should focus to reduce their carbon footprints.

Primary footprint—direct emission of carbon dioxide as in the case of burning of fossil fuels
Carbon footprint

Secondary footprint --- indirect emissions associated with manufacture of a product

Main Contributors to Carbon Footprint

- Population – more people lead to more carbon emission
- Energy – Here, carbon footprint emissions are collective, coming from a variety of sources, namely industrial processes, transport and electricity and fuel emissions.
- Industrialization – Since the industrial revolution began during the middle of the twentieth century, CO₂ has continued to rise unchecked and at alarming rates.

- Agriculture – Most agricultural processes within developed and developing nations are still being carried out commercially with the result that mass production of livestock has led to large levels of methane gas being released into the atmosphere.



- Human action (and inaction) – Ultimately, the way humankind has become accustomed to doing things every day, keeping pace with the need to do things more quickly and with more convenience, has contributed towards the exponential increase in carbon footprints on an annual basis.

Ways to Reduce Your Carbon Footprint

- Energy efficiency at home – All appliances that are not being used must be switched off immediately. And all electrical outlets not in use must also be switched off.

Hot-water geysers should be switched off for the entire day and only turned on when needed. These are simple, yet practical lifestyle habits which are easy to adopt.

- Buy renewable energy – It is quite possible to power your own home with environmentally sustainable alternatives of energy production without compromising your lifestyle and waiting for national grids to be connected via green energy supply sources. For instance, technology is now available for you to install your own solar power panels.

- Recycle and re-use – Vegetable produce can be converted into compost (or manure) for gardens, even vegetable gardens. Instead of buying more food containers, plastic containers sourced from the supermarket can be refashioned as ideal kitchen utensils.

Also, where plastic waste is no longer required, seek out recycling depots rather than relying on your supplied garbage disposal units.

- Plant a Tree – One of the best way to give it back to the environment is to plant trees. Plants absorb CO₂ and release oxygen that is then used by humans and animals. According to the Urban Forestry Network, a single young tree absorbs 13 pounds of carbon dioxide each year.

- Buy local – Adding to the above remark, buying local, organic produce effectively counters massproduced agricultural outcomes. There is a dramatic reduction in the amount of plastic being used to package products and fuel usage during long road transits is also reduced