



Uday Pratap (Autonomous) College, Varanasi

E-learning Material

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Name	Dr Sanjay Kumar Srivastava
Department	Department of Zoology
Faculty	Assistant Professor
College	Uday Pratap (Autonomous) College, Varanasi
Mobile No.	9415390652
E-mail	drsanjay70@gmail.com

Pollution :

According to **Odum (1971)** “ Pollution is an undesirable change in the physical, chemical or biological characteristics of our land, air or water that may or will harmfully affect human life or that of desirable species”.

The United Nation Conference held in Stockholm in June 1972 on Human Environment has focused attention of all the nation including India, the growing world-wide menace of environmental pollution.

Pollution is the process of making land, water, air or other parts of the environment dirty and unsafe or unsuitable to use. This can be done through the introduction of contaminant into a natural environment. Pollution is the contaminants into the environment that cause harm or discomfort to humans or other living organisms which can come in the form of chemical substances or energy such as noise, heat or light. So pollution

is a special case of habitat destruction, it is chemical destruction rather than more obvious physical destruction. Pollution occurs in all habitats, land, sea, freshwater and in the atmosphere.



Pollution, we hear it every other day at school, college and read about it in newspapers. So what is it? Pollution occurs when pollutants contaminate the natural surroundings; which brings about changes that affect our normal lifestyles adversely. Pollutants are the key elements or components of pollution which are generally waste materials of different forms. Pollution disturbs our ecosystem and the balance in the environment. With modernization and development in our lives pollution has reached its peak; giving rise to global warming and human illness.

Pollution occurs in different forms; air, water, soil, radioactive, noise, heat/ thermal and light. Every form of pollution has two sources of occurrence; the point and the non-point sources. The point sources are easy to identify, monitor and control, whereas the non-point sources are hard to control. Let us discuss the different types of pollutions, their causes and effects on mankind and the environment as a whole.

Sources of Pollution :

Pollution can be increases day by day in our daily life, its main common sources are –



1. Industries :

The industries all over the world that brought prosperity and affluence, made inroads in the biosphere and disturbed the ecological balances. The pall of smoke, the swirling gases, industrial effluents and the fall-out of scientific experiments became constant health hazards, polluting and contaminating both air and water. The improper disposal of industrial wastes are the sources of soil and water pollution. Chemical waste resulting from industry can pollute lakes, rivers and seas and soil too as well as releasing fumes.

Industrial complexes such as, petrochemical complexes, oil refineries, fertilizer factories, vegetable oil plants, synthetic material for drugs, fibers, rubber plastic, paper mills, textiles and sugar factories, chemical factories, distilleries etc.

2. Automobile exhausts :

The exhaust gases are produced by the combustion of petrol, diesel in automobiles such as bus, trucks, cars, Scooter, motorcycle, helicopter, aeroplane etc. The smoke emitted by vehicles using petrol and diesel and the cooking coal also pollutes the environment. The multiplication of vehicles, emitting black smoke that, being free and unfettered, spreads out and mixes with the air we breathe. The harmful smoke of these vehicles causes air pollution. Further, the sounds produced by these vehicles produces causes noise-pollution.

3. Smoke and Grit :

Smoke is produced by the burning of coal and mineral oils, which are burn at houses and in factories. The combustion of fossil fuels pollutes the air, the soil and the water with noxious gases such as CO₂ and CO.

4. Domestic Sewage :

Domestic sewage include household sewage, excreta and laundry detergents contaminate water sources. Household and commercial waste pollutes the environment when not disposed of properly.

5. Insecticides and herbicides :

The insecticides like DDT (Dichloro diphenyle trichloethane), DDD (Dichlorodiphenyle dichloroethylene), Heptachlor, Taxaphene are washed down with the rain water and find their way to get rid of the harmful pests and weeds get dissolved in soil water and enter the river water. These chemical compounds destroy a number of valuable aquatic food organism and reaches into food chain. Fertilizers and pesticides used in agriculture are key causes of environmental pollution.

6. Oils :

Oils when discharges into water (in Sea water) during any accident it form a thick layer on water surface which curtail oxygen supply.

7. Radioactive substances :

Elements like Strontium, Uranium, Radon, Cesium produce ionizing radiation. These are known as radioactive substances or radioisotopes or radionuclide. These substances when enters into atmosphere causes radiations.

8. Rapid urbanization and industrialization: The urbanization and the rapid growth of industrialization are causing through environmental pollution the greatest harm to the plant life, which in turn causing harm to the animal kingdom and the human lives.

9. Population overgrowth: Due to the increase in population, particularly in developing countries, there has been surge in demand for basic food, occupation and shelter. The world has witnessed massive deforestation to expand absorb the growing population and their demands.

Besides of above components various pollutants that are by products of Man's action develops pollution such as-

10. Deposited matter or solid waste : Soot, Smoke, tar or dust and domestic wastes.

11. Gases : CO₂, CO, Nitrogen Oxide, SO₂ (Sulphur Oxide), Halogen (Chlorine (Cl) Bromine, Iodine).

12. Metals : Lead, Zinc, Iron and Chromium.

13. Industrial Pollutants : Benzenes, Ether, Acetic Acid, Cyanide compound, Benopyrenes etc.

14. Agricultural Pollutants : Pesticides, Herbicides, Fungicides and fertilizers.

15. Photochemical pollutants : Ozone, Oxides of Nitrogen, Aldehyde, Ethylene, Photochemical smog and peroxy acetylene (PAN).

So that, toxic pollutants affect more than 200 million people worldwide. In some of world's worst polluted places, babies are born with the birth defects, children's have lost 30 to 40 I.Q. (Intelligence Quotient) and life expectancy may be as low as 45 years because of cancers (Skin) and other diseases.

Actually pollution may be of following types-

1. Air Pollution.

2. Water Pollution.
3. Land Pollution.
4. Noise Pollution.
5. Radioactive Pollution.
6. Light Pollution.
7. E-Pollution.
8. Personal Pollution.

1. Air Pollution :

“ The presence of materials in the air in such concentration, which are harmful to man and his environment is called air pollution”.

It is the most prevalent and dangerous form of pollution especially considered to go hand in hand with urbanization. There are many reasons to it. Primary among these is the excessive fuel combustion which has become a basic necessity for cooking, transport and other industrial activities. Air pollution is the introduction of chemicals, particles, biological materials and other substances into the atmosphere. This releases umpteen no. of chemicals to the air which are far from being removed from it. These are directly affecting our existence.

Sources of Air Pollution are vary large and varied as –

1. Industrial pollutants :

From Industrial chimneys of various industries and power houses emitted CO, CO₂, H₂S, SO₂, Hydrocarbons together with dust, smoke and grit by combustion of petrol, diesel and burning of coal and lignite in power

plants. The chemical industries releases HCL, Chlorine, nitrogen oxide, oxides of copper, Zinc, lead, arsenic etc.

In 1984, In Bhopal M.P. Union Carbide Industry accident release methyl isocyanate gas in environment that makes more casualty. It killed over 2,000 people, and over 200,000 suffered respiratory problems. An irritant (e.g. particulates less than 10 micrometers) may cause respiratory illnesses, cardiovascular disease and increases in asthma. Even today there are birth defects in the babies borne, which are believed to be because of the tragedy.

Fertilizer factories at Gorakhpur, Phoolpur, Allahabad, Ahemadabad, Nevelli Lignite complex in Tamil Nadu, Steel factories at Bhilai, Rourkela, Jamshedpur, Durgapur releases toxic chemicals.

2. Automobile Exhaust :

Automobile run by petrol and diesel produces CO, nitrogen oxides, hydrocarbons 100 to 1000 tons only in Mumbai city alone 20000000. Automobiles are emitted 3 pounds of CO and 15 lbs of nitrogen oxide. In America more than 60 % of air pollution is produced by its 83 million cars.

3. Ionizing radiation from radioactive substances :

Ionizing include α , β and γ particles produced by atomic explosions and testing of atomic weapons.

4. Smoke and Soot from forest fires, factories and other sources.

5. Naturally occurring Methane gas from farms and the breakdown of organic matter.

6. Volatile organic compounds (VOC) found in paint or other manufactured items.

7. Aerosols from hair spray, deodorant and various sprays.

8. Very small particles of dirt.

Air Pollutants : The air pollutants have been separated in two categories. According to survey carried by National Environment Engineering Research Institute (NEERI), Nagpur, Maharashtra-

1.Primary emissions or pollutants : These substances which are emitted directly from some identified sources such as

Sulphur compounds- SO_2 , SO_3 , H_2S and mercaptans produced by the oxidation of fuel.

Carbon compounds – Oxides of carbon ($\text{CO} + \text{CO}_2$) hydrocarbons produced by incomplete combustion of gasoline.

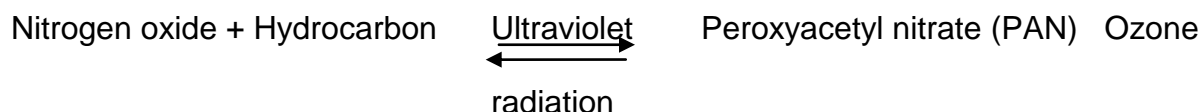
Nitrogen compounds – NO_2 , NH_3

Halogen compounds- Hydrogen fluoride (HF), HCL produced by chemical industries.

Particles – The fine particles below the diameter of 100μ are more abundant which include metals, carbon, tar, resin, pollen, fungi, bacteria, silicates and similar other substances.

2. Secondary pollutants : The secondary pollutants are produced by the combination of primary emitted pollutants in the atmosphere. In bright SUN light a photochemical reaction occurs between nitrogen oxide, oxygen and waste hydrocarbons from gasoline which form Peroxyacetyl nitrate (PAN) and Ozone (O_3).

Both are toxic components of Smog causes smarting eyes and lung damage.



Water Pollution :

Water pollution affects both the abiotic and biotic factors of different aquatic systems, such as oceans, rivers, ponds lakes, ditches, spring, pools, drainage system, dam, reservoirs etc are day by day contaminated by activities of Man.

Water pollution involves any contaminated water whether from chemical, particulate, or bacterial matter that degrades the water quality and purity. Water pollution can causes following activities in water bodies.

- ❖ It increased sediments from soil erosion.
- ❖ Improper waste disposal and littering
- ❖ Leaching of sol pollution into water supplies.
- ❖ Organic material decay in water supplies.

Sources of water pollution : The pollutants entering water sources are classified broadly into following categories.

1.Industrial Effluents :

Most of the Indian Rivers and freshwater streams are polluted by Industrial wastes or effluents which come along waste waters of different industries such as petro-chemical complexes, fertilizer industries, oil refineries, distilleries, coal washewries, synthetic material plants for drugs, fibers , rubber, plastics etc.

The, industrial wastes of these industries and mills includes metals, copper, Zinc, Lead, Mercury etc. detergents, petroleum, acid, alkali, phenols, carbamides, Lead, Mercury,Cyanide, Arsenic, Chlorine etc. and heavy water sources develop water pollution.

Mercury like other heavy metals such as lead and Cadmium has cropped up as a toxic agent. Mercury a byproduct of production of Vinyl-chloride used in many industries and also in power plants, laboratories and hospitals.

In Japan, illness and even death occurred in the 1950 among fisherman who ingested fish, crabs, shell fish, contaminated with methyl

mercury from Japanese coastal industries. This mercury poisoning produced a crippling and often fatal disease called Minimata disease.

Initial symptoms of **Minimata disease** includes numbness of the limbs, lips and tongue, impairment of motor control, deafness and blurring of vision and Brain defects in 1953 due to **Minimata disease** 17 persons died.

2. House hold and Sewage pollution :

From the domestic sewage and sewage of metropolitan cities includes biodegradable pollutants such as human faecal matter, animal waste, certain dissolved organic compounds as carbohydrates. Urea and inorganic salts such as nitrates, phosphates of detergents and sodium, potassium, calcium and chloride and also septic tanks releases waste develop bacteria and fungi and water born diseases.

Sewage treatment is usually performed by treatment plant (as Dinapur Village in Varanasi).

3. Silt Pollution :

A result of intensive agriculture earth moving for construction projects, poor conservation practices and downfall with resultant floods is the increased production of silt in stream and lakes. This load of particulate matter cuts down primary productivity by decreasing the depth of light penetration. Silt may also prevent reproduction of fishes and spawning.

4. Thermal pollution :

Various industrial processes may utilize water for cooling of thermal plants and resultant warmed water has often been discharged into streams or lakes, coal-oil fired generators and atomic plants causes heat which is carried away as hot water causes thermal pollution.

5. Estuarine and Oceanic Pollution :

The estuarine and oceans are develop pollution due to human activities by dumping of domestic and Industrial waste, sewage, oil, drilling, in coastal water, spilling of oil tankers etc.

The oceans have in fact become the final settling basin for, millions of tons of waste products from human activities. Due to oceanic pollution the marine biota has been seriously affected.

6.Eutrophication :

According to Hutchinson (1969) the Eutrophication is a natural process which literally means well nourished or enriched. It is a natural state in many lakes and ponds which have a rich supply of nutrients and also occurs as part of the aging process of lakes.

Eutrophication becomes excessive natural succession when abnormally high amounts of nutrients from sewage, fertilizer, animal waste and detergents enter streams and lakes causing excessive growth or bloom of micro-organism and aquatic vegetation or plankton blooms which decreases BOD (Biochemical Oxygen demand) and damage natural shape of water bodies.

Control of Water Pollution :

The effect of water pollution include decreasing the quantity of drinking water available, lowering water supply for crop irrigation and impacting fish and wildlife populations that require water of a certain purity for survival. It can be minimized by following methods.

1.Adequate sewage treatment :

Raw sewage should not be dumped in rivers or oceans before its disposal into them, sewage should be properly treated in sewage treatment plants.

2.Treatment of Industrial Effluents :

The industrial effluents should be cleaned before they are discharged into rivers.

3.Recycling :

The best method of prevention and control of water pollution is the recycling of various kinds of wastes. Dung of cow and buffalos can be used

for production of Gobar gas, a cheap source of fuel and manure as non conventional energy source.

Noise Pollution :

Noise is defined as sound without value or any noise that is undesired by the recipient or in other words noise is that type of sound that can not heard by our ears, such as Ultrasonic sound, loud sound of D.J. and loud speakers, Rock music or Disco music sound develop by various vehicles and machines and pressure horns and ring tones of mobile and gazettes etc.

Noise level in many urban industrialization situation are known to be deleterious to human health and efficiency with effects on the sense organs, cardio-vascular system, glandular and nervous system. High intensity sound or noise pollution is caused by many machines man has invented during his technological advancement. There are exists a long list of sources of noise pollution including different kinds of auto and motor vehicles such as scooters, motor bikes, ships, loud speakers, social gathering, loud pop music, supersonic aircraft and missiles and atomic explosion etc.

Effect of Noise pollution :

Noise pollution has certain well evident ecological and pathological effects on biota and human beings. In 1964 Robert Alex Baron first time pointed out that noise has damaging physiological and psychological effects on human beings. Noise is measured in the unit of decibel (dB) which is a tenth of the largest unit, the bel. One decibel is equivalent to faintest sound that can be heard by human ear. Some people feel discomfort with sound of 85 dB whereas most do not discomfort with sound of 115 dB and pain is usually felt at 145 db.

There is a clear evidence now that the hair cells of organs of corti of inner ear can be permanently damaged if they are subjected to repeated sounds of high intensity before they have an opportunity to recover. Workers of different industries develop noise deafness.

So that human can't see or smell noise pollution, it still affects the environment. Noise pollution happens when the sound coming from aero planes, industries or other sources reaches harmful levels.

Researches has shown direct links between noise and health including stress related illness, high blood pressure, speech interference and hearing loss.

For e.g. A study by WHO noise environmental Burden on diseases working group found that noise pollution may contributes to hundreds of thousands of deaths per year by increasing the rates of coronary hearth disease. Under clean Air act the EPA (Environment Protection Act) can regulate machine and plane noise under water noise pollution coming from ships has been shown to upset whales navigation system and kill other species that depend on the natural under water world. Noise also makes wild species communicate louder, which can shorten their life span. Recently many Nations has enacted laws to penalize noise production by the vehicles or any type of industries.

Radio-active pollution :

Radio-active isotopes or radionuclide are forms of elements with unstable atomic nuclei that is they decompose with ionizing radiation in the form of alpha or beta particles or gamma rays.

Many radioisotopes such as radium-226, Uranium-235,238, thorium-232, Potassium-40 or Carbon-14 occur naturally in rocks and soil. Other radioisotopes such as Cesium, Cobalt, Iodine, Krypton, Plutonium, Strontium result primarily as fission products from atomic bomb fallout, nuclear reactors or other radiation sources.

According to **Bebhington 1973** many radioactive substances as Argon-41, Cobalt-60, Cesium-137, Iodine-131, Krypton-85, Strontium-90, Tritium and Plutonium-239 have major environmental concern.

For e.g. Strontium-90 normally occurs in radioactive fallout has a half life of 28 years and behaves like Calcium in biogeochemical cycles. Thus it is absorbed by plants ingested by animals and deposited in bone tissues close to blood forming tissues. Strontium-90 can concentrate in natural

biological system in following way – Water bottom sediments -
aquatic plants Fresh water calms Minnows small
fish musk rats.

Grazing animals concentrate Strontium-90 by ingesting it through
grass and forage