

ENVIRONMENTAL STUDIES

UNIT-III

ENVIRONMENTAL POLLUTION

BASIC TERMS&DEFINITIONS:

Environmental pollution	Any undesirable change in the physical, chemical or biological characteristics of any component of the environment.
Pollutant	A substance which is responsible for causing pollution.
Biodegradable pollutants	Substances that can be broken down by microbes.
Biomagnification	Increase in concentration of some stable compounds at successive trophic levels in a food chain
Biological oxygen demand	The amount of oxygen required by the microorganisms to degrade the organic substances present in sewage.
Natural hazards	Hazards that destroy wildlife habitats, property and human settlements
Particulate matter	Solid particles or liquid droplets suspended in air.
Pathogens	The organism that causes disease.
Primary pollutants	Pollutants released directly in to the air.
Secondary pollutants	Pollutants formed by the reaction of two or more primary pollutants in the air.
Toxins	Poisonous chemicals harmful even in small concentrations.
Disaster	A natural event that causes great damage to property, life and human beings.

Introduction: According to ODUM (1971), Pollution is “an undesirable change in the characteristics of air, water and land that harmfully affect the life and also create health hazards for all living organisms on the globe”.

According to SOUTHWICK (1976), Pollution can be defined as “the unfavorable (or) alteration of environment caused by human activities and causing harm to human beings”.

Basically the Pollution is of two types.

(1) Natural Pollution: This type of pollution is limited in its occurrence generally from natural hazards like volcanic eruptions, emissions of natural gas, soil erosion, ultraviolet rays, cosmic rays etc and

(2) Manmade Pollution: Most of the pollution is man made only. However, Pollution is usually categorized as Air Pollution; Water Pollution, Thermal Pollution; Noise Pollution; Land & soil Pollution; Radio Active Pollution and Marine Pollution.

AIR POLLUTION

Air pollution may be described as “the imbalance in quality of air so as to cause adverse effects on the living organisms existing on earth”. Pollution is due to the presence of undesirable substance of sufficient quantity which exists in environment. The substance or energy which causes pollution is called pollutant. Pollutants may be classified according to origin and state of matter.

a) According to Origin: Air pollutants are divided into two categories as primary & secondary.

Primary air pollutants are those which are emitted directly into the atmosphere. Eg: C, CO, CO₂, SO_x, N, S, H, NO_x, CFC's etc .

Secondary air pollutants are those which are produced in the air by the interaction among the primary air pollutants or by reaction with atmospheric constituents.

Eg: Ozone (O₃); Smog; Para Acetyl Nitrate (PAN); Acid Rain; Aerosols.

b) According to State of Matter: Air pollutants include fine solids; liquids and gases. Dust,

Smoke, Fumes etc are examples for solid particles whereas fog is an example for liquid particles. Benzene (C₆H₆), Methane (CH₄), Butane, Aldehydes, Ketones, inorganic gases etc are gaseous air pollutants.

Listed below are the major air pollutants:

S. No	Compound	Pollutants
1	Carbon oxides	Carbon Monoxide (CO); Carbon dioxide
2	Sulphur oxides	Sulphur dioxide (SO ₂); Sulphur Trioxide (SO ₃)
3	Nitrogen oxides	NO ₂ ; Nitrous oxide (N ₂ O); Nitrogen Peroxide (N ₂ O ₅)
4	Organic compounds	Methane; Propane (C ₃ H ₈) ; Benzene; Chloro Fluoro Carbons (CFC)
5	Photochemical Oxidants	Ozone (O ₃); PAN; Aldehydes
6	Radioactive substances	Iodine 131; Strontium 90; Plutonium 239

Primary Pollutants:

Carbon Monoxide: It is a colorless, odorless, poisonous gas that is produced by the incomplete burning of carbon based fuels (coal, petrol, diesel and wood) which comes from the automobile industries, exhaust devices, about 70% of CO emissions are from the transport sector. When the air is polluted with CO, human blood is likely to be deprived of oxygen and leads to coma and death. In mild dosages, it leads to headache.

Oxides of Sulphur: SO₂ is a gas produced from burning of coal, mainly in thermal power plants. Some industries such as paper mills produce SO₂. It is injurious not only to men and plants, but it also attacks rapidly a few rocks such as limestones, marbles, electric contacts etc. It can even dissolve nylon. Paper absorbs SO₂ causing the paper to become brittle and fragile. SO₂ polluted air leads to corrosion of metals such as Fe, Zn, Cu, steel etc... SO₂ is a major contributor to Smog and acid rain.

Sulphur trioxide is more irritant than SO₂ because it combines immediately with water to form sulphuric acid.

Oxides of Nitrogen : Combustion of coal, oil, natural gas and gasoline which produces upto 50 ppm of Nitrogen. NO_x are also produced when fossil fuels are burned especially in power plants and motor vehicles. NO₂ poisoning results SILOFILTER disease. High levels of NO₂ exposure causes cough and make the human beings feel short of breath. People who are exposed to NO₂ for a long time have a higher chance of getting respiratory infections.

NO_x compounds contribute for the formation of Ozone. Similarly, when nitrogen oxide when combine with SO_x to form acid rain.

Chloro Fluoro Carbons: CFC's (also known as Freon) are non- toxic. They contain Carbon, Fluorine and Chlorine atoms. The five main CFCs are the following:

- CFC – 11 (Trichloro Fluoro Methane CFCl₃)
- CFC – 12 (Dichloro Fluoro Methane CF₂Cl₂)
- CFC – 113 (Trichloro Trifluoro Ethane C₂F₃Cl₃)
- CFC – 114 (Dichloro Tetrafluoro Ethane C₂F₄Cl₂)
- CFC – 115 (Chloropenta Fluoro Ethane C₂F₅Cl)

The major uses of CFCs are as coolants in refrigerators and in air conditioners; as solvents in cleaners particularly for electronic circuit boards etc. CFCs are the main cause of ozone depletion. CFCs have a lifetime in the atmosphere of about 20 to 100 years, and as a result one free chlorine atom from a CFC molecule can do a lot of damage.

Secondary Pollutants:

Ozone (O₃) / Ozone layer Depletion: Ozone consists of oxygen molecules which contain three oxygen atoms. It is not emitted directly into the air but produced in the atmosphere when oxygen combine with oxygen radical (O) in the presence of sunlight. Ozone protects us from ultra violet radiation and other harmful rays. It is observed that over the last few years, many man made processes release gases into

atmosphere causing drastic depletion of ozone layer. The chlorine atoms cause depletion of ozone slowly and holes are formed in the ozone layer. Ozone reacts with tissues and cause for breathing and decrease the working ability of the lungs, chest pains and coughing. It lowers the human body resistance power and leads to cold; pneumonia also.

Antarctic Ozone depletion: According to NIMBUS-7 satellite picture which was taken on 5th Oct 1987, the protective ozone layer showed a hole over 50% of the area of the Antarctica continent covering 7 million sq km. On Jan 1st 1989, the country Montreal (Canada) proposed redesigning refrigeration, air conditioning technology replacing the use of CFCs by ozone friendly substitutes.

Smog: Smog is a combination of smoke and fog or various gases when react in the presence of sunlight. The effects of smog on human health cause for respiratory, irritation to the eyes, diseases related to nose, throat, bronchitis, pneumonia, headache, nerves, liver, and kidneys. The first smog related deaths were recorded in London in 1873, when it killed 500 people. In 1892, December, London had worst experiences causing 1000 deaths. In 1940's severe smog began covering the cities of Los Angeles in USA.

Para Acetyl Nitrate (PAN): PAN which is a harmful chemical form in nature and causes irritation of eyes and other human sense organs. It may also cause blisters on the skin.

Acid rain: Acid rain has become one of the most important global environmental problems and poses significant adverse impact on soils, rivers, lakes, forests and monuments. The phenomenon occurs when SO_x and NO_x from the burning of fossil fuels such as Petrol, Diesel, Coal etc combine with water vapour in atmosphere and fall as rain or snow or fog. Natural sources like volcanoes, forest fires, etc also contribute SO_x and NO_x . Increased urban and industrial activities cause air pollution resulting in the rise of concentration of SO_2 and NO_x . Sulphur dioxide and NO_2 combines with water vapour in the atmosphere produce Sulphuric acid and Nitric acid respectively and results acid rain.

Some of the examples are:

Europe and parts of W.Asia have experienced rain with water pH range of 4.5 to 5.0 (acidic) in 1958. In 1962, acid rain occurred in Sweden with pH of water ranging from 4.5 to 5.0. Netherlands and Holland also experienced acid rains in the same year. In April 1984, acid rain occurred in Scotland.

Aerosols: These are Suspended Particulate matter. It consists of dust, soot, asbestos particles, Pb, Ni, Nitrate and sulphate salts, fumes, mists, smoke and sulphuric acid particles etc.. These particles measure less than 1 micron in size because of that, they directly enter into respiratory track. Exhaust gases from aero planes, automobile industries are the main sources for releasing aerosols.

Air pollution effects; Prevention & control measures:

Human beings breathe 22000 times a day on the average, inhaling 16 kg of air. Atmosphere constitutes a protective cover of gases surrounding the earth which sustains life and saves it from unfriendly environment. The atmosphere consists of several layers viz. Troposphere, Stratosphere; Mesosphere; Thermosphere & Exosphere. The lower atmosphere i.e., the troposphere contains 70% of gaseous components of major, minor and traces. Table depicts the available components in the atmosphere as:

Component	Symbol	Concentration in Volume%	Status
Nitrogen	N_2	78.09	Major
Oxygen	O_2	20.94	Major
Argon	Ar	00.93	Minor
Carbon dioxide	CO_2	0.0318	Minor
Ne, He, Kr, H_2 , CO, O_3			Traces

NH₃; NO₂, SO₂; H₂S, Xenon etc are still in traces.

Ultra violet radiation from the sun is absorbed by ozone in the stratosphere which is so called ozone layer located between 17 - 26 kms above sea level.

Effects of Air pollution: The effects of pollution may be direct and affect certain organisms. The effects

of pollution may possess a hazard or nuisance. Long continued pollution even affects the evolution of a species and eliminates organisms that cannot tolerate certain pollutants and favour others who can eat. Air pollution causes deaths, Impair health, reduce visibility and brings vast economic losses. It can also cause intangible losses to historic monuments such as Taj Mahal. Finally, Air pollution can affect the environment on a global scale.

Prevention and control of Air Pollution:

- Inputs that do not contain the pollutants.
- Operating process to minimize generation of the pollutants.
- Replacing the process with one does not generate the pollutant.
- Removing the pollutants from the process.
- Substitution of raw materials.

Ex: The substitution of high sulphur coal with low sulphur coal in power plants.

Ex: Changing a fossil fuel with nuclear energy can eliminate sulphur emission.

→ By involving the Process Modification:

Ex: Chemical and petroleum industries have changed by implementing automated operations, computerized process control by reducing the oxidation of SO₂ to SO₃ by reducing excess air.

→ By involving the control technologies: Control equipment viz., Wet Collector (scrubber);

Gravity Settling chamber; Cyclone Collectors; Dry Scrubbers; filters are to be used to minimize the air pollution.

WATER POLLUTION

Hydrosphere in the universe contains water in the form of oceans, rivers, lakes, tanks and many other water sources. Water sources in the world are of two types. They are (1) Marine water bodies and (2) Fresh Water bodies. Water is a good solvent for many substances. Because of this property water cannot exist in its pure form at many parts of the world. Water pollution is mainly because of sewage, industrial disposals effluents.

Chemical examination of water (tests): pH; Biological Oxygen Demand, Dissolved Oxygen; Chemical Oxygen Demand etc are some of the chemical tests to find the stage of pollution of water.

pH: The value of pH gives the degree of acidity or alkalinity of polluted water. Determination of pH is important in calculating the coagulant (thick or thin) dose.

Biological Oxygen Demand (BOD): It is defined as the quantity of oxygen utilized by micro organisms at a temperature of 20°C, generally measured for 5 days. When water is polluted by unwanted materials, naturally the O₂ content gets reduced and that water become not fit for consumption either by human beings or animals or plants. Living organisms require water with some quantity of sustainable oxygen in it. That oxygen is necessary for living organisms is generally called BOD. If there is reduction in oxygen content of water, it becomes unfit for biological consumption because there is change in BOD.

Dissolved O₂: The amount of oxygen in dissolved form in water at a particular temperature and atmospheric pressure is known as dissolved Oxygen. In polluted waters, dissolved oxygen is the factor which determines whether the biological changes are carried by aerobic (needing oxygen) or by anaerobic (oxygen not required) micro-organisms.

Ex: 5 to 8 mg/L of dissolved oxygen is required for most of the species and fishes.⁴⁵

Chemical Oxygen Demand (COD): This test is conducted to determine the pollution strength of the sewage. Potassium dichromate and potassium permanganate are used as oxidizing agents.

Common types of water pollutants:

Disease causing agents: Bacteria, viruses, protozoan's that enter water from domestic sewage and animal wastes.

Water soluble inorganic chemicals: Acids, salts and compounds of toxic metals such as Pb, Hg can make water unfit to drink, harm fishes and other aquatic life. Also Nitrate, Phosphate compounds dissolve in water that can cause excessive growth of algae, which then die and decay, depleting dissolved O₂ in water and killing fish.

Water Soluble Organic chemicals: Oil, gasoline (a type of oil is obtained from petroleum), pesticides, detergents and many other water soluble chemicals that threaten human health and harm fish.

Heat: Large quantity of water is heated when it is used in the cooling towers of thermal power plants. When this hot water is discharged into the nearby water bodies, it causes an increase in its temperature.

Sewage: sewage is waste water from municipal area where there is human habitation. Sewage which comes from homes is called

DOMESTIC SEWAGE:

In nature water pollution is classified into three types by Kimball (1975). They are:

1. Domestic water pollution: Sewage is a part of domestic water pollution. Domestic sewage not only contains unwanted waste materials, but it is also infested with harmful bacteria, virus etc. These are responsible for causing diseases in animals and human beings, if they drink this polluted water and even plants may die if polluted water is provided. Domestic water pollution leads to Diarrhea, Cholera, and Typhoid etc in human beings.

2. Agricultural Water Pollution: Water require for plants for its growth. Major irrigation, minor irrigation, sprinkler irrigation, drip irrigation, lift irrigation carry waste substances and causing water pollution in addition to the utilization of fertilizer and pesticides. Agricultural water pollution leads to Eutrophication & Water Bloom.

Eutrophication is the ecosystem response to the addition of artificial or natural substances, such as nitrates and phosphates, through fertilizers or sewage, to an aquatic system. Eutrophication also occurs when fresh water bodies like ponds, lakes, pools which contain organic waste material. Because of that, the fresh water ponds and lakes get polluted. Eutrophication is a type of water pollution. Eutrophication was recognized as a pollution problem in European and North American lakes and reservoirs in the mid-20th century. Since then, it has become more widespread. Surveys showed that 54% of lakes in Asia are eutrophic; in Europe, 53%; in North America, 48%; in South America, 41%; and in Africa, 28%. Ecological effects: The important troubling ecological impacts are :

- Excessive nutrients in water bodies promote plant growth which leads to a drop in water quality;
- Disruption of the natural ecosystem. Ex: lack of oxygen for shellfish and marine life (causing a drop in their population).
- Decrease in the recreational and aesthetic value of water bodies
- Health problems when it occurs in drinking water reserves
- Coral reef decline
- Decreased biodiversity,
- Changes in species composition and dominance and toxicity effects.
- Toxic phytoplankton species
- Decreases in water transparency (increased turbidity)
- Colour, smell, and water treatment problems
- Dissolved oxygen depletion
- Increased incidences of fish kills
- Loss of desirable fish species

Water Bloom:

It is defined as “A growth of algae at or near the surface of a body of water, such as a pond”.

This is another kind of water pollution because of the presence of Blue Green Algae (BGA). Blue-green algae are microscopic organisms that can be considered as simple aquatic plants that occur naturally in habitats such as marine waters, rivers, lakes, damp soil, tree trunks, hot springs and snow. They can vary considerably in shape, colour and size. They usually are present in low numbers. Blue-green algae can become very abundant in warm, shallow, undisturbed surface water that receives a lot of sunlight. When this occurs, they can form blooms that discolor the water or produce floating rafts or scums on the surface of the. Because of the presence of B G A, the water turns blue in color or blue green which is unsuitable for drinking. This type of pollution of fresh water bodies by Blue Green Algae is generally called “Water Bloom”.

3. Industrial water pollution: Many industries discharge waste materials containing harmful chemicals. Such Industrial wastes are called *effluents*. Rivers get polluted when the river water is polluted by mixing of chemical substances released by the petrochemical industries, paper industries, chemical industries etc. The river Godavari is polluted because of effluents released by the paper industry. It affects the entire water ecosystem causing enormous damage to fishes, prawns and fresh water animals.

Eg: Minimata disease & Fluorosis.

Minamata disease is a neurological syndrome caused by severe mercury poisoning. Symptoms include ataxia, numbness in the hands and feet, general muscle weakness, narrowing of the field of vision and damage to hearing and speech. In extreme cases, insanity, paralysis, coma, and death follow within weeks of the onset of symptoms. Minamata disease was first discovered in Minamata city in Japan in 1956. It was caused by the release of methyl mercury from, the Chisso Corporation's chemical factory, which continued from 1932 to 1968. This highly toxic chemical bio- accumulated in shellfish and fish in Minamata Bay which when eaten by the local populace resulted in mercury poisoning. While cat, dog, pig, and human deaths continued over more than 30 years, the government and company did little to prevent the pollution.

Fluorosis: People suffer from a disease called fluorosis after consuming water containing fluorine for sufficiently a long time. Quantity of fluoride in water is only 1 ppm. Diseases caused by fluorosis are:

→ Back pain and cannot easily bend.

→ Joints get stiffened as so movement of joints is impaired.

→ Teeth are the worst effected and a brown coating appears on the enamel of teeth giving bad appearance.

→ Persons with fluorosis cannot erect freely.

Preventions or control measures of water pollution:

1. Drinking water should be boiled, cooled and then used.

2. Disinfection of drinking water should be done by using chemicals like bleaching powder.

3. Pesticides and insecticides should be prevented from nearby use of water lakes, ponds and pools.

4. Drainage water should not be allowed to mix with drinking water.

5. Drainage system should be maintained properly.

6. Chlorination process is to be adopted for drinking water. For 1 litre of water 30-40 mg of chlorine is to be added to get perfect disinfection. It kills bacteria, fungi, fungal spores and other microbes also.

NOISE POLLUTION

Everyone knows that sound is a form of energy that is capable of causing disturbances in human beings. Ears are the hearing organs in human beings. A thin membrane is called Tympanum (or) ear drum receives the vibrations produced by sound to a limited extent. Human ear is capable of perceiving about 85 decibels of sound. Beyond the limit, the ear drum cannot bear sound. In nature, we hear different types of sounds. Sound is a kind of vibration which travel through air, water, and are sensed by the ear. This is from music, speech, etc from radio / television / computers etc., one thing in this matter is that we can increase the volume of sound or decrease as per our taste whereas, a noise is a sound which cannot be heard clearly and only mixed sounds will be heard.

Ex: In an office one is talking on mobile, phone ringing another side, ring tones in some person's hands, loud conversations with one and another etc., this is called noise. One cannot increase or decrease the volume of noise. In general, a sound is a vibration from a particular machine, place or material which can be heard clearly whereas a noise a mixed vibrations that will come to us from all directions. A sound can be clear and can be able to hear, whereas a noise will not be clear and cannot be heard.

Sources of Noise

Noise is an unwanted sound and noise pollution occurs through different sources:

→ Vehicles produce noise that leads to noise pollution.

→ Automobile industry is another source of noise pollution.

→ Noise pollution is very common in industrial areas where machines are working for factories making

more noise. The sources of noise are more in urban and industrial areas, than in rural areas. The sources of noise may be stationary or mobile. The stationary sources include industries, loud speakers, mining operations and use of machineries, TV, Radio and Grinders etc. The mobile sources include Road Traffic, Highway Noise, Railway Traffic and Air Traffic.

(1) Stationary sources:

Industrial noise: The main categories of industrial activity that are particularly relevant to the study of noise are the following: Product fabrication Product assembly Power generation by means of generators. Combusting process in furnaces. (Burning of gases)

Noise from construction works: Construction noise, a major source of noise pollution is emitted by construction equipment. The sources of noise are dozers, excavators, front end loaders, soil compactors, cranes, air compressors, concrete vibrators, riveting steel structure during the casting, dismantling of construction materials etc...

Noise from other sources: These include sources such as sirens, barking dogs, ambulances, Police vehicles, Fire engines etc.

(2) Mobile sources:

Road traffic: Of all sources of noise pollution, road traffic is the most prevalent and perhaps the most source of noise pollution. More people are exposed to noise from motor vehicles and the noise depends on various factors such as Road location, Road design, Vehicle standards, Driver behaviors, Horns, Traffic density. ,

Noise of common road vehicles

Vehicle type	Noise(db)
Medium road traffic (Main roads)	70- 80
Heavy road traffic (High ways)	80- 90
Buses & Trucks upto 3.5 tons	85- 95
Trucks upto 3.5-12 tons	90-100
Motor cycles	90-105

It can be observed that motor cycles with their exposed engines and inadequate silencing arrangements are notorious noise producers, which produce more than 30 times, sound than a small passenger car.

Railway traffic: Noise from railway traffic is not serious nuisance as compared to the road traffic noise. The level of noise associated with rail traffic is related to the type of engine, the speed of the train, track type and condition. The majority of noise emitted by trains is produced by the engine (or) by the interaction of wheels with the tracks, horns, warning signals at crossings etc.,

Air traffic: The noise of air craft is different from that of road traffic in the sense it is intermittent. Noise is maximum during takeoff and landing. Noise made by jet planes is more disturbance than that of propeller driven air craft. Supersonic air craft produce noise at high levels due to its intensity.

Effects of Noise: At 120 decibels the ear registers pain but hearing damage begins about 85 decibels. Apart from hearing loss, noise can cause lack of sleep, irritation, indigestion, ulcers, High B.P., Heart diseases , Stress etc.,.

Annoyance (Feeling slightly angry): One of the most important effects of noise on human is annoyance. Due to this breathing rate affects.

Noise- induced hearing loss: Exposure to noise for long enough duration results in damage to the inner ear and thus decreases one’s ability to hear. The louder the noise the less time it takes to cause hearing loss.

Effects on sleep: Noise disturbs sleep. It has been found that the cases related to various levels of noise are associated with sleep disturbances. Sleep disturbance by noise depends on the characteristics of the noise such as frequency, loudness and whether the noise is continuous or intermittent.

Other effects: There are many other effects of noises such involve aggression (ready to attack). People may turn mad and nerves may not function normally, People may be deformed in many ways including

increased stress and strain, nonfunctioning of hands, legs etc due to noise pollution if exposed continuously.

Noise pollution control: Noise pollution could be controlled by either reducing the noise at the source or by preventing its transmission. The first step in the prevention of noise pollution is to control the noise at source itself.

Ex: Lubrication of machines reduces the noise produced, Tightening the loose nuts, Reducing the vibrations produced by machines etc.

Failing to control the noise at its source, the second step is to prevent its transmission.

Ex: keeping the noise machine covered in an enclosure so that the sound does not escape and reach the receivers, construction of noise barriers on road sides, sound proof the buildings by using heavy curtains on the windows, acoustical tiles on the ceiling and walls, by sealing the cracks in the walls to reduce the noise coming from outside. If the noise levels are not able to bring down to the desired levels in some cases, the only alternative is to follow:

- Avoiding horns except in emergency situations.
- Sound proof or eco-generators and Turning down the volume of stereos.
- Conducting the awareness programs.

MARINE POLLUTION

Pollution of oceans is damaging the marine environment and is becoming a major problem. Marine environment is interesting for various reasons such as Sea food, Navigation, Adventure, Tourism etc. Marine Pollution is harmful and its danger can be identified in a variety of ways. Sources & causes of marine pollution: Marine pollution originates from one of two sources the land or the sea which are explained below:

Marine Oil Pollution: Oil is basically an important pollutant which destroys marine environment. The various sources of oil pollution are: Run-off oil from streets; disposal of lubricants from machines; Off shore oil and gas exploitation from off-shore drilling; blowouts at off-shore drilling rigs; oil escaping under high pressure from a bore hole in the ocean floor. ; Waste chemicals, mud and accumulation of toxic substances in the ocean in the form of mercury, dioxin, PCBs, PAHs (Poly Aromatic Hydrocarbons), Radioactivity. Benzene; xylene (colorless, flammable liquids) and heavy metals such as lead; copper; nickel, mercury also cause for marine pollution during the off shore drilling activities. Both dumping and exploitation of ocean resources cause ocean pollution also.

PAHs: It is a chemical compound and organic pollutant. These occur in oil, coal and tar deposits and are produced as by products of fuel burning. PAHs are lipophilic meaning they mix more easily in oil than water.

Ex: Acenaphthene; Anthracene; Benzopyrene; Chrysene; Coronene; Fluorene; Pyrene.

Effects of Marine Pollution:

S No	Source	Effect
1	Sewage & run- off from Forestry.	Depletes oxygen in water causes killing of fishes.
2	Sediments from mining	Sediments clog in the gills of fishes.
3	Sewage from municipalities, Towns, cities etc...	Contaminate sea food.
4	Industrial discharge; pesticides from farms	Cause disease in coastal marine life.
5	Oil from off hore drilling; industries / automobiles.	Low level contamination kills larvae whereas high level contamination causes death for sea fishes.
6	Litter (rubbish), waste, plastics.	Marine life disturbs.

Other sources from land: The major sources of marine pollution originating from the land vary from country to country. Effluents are discharged either directly into the sea or enters the coastal waters through rivers. Thousands of barrels of oil burn when oil wells were set on fire. Tanker accidents on land carries oil to the nearby streams / canals and cause for marine pollution. Due to burning of oil, smoke, SO₂, NO₂, CO are added towards atmospheric contamination. The effects of oil pollution depend mainly on the following factors:

Type of oil and its viscosity; amount / quantity released; distance covered; time; average water temp etc.

Marine Pollution Abatement / Prevention & control measures of Marine pollution: The following are the some of the control measures for marine pollution:

- Improving existing sewage disposal facilities
- Ensuring individual houses have sewage disposal systems (such as septic tanks).
- Large resorts should use and manage their own packaged treatment plants.
- Marine planning and management should be considered as processes such as land – sea interaction; inter disciplinary co-operation; participation of public & private sector organizations; balance between protection and development public participation
- Oil tankers are double hulled (two layered bottom) to reduce the chance of oil leakage
- Recycling facilities for used oil.

THERMAL POLLUTION

Thermal pollution is also known as heat pollution and occurs when heat is released into water or air that produces undesirable effects. Sudden heat release usually due to forest fire or volcanoes or human induced activities. Thermal pollution is also the addition of excess undesirable heat to water that makes it harmful to human, animal or aquatic life.

Sources of Thermal Pollution: Various sources of thermal pollution include Thermal Power Plants; Nuclear Power Plants; Petroleum Refineries; Steel Plants; Metallurgical industries; Paper Mills; Chemical Plants. Coal fired power plants constitute major sources of thermal pollution. Nuclear plants discharge much heat and also traces of toxic radioactive substances. Many industries use water for cooling purpose and thus the heat effluents are finally discharged into water.

Temperature and its effects: Temperature plays an important role in determining the conditions in which living things can survive. Birds and mammals require a narrow range of body temp for survival whereas aquatic species can exist at a certain range of temperatures. Thermal pollution increases water temperature causing a change (lowering) of dissolved oxygen levels. This disrupts and causes decay of plant and animal species.

Ex: the warmer water increases the metabolic rate of fish and other animals in the sea; this decreases the life expectancy of aquatic animals.

Management of Thermal Pollution: Thermal Pollution is controlled by the following methods:

1. Cooling Towers are designed to control the temperature of water which transfers some of the heat from the water to the surrounding atmosphere by evaporation. There are two types of cooling towers namely wet cooling towers and dry cooling towers.
2. Cooling ponds are employed for thermal discharges. Heated effluents on the surface of water in cooling ponds maximize dissipation of heat to the atmosphere.
3. Artificial lakes are manmade bodies of water which offer possible alternative. The heating effluents are discharged into lake at one end and the water for cooling purpose may be withdrawn from the other end.

SOLID WASTE MANAGEMENT

Solid Waste is defined as “ any garbage, refused materials, sludge from a waste treatment plant and other discarded material including solids, semisolids etc resulting from industrial, commercial, mining, agricultural operations etc.”

Solid Waste Management has become very important role in order to minimize the adverse effects of solid wastes. Solid waste (other than liquid or gaseous) can be classified as Municipal Solid Waste (MSW); Industrial Solid Waste; Hazardous Solid Waste; Agriculture Solid Waste; Mining Waste, Sewage Sludge Waste etc..

Solid wastes are being produced since the beginning of civilization. The disposal of Solid Waste has been increased due to the rapid developments in industrialization and urbanization. High population density, intensive land use for residential, commercial and industrial activities led to generation of more solid waste. In Andhra Pradesh, the solid waste generated in medium and small municipalities in the range of 30 – 150 MT / day. The per capita generation of Municipal solid waste in class I cities is in between 100 – 500 gms /day per person.

Sources of Solid Wastes:

1. **Municipal Solid Waste** is commonly known as garbage consists of packing materials, furniture, clothing, bottles, food scraps, newspapers, home appliances; paints, batteries etc. Municipal solid wastes are arise from residential quarters, commercial (markets, hotels, garages); institutions; public places, open areas/streets, parks, play grounds etc. MSW also include the following wastes:

Food Wastes usually generate from domestic houses, hotels, markets and consist of fruits, vegetable residues resulting from the handling, preparation, cooking and eating of foods. **Rubbish waste** consists of combustible wastes (papers; cardboards, torn clothes, plastics, wood etc) and non – combustible waste (glass, crockery, aluminum tins, ferrous metals; construction wastes).

Demolition & Construction wastes result from the construction, remodeling and repairing of residential, commercial buildings and industrial factories. These wastes include dust, stones, concrete, bricks, steel pieces etc.

Special Wastes include street sweepings, road side litter, drainage debris; dead animals and abandoned vehicle parts.

2. **Industrial Waste** arise from industrial activities such as chemical industries; metal and mineral processing industries. Radio Active wastes are generated by Nuclear Power Plants. Thermal Power Plants produce fly ash in large quantities. Fly ash is a fine solid particles result from the burning of wood, coal and other combustible wastes.

3. **Hazardous Solid Waste** is any solid waste or combination of wastes that posses a substantial danger, now or in future to human beings and plant / animal life and cannot be handled or disposed. The following is a list of types of hazardous wastes:

→ wastes from specific and non-specific sources. Ex: Disposable synergies from hospitals is a specific source identified as hazardous solid waste.

→ Ignitable materials (easily inflammable below 60°C)

→ Corrosive materials (iron rods / pieces)

→ Reactive materials (undergoes rapid reaction with water or other substances and releases toxic gases. Ex: limestone / marble).

→ Toxic materials which consists of Pb, Cl (Toxic to human beings)

Effects of Solid Waste: The improper handling and transfer of the solid wastes results in various health and environmental problems. The main impacts of waste accumulation are:

→ Garbage dumping places are breeding places for diseases.

→ Rats and pigs roam and feed on garbage and transmit diseases like brain fever from pigs to human beings and plague from Rats.

→ Solid wastes may choke the drains and gully pits resulting in water logging which in turn results in breeding of mosquitoes and then cause for Malaria & dengue in human beings.

→ Noxious fumes (harmful gas) may pollute air due to the burning of waste products especially plastic containers.

→ Obnoxious (very unpleasant) odours pollute the air due to decomposition of organic solid wastes.

→ Municipal solid wastes heap up on roads due to improper disposal system. Every year several tones of solid waste is dumped along the high-ways thereby spoiling the landscape (appearance of an area of land).

→ Urban and industrial solid wastes often contain a variety of toxic chemicals which may enter into the food chain and affect both terrestrial and aquatic organisms.

DISASTER MANAGEMENT

Disaster means a terrible event that causes a great damage / loss to the human beings. It is a situation arising from natural forces where large scale disruption of infrastructure, services etc. occurs. It causes a serious impact on human life, economy and environment. Natural disasters are always severe and sudden. Some disasters are:

- (A) Geological in nature like the earthquakes.
- (B) Landslides (rocks slides down from the side of a hill), volcanic eruptions etc.
- (C) Climatic disasters / Natural calamities:

These are of different types affect nations all over the world. Because of the large geographical size of the country, India often faces natural calamities like floods, cyclones and drought occurring frequently in different parts of the country. Natural calamities are of two types:

1. Major calamities: Ex: earthquakes; droughts; floods, tsunamis; cyclones etc
2. Minor calamities: Ex: hailstorms; avalanches; fire accidents

(D) Man induced disasters include wars, battles, riots, rail/road accidents, nuclear explosions.

The disaster Management: The natural disaster management involves the following steps:

Relief measures: it include rescue tools; communication equipments; heavy machines to remove debris; water pumps; technicians; drugs, doctors, ambulances..

Disaster predictions: The predictions of natural hazards may be made on the basis of past history of the area with regular monitoring of the environmental changes caused by human activities to assess the genesis of natural disasters.

Education: Disaster education plays a significant role in disaster education. It creates awareness and improves the standards to prevent from the disasters.

Geographic Information Systems: (GIS): GIS is a system that captures, stores, analyzes. Manages and presents data with reference to geographic location of the area. In simple terms, GIS is the merging of cartography, statistical analysis and database technology. GIS may be used in Archaeology, Geography, Remote Sensing, Land surveying; Natural Resource Management; Urban Planning etc.. GIS programmes help by means of maps available data of the problem areas, to predict the severity of the disaster.

Words	Meanings
Aerosol	Atmosphere or gas containing finely divided solids or liquid particles of microscopic size (0.1 – 100 microns).
Avalanche	Large amount of snow falls down.
Battles	Between the persons / enemies.
Contamination	A substance causing pollution is too low to cause harm Dioxin Poisonous chemical.
Disaster	Something that causes a lot of harm (bad situation).
Fly ash	Fine solid particles exist during the burning of coal.
Fog	high concentration of liquid particles formed by the Condensation of vapour (reduction of visibility to < 1 km).
Formaldehyde	A chemical substance.
Fumes	Very fine liquid or solid particles. (0.03 - 0.3 microns).
Garbage	Unwanted things.
Gases	Matter having no independent shape and expands Continuously.

Gasoline	A mixture of volatile hydrocarbons used as a fuel known as petrol.
Hailstorm	Small pieces of frozen rain falls from the sky.
Hazard	Something that is dangerous.
Haze	When the air is not clear because of the presence of heat/smoke.
Herbicides:	A chemical used to kill the unwanted plants.
Impair	To harm something and make it less good.
Intangible	Can't prove the feelings or quality exists.
Landscape	The appearance of an area of land.
Litter	Pieces of paper left in Public places.
Matter	Physical substance that exist in the universe.
Mists	Liquid particles formed by the condensation of vapor or a chemical Reaction.
Noxious gases	Harmful gases.
Obnoxious	Very unpleasant.
Pollutant	The substance or energy or things which cause pollution. Ex: Aerosol, dust, smoke, fly ash, gases, fumes, smog, fog.
Radon	A type of gas due to poor ventilation. It is confined to inside the house.
Riots	Violent behavior by a crowd of people.
Sludge	Soft, wet soil.
Smog	Mixture of smoke & fog or contain large quantities of different Chemicals.
Smoke	Results from incomplete combustion of fuels(0.001- 1 microns).
Soot	Results from incomplete combustion of carbonaceous material bituminous coal, kerosene lamp. Ex: chimney consists soot
SPM	A mixture of liquid or solid particles and gas under pressure which is released from a container. Ex: Deodorants.
War	Between the nations.

QUESTIONS:

1. What are the natural and manmade pollutants that cause air pollution ?
2. Enumerate with examples the major sources of surface water and ground water pollution .?
3. Discuss the various sources of marine pollution and how can you prevent pollution of our oceans?
4. Describe various effects and control measures of thermal pollution ?
5. Briefly describe the sources , effects and control of noise pollution?
6. What adverse effects can solid wastes cause ? How can the solid waste be managed?
7. Why do earthquakes occur ? Explain the case of any earthquake that occur in India?
8. What type of the damage can be caused by ionization radiations?