

UNIT IV

Environmental Pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution; solid and liquid waste management.

Environment Protection Act: Air, water, forest and wild life Acts, enforcement of environmental legislation.

4.1 ENVIRONMENTAL POLLUTION

Q1. Define pollution. Explain the classification of pollution.

Ans : (Imp.)

Meaning

Pollution is the effect of undesirable changes in our surroundings that have harmful effects on plants, animals and human beings. This occurs when only short-term economic gains are considered at the cost of long-term ecological benefits for humanity. No phenomenon has led to greater ecological changes than that created by humans. In the last few decades, we have contaminated the air, water and land on which life itself depends with a variety of waste products. For example, deforestation and desertification.

Pollutants include solid, liquid and gaseous substances present in greater than natural abundance, produced by human activity, which have a detrimental effect on the environment. The nature and concentration of a pollutant determines the severity of its detrimental effects on human health. An average human requires about 12 kg of air each day, which is nearly 12-15 times greater than the amount of food we eat. So, even a small concentration of pollutants in the air becomes more significant in comparison to similar levels present in food. Pollutants that enter the water have the ability to spread to distant places, especially in the marine ecosystem.

Classification

From an ecological perspective, pollutants can be classified as follows:

Pollution may be defined as an undesirable change in the physical, chemical or biological characteristics of air, water and land that may be harmful to human life and other animals, living conditions, industrial processes and cultural assets. Pollution can be natural or man-made. The agents that pollute are called pollutants.

Pollutants

Pollutants are by-products of man's action. The important pollutants are summarized below:

- **Deposited matter**
Soot, smoke, tar or dust and domestic wastes.
- **Gases**
CO, nitrogen oxides, sulphur oxides, halogens (chlorine, bromine and iodine).
- **Metals**
Lead, zinc, iron and chromium.
- **Industrial pollutants**
Benzene, ether, acetic acid etc., and cyanide compounds.
- **Agriculture pollutants**
Pesticides, herbicides, fungicides and fertilizers.
- **Photochemical pollutants**
Ozone, oxides of nitrogen, aldehydes, ethylene, photo-chemical smog and proxy acetyl nitrate.
- **Radiation pollutants**
Radio active substances and radio active fall-outs of the nuclear test.

Classification of Pollutants

On the basis of natural disposal, pollutants are of two types:

(i) Non-degradable pollutants

These are the pollutants, which degrade at a very slow pace by the natural biological processes. These are inorganic compounds such as salts (chlorides), metallic oxides waste producing materials and materials like, aluminium cans, mercuric salts and even DDT. These continue to accumulate in the environment.

(ii) Biodegradable pollutants

These include domestic sewage that easily decomposes under natural processes and can be rapidly decomposed by natural/ artificial methods. These cause serious problems when accumulated in large amounts as the pace of deposition exceeds the pace of decomposition of disposal.

On the basis of the form in which they persist after their release into the environment, pollutants can be categorized under two types:

1. Primary pollutants

These include those substances, which are emitted directly from some identifiable sources. This include-

(a) Sulphur compounds

SO_2 , SO_3 , H_2S produced by the oxidation of fuel.

(b) Carbon compounds

Oxides of carbon ($\text{CO} + \text{CO}_2$) and hydrocarbons.

(c) Nitrogen compounds

NO_2 and NH_3 .

(d) Halogen compounds

Hydrogen fluoride (HF) and hydrochloric acid (HCl).

(e) Particles of different size and substances

These are found suspended in air.

The fine particles below the diameter of 100μ are more abundant and include particles of metals, carbon, tar, pollen, fungi, bacteria, silicates and others.

2. Secondary pollutants

The secondary pollutants are produced by the combination of primary emitted pollutants. In the atmosphere. In bright sunlight, a photochemical reaction occurs between nitrogen oxides; oxygen and waste hydrocarbons from gasoline that forms peroxyacetyl nitrate (PAN) and ozone (O_3), Both of them are toxic components of smog and cause smarting eyes and lung damage.

3. Smog

The fog deposited with smoke and chemical fumes forms a dark and thick covering, the smog. Smog is very common in almost all the industrial areas as the smog is trapped for many days by the stagnant air. It is harmful both for animals and plants.

4.2 CAUSES, EFFECTS AND CONTROL MEASURES OF AIR POLLUTION

Q2. Define air pollution. Explain the causes of air pollution.

Ans :

(Imp.)

Meaning

The term pollutant refers to a substance that makes an area, substance or atmosphere dirty or harmful to people. The various pollutants in the atmosphere are ozone, carbonmonoxide, nitrogen dioxide, particulate matter, sulphurdioxide, lead, radioactive materials, chemicals such as pesticides, infectious agents (pathogens), mercury, sewage sludge and many other substances.

Air pollution occurs due to the presence of undesirable solid or gaseous particles in the air, in quantities that are harmful to human health and the environment. The air may become polluted by natural causes such as volcanoes, which release ash, dust, sulphur and other gases, or by forest fires that

are occasionally caused by lightning. However, unlike pollutants created by human activity, naturally occurring pollutants tend to remain in the atmosphere for a short time and do not lead to permanent atmospheric change.

Pollutants that are emitted directly from identifiable sources are produced both by natural events (dust storms and volcanic eruptions) and by human activities emission from vehicles, industries. These are called primary pollutants. There are five primary pollutants that together contribute to about 90% of the global air pollution. These are carbon oxides (CO and CO_2), nitrogen oxides, sulphur oxides, volatile organic compounds (mostly hydrocarbons) and suspended particulate matter).

The pollutants produced in the atmosphere when certain chemical reactions take place among the primary pollutants are called secondary pollutants; for example, sulphuric acid, nitric acid and carbonic acid.

Carbon monoxide is a colourless, odourless and toxic gas produced when organic materials like natural gas, coal or wood are incompletely burnt. Vehicular exhausts are the largest single source of carbon monoxide. However, carbon monoxide is not a persistent pollutant. Natural processes can convert carbon monoxide to other compounds that are not harmful. Therefore, the air can be cleared of its carbon monoxide if no new carbon monoxide is introduced into the atmosphere.

Sulphur oxides are produced when sulphur containing fossil fuels are burnt.

Nitrogen oxides are found in vehicular exhausts. Nitrogen oxides are significant, as they are involved in the production of secondary air pollutants such as ozone, which is harmful at lower levels of the atmosphere but not in the stratosphere.

Hydrocarbons are a group of compounds consisting of carbon and hydrogen atoms. They either evaporate from fuel supplies or are remnants of fuel that did not burn completely. Hydrocarbons are washed out of the air when it rains and run into surface water. They cause an oily film to be produced on the surface and do not cause problems until they react to form secondary pollutants. Using higher oxygen concentrations in the fuel-air mixture, using valves to prevent the escape of gases and fitting

catalytic converters in automobiles are some of the modifications that can reduce the release of hydrocarbons into the atmosphere.

Automobile and Industrial Pollution

Air pollution has been aggravated by developments due to industrialization which leads to higher levels of energy consumption. The high influx of people to urban areas, increase in consumption patterns and unplanned urban and industrial development, have led to the problem of air pollution. Currently, in India, air pollution is widespread in urban areas where vehicles are the major contributors as well as in a few other areas with a high concentration of industries and thermal power plants.

Automobile pollution

Automobile emissions are of particular concern since these are ground level sources and thus have the maximum impact on the general population. Also, vehicles contribute significantly to the total air pollution load in many urban areas. The number of motor vehicles has increased from 0.3 million in 1951 to 37.2 million in 1997 (MoST 2000). Out of these, 32% are concentrated in metropolitan cities. Delhi alone accounts for about 8% of the total registered vehicles and has more registered vehicles than those in the other three metros (Mumbai, Calcutta, and Chennai) taken together. At the all-India level, the percentage of two-wheeled vehicles in the total number of motor vehicles has increased from 9% in 1951 to 69% in 1997, and the share of buses declined from 11% to 1.3% during the same period (MoST 2000). This clearly points to a tremendous increase in the share of personal transport vehicles. In 1997, personal transport vehicles (two-wheeled vehicles and cars only) constituted 78.5% of the total number of registered vehicles.

Industrial pollution

India has made rapid progress in industrialisation, and it is one of the ten most industrialised nations of the world. But this status has brought with it unwanted and unanticipated consequences such as unplanned urbanisation, pollution and the risk of accidents. The CPCB (Central Pollution Control Board) has identified seventeen categories of industries (large and medium scale) as significantly

polluting and the list includes highly air polluting industries such as integrated iron and steel, thermal power plants, copper/zinc/aluminium smelters, cement, oil refineries, petrochemicals, pesticides and fertiliser units.

Q3. What are the sources of air pollution?

Ans :

The WHO defines air pollution as the presence of materials in the air in such concentration which are harmful to man and his environment. A number of ingredients find their way in the air and these are mostly gases, which rapidly spread over wide areas. (Imp.)

Sources of Air Pollution

Various sources of air pollution are fossil fuels, industries, agricultural activities, wars, natural causes and emissions from vehicles.

(i) Burning Fossil Fuels

Burning of wood, charcoal and other fossil fuels causes air pollution by the release of carbon dioxide (CO_2), carbon sulphur dioxide etc. Petroleum consists mainly of hydrocarbons, sulphur and nitrogen.

(ii) Emissions from Automobiles

Vehicles are mainly responsible for more than 80% of total air pollution. The major pollutants released from automobiles, locomotives, aircraft etc., include CO , unburnt hydrocarbons and nitrogen oxide.

(iii) Industries

Paper and pulp factories, petroleum refineries, fertilizer plants, and steel industries, thermal power plants are the main sources of air pollution. They add various harmful gases like CO , SO_3 , NO , Hydro-carbons etc., to the atmosphere. Textile factories release cotton dust into the air. Cities experiencing this type of pollution are Kanpur, Surat and Ahmedabad.

The pesticide and insecticide industries are posing serious threat to the environment. Food processing industries and tanneries emit offensive odors. Release of poisonous gases from accidents also poses serious threats. e.g. Bhopal Gas Tragedy in which methyl isocynate (MIC) gas leakage killed several people. In Tokyo, about 34 tones of carbon particles mixed with other suspended particles settle per square kilometer every day.

Agricultural Activities

Spraying of insecticides and weedicides also cause air pollution. These, when inhaled create severe problems to both animals and man.

Wars

Various forms of explosives used in war pollute the air by releasing poisonous gases. This greatly disturbs the ecology of the area. Nuclear explosions pollute air by radioactive rays. The effects of nuclear explosions on Hiroshima and Nagasaki are well-known examples.

Natural Causes

as emissions from active volcanoes, marsh gas, spores of fungi and pollens are the natural causes of air pollution.

Q4. List the effects of air pollution on plants and human beings.

Ans:

S.No.	Pollutants	Sources	Effects
1.	Carbonmonoxide A colorless, odourless toxic gas	Burning of fossil fuels emit carbon monoxide. Incomplete burning of coal, wood, gasoline furnaces and heaters at home too emit carbon monoxide.	Carbonmonoxide causes health problem like dizziness, tiredness in humans. Serious health problems arise in patients with heart complications.
2.	Nitrogendioxide A reddish brown gas with a strong smell.	Nitrogendioxide is formed from vehicular exhausts and power plants. Nitrogendioxide reacts with the atmosphere to form ozone and acid rain.	Nitrogendioxide causes harm to the respiratory system in humans. The acid rain formed due to nitrogen dioxide in the atmosphere harms the plants and the animals.
3.	Sulfurdioxide A corrosive gas with the smell of rotten eggs at high levels.	Burning of coal and oil in power plants. Emanates from chemical and paper factories. It may react with the atmosphere to form acid rain and particulate matter.	Patients with respiratory disorders are affected by exposure to sulfurdioxide. Further, it causes irritation in the eyes, nose, throat. It harms the crops, trees and damages the buildings.
4.	Lead A bluish gray metal that is heavy and soft	The major source of atmospheric lead is the automobile exhaust where unleaded gasoline is not used. The other sources are the power plants and the industries. the peeling out of paints in the houses and old water pipes are the other sources.	Renal malfunction, anemia and damage to the brain tissues.
5.	Particulates They include any material that exists as solid, liquid or gas suspended in air with 0.00005 mm to 0.1 mm width.	The particulates in air are divided into two types, (a) Coarse particles Example : dusts. (b) Fine particles Example G aerosols like smoke, fog or mist, tobacco smoke, soot, fly ash, asbestos, pesticides.	Particulate matter injures the respiratory system of humans and causes frequent attacks of asthma, chronic bronchitis, lung cancer.
6.	Ozone It is a form of oxygen with three atoms formed by photodissociation of oxygen gas molecules in the atmosphere	Ozone exists in both upper and lower parts of the atmosphere. It is formed by a complex chemical reaction that involves hydrocarbons, nitrogen oxides and sunlight.	The ozone layer in the upper atmosphere shields us from the damaging rays of the sun. The ozone layer in the lower atmosphere is hazardous to the health of patients with may kill the seedlings, damage the chronic respiratory ailments. It foliage and make them susceptible to pests, diseases and harsh weather.

Q5. Explain various measures to control air pollution.

Ans :

The varied contaminants of the air, like carbon monoxide, nitrogen dioxide, sulphur dioxide, lead, particulate matter, methane, ozone and other toxic air pollutants cause serious damage to human health and property. According to a WHO report, each year, thousands of people die due to inhalation of poor quality air in the world's major cities. Several investigations have revealed that more than a billion people are exposed to pollution levels upto a hundred times more than the guidelines recommended by WHO. Hence, adequate measures need to be taken to mitigate or reduce air pollution to the maximum possible extent. Some of them are indicated below:

- One of the most effective methods to control air pollution in atmosphere is to provide a greater height to the smoke stacks of the industries. This facilitates the release of pollutants far away from the ground.
- Use of proper filters or collectors or electrostatic precipitators to control particulate matter.
- The motor vehicle ownership is increasing by the day. Air pollution can be controlled by increasing the energy efficiency of the vehicles. This leads to minimal consumption of fuel and therefore reduced emissions to air. The vehicles should be well maintained and serviced at proper intervals to limit the release of pollutants to air.
- Air pollution can be minimized by reducing the dependence on private motor vehicles and encouraging people to use public transport and car pooling.
- People should be encouraged to ride bicycles as they are zero emission vehicles, economical, low maintenance and non-polluting. Bicycling can be a great form of exercise and fun.
- The industries should be located far from the residential areas.
- Usage of raw materials in industries which cause less pollution should be made mandatory.

4.3 CAUSES, EFFECTS AND CONTROL MEASURES OF WATER POLLUTION

Q6. Define water pollution. Explain various causes of water pollution.

Ans :

(Imp.)

Meaning

Water is a very vital resource for the survival of life and the extent of this resource. Such an important component of earth's system is being polluted.

There is adequate fresh water to maintain one more population doubling on global basis, given the present usable patterns. India is rich in rainfall and surface water resources. India has a very low capital availability of drinking water. Nearly 40,000 or more villages in the country may not be having drinking water.

Pollution of water is altering of its quality so that it becomes unfit or less fit for the purpose for which its natural state is used. Water pollution occurs when chemicals or nutrients or wastes enter water faster than they can be removed by natural processes.

The pollutants include sewage, industrial chemicals and effluents, silt, oil and other wastes. Besides, chemicals from the air dissolved in rain water and fertilizers, pesticides and herbicides leached from the land also pollute water.

Causes

The causes of water pollution includes,

1. Dumping of industrial effluents into water bodies.
2. Fertilizers and pesticides when applied on crops runoff into rivers and streams, thereby causing water pollution.
3. Nitrogenous fertilizers when accumulates in water bodies, then it makes the water unsafe to drink. Thus, contaminates potable water.
4. Nitrogenous fertilizers when runoff into ponds, lakes and stream, leads to eutrophication. Eutrophication, excess growth of algae occurs which depletes the total oxygen of the aqua-

life, hence death of the aquatic organisms occurs.

Release of municipal wastes into water bodies causes water pollution.

The effluents released from chlorine plants into water bodies, leads to toxicity of the aquatic vegetation.

Domestic sewage is drained into the water bodies, thus causing water pollution.

The warm water is released from the power plants into the water bodies. This leads to thermal pollution of water.

Spillage of oil rigs, pipelines from oil offshore exploration and tankers pollute the sea water.

Testing of nuclear weapons and during nuclear accidents, the radioactive wastes are formed which are dumped into oceans. These wastes gets absorbed by the plankton and do not metabolize, hence gets accumulated in the food chain.

11. The process of making coirs from decaying husks of coconut is known as retting. This process releases hydrogen sulphide which pollutes the water bodies.

12. Some chemicals in potable water, chemicals in drinking water may be introduced due to the anthropogenic activities or they may be occurring naturally. Some of the chemicals in water are,

(a) Fluoride

This element is essential for prevention of dental caries, but an increased level has adverse effect on health like yellowing of teeth, damage to spinal cord and crippling diseases.

(b) Arsenic

High concentration of arsenic can lead to arsenic skin lesions, damage to the liver and nervous systems and vascular diseases.

(c) Lead

The household plumbing system and equipment can contaminate the drinking water. High levels can affect the central nervous system.

(d) Petrochemicals

The underground petroleum storage tanks contaminate the ground water. Low levels are carcinogenic.

(e) Pesticides

The pesticides in water affects the nervous system and carcinogenic too. The chlorides in the pesticides cause damage to the reproductive and endocrine systems.

(f) Salts

The salts in drinking water makes it unfit for human consumption and irrigation purposes.

13. Human activities like mining, felling of trees, generating power also leads to water pollution.

Q7. What are the effects of water pollution?

Ans :

- The main effects of water pollutants are:
1. Compounds of mercury, arsenic and lead are poisonous and chemically harmful as they even affect water treatment plants e.g. organic sulphur compounds interfere with nitrification.
 2. Mercury when dissolved in water is absorbed by aquatic plants and enters the food chain. Lead impairs metabolism and brings about congenital deformities, anaemia etc.
 3. Cadmium damages kidneys and liver.
 4. Inorganic nitrates and phosphates promote growth of oxygen-consuming algae, which result in the death of fishes and other aquatic animals.
 5. Presence of dyes and compounds in the discharged water changes the colour of water.
 6. Soap, detergents and, alkalis result in foam formation.
 7. Industrial effluents containing iron, free chlorine, phenol, manganese, oils, hydrocarbons, ammonia, algae and microorganisms impair the taste and odours of water.

8. The nitrates and phosphates dissolved in water accelerate the growth of microorganisms, which consume much of the dissolved oxygen depriving fish and other aquatic life (Eutrophication).

9. Biomagnification is the increase of toxic materials at each trophic level of a food chain.

For example, DDT after reaching a water system is absorbed by the microorganisms on which smaller fishes feed. From them, DDT reaches the carnivorous animals. Since bigger fishes consume more food, large amounts of DDT accumulates in their body.

Q8. What are the various measures of water pollution?

Ans : (Imp.)

In order to lead a healthy life, we must take proper precautions in disinfecting the city water.

The various ways by which we can control water pollution are,

1. Safe disposal of human excreta.
2. Paints, hazardous wastes and motor oils should not be discarded down the drain, as they migrate to the water source thereby contaminating it.
3. A non-phosphate or low phosphate detergent may be used to wash clothes as the high phosphate content in lakes and streams endanger the lives of fish and wildlife.
4. Plastic bags should not be dumped into water bodies, as aquatic animals consume it, which leads to their death.
5. Water supplied to cities for drinking should be disinfected properly.
6. The effluent waste should be released into the water after pretreating it. The treated effluent can be used for gardening purpose.
7. Usage of root zone method helps to control water pollution. In this process, the zones of specially designed reed beds. The reeds function by absorbing oxygen and

creates a condition for thriving of various microorganisms. These micro-organisms purify the contaminated water.

8. Treatment of sewage prevents water pollution.

9. Avoid excess use of chemical fertilizers and pesticides as it leads to water pollution. Thus biogas fertilizers and biopesticides should be used in agriculture.

10. Recycling of waste materials help to minimize water pollution.

11. Installation of sewage treatment plants help to minimize water pollution.

12. The pollution control system designed and developed at NASA's Marshall Space Flight Center (MSFC) combines both water and air pollution control into one system. This can be implemented in all the developing countries to control water pollution.

4.4 CAUSES, EFFECTS AND CONTROL MEASURES OF SOIL POLLUTION

Q9. Define Soil Pollution. State the various Causes of Soil Pollution.

Ans : (Imp.)

Meaning

Soil is made up of biotic and abiotic components, it is a mixture of organic matter, mineral's and some organisms, namely bacteria and fungi. Soil functions as a habitat for many organisms and covers a large portion of earth's surface.

The formation of soil is a slow process because it is the result of physical, chemical and biological processes. Soil supplies water and nutrients to plants, the plants get their oxygen from the air trapped in the soil. The organic material from plants affects the texture and composition. The soil needs to be conserved because it is a non-renewable resource though traditionally it is considered as an infinite resource. Soil conservation is important for food production. Productive soils are mixtures of water, minerals, interacting gases, microbes and organic matter.

Causes
 Human activities, mostly agriculture and deforestation - destroy soil structure and fertility. Inappropriate irrigation practices, loss of vegetative cover, indiscriminate application of fertilizers, pollution from pesticides and crop mismanagement are some of the factors that affect soil structure and fertility.

Food production can be enhanced only at the expense of damage to top soil through the depletion of nutrients. In the long term, even very fertile soils become degraded if this trend continues.

Deforestation leads to soil erosion because when the trees and vegetation are removed, the soil is exposed to winds and rains and gets eroded faster. Soil erosion by heavy winds and rains has damaged many regions in India. Nearly 2 billion hectares of crop and grazing land are suffering from moderate to severe soil degradation. In some regions, fertile top soils are being depleted 300 times faster than the nature can regenerate them.

Q10. State the effects and measures of soil pollution.

Ans :

Effects

The foremost effect of loosing top soil is causing water pollution and reduced food production leading to food shortage. With population growth, it becomes more critical.

Secondly, continuous exposure of eroded soil to sun for longer periods may transform the land into sandy and rocky nature. These are symptoms of desertification rendering the soils unsuitable for cultivation. As a result, the extent of agricultural land would decrease.

Control Measures

The pressure on intensification of farm activities increases for two reasons:

- (i) Population growth and
- (ii) Decrease of the available farm land due to urbanization. Protection of soils thus becomes important.

Soil erosion can be controlled by a variety of forestry and farm practices. For example,

- (i) Trees may be planted on barren slopes,
- (ii) Contour cultivation and 'strip' cropping may be practiced instead of 'shifting' cultivation and
- (iii) Terracing and building diversion channels may be undertaken

Reducing deforestation and substituting chemical manures by animal wastes would also help to arrest soil erosion in the long term. Maintaining soil productivity is vital and essential for sustainable agriculture.

Q11. Explain about soil erosion in India.

Ans :

Soil erosion is a worldwide phenomenon, but it is especially high in Central Africa, China, India, Nepal, Australia, Spain, USA and USSR. India loses about 40,000 hectares of land every year as an effect of wind and water erosion. Damage to the topsoil is 18.5% of the total world's loss. This is due to overgrazing by livestock. The population of livestock in India is the highest in the world. Overgrazing damages the topsoil, which reduces soil fertility.

(i) Deforestation or overgrazing

Over-grazing is the main cause of soil erosion in India. Roots of grasses act as binding material and keep the soil intact, which upon grazing are destroyed.

(ii) Desertification

Loss of soil productivity by erosion of top soil results in the formation of deserts. Deserts are spreading in all continents. Desertification takes place by shifting of sand dunes by wind and over-grazing. That desert in India is spreading at the rate of 12,000 hectares of land every year.

(iii) Shifting cultivation

Tribal communities follow the practice of cutting down trees and setting them on fire and then raising the crops on the resulting ash. This is called Jhumming in northeastern India. It is harmful if the Jhumming cycles are longer than ten years but short cycles destroy forests and cause soil erosion. e.g. Asia and Africa.

(iv) Developmental activities

Large areas of fertile and productive croplands, woodlands and grasslands are lost to various developmental activities such as rapid urbanization, building of airports, industries, railways, roads, mining and construction of dams.

4.5 CAUSES, EFFECTS AND CONTROL MEASURES OF NOISE POLLUTION

Q12. What is noise pollution? State the various causes of noise pollution.

Ans :

Definition

Noise pollution is the uneasy, unwanted and undesired sound produced by traffic, industrial units, aero planes and similar sources'.

Causes

It exists mostly in densely populated areas, cities and industrial complexes. Railway stations, bus stations, airports, shopping complexes and other commercial zones are the sources of noise generation. Television, Radio, kitchen gadgets produce noise in the house. Even music can be a noise when it is loud and harsh.

In industries, huge machines running at high speeds produce sounds of different nature with different intensities. These sounds contribute to noise pollution. In public places such as temples, mosques, churches and commercial centers and functions such as meetings, and marriages, loud speakers are used indiscriminately creating noise of high intensity. The machinery used at construction sites create noise of irritating nature. Automobiles, trucks and buses produce noise from engines, blowing of horns and defective silencer-pipes.

Sound levels are measured in units called, decibels. For example, conversation produces sound at about 40 decibels, a train at about 80 decibels, a music concert at about 80 decibels, so on. The limit that humans can accept is about 110 decibels without pain and damage.

Q13. Explain the effects and control measures of noise pollution.

Ans :

(Imp.)
Noise can be defined as unwanted/unpleasant sound. So noise pollution is unwanted sound dumped into the atmosphere without regard to the adverse effects it may have. In our country urbanization and industrialization have become twin problems. Cities and towns have sprouted up where industries are concentrated. Lack of town planning had led to residential, commercial and industrial areas being mixed up. Houses, schools and hospitals are situated near industries. All the boons of industrialization and civilization such as motor horns, heavy and light machinery, work and movement, blaring radios, supersonic aeroplane have become disturbing and irritant. Our ears can hear ordinary conversation between 30-60 decibels. Modern conversation has a noise value of 60 decibels. A decibel value greater than 80 decibels causes noise pollution. Noise becomes troublesome above 140 decibels.

Effect of Noise Pollution

1. Constant noise affects a man physically and mentally. Physical effects include blood vessels to contract, skin to become pale, muscles constrict and rise in blood pressure leading to tension and nervousness.
2. High intensity sound emitted by industrial plants, bottling machines, supersonic aircraft when continued for long periods of time not only disturbs but also permanently damages hearing.
3. Offices, industries and crowded places where constant noise prevails can produce temper tantrums, headaches, fatigue and nausea.
4. Loud and sudden noise affect the brain. Intermittent noise leads higher incidence of psychiatric illness and also a danger to health of pregnant mothers and small infants.
5. Noise has harmful effects on non-living materials too, e.g. cracks develop under the stress of explosive sound.

There are four fundamental ways in which noise can be controlled: reduce noise at the source, and protect the path of noise, increase the path-length, and protect the recipient. In general, the best control method is to reduce noise levels at the source.

Source reduction can be done by effectively muffling vehicles and machinery to reduce the noise. In industries, noise reduction can be done by using rigid sealed enclosures around machinery lined with acoustic absorbing material. Isolating machines and their enclosures from the floor, using special spring mounts or absorbent mounts and pads, and using flexible couplings for interior pipelines also contribute to reducing noise pollution at the source.

However, one of the best methods of noise source reduction is the regular and thorough maintenance of coating machinery. Noise levels at construction sites can be controlled using proper construction planning and scheduling techniques. Locating noisy air-compressors and other equipment away from the site boundary, along with creating temporary barriers to physically block the noise, can contribute to tracing noise pollution.

Most of the vehicular noise comes from the movement of the vehicle tires on the pavement and wind resistance. However, poorly-maintained vehicles can add to the noise levels. Traffic volume and speed also have significant effects on the overall sound. For example, doubling the speed increases the sound levels by about 9 dB and doubling the traffic volume (number of vehicles per hour) increase sound levels by about 3 dB. A smooth flow of traffic also causes less noise than does a stop-and-go traffic pattern. Proper highway planning and design are essential for controlling traffic noise. Establishing lower speed limits for highways that pass through residential areas, limiting traffic volume, and providing alternative routes for truck traffic, are effective noise-control measures. The path of traffic noise can also be blocked by constructing vertical barriers alongside the highway.

Planting trees around houses can also act as effective noise barriers. In industries, different types of absorptive material can be used to control interior noise. Highly-absorptive interior finish material for

walls, ceilings and floors can greatly decrease indoor noise levels. Sound levels drop also significantly with increasing distance from the noise source. Increasing the path-length between the source and the recipient offers a passive means of control. Municipal landuse ordinances pertaining to the location of airports make use of the attenuating effect of distance on sound levels. The use of earplugs and earmuffs can protect individuals effectively from excessive noise levels; specially-designed earmuffs can reduce the sound level reaching the eardrum by as much as 40 dB. However, very often workers tend not to wear them on a regular basis despite company requirements for their use.

4.6 CAUSES, EFFECTS AND CONTROL MEASURES OF THERMAL POLLUTION

Q14. What is Thermal Pollution? State the causes effects Control Measures of Thermal Pollution.

Ans :

Meaning

Thermal pollution is the pollution created when the waste heat, a by product in many industrial processes is released into water bodies such as lakes and rivers.

Causes

Many heavy industries use water for cooling purposes during manufacturing processes. Cold water is run through the cooling cycle and discharged at a higher temperature.

For example, metallurgical plants, chemical and pharmaceutical industries, paper and pulp industries, petroleum products and plastic industries are some of the major industries that utilize fresh cool water and release as waste hot water. Thermal power plants are the major consumer of fresh water and probably the major contributor to thermal pollution.

It is estimated that a thermal power plant requires about 40 gallons of water for producing one kilowatt hour power, and a nuclear plant requires around 55 gallons per kilowatt hour. All this waste water is released into nearby water bodies.

Effects

The hot water released into water bodies raises the ambient temperature and increases the biological growth rate and the oxygen demand while at the same time reducing oxygen diffusivity.

As a result, the dissolved oxygen levels drop drastically affecting the aquatic life, particularly fish population. The water quality also gets changed. If the water bodies are already contaminated with chemical pollutants, the addition of thermal pollution enhances the toxicity because the presence of chemical pollutants also affect the dissolved oxygen in water.

The decrease in oxygen content in the water bodies due to thermal pollution depends on the temperature of the released water. The survival of fish and other aquatic life depend on the dissolved oxygen level in water.

Control Measures

Technological improvements in thermal power plants reduce the generation of waste heat. Cooling towers are used which transfer heat from the water to atmosphere by evaporation, preventing thermal pollution. This is also achieved differently, by constructing cooling ponds and discharging waste water into them. The ponds are so designed that the heated water is released at the shallow end about 1 to 2 meters depth which gets cooled by natural cooling and the cooled water is drawn from the bottom of the pond at the other end about 15 meters deep for cooling purposes. Thermal pollution could be significantly reduced if the heat is directly converted into energy.

Alternative applications could be found for the waste hot water. Certain commercially available fish cultures are grown in hot water, hence aquaculture could be developed. Desalination of sea water is also attempted using the heat available in the waste water. Some of these measures have to be fully developed to utilize waste heat, a useful by product of industrial activity.

4.7 SOLID AND LIQUID WASTE MANAGEMENT

Q15. Classify the Sources of Municipal Solid Wastes. Explain the methods adopted for disposal of such wastes in urban areas.

Ans :

Solid waste management refers to application of suitable techniques technologies and management programs aimed at the following objectives,

- Reduction in waste.
- Effective management of waste with least impact on environment and economically sustainable.

The garbage or waste generated from every household, industry or hospital is referred to as the solid waste.

Depending upon the source, the solid waste may be classified into different types,

1. Household Waste

House hold waste includes vegetable and fruit peels, leftover foodstuff, carry bags, containers, trash bags, bottles, leaves from the garden, the debris of the construction and demolition sites and sanitation residue. All these are also classified as municipal waste.

2. Industrial Waste

The industrial waste from the industries, hospitals and household wastes includes old batteries, shoe polish, paint tins, old medicines and medicine bottles.

3. Hospital Waste

The hospital waste which is considered hazardous are the chemicals like formaldehyde and phenols used as disinfectants, mercury used in thermometers and sphygmomanometers. In industries, the hazardous wastes generated are metals, chemicals, paper, pesticide, dye.

Hospital waste includes the soiled clothes with blood and other body fluids, anatomical waste, sharp, disposable, discarded medicines, chemical wastes, swabs, bandages, glucose bottles, intravenous tubes, blood and urobags, surgical gloves, catheters, human excreta etc. All these are also referred to as biomedical waste.

The first step in the disposal of the solid waste is the segregation of waste. The waste can be segregated as,

Biodegradable Waste

(a) This group includes the kitchen waste, vegetables, fruits, flowers, paper, leaves from the garden, all form the organic waste.

Non-biodegradable Waste

(b) This group includes,

Recyclable waste - Paper, glass, metals, plastics.

(ii) Toxic waste - The containers of fertilizers and pesticides, old batteries, shoe polish, old medicines, paints and chemicals.

(iii) Soiled waste - The waste from the hospitals like clothes soiled in blood and other body fluids.

The kabadiwalias have an important role in Indian homes in the segregation of wastes. They buy old items like newspapers, bottles, magazines, oil cans, old exercise books, plastic bags, etc. These items may be recycled or reused.

The wet waste generated from the households, consisting of leftover foodstuff, vegetable peels and fruits can be dumped in the compost pit and used as a manure for plants. The dry waste consisting of cans, bottles, plastics, metals, newspapers, magazines, aluminium foils etc can be used for recycling.

The ragpickers have an important role in waste management. This group includes the men, women and children from the lower strata of the society, who go around residential areas to scavenge the recyclable matter (like paper, plastic, glass, ceramics and cans) sell them to the retailers and wholesellers. These are then sold to the industries that use this waste matter as raw material.

The rate at which the population is booming and the increased urbanization has led to increase in the generation of waste. The waste is disposed off by adapting various methods as described below,

1. Open Dumps

The solid wastes of all kinds are dumped in open and uncovered areas. The waste is not segregated. The open dumps form a breeding ground for mosquitoes, flies, rodents and

other disease causing organisms. The surface water and rain water flowing into open dumps contaminate the surrounding areas and form a causative agent for spread of diseases.

2. Landfills

Landfills refer to a pit that is dug in the ground. The solid wastes are dumped into this pit and covered so as to prevent the breeding of flies, mosquitoes and rodents. Then a layer of soil is spread on top of the waste matter and it is then compressed by using an earth moving equipment. Once the land fill is full by repeating the above process, the area is covered by a thick layer of soil and the area is developed and used as a parking lot or a park.

3. Sanitary Landfills

In this method, the low lying areas created during mineral excavations and granite quarries are restored to the original level by using solid wastes. The land thus reclaimed may be used either for cultivation or industrial setup. The solid wastes are deposited on these sites and layered with soil and other suitable material. The rate of decomposition of solid waste is slow due to the fact that less oxygen is available due to tight compression of the garbage. Since these landfills are covered, this prevents the breeding of disease vectors like flies, mosquitoes and rodents. The heat generated during the process of decomposition of wastes helps in the destruction of pathogenic organisms and larval forms in the wastes. During the process of anaerobic decomposition, some amount of methane gas evolves which is tapped and sold as fuel in some countries.

4. Incineration

It refers to burning of wastes in large furnaces. The recyclable materials are segregated from the solid wastes and the remaining material is burnt in large furnaces to form ash. Some of the ash formed during the process of burning may float along with hot air and contaminate the air and water. The remaining ash in the furnace contains high concentrations of toxic materials like dioxins and

heavy metals. When this ash is used as a landfill, it causes severe contamination of the area and also results in soil leaching. Hence, incineration is kept as the last option for the treatment of solid wastes.

The generation of huge amount of wastes daily by each one of us has led to various problems. The major health hazards include the skin and blood infections, eye and respiratory infections, intestinal infection, cancer of incineration operators due to exposure to hazardous compounds.

Q16. Explain about Collection of Municipal Solid Waste.

Ans :

The municipal solid waste collection involves the following functional components,

(a) Municipal Solid Waste Collection from Non-point Sources

The waste generated from various households are collected by garbage collectors who are employed under contract by the firms or local governing bodies. The waste is collected generally in three-wheeled cart and dumped in the community bins/communal containers.

This stage also involves the garbage clearance operations including sweeping of roads, removal of road silts, rubbles, debris, shrubs and all types of solid wastes on the roads on all days of the week.

(b) Municipal Solid Waste Collection from Point Source

The waste deposited in the community bins/communal containers now form the point source for municipal solid waste. The community bins are placed at specified street corners, near markets, apartment complexes, shopping malls, hotels, gardens and religious places.

The frequency of lifting garbage from the community bins should be increased to prevent garbage pile up and create other health problems.

(c)

Transfer of Garbage to Disposal Sites

Large dumper placer vehicles collect waste from the community bins and dump the waste at garbage dumping yards, located several kilometers away from the main city. At certain places, small collection vehicles are used to carry the garbage to transfer stations where the wastes are loaded into large vehicles (such as, trailers or Bulk Refuse Carriers) for transportation to the disposal or processing sites or a specified landfill site.

Q17. What is meant by Environmental Legislation?

Ans :

Composting

Composting is a biological process wherein biodegradable organic matter undergoes aerobic decomposition by aerobic microorganisms, ants, nematodes and oligochaete worms to form compost. Compost is very rich in nutrients, especially carbon and nitrogen. The waste produced in the kitchen can be recycled by the method of composting and used as organic fertilizer for growing plants.

The advantages of composting are as follows,

1. Easy cultivation of soil
2. Prevents the erosion of soil by keeping the soil covered
3. Helps to keep the soil cool in summer and warm in winter
4. Supplies essential nutrients to the growing plants.

Vermicomposting

Vermicomposting is a process in which worms (Example: Earthworm species Eisenia foetida & Lnmbricus rebellus) are added for the breakdown of the organic matter to form the end-product vermicompost. Other organisms like insects, moths and bacteria too contribute to vermicomposting. The excreta added by these worms enriches the compost with the nutrients.

The advantages of vermicomposting are as follows,

1. Enrichment of soil with nutrients essential for growing plants.
2. Improvement of water-holding capacity in soil.
3. Improvement in structure and growth of root.
4. Improvement in plant growth and crop yield.

Q18. Write a note on Recycling.

Ans :

Recycling is reusing some components of the waste that may have some economic value. Recycling has readily visible benefits like conserving resources, reducing energy used during manufacture, and reducing pollution levels. Some materials, such as aluminum and steel, can be recycled many times. Metal, paper, glass and plastics are recyclable. Mining of new aluminum is expensive and, hence, recycled aluminum has a strong market and plays a significant role in the aluminum industry. Paper recycling can also help preserve forests, as it takes about 17 trees to make one ton of paper. Crushed glass (cullet) reduces the energy required to manufacture new glass by 50%. Cullet lowers the temperature requirement of the glassmaking process thus conserving energy and reducing air pollution. However, even if recycling is a viable alternative, it presents several problems.

The problems associated with recycling are either technical or economical. Plastics are difficult to recycle because of the different types of polymer resins used in their production. Since each type has a distinct chemical composition, different plastics cannot be recycled together. Thus, separation of different plastics before recycling is necessary. Similarly, in recycled paper, the fibers are weakened and it is difficult to control the colour of the recycled product. Recycled paper is banned for use in food containers to prevent the possibility of contamination. It very often costs less to transport raw paper pulp than scrap paper. Collection, sorting and transport account for about 90% of the cost of paper recycling. The processes of pulping, de-inking and screening wastepaper are generally more expensive than making paper from virgin wood or cellulose fibers. So, very often recycled paper is more expensive than virgin paper. However, as technology improves the cost will come down.

Disposal of solid waste is done most commonly through a sanitary landfill or through incineration. A modern sanitary landfill is a depression in an impermeable soil layer that is lined with an impermeable membrane. The three key characteristics of a municipal sanitary landfill that distinguish it from an open dump are:

- Solid waste is placed in a suitably selected and prepared landfill site in a carefully manner.
- The waste material is spread out and compacted with appropriate heavy machinery.
- The waste is covered each day with a layer of compacted soil.

Q19. Explain about Vermi Composting.

Ans :

Nature has perfect solutions for managing the waste it creates, if left undisturbed. The biogeochemicalcycles are designed to clear the waste material produced by animals and plants. We can mimic the same methods that are present in nature. All dead and dry leaves and twigs decompose and are broken down by organisms such as worms and insects, and finally by bacteria and fungi, to form a dark rich soil-like material called compost.

These organisms in the soil use the organic material as food, which in turn provides them with nutrients for their growth and activities. These nutrients are returned to the soil to be used again by trees and other plants. This process recycles nutrients in nature. All De used as a manure for farms and gardens.

Steps for Vermicomposting

- Dig a pit about half a meter square, one meter deep
- Line it with straw or dried leaves and grass
- Organize the disposal of organic waste into the pit as and when generated
- Introduce a culture of worms that is now produced commercially
- Ensure that the contents are covered with a sprinkling of dried leaves and soil everyday

- Water the pit once or twice a week to keep it moist
- Turn over the contents of the pit every 15 days
- In about 45 days the waste will be decomposed by the action of the micro-organisms
- The soil derived is fertile and rich in nutrients.

4.8 ENFORCEMENT OF ENVIRONMENTAL LEGISLATION

Q20. What is meant by Environmental Legislation?

Ans : (Imp.)

The term environmental legislation refers to the management of the environment under a strong legal framework to help protect the environment.

An international conference on human environment was organized in Stockholm from 5th June to 16th June, 1972 as U.N. Conference on Human Environment to bring awareness to people to exert efforts for preservation of the environment for the well-being and prosperity of all. Since then, 5th June is celebrated every year as World Environment Day across the world. In India, the Department of Environment was setup in 1980, which later became the Ministry of Environment and Forests in 1985. The MoEF served as the nodal agency, as the centre for planning, encouraging and organizing the environmental programmes. Along with the MoEF, the Central Pollution Control Board and the State Pollution Control Board form the regulatory and administrative core.

Constitutional Provisions for Environmental Protection

In the Constitution of India, Article 48-A states: "The state shall endeavour to protect and improve the environment and to safeguard forests and wildlife of the country". Protection of environment has been made a fundamental duty of every citizen of India under Article 51A (g). According to it, "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures".

The Government of India has formulated about 30 Acts and Rules related to the environment. The environmental legislations passed by the Government of India are enlisted below,

- (i) The River Boards Act, 1956.
- (ii) The Merchant Shipping Act, 1970.
- (iii) The Wildlife Protection Act, 1972, Rules 1973 and Amendment 1991.
- (iv) The Water (Prevention and Control of Pollution) Act, 1974.
- (v) The Water (Prevention and Control of Pollution) Cess Act, 1977.
- (vi) The Water (Prevention and Control of Pollution) Rules, 1978.
- (vii) The Forest (Conservation) Act 1980, and Rules, 1981.
- (viii) The Air (Prevention and Control of Pollution) Act, 1981.
- (ix) The Air (Prevention and Control of Pollution) Rules, 1982.
- (x) The Atomic Energy Act, 1982.
- (xi) The Environmental (Protection) Act, 1986.
- (xii) The Environmental (Protection) Rules, 1986.
- (xiii) The Air (Pollution and Control of Pollution) Amendment Act, 1987.
- (xiv) The Motor Vehicles Act, 1988.
- (xv) The Hazardous Waste (Management and Handling) Rules, 1989.
- (xvi) The Manufacture, Storage and Import of Hazardous Rules, 1989.
- (xvii) The Manufacture, Use, Import, Export and Storage of Hazardous Microorganism/ Genetically Engineered Organism or Cells Rules, 1989.
- (xviii) The Coastal Regulation Zone Notification, 1991.
- (xix) The Public Liability Insurance Act and Rules and Amendment, 1991.
- (xx) The National Environment Tribunal Act, 1995.

- (xxi) The National Environment Appellate Authority Act, 1997.
- (xxii) The Biomedical Waste Management and Handling Rules, 1998.
- (xxiii) The Environment (Siting for Industrial Projects) Rules, 1999.
- (xxiv) The Municipal Solid Waste (Management and Handling) Rules, 2000.
- (xxv) The Ozone Depleting Substances (Regulation and Control) Rules, 2000.
- (xxvi) The Batteries (Management and Handling) Rules, 2001. The Ministries and departments that deal with environmental issues are Ministry of New and Renewable Energy Sources, Ministry of Power, Ministry of Rural Development, Ministry of Urban Development and Poverty Alleviation, Ministry of Petroleum, etc.

Q21. What is meant by Enforcement of Environmental Legislation?

Ans :

Effective implementation of environmental legislation need the involvement of an agency that collects relevant data, process it and pass it on to the law enforcement agency.

In order to protect and conserve the pristine environment, a number of laws have been enacted by the Indian Government which include laws to curb all sorts of pollution-environment, water, noise and air, forest conservation, coastal regulation, biological diversity, wildlife protection and many more.

It has been observed that, inspite of the existence of legal framework for protection of environment, environmental degradation still continues, perhaps due to lapses in enforcement of environmental legislation.

4.9 ENVIRONMENT PROTECTION ACT

Q22. Explain briefly about Environment Protection Act 1986.

Ans :

(Imp.)

This Act is a general legislation to cover the lapses and gaps in the above Acts. This Act empowers the Central government to fix the standards for

quality of air, water, soil and noise and to formulate procedures and safe guards for the handling of hazard substances.

The Act further empowers the government to lay down procedures and safe guards for the prevention of accidents which cause pollution and remedial measures if an accident occurs. The government has the authority to close or prohibit or regulate any industry or its operation or the processes, if the violation of the provisions of the Act occur.

The penal sections of the Act contain more stringent penalties. Any person who fails to comply or who contravenes any provision of the Act shall be punishable with imprisonment for a term extending to five years or be punishable with fine up to Rupees one lakh or both. If the violation continues, an additional fine of Rupees five thousand per day may be imposed for the entire period of violation of rules. The Act fixes the liability of the offence punishable under Act on the person who is directly in charge, - whether he/she is the director or Manager or Secretary or any other officer, unless he/she proves that it was committed without his/her knowledge or consent or is not attributable to any neglect on the part of such a person.

The Act empowers the officer of Central government to inspect the site or the plant or the machinery for preventing pollution; and to collect samples of air, water, soil or other material from any factory or its premises for testing.

The Act provides that the legal machinery shall admit complaints submitted by Central government or any person or authority authorized on its behalf, or by any person who has given notice of not less than sixty days of his intention to lodge a complaint. Such a person is entitled to file the complaint after the expiry of sixty days or before it as and when he/she gets permission to do so.

The Environment (Protection) Act is the most comprehensive legislation with powers for the central government to directly act, avoiding many regulatory authorities or agencies.

Enforcement

All the Acts are very comprehensive, and the regulations and rules are framed to reflect the spirit of these Acts.

The industries which pollute most should be equipped with pollution-control gadgets and effluent treatment plants. This is a costly proposal and the industry prefers to pay the penalty for non-compliance which is relatively cheaper. More R and D activity is needed to develop these equipment. The efforts and contributions of NEERI, Nagpur in this area are helping the industry to implement..

Secondly, there is a general feeling that some powerful lobbies come in the way when action is initiated on a violation of law by any industry. The implementation mechanism should be strengthened.

Public Awareness

The environmental awareness among the people need to be promoted to enable proper implementation of the rules and regulations. The NGOs have immense opportunities in educating the people about the provisions in the various Acts and about their rights and responsibilities. Many environmental organizations, NGOs, and individuals have been advocating for arresting environmental degradation through awareness-building activities; and to include the environmental assessment or audit as processes in the frame work of planning. Social mass movements are an outcome of these efforts.

In the last three decades, India has witnessed various mass movements raising different kinds of issues, namely, water conservation and management, natural resources management and harnessing and distribution of resources within the framework of equality and justice. The movements are led by farmers, fisher folk mostly belonging to underprivileged sections of the society and women folk. These movements have led to the emergence of an 'environmental ideology' which is taking up the challenge.

- (i) To prepare an alternative vision of human society and economy,
- (ii) To choose environmentally benign and socially just technologies and
- (iii) To make decision-making through democratic processes.

The resource-based communities are now questioning the State's policy of taking away their

accessibility to the resources in the name of 'public purpose'. Along the entire coastal lines of 7000 kilometers, the fishermen, farmers and traditional prawn cultivators are challenging attacks from tourism, aquaculture, fishing by foreign vessels, and port development authorities.

Promoters of hydro power projects and mining are also questioned for the environmental impact and causing displacement to people from their traditional homes.

But the planners and the beneficiaries of these projects criticize these movements as 'anti-development' though the facts are otherwise. Despite a national capacity of 90 thousand MW of power generation, nearly 50 to 80 percent of rural people do not have electric power. Similarly, water from the big river basin are tapped to be diverted to urban people, leaving no water to rural areas and tribal hamlets located at the tail-end of the canal works.

The benefits and sustainability of all development projects are being questioned by these groups. As a result, social and environmental costs are being accepted as important in setting developmental priorities, and the environmental appraisal and the social impact assessment are considered essential. With the support from pro-people academies, technocrats and advocates and other pro-environmental institutions, these movements are critical of these assessments which are often faulty.

Besides, they are identifying the unsustainability of benefits also. To cite examples of this uprising : the people in Kerala against the pollution of Chaliyar river, the residents of Bhatti mines on the outskirts of Delhi, the farmer's movements in Karnataka raising the issues of bio diversity in farming, the fisherfolk of Umbergaon in Gujarat against the construction of port and so on.

These uprisings could succeed in bringing together the environmentalists, the development activists and human rights groups together, which could be considered as a modest achievement.

The main challenge being faced by these movements is 'to suggest alternatives'. They argue that the local communities have the first right to the resources and hence their participation in the

planning process and their consent to clear a project should be made mandatory; the State however would prepare the policy frame work and the links from the local community to regional and national perspectives.

This alternative approach is growing stronger on the issue, and in this process, the marginalized sections of society, the women, and backward communities at the community level become the participants., which is contrary to the top-down approach all along practiced. The watershed development projects, the micro-hydel projects are typical examples of this new alternative.

The mass movements with the environmental vision have a great role to play in bringing about the process of sustainable developments.

4.9.1 Air Act

Q23. Discuss briefly the provisions of Air Act 1981.

(Imp.)

Ans :

The Government passed this Act in 1981 to clean up our air by controlling pollution. It states that source of air pollution such as industry, vehicles, power plants, etc., are not permitted to release particulate matter, lead, carbon monoxide, sulfur dioxide, nitrogen oxide, volatile organic compounds (VOCs) or other toxic substances beyond a prescribed level. To ensure this, Pollution Control Boards (PCBs) have been set up by Government to measure pollution levels in the atmosphere and at certain sources by testing the air. This is measured in parts per million or in milligrams or micrograms per cubic meter. The particulate matter and gases that are released by industry and by cars, buses and two wheelers is measured by using air-sampling equipment. However, the most important aspect is for people themselves to appreciate the dangers of air pollution and reduce their own potential as polluters by seeing that their own vehicles or the industry they work in reduces levels of emissions.

This Act is created 'to take appropriate steps for the preservation of the natural resources of the Earth which among other things includes the preservation of high quality air and ensures controlling the level of air pollution. The main objectives of the Act are as follows:

- (a) To provide for the prevention, control and abatement of air pollution.
- (b) To provide for the establishment of Central and State Boards with a view to implement the Act.
- (c) To confer on the Boards the powers to implement the provisions of the Act and assign to the Board functions relating to pollution.

Air pollution is more acute in heavily industrialized and urbanized areas, which are also densely populated. The presence of pollution beyond certain limits due to various pollutants discharged through industrial emission is monitored by the PCBs set up in every state.

Powers and Functions of the Boards

1. Central Board

The main function of the Central Board is to implement legislation created to improve the quality of air and to prevent and control air pollution in the country. The Board advises the Central Government on matters concerning the improvement of air quality and also coordinates activities, provided technical assistance and guidance to State Boards and lays down standards for the quality air. It collects and disseminates information in respect of matters relating to air pollution and performs functions as prescribed in the Act.

2. State Pollution Control Boards

The State Boards have the power to advise the State Government on any matter concerning the prevention and control of air pollution. They have the right to inspect at all reasonable times any control equipment, industrial plant, or manufacturing process and give orders to take the necessary steps to control pollution. They are expected to inspect air pollution control areas at intervals or whenever necessary steps to control pollution. They are empowered to provide standards for emissions to be laid down for different industrial plants with regard to quantity and composition of emission of air pollutants into the atmosphere. A State Board may establish or recognize a laboratory to perform this function.

The State Governments have been given powers to declare air pollution control areas after consulting with the State Board and also give instructions to ensure standards of emission from automobiles and restriction on use of certain industrial plants.

Penalties

The persons managing industry are to be penalized if they produce emissions of air pollutants in excess of the standards laid down by the State Board. The Board also makes applications to the court for restraining persons causing air pollution. Whoever contravenes any of the provision of the Act or any order or direction issued is punishable with imprisonment for a term which may extend to three months or with a fine of Rs 10,000 or with both, and in case of continuing offence with an additional fine which may extend to Rs 5,000 for every day during which such contravention continues after conviction for the first contravention.

What can individual do to control air pollution?

- 1) When you see a polluting vehicle, take down the number and send a letter to the Road Transport Office (RTO) and the PCB.
- 2) If you observe an industry polluting air, inform the PCB in writing and ascertain if action is taken.
- 3) Use cars only when absolutely necessary; walk or cycle as much as possible instead of using fossil fuel-powered vehicles.
- 4) Use public transport as far as possible, as more people can travel in a single large vehicle rather than using multiple small vehicles which add to pollution.
- 5) Share a vehicle space with relatives and friends; carpools minimize the use of fossil fuels.
- 6) Do not use air fresheners and other aerosols and sprays which contain CFCs that deplete ozone layer.
- 7) Do not smoke in a public place, it is illegal and endangers not only your own health but that of others.

8) Coughing can spread bacteria and viruses. Use a handkerchief to prevent droplet infection which is airborne, as it endangers the health of other people.

It is a citizen's duty to report to the local authorities such as the Collector, the PCB and the press about offences made by polluter so that action can be taken against the offender. It is equally important to prevent and report to the authorities on cutting down of trees, as this reduces nature's ability to maintain the carbon dioxide and oxygen levels. Preventing air pollution and preserving the quality of our air is a responsibility that each individual must support so that we can breathe clean air.

4.9.2 Water Act

Q24. Discuss briefly the provisions of Water Act 1974.

Ans :

The Government formulated water Act in 1974 to prevent the pollution of water by industrial, agricultural and household wastewater that can contaminate our water sources. Wastewaters with high levels of pollutants that enter wetlands, rivers, lakes, wells as well as the sea are serious health hazards. Controlling the point sources by monitoring levels of different pollutants is one way to prevent pollution, by punishing the polluter. Individuals can also do several things to reduce water pollution such as using biodegradable chemicals for household use, reducing the use of pesticides in gardens, and identifying polluting sources at workplaces and in industrial units where oil or other petroleum products and heavy metals are used. Excessive organic matter, sediments and infecting organisms from hospital wastes can also pollute our water. Citizens need to develop a watchdog force to inform authorities to take appropriate actions against different types of water pollution. However, preventing pollution is better than trying to cure the problems it has created, or punishing offenders.

The main objectives of the Water Act are to provide for prevention, control and abatement of water pollution and the maintenance or restoration

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of the wholesomeness of water. It is designed to assess pollution levels and punish polluters. The Central Government and State Governments have set up PCBs to monitor water pollution.

Functions of the Pollution Control Boards

The Government has given the necessary powers to the PCBs to deal with the problem of pollution in the country. The Government has also suggested penalties for violation of the provisions of the Central and state water-testing laboratories have been set up to enable the Boards to assess the extent of water pollution and standards have been laid down to establish guilt and default. The Central and State Boards are entitled to certain powers and functions which are as follows:

1. Central Board

It has the power to advise the Central Government on any matters concerning the prevention and control of water pollution. The Board coordinates the activities of the State Boards and also resolves disputes. The Central Board can provide technical assistance and guidelines to State Boards to carry out investigations and research relating to water pollution, and organizes training for people involved in the process. The Board organizes a comprehensive awareness program on water pollution through mass media and also publishes data regarding water pollution. The Board lays down or modifies the rules in consultation with the State Boards on standards of disposal of waste. The main function of the Central Board is to promote the cleanliness of rivers, tanks, streams and wells in the country.

2. State Boards

They have the power to advise the State Government on any matters concerning water pollution. It plans a comprehensive program for the prevention of water pollution. It collects and disseminates information on water pollution and participates in research in collaboration with the Central Board in organizing training of people involved in the process. The Board inspects sewage or trade effluents, treatment plants, purification plants and the systems of

disposal and also evolves economical and reliable methods of treatment of sewage and other effluents. It plans the utilization of sewage water for agriculture. It ensures that if effluents are to be discharged on land, then the waste is diluted. The State Board advises State Governments with respect to location of industries. Laboratories have been established to enable the Board to perform its functions.

The State Boards have the power to obtain information from officers empowered by it who make surveys, keep records of flow, volume, and other characteristics of the water. They are given the power to take samples of effluents and suggest the procedures to be followed in connection with the samples. The concerned board analyst is expected to analyze the sample sent to him and submit a report of the result to the concerned Board. The Board is required to send a copy of the result to the respective industry. The Board also has the power of inspecting any plant record, register, document or any material object, and conducting a search in any place in which there is reason to believe an offence has been committed under the Act.

Penalties are charged for acts that have caused pollution. This includes failing to furnish information required by the Board, or failing to inform the occurrence of any accident or other unforeseen act. An individual or organisation that fails to comply with the directions given in the subsections of the law can be convicted or punished with imprisonment for a term of three months or with a fine of Rs.10,000 or both and in case failure continues an additional fine of Rs. 5,000 every day. If a person who has already been convicted for any offence is found guilty of the same offence again, s/he after the second and every subsequent conviction, would be punishable with imprisonment for a term not less than two years but which may extend to seven years with a fine.

What can individuals do to prevent water pollution?

1. Inform the PCB of any offender who is polluting water and ensure that appropriate action is taken. One can also write to the press.
2. Do not dump wastes into a household or industrial drain which can directly enter any water body, such as a stream, river, pond, lake or the sea.
3. Do not use toilets for flushing down waste items as they do not disappear but reappear at other places and cause water pollution.
4. Use compost instead of chemical fertilizers in gardens.
5. Avoid the use of pesticides at home like DDT, Malathion, Aldrin, and use alternative methods like a paste of boric acid mixed with gram flour to kill cockroaches and other insects. Use dried neem leaves to help keep away insects

4.9.3 Forest Act

Q25. Discuss briefly the Provisions of Forest Act.

Ans :

This Act was passed with a view to checking further deforestation. The objective of the Act is that Deforestation causes ecological imbalance and leads to environmental deterioration. Deforestation has been taking places on a large scale in the country and it has caused widespread concern.

THE AIR (PREVENTION AND CONTROL OF POLLUTION) RULES, 1982 In exercise of the powers conferred by Sec. 53 of the Air (Prevention and Control of Pollution) Act 1981, the Central Government in consultation with the Central Board for the prevention and control of water pollution makes the rules in the form of Air (Prevention and Control of Pollution) Rules, 1982.

THE AIR (PREVENTION AND CONTROL OF POLLUTION) AMENDMENT ACT, 1987 The implementing agencies have experienced some administrative and practical defaulters in effectively implementing the provisions of this Act and have brought these to the notice of the Government and the Government have decided to make necessary amendments to the Act. The Act was accordingly amended in 1987 and is called as the Air (Prevention and Control of Pollution) Amendment Act 1987.

Sec. 37 of the Principal Act Providing for Penalties is Amended as

1. "Whoever fails to comply with the provisions of Section 21 or Sec. 31 A shall in respect of each such failure, be punishable with imprisonment for a term which shall not be less than a year and six months but which may extend to six years and with fine, and in case the failure continues, with an additional fine which may extend to five thousand rupees for every day during such failure continues after the conviction for the first such offence.
2. If the failure referred to in sub sec. (1) continues beyond period of one year after the date of conviction, the offender shall be punishable with imprisonment for a term which shall not be less than two years but which may be extended to seven years and with imprisonment for a term which shall not be less than two years but which may extend to seven years and with fine. In Sec. 38 of the principal Act, for the words five hundred rupees the words Ten thousand rupee are substituted. Sec. 39 penalty for contravention of certain provisions is amended as whoever contravenes any of the provisions of this Act or any order or direction issued thereunder, for which no penalty has been elsewhere provided in this Act, Shall be punishable with imprisonment for a term which may extend to three months or with fine which may extend to three months or with fine which may extend to ten thousand rupees or with both, and in the case of continuing contravention with an additional fine which may extend to ten thousand rupees for every day during which such contravention continues after conviction for the first such contravention.

4.9.4 Wild Life Acts**Q26. Explain about Wildlife Protection Act 1972.**

The Act is aimed to protect and preserve wild life. Wild life refers to all animals and plants that are not domesticated. India has rich wild life heritage; it has 350 species of mammals, 1200 species of birds and about 20,000 known species of insects. Some of them are listed as 'endangered species' in the Wild Life (Protection) Act.

Wild life is an integral part of our ecology and plays an essential role in its functioning. The wild life is declining due to human actions; the wild life products skins, furs, feathers, ivory etc., have decimated the population of many species. Many species are already extinct and several others face extinction.

The Act envisages national parks and wild life sanctuaries as protected areas to conserve wild life. Wild life populations are regularly monitored and management strategies formulated to protect them.

The Act covers the rights and non-rights of forest dwellers too it provides restricted grazing in sanctuaries but prohibits in national parks. It also prohibits the collection of non-timber forest produce which might not harm the system. The rights of forest dwellers recognized by the Forest Policy of 1988 are taken away by the Amended Wild life Act of 1991.