ENVIRONMENTAL POLLUTION AND ITS EFFECTS

Environment It is made up of air, water, land, and biota. It is virtually everything that surrounds an organism. The surroundings may be living or non-living. Each living organism constantly interacts with its environment and adapts to it.

Pollutant It is a material which is present in excess of the natural concentration and produces a bad effect upon the environment.

Thus, anything or any substance, if present in undesirable concentrations and in the wrong place at the wrong time is a pollutant.

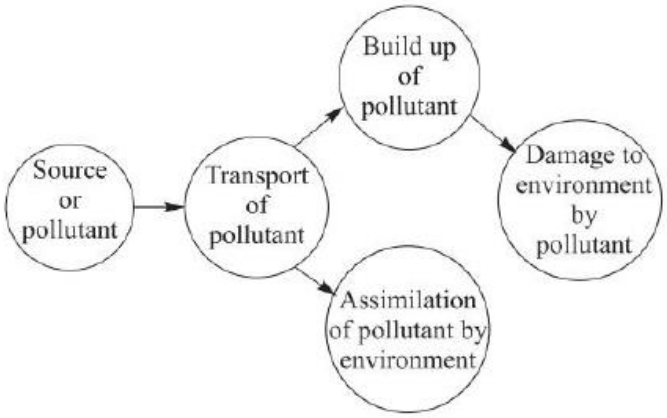
Source It is the system (material or activity) which releases the pollutant.

Receptor It is something that is affected by the pollutant.

Sink It is the store where the pollutant is received and stored for a long time.

Pollution or Environmental Pollution It can be defi ned as an undesirable change in the physical, chemical, or biological characteristics of our environment by the introduction of substances or energy by humans into the environment.

Environmental Pollution Process



PUBLIC HEALTH ASPECTS

Health is an outcome of the interactions between people and their environment. Disturbance of ecosystems and natural cycles, resource depletion, waste generation and pollution of natural resources affects human health.

Common cold, influenza, chicken pox, tuberculosis, silicosis, gout, black lung cancer, bronchitis and asthma are diseases caused by air pollution.

Cholera, typhoid, dysentery, Minamata disease, hepatitis, intestinal disorders are diseases caused by water pollution.

Bolutism, viral food poisoning, fungal food poisoning, staphylococcal poisoning are food-borne diseases.

Teeth/gum diseases, rickets/osteomalacia, anaemia and avitaminosis are deficiency diseases.

Cancer is caused by harmful environmental exposure, tobacco smoking and alcohol consumption.

The key to attaining a good health is based on proper nutrition, safe drinking water availability, provision of maternal and child health care, immunisation against the major infectious diseases, prevention, and control of locally endemic diseases, etc.

Characteristics of a healthy person are

(i) Absence of physical discomfort,
(ii) Cheerfulness,
(iii) Courage to face reality,
(iv) Enthusiastic and efficient ability to work,
(v) Self-control and self-confidence,
(vi) Stable mental attitude,
(vii) Efficiency, and
(viii) Freedom from disease.

AIR POLLUTION

Air pollution is the presence of substances in the air (which generally originate from human activities) in sufficient concentrations and sufficient time, to interfere with the comfort, health, safety or full use and enjoyment of property.

Sources of Air Pollution

(i) Point Sources These are sources which cause direct release of air pollutants.
Example The emission of gases from an industry through a chimney.

(ii) Nonpoint Sources These are sources which release substances which are capable of undergoing chemical reactions in the atmosphere to generate air pollutants.
Example Photochemical smog

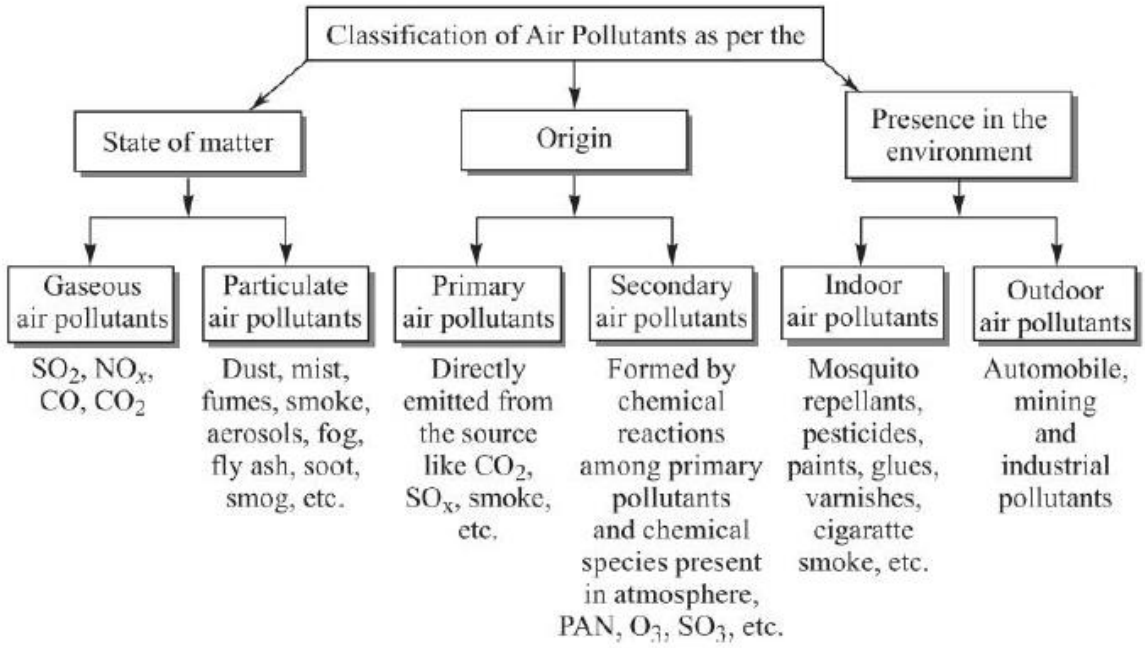
(iii) Man-made or Anthropogenic Sources These are sources which generate air pollutants by human activities.
Examples Vehicular discharges, burning of fossil fuels, population explosion

Air Pollutants

Air pollutants are gaseous, liquid or solid substances present in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or the environment.

Classification of Air Pollutants

The air pollutants can be classified in the following three ways:



Ambient air-quality standards in India [Concentration µg/m3]

	Area Type	*SO_2*	*CO*	*NO_x*	*SPM*
(i)	Sensitive areas like places with monuments, sanctuaries, tourist resorts	30	1000	30	100
(ii)	Residential and rural areas	80	2000	50	200
(iii)	Industrial and mixed use areas	120	5000	120	500

Natural and Man-made (Synthetic) Air Pollutants and their Consequences

Carbon Monoxide (CO)

Sources Forest fires, agricultural burning, incomplete combustion of fuels, tobacco smoking, automobile exhausts, etc.

Effects Toxicity, blood poisoning leading to death, increased proneness to accidents.

Sulphur Dioxide (SO2)
Sources Combustion of coal and petroleum products, sulphuric acid plants, powerhouses, metallurgical operations.
Effects Irritation of throat and eyes, suffocation, aggravation of asthma and chronic bronchitis.

Oxides of Nitrogen (NOx)
Sources Nitric acid plants, automobile exhausts, explosives and fertiliser industries, power stations.
Effects Headache, respiratory irritation, impairment of lung defences, corrosion of teeth, loss of appetite.

Mercury (Hg)
Sources Mining and refining of Hg, industries linked with manufacture of medicinal products, pesticides which use organic mercurial.
Effects Inhalation of Hg vapours cause toxic effects, highly toxic organo-mercurial may cause irreversible damage to brain and nervous system.

Lead (Pb)
Sources Automobile emissions, electroplating waste, plumbing, lead paint industry, printing, etc.
Effects Liver and kidney damages, mental retardation in children, abnormalities in fertility and pregnancy, gastrointestinal damage.

Measures Used for Controlling Air Pollution
The most effective method to control air pollution is to prevent the formation of pollutants or to reduce their emission at the source itself.
(i) Source Correction Methods In case of industrial pollutants, the designing and development of plants may be so selected to have minimum emission of air pollutants.
Examples
(a) By suitable design modification of the tanks, evaporation from petroleum refineries can be minimised.
(b) Use of correct grade of raw material like low-sulphur oil and coal is recommended.

(ii) Cleaning of Gaseous Effluents These techniques control pollution by the removal of pollutants from the exhaust. These methods are used in combination with source correction methods.
(a) For Gaseous Pollutants The gaseous pollutants are removed by absorption in a liquid, or adsorption on a solid. Catalytic converters are also used as they convert gaseous air pollutants into harmless gases.
(b) For Particulates
Following techniques are generally used for control of particulate emissions:

- Gravitational settling chambers,
- Cyclone separators,
- Fabric Filters,
- Electrostatic precipitators, and
- Wet scrubber, etc.

WATER POLLUTION
Water pollution is defi ned as presence of any foreign substance or energy in water in such concentration and for such duration that tends to degrade the quality of water so that humans, animals, or any other organism cannot enjoy the beneficial qualities of water but the use constitutes a hazard.

Water pollution is classified as freshwater pollution (it includes both surface and ground water pollution) and marine water pollution.

Sources of Water Pollution

(i) Point Sources When the cause and place of pollution is easily identifiable, it is known as a point source of water pollution.
Examples Municipal and industrial discharge pipes.

(ii) Nonpoint Sources When the cause and place of pollution cannot be readily identified, it is known as a nonpoint source of water pollution.
Examples Mining runoff and acid rain.

Water Pollutants

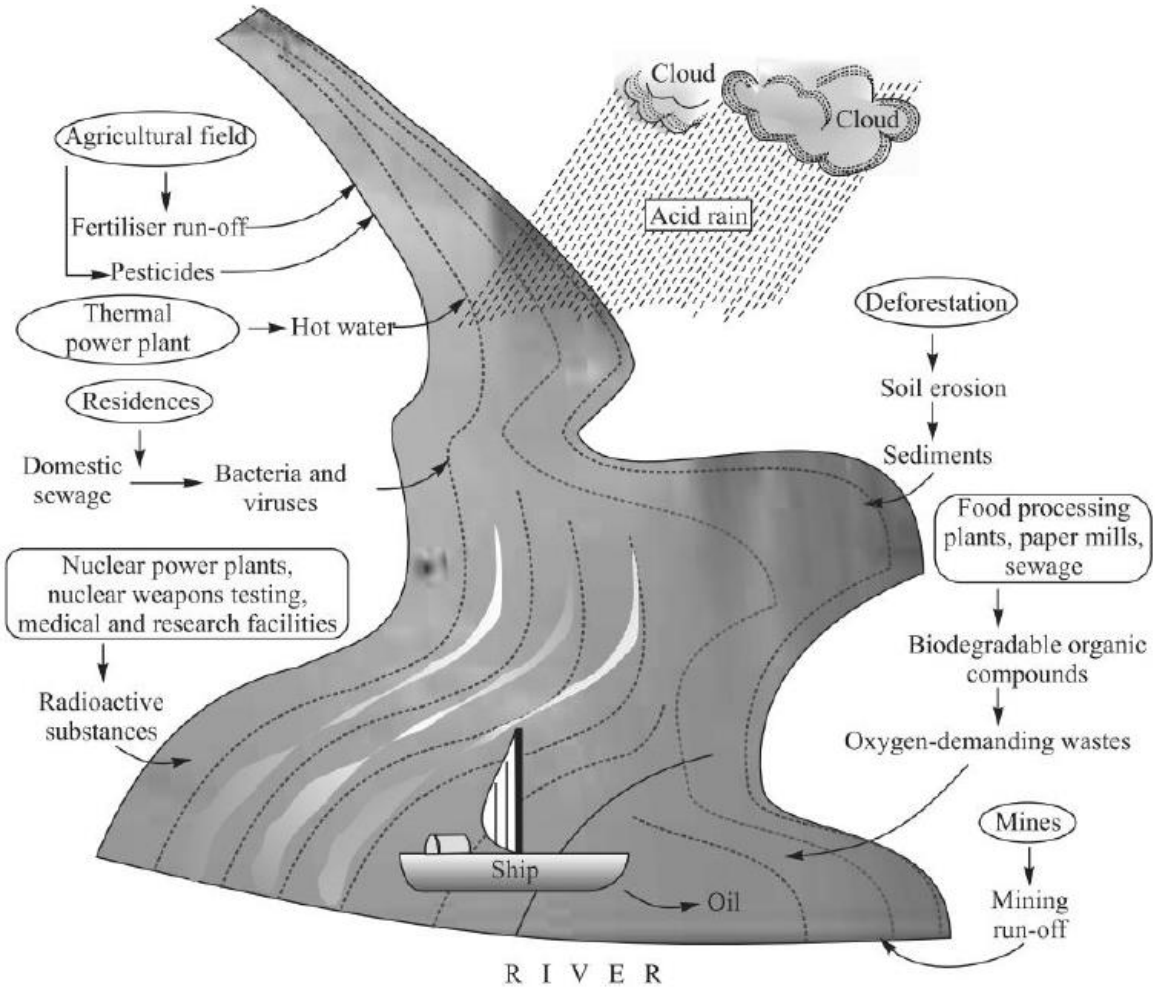
(i) Organic Pollutants They include oil, synthetic organic compounds, sewage and agricultural run-off, disease-causing wastes, and oxygen-demanding wastes.

(ii) Inorganic Pollutants They include metals, metal compounds, organometallic compounds, mineral acids, inorganic salts, etc.

(iii) Suspended Solids and Sediments They comprise of sand, silt and minerals eroded from the land.

(iv) Radioactive Materials They include radioactive isotopes from nuclear reactors, nuclear power plants, research, industrial applications, agriculture and therapeutic as well as diagnostic medical applications.

(v) Thermal Pollution They include discharge of waste heat to water bodies by thermal and nuclear power plants.



Sources of water pollution

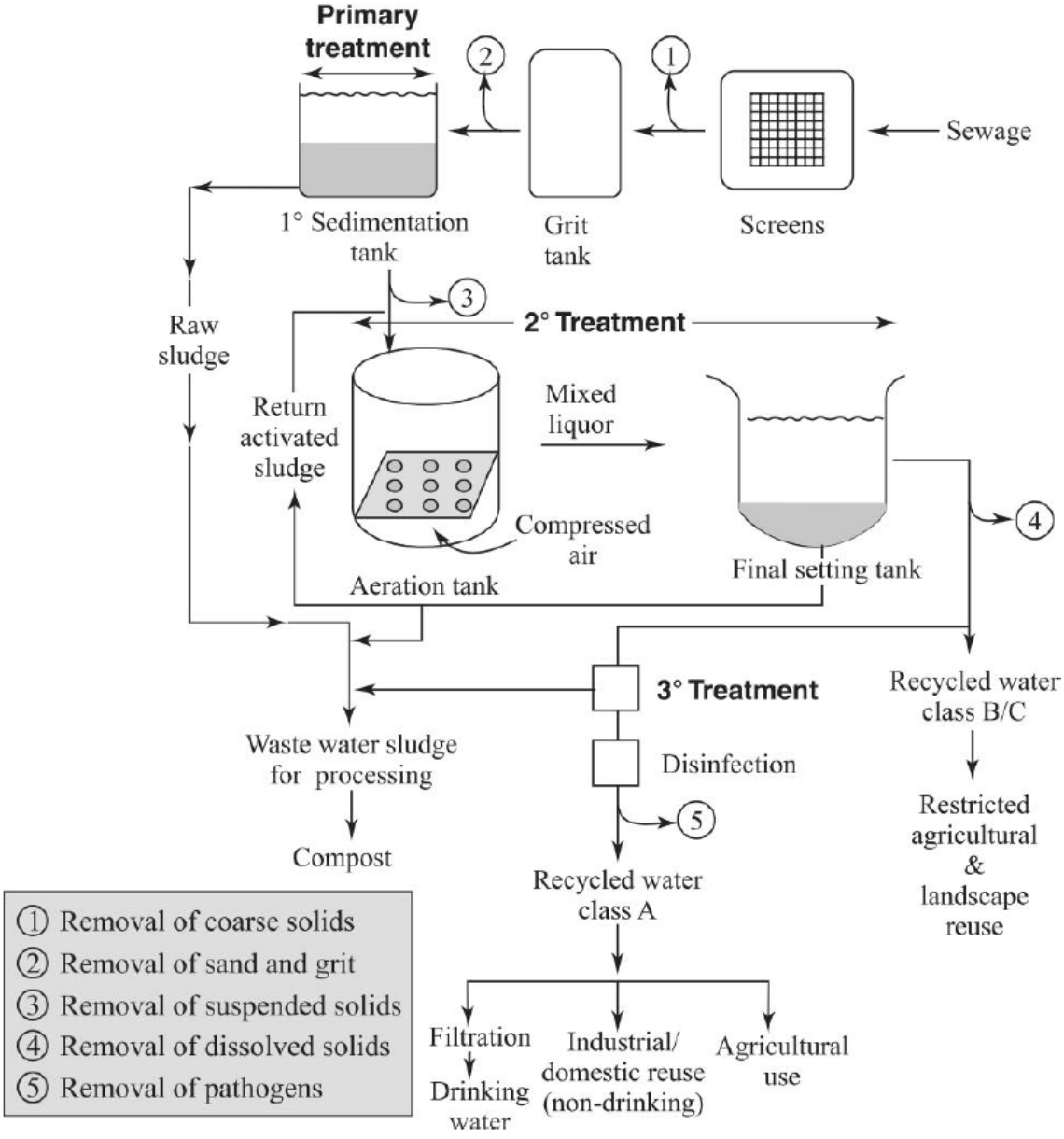
Various Remedial and Control Measures to Minimise Water Pollution

- Create strict rules and regulations to prevent the continued pollution of water.
- Conserve clean water supplies.
- Avoid littering in any form.
- Support clean agriculture by preferably purchasing and consuming healthy organic foods. In the growing of organic food, no pesticide or other harmful contaminants are used.
- Oppose coastal development and preserve natural wetlands, as they serve as nature's filter. The vast amount of various plant life, naturally occurring bacteria and algae and microorganisms help to filter destructive pollutants. Wetlands can be easily preserved through replanting efforts.
- Create awareness in public through media, child education, etc., for preventing water pollution.
- Treat waste water (from domestic and industrial houses) before disposal.
- Prevent pollution caused by animals.
- Reduce urban/suburban run-off of lawn fertilisers and pesticides—stop use of chemical pesticides around your house and lawn.
- Contribute some money to replace outdated municipal water-treatment plants.
- Stop deforestation, save paper. A healthy forest acts like a sponge to soak up and clean rainwater and then supply it to nearby lakes and rivers.
- Reduce pollution from oil and petroleum liquids:
    - Maintain your vehicle more.
    - Drive your vehicle less.
- Reduce mercury emissions:
    - For new coal-fired power plants, use coal-gasification to filter out all mercury pollution.
    - For existing coal-fired power plants, use better scrubber technology to reduce mercury emissions by 90%.
    - Conserve electricity.
- Insist that regulatory agencies force mining industries to
    - Use clean technologies for mining operations
    - Clean up long-abandoned but still-polluting mines
- Fight global warming to avoid ocean acidification and rise in the ocean temperature.
- ***Increase tax*** on chemicals, petroleum products, packaging to reduce their consumption. This helps in preventing water pollution.
- Facilitate soaking of rain through permeable surfaces in parking lots, sports courts, driveways, sidewalks, etc. Impermeable surfaces increase rainwater run-off, resulting in more water pollution.
- Use less plastic bags, as they are easily blown around and end up polluting water bodies.
- ***Promote industrial symbiosis*****.** In it, the unusable waste from one company's
- industrial process become the input for another's. It helps in keeping effluents out of waterways, and keeping solid waste out of landfill.

Water Treatment

Using a network of sewers (i.e., underground pipes), sewage (i.e., waste water) from residential and commercial areas and industries is collected.

This sewage is then transported through a sewerage system to treatment plants for purification. Waste-water treatment is carried out in the following steps:



(i) Primary Treatment It helps in the removal of suspended particles.
(ii) Secondary Treatment It helps in the aerobic decomposition of organic matter.
(iii) Tertiary Treatment It helps in the production of safe water, free from harmful chemicals and pathogenic bacteria.

LAND POLLUTION OR SOIL POLLUTION

Soil pollution can be defi ned as the introduction of substances, biological organisms, or energy into the soil that lead to a change in the quality of soil so that plant growth and animal health is adversely affected.

Causes of Soil/Land Pollution

Soil pollution is caused due to direct and indirect sources. The direct sources harm the soil much more than the indirect sources.

Examples of direct causes are poor management of solid and liquid domestic/industrial/agricultural waste, waterlogging, soil erosion, salination, disposal of medical wastes, etc.

Examples of indirect causes are acid rain and disposal of radioactive substances.

The main reasons of soil pollution are briefly described below:

(i) Faulty Agricultural Practices

- Unskilled Irrigation (Waterlogging)
- Shifting Cultivation
- Injudicious Use of Chemical Fertilisers
- Pesticides

(ii) Mining

(iii) Solid Wastes from Homes and Industries

(iv) Acid Rain

Effects of Soil Pollution

The harmful effects of soil pollution are briefly described below:

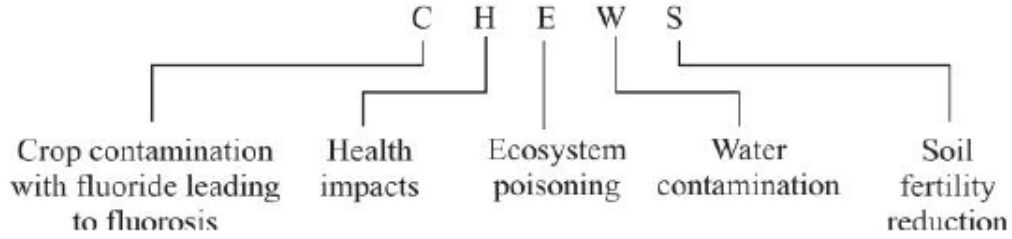
(i) Fluorosis occurs as a result of consumption of fluoride containing maize and jawar crops. The fluoride is absorbed by the crops from the fluoride contaminated soil.

(ii) Emission of toxic gases (from dumped solid wastes on land) are detrimental to health. The unpleasant smell and spread of insects cause inconvenience to people.

(iii) Poisoning of the ecosystem takes place by soil pollution.

(iv) Contamination of underground and surface drinking water takes place by soil pollution.

(v) Reduction in the fertility of soil takes place by soil pollution.



Harmful effects of soil pollution

Control of Soil Pollution

The land pollution can be controlled by the following methods:

(i) Polluted soil can be treated by bioremediation. It uses microorganisms (yeast, fungi or bacteria) to break down, or degrade, hazardous substances into less toxic or nontoxic substances (such as CO_2 and H_2O). Proper treatment of liquid wastes from industries and mines must be done.

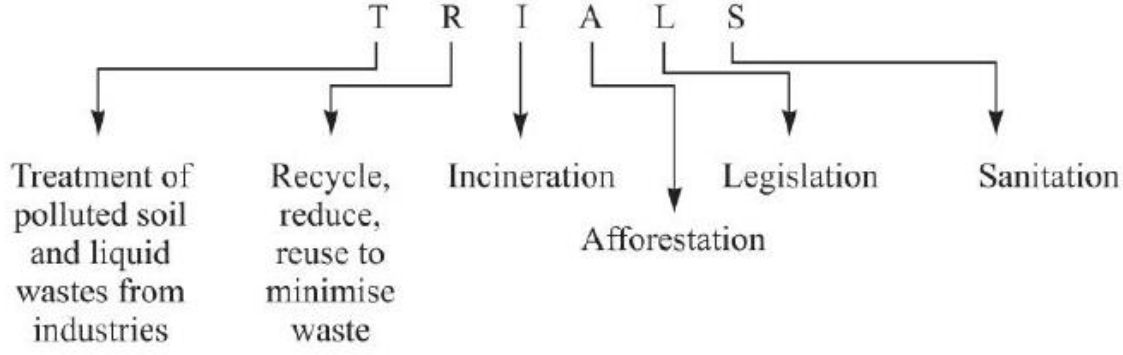
(ii) The principles of three Rs, namely, Recycle, Reuse and Reduce, help in minimising the generation of solid waste. For example, use of biofertilizers and natural pesticides help in minimising usage of chemical fertilisers and pesticides.

(iii) Proper disposal methods must be employed. For example, composting of biodegradable solids and incineration of nonbiodegradable solids should be done.

(iv) Planned afforestation helps in preventing soil erosion.

(v) Formulation and effective implementation of stringent pollution-control legislation also helps in controlling soil pollution.

(vi) Faulty sanitation practices must be improved.



Control of land pollution

NOISE POLLUTION

Vibrations transmitted through an elastic medium (air, water, or solids), with frequencies in the approximate range of 20 to 20,000 hertz, capable of being detected by ears is known as sound.

Noise is a sound that is undesired, unexpected, unpleasant, or loud. It is undesired in that it interferes with sleep, rest, recreation, work, or communication. The word noise comes from the Latin word nausea meaning sea sickness.

Noise pollution is defined as environmental noise or an unwanted sound that is annoying, distracting, or physically harmful. Harms include hearing loss, stress, sleeplessness, etc. Noise pollution is also known as sound pollution.

Decibel (dB) is used as a measure of sound intensity level or sound pressure level. It is named after Alexander Graham Bell, the inventor of the telephone.

$$\textit{Intensity level (dB)} = 10\log_{10}\left[\frac{\text{Intensity measured}}{\text{Reference intensity}}\right]$$

$$\text{dB} = 10\log_{10}\left(\frac{I_m}{I_o}\right)$$

As intensity varies with the square of pressure, intensity level can also be replaced as Sound Pressure Level (SPL).

Thus,

$$\text{SPL (dB)} = 10\log_{10}\left(\frac{\text{Pressure measured}}{\text{Reference pressure}}\right)^2$$

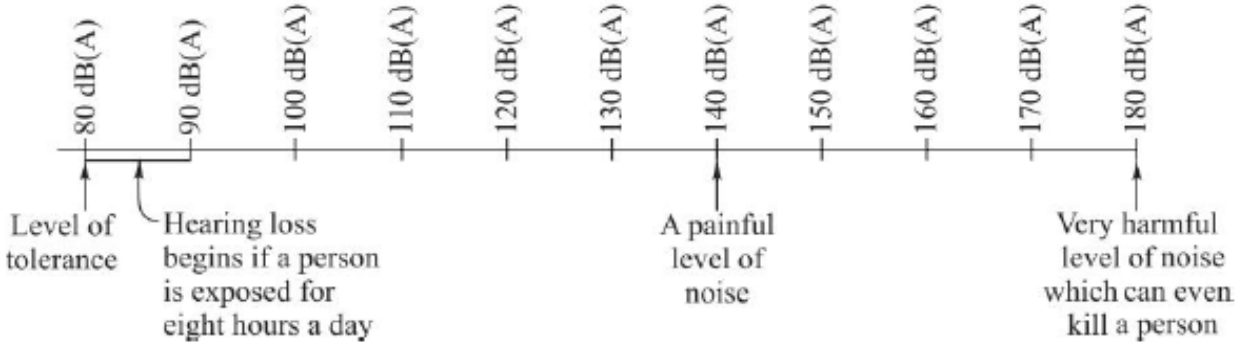
$$\text{SPL (dB)} = 20\log_{10}\left(\frac{\text{Pressure measured}}{\text{Reference pressure}}\right)$$

$$\text{SPL (dB)} = 20\log_{10}\left(\frac{P_m}{P_o}\right)$$

Apart from loudness, the frequency or pitch of the sound also determines whether it is harmful or not. A modified scale called decibel–A [dB(A)] takes pitch into account.

For humans, normal level of tolerance is 80 dBA. Sound level above or below this is considered as noise pollution.

Most of the electronic vehicles and motors emit sound above 80 dBA level. Amplified rock music is 120 dBA.



Sector	Industrial	Commercial	Residential
Limit	75 dB	65 dB	55 dB

Further, use of public address systems after 10 p.m. and before 6 a.m. is not permitted.
Rules also establish zones of silence within a radius of 100 m of schools, courts, hospitals, etc.

Sources of Noise

Source is the equipment or process directly responsible for sound generation.
The major sources of noise are summarised below:
(i) Transportation Sources Railways, road traffic and air traffic.
(ii) Industrial Sources Industrial activities such as power generation, processing, product fabrication and product assembly.
(iii) Public Address Use of loudspeaker at any occasion like marriages, functions, festivals, etc.
(iv) Agricultural Machine Sources Use of tractors, tube wells, farm machines for agriculture.
(v) Defence Equipment Sources Shooting practices, wars, bomb explosion, etc.
(vi) Household Sources Mixer-grinder, lawn mowers, food blenders, vacuum cleaners, etc.
(vii) Other Sources Rock concerts, barking dogs, construction equipment's, etc.

Source	*Noise level in dB(A)*
Threshold of audibility/ hearing	0
Conversation–quiet	20–30
Conversation–Face to face	60
Classroom teaching	55–60
Home appliances	65–75
Road Traffic–Medium	70–80
Road Traffic–Heavy	80–90
Inside cinema hall	85–95
Horns of vehicles	90–105
Rail engine at 15 m	97–105
Loudspeakers	100–120
Threshold of pain	130
Jet engine at 25 m	140
Diwali crackers	125–160
Bomb explosion	190

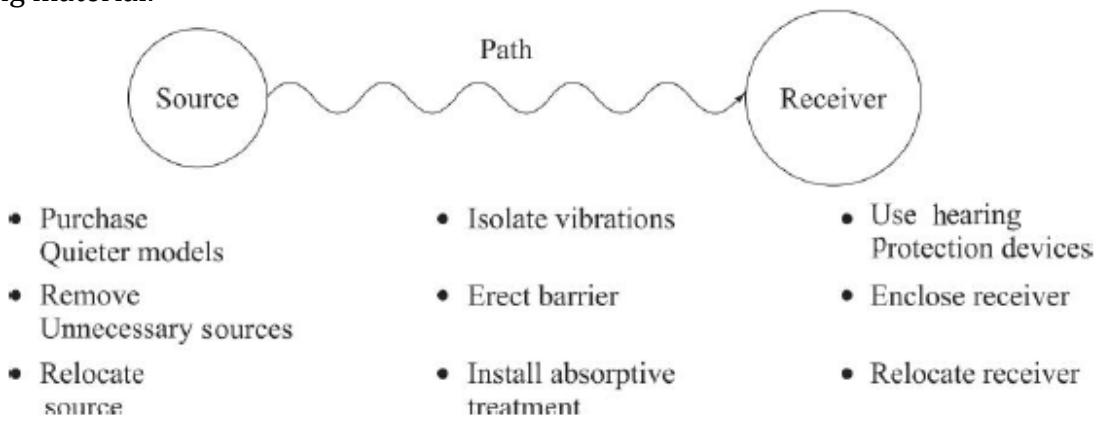
Effects of Noise Pollution

Noise affects human health in the following ways:
(i) Physical Effects Damage to ear drum, temporary impairment of hearing, permanent deafness.
(ii) Physiological Effects Muscular strain, headache, eye strain, decreased colour perception, nervous breakdown, pain in heart, etc.
(iii) Psychological Effects Emotional disturbance, depression, fatigue, frustation, irritation, reduced efficiency, etc.

Control of Noise Pollution

Noise pollution can be controlled by reducing noise at the source, interrupting the path of noise and/or protecting the receiver.
(i) Noise Control at the Source It is most effective to eliminate noise at the source.
Examples
(a) Reduction of noise generated by mechanical vibration of a machine by damping or isolation of the vibration by applying a damping material (rubber) to the vibrating components.

(b) Reduction of impact force by optimising the impact distance and covering either or both impact surfaces by rubber.
(c) Modification of manufacturing design like enclosing the engine parts within proper noise-insulating material.



(ii) Noise Control at Path When the source cannot be made quiet, noise can be controlled by modifying the path.
Examples
(a) Attenuation of noise by moving noise source away from sensitive area
(b) Suppression of noise from automobiles using silencers
(c) Reduction of noise around residential areas by planting trees in the form of green belt
(d) Reduction of transmission of noise using acoustic screens and barriers
(e) Enclosing noisy machines in isolated buildings

(iii) Noise Control at Receiver If source and/or path control do not work, control at the receiver should be explored.
(a) Use of Hearing Protection Devices (HPD) like ear plugs, ear muffs, etc. They reduce the level of noise (by 10 dB to 55 dB)
(b) Enclose receiver.
(c) Relocate receiver.

SOLID WASTE AND ITS MANAGEMENT

Solid Waste

The waste materials which have been rejected for further use and which can neither readily escape into the atmosphere nor can be transported by water into streams are called solid waste.
All the discarded solid materials from municipal, agricultural and industrial activities are included in solid wastes.

Types and Sources of Solid Wastes

The various types of solid wastes are briefly described below:
(A) Municipal Wastes These include garbage (i.e., biodegradable food waste), rubbish (i.e. nonbiodegradable solid waste from homes, offices, markets, hotels, etc.), Construction and Demolition Wastes: Sludges from septic tanks; wires
(B) Special Wastes These include hazardous wastes lie toxic substances (pesticides, heavy metal sludges); radioactive wastes; biological waste; explosives, inflammable substances
(C) Domestic Wastes These include wastes generated from domestic cooking and serving of food. Examples Garbage, waste paper, plastic, cloth, etc.
(D) Agricultural Wastes These wastes result from farms, feed lots and livestock yards.
Examples Corn residues, bagasse from sugarcane manures, paddy husk, etc.
(E) Industrial Wastes These include the following:
(i) Process Wastes: Examples Plastic wastes, rubber wastes, metal scraps, food-processing wastes,
(ii) Non-process: Wastes Examples Office and cafeteria wastes, packing wastes, etc.

(F) E-Waste It is a new form of waste from discarded mobile phones, mobile chargers, remotes, CDs, headphones, batteries, computers/TVs, monitors, printers etc.

Causes of Generation of Solid Wastes

The main causes for the rapid growth in the quantity of solid-waste generation are-

(i) Overpopulation Solid waste generated per person multiplied by total population results in increased generation of solid waste every day.

(ii) Urbanisation Urbanisation requires various construction activities like construction of buildings, markets, shopping malls, roads, railways, airports, bridges, dams, water supply and sewage disposal systems.

(iii) Affluence Consumers with high purchasing capacity discard obsolete goods. This leads to solid waste generation.

(iv) Advances in Technology These lead to large-scale production of goods for consumption-based society preferring disposable items and almost every item 'packaged'.

Effects of Solid Wastes

The accumulation and improper handling of solid wastes results in various health and environmental hazards. Some of these effects are described below:

(i) Flies and mosquitoes breed on choked drains and gully pits through solid wastes. These flies and mosquitoes then contaminate food and water.

(ii) Stray animals and scavengers invade the roadside garbage dumps. It results in harming the aesthetic beauty of the surroundings.

(iii) Bad odours pollute the air as a result of decomposition of organic solid wastes.

(iv) Percolation of decomposed garbage cause pollution of underground water and land. The crops and water supply get contaminated and result in occurrence of cholera, hepatitis, jaundice, gastro-intestinal diseases.

(v) Rats living in solid waste dumping sites rapidly multiply in numbers and may cause plague and other diseases.

(vi) E-waste is either burnt or buried, so it can have harmful effects on the environment. This is because E-waste contains many hazardous materials like lead, mercury, cadmium, flame retardants, etc.

Solid-Waste Management

Important solid-waste management practices are briefly described below:

(i) Source Reduction It involves changing the design manufacture or use of products and materials to reduce the amounts of solid-waste generation.

Examples Two-sided copying of paper, backyard composting, etc.

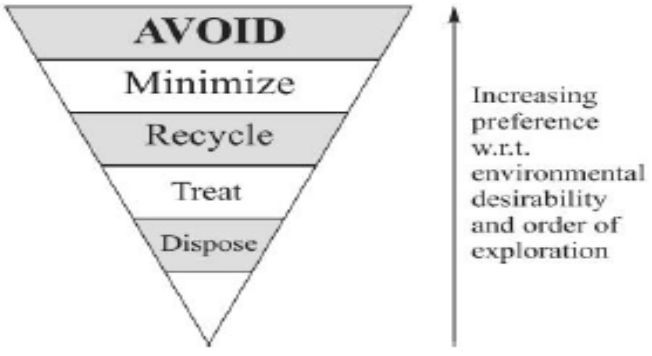
(ii) Recycling

Advantages Energy saving, prevention of emission of many greenhouse gases/ water pollutants, job creation, resource conservation for future and reduced need of new landfills and incinerators.

(iii) Treatment Suitable treatment is given depending on the nature of solid wastes.

(iv) Disposal Solid wastes can be disposed in combustion facilities and landfills.

A hierarchy of waste management is illustrated as:



Solid-Waste Disposal

The various methods commonly employed for disposal of solid waste are explained below.

(A) Composting Composting is the thermophilic and aerobic decomposition of organic matter present in solid waste by microorganisms, mainly bacteria and fungi. As a result of this composting process, the organic matter is transformed into a stable humus like substance, which is a valuable manure for crops.

Classification of Composting Techniques Based on Oxygen Use

(a) Aerobic Composting It requires high temperature and results in rapid decomposition of organic matter. Odours are also absent.

(b) Anaerobic Composting It requires low temperatures. Decomposition of organic matter of solid waste is slow. It needs minimum attention.

Vermicomposting It uses a special kind of earthworm and a container of food scraps. After some time, the food is replaced with worm droppings, a rich brown matter that serves as excellent natural plant food (manure).

(B) Illegal Dumping/Open Dumping/Fly Dumping/Midnight Dumping

It is the disposal of solid waste by dumping in open areas, dumped from vehicles along roadsides, and/or dumped late at night.

Advantages It is done to avoid either the time and effort required for proper disposal or to avoid disposal fees.

Disadvantages

(a) Illegal dumping of non-hazardous wastes often attract more waste, even the hazardous wastes.
(b) Illegal dump sites divert land from more productive uses.
(c) Property values decrease as a result of illegal dumping.
(d) Public nuisance is created by illegal dump sites.

(C) Land Dumping

Solid wastes are dumped in low-lying areas outside the city/town limits. These areas have no provision of leachate collection and treatment. Moreover, landfill gas is neither collected nor used.

Advantages

(a) It requires no planning.
(b) It is cheaper.

Disadvantages

(a) The waste is untreated, uncovered and not segregated. It is the breeding ground for flies, other insects, rats, etc., that spread diseases.
(b) Rainwater run-off from these dump sites contaminates nearby land and water thereby spreading diseases.

(D) Landfills

A landfill site is a pit that is dug in the ground. The solid waste is dumped and the pit is covered with a layer of soil to form a cell. The process is repeated every day so that many cells completely fill the landfill site. Finally, about 1 m of earth-layer covering is done.

Advantages

(a) Breeding of insects is prevented.
(b) Landfill sites can be developed as parks or parking spaces.

Disadvantages

All types of wastes are dumped in landfill sites without segregation. When rainwater seeps through them, it gets contaminated and in turn pollutes the surrounding area and groundwater.

(E) Sanitary Landfills

Sanitary landfill sites have liner systems and other safeguards to prevent groundwater contamination. These sites are consistent with the economic considerations, hydrogeological requirements, climatic conditions and topography.

Advantages
(a) The site is well above the groundwater table; so underground water pollution is avoided.
(b) The site is easily accessible; so, the process is low in cost.
(c) The finished sanitary landfill can be used for the development of regions of recreation like parks, golf courses, etc.
Disadvantages
(a) Leachate from sanitary landfill site can contaminate the groundwater.
(b) The sites cannot be used in future as productive farmland.
(c) In a sanitary landfill, about 60% of methane gas (odourless) is generated.

(F) Combustion
Solid waste is burned at high temperature in combustion facilities.
Advantages
(a) Energy is generated.
(b) Amount of waste is reduced by up to 90% in volume and 75% in weight.
Disadvantages
(a) Cost increases with rise in the moisture content of solid waste.
(b) Ash formed after combustion has high concentrations of dangerous toxins such as dioxins and heavy metals. It results in air and water pollution.

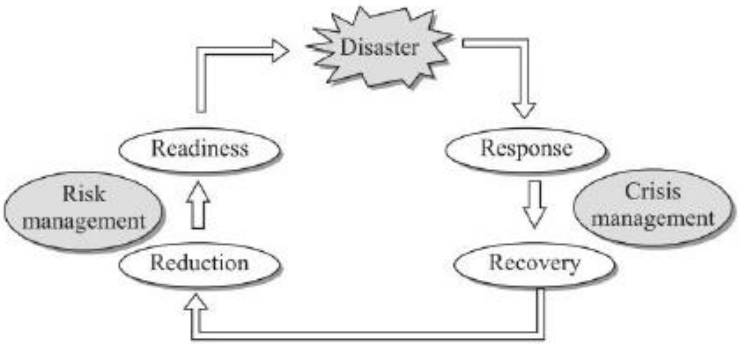
(G) Incineration
It is the controlled combustion of organic solid wastes to convert them into incombustible residue and gaseous products. The weight and volume of solid waste is reduced and often energy is also produced.
Advantages
(a) As the volume of the waste is reduced, in taking the waste to the ultimate disposal site, less transportation cost is required.
(b) Larger wastes can be accommodated in each landfill area because incineration reduces the land requirement to one-third.
Disadvantages
(a) Not applicable for radioactive wastes
(b) High capital and operational costs
(c) Air pollution chances if incineration is not properly done
(d) Highly trained manpower is needed

DISASTER MANAGEMENT
Disaster can be defined as a man-made or natural event (like floods, earthquake, cyclone, or landslides) which results in great damage or loss of life.
A disaster is a consequence of inappropriately managed risk. The risk is the product of hazard and vulnerability.

Disaster = Risk – Capacity
or Disaster = [Hazard x Vulnerability] – [Capacity of the community]

Hazard is a situation which poses a level of threat to life, health, property or a dangerous condition or event that may deleteriously affect society or an environment.
Vulnerability is the extent to which damage will likely happen by the impact of a particular hazard.
Capacity means resources and strengths which exist in households and communities and enable them to cope with, withstand, prepare for, prevent or quickly recover from a disaster.

Disaster management is the practice of successful management of natural and man-made disasters.
The major objective of disaster management is to reduce the adverse effects of a disaster on the affected community and to help them return to normal life within the shortest possible time.



Disaster management cycle (the 4 R's)

(i) Response It includes activities during a disaster such as public warning systems, emergency operations, search, rescue (i.e. save life) and relief (i.e., food aid).

(ii) Recovery It includes activities following a disaster like rehabilitation and reconstruction which includes temporary housing; processing of insurance claims; distribution of grants; provisions for long-term medical care and counselling.

(iii) Reduction It includes activities that reduce the effects of disasters like building codes and zoning, vulnerability analyses; public education.

(iv) Readiness It includes activities prior to a disaster like preparation of emergency plans for disasters, emergency training through workshops; warning systems, etc.