



**JAIPUR COLLEGE OF PHARMACY, JAIPUR
B.PHARMACY, FIRST YEAR, SECOND SEMESTER
ENVIRONMENTAL SCIENCES**

Prepared by: Mr. Ashutosh Sharma

UNIT-III

ENVIRONMENTAL POLLUTION

Environment involves the animate and inanimate surroundings and their interaction making them to coexist, the balance between interaction and coexistence leads to ecological balance. Natural or human activities influence the balance which is manifested through changes occurring in air, water and land. Any disturbance in air, water and land is reflected in the deviation from natural balance in living beings. This undesirable change in the composition of air, water and land and the disturbed inter-relation (ecology) is called Environmental Pollution.

Environmental Pollution is any discharge of material or energy into water, land, or air that causes or may cause acute (short-term) or chronic (long-term) detriment to the Earth's ecological balance or that lowers the quality of life. Pollutants may cause primary damage, with direct identifiable impact on the environment, or secondary damage in the form of minor perturbations in the delicate balance of the biological food web that are detectable only over long time periods.

CAUSES OF POLLUTION

The two major causes of pollution:

1. **Natural Pollution:** Environment is polluted often by natural phenomenon, such as earthquakes, floods, drought, cyclones, etc.
2. **Man-made Pollution or anthropogenic causes:** anthropogenic source consist of a wide variety of sources that lead to environmental pollution.



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TYPES OF POLLUTION

The following are the types of pollution perceived in our environment:

1. Air pollution
2. Thermal pollution
3. Land pollution
4. Radiation Pollution
5. Noise pollution
6. Water pollution

AIR POLLUTION

It can be defined as addition of any contaminant to the air which causes harm to the health of living organisms.

Air pollution is the accumulation in the atmosphere of substances that, in sufficient concentrations, endanger human health or produce other measured effects on living matter and other materials. Among the major sources of pollution are power and heat generation, the burning of solid wastes, industrial processes, and, especially, transportation. The six major types of pollutants are carbon monoxide, hydrocarbons, nitrogen oxides, particulates, sulphur dioxide, and photochemical oxidants.

CAUSES OF AIR POLLUTION

Various types of air pollutants that cause air pollution are:



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1. Carbon compounds: CO₂ is released by complete combustion of fossil fuels and CO, a very toxic gas is released by automobile exhausts.
2. Sulphur compounds: through the thermal power plants, using coal and from the oil refineries, SO₂, H₂S, H₂SO₄, are released.
3. Nitrogen Oxides:- these oxides like NO, NO₂, HNO₃ are released by automobiles, power plants and industries
4. Ozone: due to cooling industries the CFC is released which has affected the O₃ in the atmosphere.
5. Fluorides: they are produced by the industrial and insecticide spary.
6. Hydrocarbons:- they are released by the automobiles e.g. Benzene, Benzpyrene etc.
7. Metals: the metals such as lead, nickel, tin, beryllium, titanium are present in to form of solid particles produced by metallurgical processes.
8. Photochemical matter: the products such as PAN, PB₂N are the photochemical smog produced by automobile.
9. Particulate matter: the suspended particulated matter (SPM) is released into the air by the stone crushing industries and dust and the ash from the thermal power plants.
10. Biological particulate: they are mainly the bacterial cells, fungal spores and pollens.

EFFECT OF AIR POLLUTION

The constant pollution of the air has very negative effects on nature and on human health. Those long-term and medium-term effects have become problems that are difficult to solve.

The main negative effects that air pollution is causing worldwide:



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1. Global Warming

Probably global warming is one of the most worrying effects for scientists and environmentalists. Global warming is a direct consequence of the greenhouse effect, which is produced by the high emission of CO₂ and methane into the atmosphere. Most of these emissions are produced by the industry, so this can be remedied by social responsibility and action by companies and factories.

2. Climate Change

Climate Change is another consequence of global warming. When the temperature of the planet increases, there is a disturbance in the usual climatic cycles, accelerating the changes of these cycles in an evident way.

Due to climate change, the mass of the poles is melting, and this is leading to flooding and the rising of sea levels.

3. Acid Rain

The gases emitted by industries, power plants, boilers, heating and transport are very toxic. Those gases include sulphur dioxide (SO₂) and nitrogen oxides (NO_x) issued into the atmosphere that come from fossil fuels burning. When those substances accumulate in the atmosphere and react with water, they form dilute solutions of nitric and sulphuric acid, and when those concentrations become rain, both the environment and surfaces suffer.

4. Smog effect

The smog effect or beret effect happens when there is a kind of dark fog concentrated over the cities and fields. That fog is a load of pollutants and can be of 2 types: sulphurous smog and photochemical smog, both dangerous and



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harmful to health. Both types of smog are a consequence of industrial and urban action. However, sulphurous smog has its origin mainly in the use of coal in many industrial processes. That has been reduced in the most advanced countries – nevertheless, there are still many developing countries that do not have treatment protocols for pollutants.

5.Deterioration of fields

Acid rain, climate change and smog all damage the Earth surface. Contaminated water and gases seep into the earth, changing the composition of soils. That directly affects agriculture, changing crop cycles and the composition of the food we all eat.

6.Extinction of animal species

As the ice masses of the poles melt and sea levels rise, many animal species, whose survival depends on oceans and rivers, are threatened. Currents change, ocean temperatures change and migratory cycles change, and many animals are forced to seek food in environments unknown to them. Deforestation and poor soil quality also mean the disappearance of ecosystems and habitats.

7.Respiratory health problems

It is probably one of the most obvious and worrying effects for human beings. Pollutants can cause respiratory illnesses and allergies ranging from coughs to asthma, cancer or emphysema.

Inhalation of toxic agents directly affects the lungs and other organs that make up the respiratory system. Also, poor oxygenation can lead to cardiovascular problems.



8.Deterioration in building materials

Air pollutants also deteriorate and change the constitution of building materials, so many buildings and infrastructure are weakened, eroded or destroyed at an accelerated rate over time.

9.Chemical Sensitivity

People develop intolerances and allergies to many agents present in the atmosphere and to other external agents that can go through due to the holes in the ozone layer. This is because there is a high concentration of chlorofluorocarbons that alter the thickness of the ozone layer.

Chlorofluorocarbons (CFCs) are released using aerosols, industrial refrigerants, solvents and other very harmful chemicals.

10.Skin Damage

Many of the chemical intolerances directly affect people's skin. However, one of the worst damage is skin cancer. That disease in many cases develops from the direct incidence of ultraviolet light rays on the skin.

The ozone layer acts as a filter for those rays. If the ozone layer is thinner, the effectiveness of the filter decreases, letting rays pass, which are very harmful to humans.

All those important effects can increase if their causes are not rapidly acted upon. Most of them are the result of very intense, polluting and uncontrolled industrial activity.



CONTROL OF AIR POLLUTON

The following should be done to manage and control air pollution

1. Use of better designed equipment and smokeless fuels, hearths in industries and at home.
2. Automobiles should be properly maintained and adhere to recent emission-control standards.
3. More trees should be planted along road side and houses.
4. Renewable energy sources, such as wind, solar energy, ocean currents, should fulfil energy needs
5. Tall chimneys should be installed for vertical dispersion of pollutants.

The commonly used equipments / process for control of dust in various industries are

- a) Mechanical dust collectors in the form of dust cyclones;
- b) Electrostatic precipitators – both dry and wet system;
- c) particulate scrubbers;
- d) Water sprayer at dust generation points;
- e) proper ventilation system and
- f) various monitoring devices to know the concentration of dust in general body of air.

The common equipment / process used for control of toxic / flue gases are the

- (a) process of desulphurisation;
- (b) process of denitrification;
- (c) Gas conditioning etc. and
- (d) various monitoring devices to know the efficacy of the systems used.



WATER POLLUTION

INTRODUCTION

The importance of water for sustenance of life cannot be overemphasized. Whether it is in use of running water in our homes, rearing cattle and growing crops in our farms, or the increased uses in industry, remain immeasurable. It is important therefore, to not that depletion of this commodity either through contamination, or careless use results in serious consequences.

WATER POLLUTION

Water is considered polluted if some substances or condition is present to such a degree that the water cannot be used for a specific purpose. Olaniran (1995) defined water pollution to be the presence of excessive amounts of a hazard (pollutants) in water in such a way that it is no long suitable for drinking, bathing, cooking or other uses.

Pollution is the introduction of a contamination into the environment (Webster.com, 2010). It is created by industrial and commercial waster, agricultural practices, everyday human activities and most notably, models of transportation. No matter where you go and what you do, there are remnants earths environmental and its inhabitants in many ways. The three main types of pollution are: Land Pollution, Air Pollution and Water Pollution. Both for the purpose of this research, emphasis are on water pollution and control.

SOURCES OF WATER POLLUTION

Water pollution arises from various activities, among which are:



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- a. Sewage leakages
- b. High population density
- c. oil spillage
- d. Menace of Nipa palm and water hyacinth
- e. Industrial waste dumped into our waters
- f. Pollution of ground water through drilling activities
- g. Flooding during rainy season which carries waste deposits into our waters.
- h. Building lavatories and visionaries over running water or even the sea as it the practice in some riverine areas.
- i. Radioisotopes
- j. Heavy metal
- k. Combustion
- l. Toxic waste disposal at sea
- m. Mineral processing plant (e.g. coal production)
- n. Eroded sediments
- o. Deforestation
- p. Mining
- q. Littering
- r. Pesticides
- s. herbicides and fertilizers
- t. Failing septic system
- u. House hold chemicals
- v. Animal wastes.

Water pollution is generally induced by humans. It results from actions of humans carried on to better self. These could be treated under the various activities that man engages in, that lead to pollution. The growth of human



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population, industrial and agricultural practices is the major causes of pollution. Water pollution becomes worse as a result of overcrowding in urban areas. Agricultural, domestic and industrial wastes are the major pollutants of agnatic habitats.

Sewage is the biggest pollutant of fresh water when discharged into them. Sewage is the waterborne waster of society and the discharge of untreated sewage into a river is very enormous and unhealthy. The striking consequence is a substantial and immediate drop in the amount of dissolved oxygen in the water. This happens because organic matter stimulates decomposers especially bacteria which break down suspended solids in the sewage. As they respire, the decomposers use up dissolved oxygen (O_2) and the Biological Oxygen Demand (BOD) reduces. The flora and fauna of the rivers experience change and reduction in number due to death by suffocation.

Highly polluted rivers have obnoxious smell and contain little or no flora or fauna. Another source of water pollution is the discharge of hot water from cooling engines in the industries. This increases water temperature and lowers the metabolic rate of organisms. This then raises their oxygen demand. The effects of pollution are greater in shallow, enclosed or slow flowing streams. Excess fertilizer, herbicides and pesticides when washed by rain into rivers causes serious danger to life. Excess phosphorus in fertilizer cause serious entroplication. Apart from fertilizers, detergent are also very toxic to marine life when washed into water. Chemical pollutants from distaffs have been found to be animal carcinogens. The dyeing industries in Nigeria (tie and dye) produce chemicals such as zinc sulphate and copper salts which are non-biodegradable, when they are discharged into rivers; they produce devastating effects on aquatic environments.



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Pollution poses a serious risk to life especially when the water is a source of drinking and for domestic purposes for humans polluted waters are potent agents of diseases such as cholera, typhoid and tuberculosis. A major water pollutant has been oil spilled in large quantities from tankers or broken oil pipes from oil industries which kills sea weeds, mollusks, marine birds, crustaceans, fishes and other sea organisms that serve as food for humans. This leads to calcium deficiencies in our diet. Some insecticides like DDT are particularly dangerous when allowed into bodies of water because its concentration increases along the food chain. Oysters for an example can accumulate DDT to a concentration 70,000 times that of DDT in sea water. The effect of water pollution in some areas has been to an extent of irreversibly changing aquatic ecosystems. This is dangerous to plants and animals including humans.

Since water pollution has direct consequences on human well beings, an effective teaching strategy in the formal education sector is essential for a better understanding so as to develop the right attitude towards water. This is why the guided discovery approach is a teaching strategy which when adequately utilized and combined with other methods of science teaching will leave lasting impression on the learner as well as help him solve the problems of his immediate environment.

EFFECTS OF WATER POLLUTION

Water pollution has a dual effect on nature. It has negative effects on the living and also on the environment. The effects of pollution on human beings and aquatic communities are many and varied. Water pollution causes approximately 14,000 deaths per day, mostly due to contamination of drinking water by untreated sewage in developing countries. An estimated 700 million



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Indians have no access to a proper toilet, and 1,000 Indians children's die of diarrhea every day and so many other countries too. Nearly 500 million Chinese lack access of safe drinking water.

Definitely with all these, we can expect that there is going to be a reduction in productivity. Biomass and diversity of communities are to be expected when large amount of toxic materials are released into the streams, lakes and coastal waters in the ocean. Much of aquatic pollution involves sewage in which organic waste predominate. This waste can increase secondary productivity while altering the character of the aquatic community. Most fishes especially the species desired as food by man are among the sensitive species that disappear with the least intense pollution.

Water pollution leads to damage to human health. Disease carrying agents such as bacteria and viruses are carried into the surface and ground water. Drinking water is affected and health hazards result. Direct damage to plants and animals nutrition also affects human health. Plants nutrients including nitrogen, phosphorus and other substances that support the growth of aquatic plant life could be in excess causing algal bloom and excessive weed growth. This makes water to have odour, taste and sometimes colour. Ultimately, the ecological balance of a body of water is altered. Sulphur dioxide and nitrogen oxides cause acid rain which lowers the pH value of soil and emission of carbon dioxide causes ocean acidification, the ongoing decrease in the PH of the Earth's Oceans as CO₂ becomes dissolved.



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Management and Control

There are many approaches that could be adopted in water pollution control and management. It could be through prevention, practice efforts or join a project/program;

Regulation and monitoring or engaging in control measures by reducing or minimizing waste.

Prevention of water pollution includes the following ways:

- a. Wash your car far away from any storm water drains.
- b. Don't throw trash, chemicals or solvents into sewer drains
- c. inspects your septic system every 3 – 5 years
- d. avoid using pesticides and fertilizers that can run off into water systems
- e. sweep your driveway instead of hosing it down \
- f. always pump your waste-holding tanks on your boat
- g. use non-toxic cleaning materials
- h. clean up oil and other liquid spills with kitty litter and sweep them up
- i. don't wash paints brushes in the sink.

Another way is to join or get involved with pollution prevention is to practice efforts on your own or join projects or programme. Some of these are available with the Environmental Protection Agency website (EPA).

Regulation and monitoring is an effective way of pollution management. Many nations worldwide have enacted legislation to regulate various types of pollution as well as to mitigate the adverse effects of pollution.



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Pollution control means to control the emissions and effluents into the air, water and land or soil. Without pollution control, the waste products from consumptions, heating, agriculture, mining, manufacturing, transportation and other human activities, whether they accumulate or disperse, will degrade the environment. Pollution prevention and waste minimization are more desirable than pollution control.

However, pollution could be minimize by adopting these practices

- a. by recycling
- b. by reusing
- c. waste minimization
- d. by mitigating
- e. by preventing
- f. by compost.

Apart from all these mentioned above, you can also use pollution control devices which include Dust collection system e.g. bag houses, cyclones, electrostatic precipitators, scrubbers e.g. baffle spray scrubber, ejector venture scrubber, mechanically aided scrubbers, spray tower, wet scrubber, sewage treatment e.g. sedimentation (primary treatment), activated sludge bio filters (secondary treatment, also used for industrial waste water), aerated lagoons, constructed wetlands (also used in urban runoff); industrial wastewater treatment e.g. ultra filtration, API oil-water separators, bio filters, dissolved air flotation (DAF), powdered activated carbon treatment; the last but not the least are vapour recovery system and phytoremediation.



SOIL POLLUTION

Soil pollution is defined as the build-up in soils of persistent toxic compounds, chemicals, salts, radioactive materials, or disease causing agents, which have adverse effects on plant growth and animal health.

Soil is the thin layer of organic and inorganic materials that covers the Earth's rocky surface. The organic portion, which is derived from the decayed remains of plants and animal, is concentrated in the dark uppermost topsoil. The inorganic portion made up of rock fragments, was formed over thousands of years by physical and chemical weathering of bedrock. Productive soils are necessary for agriculture to supply the world with sufficient food.

There are many different ways that soil can become polluted, such as:

- Seepage from a landfill
- Discharge of industrial waste into the soil
- Percolation of contaminated water into the soil
- Rupture of underground storage tanks
- Excess application of pesticides, herbicides or fertilizer
- Solid waste seepage

The most common chemicals involved in causing soil pollution are:

- Petroleum hydrocarbons
- Heavy metals
- Pesticides
- Solvents



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Inorganic toxic compounds

Inorganic residues in industrial waste cause serious problems as regards their disposal. They contain metals which have high potential for toxicity. Industrial activity also emits large amounts of arsenic fluorides and sulphur dioxide. Fluorides are found in the atmosphere from superphosphate, phosphoric acid, aluminium, steel and ceramic industries. Sulphur dioxide emitted by factories and thermal plants may make soils very acidic. These metals cause leaf injury and destroy vegetation.

Copper, mercury, cadmium, lead, nickel, arsenic are the elements which can accumulate in the soil, if they get entry either through sewage, industrial waste or mine washings. Some of the fungicides containing copper and mercury also add to soil pollution. Smokes from automobiles contain lead which gets adsorbed by soil particles and is toxic to plants. The toxicity can be minimized by building up soil organic matter, adding lime to soils and keeping the soil alkaline.

Organic wastes

Organic wastes of various types cause pollution hazards. Domestic garbage, municipal sewage and industrial wastes when left in heaps or improperly disposed seriously affect health of human beings, plants and animals [5-7]. Organic wastes contain borates, phosphates, deter-gents in large amounts. If untreated they will affect the vegetative growth of plants. The main organic contaminants are phenols and coal.

Asbestos, combustible materials, gases like methane, carbon dioxide, hydrogen sulphide, carbon monoxide, sulphur dioxide, petrol are also contaminants. The



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radioactive materials like uranium, thorium, strontium etc. also cause dangerous soil pollution. Fallout of strontium mostly remains on the soil and is concentrated in the sediments. Decontamination procedures may include continuous cropping and use of chelate amendments. Other liquid wastes like sewage, sewage sludge, etc. are also important sources of soil problems.

a. Sewage and sewage sludge

Soil pollution is often caused by the uncontrolled disposal of sewage and other liquid wastes resulting from domestic uses of water, industrial wastes containing a variety of pollutants, agricultural effluents from animal husbandry and drainage of irrigation water and urban runoff. Irrigation with sewage water causes profound changes in the irrigated soils. Amongst various changes that are brought about in the soil as an outlet of sewage irrigation include physical changes like leaching, changes in humus content, and porosity etc., chemical changes like soil reaction, base exchange status, salinity, quantity and availability of nutrients like nitrogen, potash, phosphorus, etc. Sewage sludges pollute the soil by accumulating the metals like lead, nickel, zinc, cadmium, etc. This may lead to the phytotoxicity of plants.

b. Heavy metal pollutants

Heavy metals are elements having a density greater than five in their elemental form. They mostly find specific absorption sites in the soil where they are retained very strongly either on the inorganic or organic colloids. They are widely distributed in the environment, soils, plants, animals and in their tissues. These are essential for plants and animals in trace amounts. Mainly urban and industrial aerosols, combustion of fuels, liquid and solid from animals and human beings, mining wastes, industrial and agricultural chemicals etc. are



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contributing heavy metal pollution. Heavy metals are present in all uncontaminated soils as the result of weathering from their parent materials.

Organic pesticides

Pesticides are quite frequently used to control several types of pests nowadays. Pesticides may exert harmful effects to micro-organisms, as a result of which plant growth may be affected. Pesticides which are not rapidly decomposed may create such problems. Accumulation of residues of pesticides in higher concentrations are toxic. Pesticides persistence in soil and movement into water streams may also lead to their entry into foods and create health hazards.

Types of soil pollution

1. Agricultural Soil Pollution
 - a. pollution of surface soil
 - b. pollution of underground soil
2. Soil pollution by industrial effluents and solid wastes
 - a. pollution of surface soil
 - b. disturbances in soil profile
3. Pollution due to urban activities
 - a. pollution of surface soil
 - b. pollution of underground soil



Sources of soil pollution

The sources which pollute the soil are twofold: Agricultural sources and non-agricultural sources. Figure 1 shows the different sources for the soil pollution.

a. Agricultural sources

Soil pollution comes from different sources including agriculture and animal husbandry. Some of the agricultural practices lead to soil pollution. They are animal wastes, use of long lived pesticides, herbicides, fungicides, nematocides, etc. fertilizers and some agricultural practices.

b. Non-agricultural sources

Soil pollution by non-agricultural sources is usually the direct result of urban sprawl caused by rapidly increasing population and a rapidly per capita output of waste related to our modern way of life. Its materials that find their entry into the soil system have long persistence and accumulate in toxic concentration and thus become sources of pollution. Some of those most important soil pollutants are inorganic toxic compounds.

Causes of soil pollution

Soil pollution is caused by the presence of man-made chemicals or other alteration in the natural soil environment. This type of contamination typically arises from the rupture of underground storage tanks, application of pesticides, and percolation of contaminated surface water to subsurface strata, oil and fuel dumping, leaching of wastes from landfills or direct discharge of industrial wastes to the soil. The most common chemicals involved are petroleum hydrocarbons, solvents, pesticides, lead and other heavy metals. This



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occurrence of this phenomenon is correlated with the degree of industrialization and intensities of chemical usage. A soil pollutant is any factor which deteriorates the quality, texture and mineral content of the soil or which disturbs the biological balance of the organisms in the soil. Pollution in soil has adverse effect on plant growth.

Pollution in soil is associated with

- Indiscriminate use of fertilizers
- Indiscriminate use of pesticides, insecticides and herbicides
- Dumping of large quantities of solid waste
- Deforestation and soil erosion

1. Indiscriminate use of fertilizers

Oxygen from air and water but other necessary nutrients like nitrogen, phosphorus, potassium, calcium, magnesium, sulfur and more must be obtained from the soil. Farmers generally use fertilizers to correct soil deficiencies. Fertilizers contaminate the soil with impurities, which come from the raw materials used for their manufacture. Mixed fertilizers often contain ammonium nitrate (NH_4NO_3), phosphorus as P_2O_5 , and potassium as K_2O . For instance, As, Pb and Cd present in traces in rock phosphate mineral get transferred to super phosphate fertilizer. Since the metals are not degradable, their accumulation in the soil above their toxic levels due to excessive use of phosphate fertilizers becomes an indestructible poison for crops.

The over use of NPK fertilizers reduce quantity of vegetables and crops grown on soil over the years. It also reduces the protein content of wheat, maize, grams, etc., grown on that soil. The carbohydrate quality of such crops also gets degraded.



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2. Indiscriminate use of pesticides, insecticides and herbicides

Plants on which we depend for food are under attack from insects, fungi, bacteria, viruses, rodents and other animals, and must compete with weeds for nutrients. To kill unwanted populations living in or on their crops, farmers use pesticides. The first widespread insecticide use began at the end of World War II and included DDT (dichlorodiphenyltrichloroethane) and gamma-xylene. Insects soon became resistant to DDT and as the chemical did not decompose readily, it persisted in the environment. Since it was soluble in fat rather than water, it biomagnified up the food chain and disrupted calcium metabolism in birds, causing eggshells to be thin and fragile.

3. Dumping of solid wastes

In general, solid waste includes garbage, domestic refuse and discarded solid materials such as those from commercial, industrial and agricultural operations. They contain increasing amounts of paper, cardboards, plastics, glass, old construction material, packaging material and toxic or otherwise hazardous substances. Since a significant amount of urban solid waste tends to be paper and food waste, the majority is recyclable or biodegradable in landfills.

Similarly, most agricultural waste is recycled and mining waste is left on site. The portion of solid waste that is hazardous such as oils, battery metals, heavy metals from smelting industries and organic solvents are the ones we have to pay particular attention to. These can in the long run, get deposited to the soils of the surrounding area and pollute them by altering their chemical and biological properties.



4. Deforestation

Soil Erosion occurs when the weathered soil particles are dislodged and carried away by wind or water. Deforestation, agricultural development, temperature extremes, precipitation including acid rain, and human activities contribute to this erosion. Humans speed up this process by construction, mining, cutting of timber, over cropping and overgrazing. It results in floods and cause soil erosion. Forests and grasslands are an excellent binding material that keeps the soil intact and healthy. They support many habitats and ecosystems, which provide innumerable feeding pathways or food chains to all species. Their loss would threaten food chains and the survival of many species. During the past few years quite a lot of vast green land has been converted into deserts.

Effects of soil pollution

a. Agricultural

- Reduced soil fertility
- Reduced nitrogen fixation
- Increased erodibility
- Larger loss of soil and nutrients
- Deposition of silt in tanks and reservoirs
- Reduced crop yield
- Imbalance in soil fauna and flora

b. Industrial

- Dangerous chemicals entering underground water
- Ecological imbalance
- Release of pollutant gases



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- Release of radioactive rays causing health problems
- Increased salinity
- Reduced vegetation

Estd. 2003

c. Urban

- Clogging of drains
- Inundation of areas
- Public health problems
- Pollution of drinking water sources
- Foul smell and release of gases
- Waste management problems

Environmental

- Soil becomes unavailable to grow food
- If contaminated soil is used to grow food, the land will usually produce lower yields
- Can cause even more harm because a lack of plants on the soil will cause more erosion
- The pollutants will change the makeup of the soil and the types of microorganisms that will live in it.
- Thus it's possible for soil pollution to change whole ecosystems



Control of soil pollution

The following steps have been suggested to control soil pollution. To help prevent soil erosion, we can limit construction in sensitive area. In general we would need less fertilizer and fewer pesticides if we could all adopt the three R's: Reduce, Reuse, and Recycle. This would give us less solid waste.

1. Extraction and separation techniques

In solvent extraction, the contaminated & oil is mixed with an extracting agent in general (an aqueous solution but preferably an organic solvent). Potential applications include the removal of metals such as cadmium, copper, zinc, nickel, chromium, arsenic, antimony and lead using a mineral solution, zinc lead, organo-metallic compounds and some cyanides using sodium hydroxide solution. Hydrocarbons and halogenated hydrocarbons can also be removed. Contamination is often preferentially present in the finer or coarser fraction of the soil or the organic components (ex. humus), contamination can therefore, be removed in some cases using a process which separates the soil into fractions on the basis of specific gravity or particle size or settling velocity.

2. Thermal methods

In thermal methods, there are two ways of heat treatment; removal of contaminants by evaporation either by direct heat transfer from heated air or an open flame or by indirect heat transfer, and destruction of the contaminants directly or indirectly at an appropriate temperature. The gas leaving the heating appliance must be treated to destroy or remove any contaminants or unwanted products of combustion. A related process is steam stripping in which steam is



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injected into soil to aid evaporation of relatively volatile contaminants which may be water soluble or insoluble.

3. Chemical methods

Treatment of the soil in suspension in a suitable liquid and without sludging is the two possible methods. In these, intimate, contact between soil and chemical is essential and should be frequently done so that the process of detoxification is complete.

4. Microbial treatment methods

The microbial treatment methods appear to be more promising which can deal with whole range of organic contaminants including phenol, polychlorinated hydrocarbons, oil and oil products, dioxins, etc. There are two different ways of approaching the problems.

1. A community of microbes already existing on the site is collected and cultured in the laboratory.
2. Strains of microbes are developed in the laboratory that is capable of metabolizing particular chemicals.

Excavation of the soil prior to treatment offers the greatest scope for creating optimum conditions. The excavated soil can be placed on thin layers to various depth using standard earth moving techniques and microbes and nutrients applied using standard agricultural techniques such as fertilizing, ploughing, harrowing, etc.



5. Reducing chemical fertilizer and pesticide use

Applying bio-fertilizers and manures can reduce chemical fertilizer and pesticide use. Biological methods of pest control can also reduce the use of pesticides and thereby minimize soil pollution.

6. Reusing of materials

Materials such as glass containers, plastic bags, paper, cloth etc. can be reused at domestic levels rather than being disposed, reducing solid waste pollution.

7. Recycling and recovery of materials

This is a reasonable solution for reducing soil pollution. Materials such as paper, some kinds of plastics and glass can and are being recycled. This decreases the volume of refuse and helps in the conservation of natural resources. For example, recovery of one tonne of paper can save 17 trees.

8. Reforesting

Control of land loss and soil erosion can be attempted through restoring forest and grass cover to check wastelands, soil erosion and floods. Crop rotation or mixed cropping can improve the fertility of the land.