



## 2.4 SOIL POLLUTION

### Definition

Soil pollution is defined as, "the contamination of soil by human and natural activities which may cause harmful effects on living beings."

**Table 2.3 Composition of soil**

Components	%
Mineral matter (inorganic)	45
Organic matter	5
Soil water	25
Soil air	25

### 2.4.1 Types, effects and sources (causes) of soil pollution

Soil pollution mainly results from the following sources

1. Industrial wastes.

2. Urban wastes.
3. Agricultural practices.
4. Radioactive pollutants.
5. Biological agents.

#### 1. Industrial wastes

Disposal of industrial wastes is the major problem for soil pollution.

#### Sources

The industrial pollutants are mainly discharged from the various origins such as pulp and paper mills, chemical industries, oil refineries, sugar factories, tanneries, textiles, steel, distilleries, fertilizers, pesticides, coal and mineral mining industries, drugs, glass, cement, petroleum and engineering industries etc.,

#### Effect

These pollutants affect and alter the chemical and biological properties of soil.

As a result, hazardous chemicals can enter into human food chain from the soil (or) water and disturb the biochemical process and finally lead to serious effects on living organisms.

#### 2. Urban wastes

Urban wastes comprises both commercial and domestic wastes consisting of dried sludge of sewage. All the urban solid wastes are commonly referred to as refuse.

#### Constituents of urban refuse

This refuse contains garbage and rubbish materials like plastics, glasses, metallic cans, fibres, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned vehicles and other discarded manufactured products. Urban domestic wastes though disposed off separately from the industrial wastes, can still be dangerous. This is so because they cannot be easily degraded.

#### 3. Agricultural practices



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Modern agricultural practices pollute the soil to a large extent. Today with the advancing agro-technology, huge quantities fertilizers, pesticides, herbicides, weedicides are added to increase the crop yield. Apart from these farm wastes, manure, slurry, debris, soil erosion containing mostly inorganic chemicals are reported to cause soil pollution.

#### 4. Radioactive pollutants

Radioactive substances resulting from explosions of nuclear dust and radioactive wastes (produced by nuclear testing laboratories and industries) penetrate the soil and accumulate there by creating land pollution.

##### Examples

1. Radio nuclides of radium, thorium, uranium, isotopes of potassium (K-40) and carbon (C-14) are very common in soil, rock, water and air.
2. Explosion of hydrogen weapons and cosmic radiations induce neutron, proton reactions by which nitrogen (N-15) produces C-14. This  $C^{14}$  participates in the carbon metabolism of plants which is then introduced into animals and man.
3. Radioactive waste contains several radio nuclides such as Strontium-90, Iodine-129, Cesium-137 and isotopes of iron which are most injurious. Sr-90 gets deposited in bones and tissues instead of calcium.
4. Nuclear reactor produces waste containing Ruthenium-106, Iodine-131, Barium-140 and Lanthanum-140, Cesium-144 along with the primary nuclides Sr-90 and Cs-137 has a half life of 30 years while Sr-90 has 28 years. Rain water carries Sr-90 and Cs-137 to be deposited on the soil where they are held firmly with the soil particles by electrostatic forces. All these radio nuclides deposited on the soil emit gamma radiations.

#### 5. Biological agents

Soil gets large quantities of human, animal and bird's excreta which constitute the major source of land pollution by biological agents.

##### Examples

- (i) Heavy application of manures and digested sludges could cause serious damage to plants within a few years. Because the sludges are containing more live viruses and viable intestinal worms.
- (i) In addition to these excreta, faulty sanitation, municipal garbage, waste water and wrong methods of agricultural practices also induce heavy soil pollution.

**Table 2.4 Major physico-chemical characteristics of untreated wastes of Organic chemical industries in Soil**

S. No.	Industry	Physico-chemical characteristics
1	Pulp paper	Suspended solids, high (or) low pH, colour, fibres, BOD, COD, high temperature, fibres.
2	Rubber industry	Chlorides, suspended and dissolved solids, variable pH and high BOD.



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3	Oil refineries	Acids, alkalis, phenols, resinous materials and petroleum oils.
4	Antibiotics	Toxic organics and high acidity (or) alkalinity.
5	Synthetic drugs	High suspended and dissolved organic matter including vitamins.
6	Distillery	Very high COD, low pH, high organic matter, high suspended and dissolved solids containing nitrogen, high potassium.
7	Organic chemical industry	Toxic compounds, phenols, high acidity, alkalinity.

**Table 2.5 Major physico-chemical characteristics of untreated wastes of Inorganic chemical industries in Soil**

S. No.	Industry	Physico-chemical characteristics
1.	Thermal Power Plants	Heat, heavy metals, dissolved solids and inorganic compounds.
2.	Steel Mills	Acids, phenols, low pH, alkali, limestone, oils, fine suspended solids, cyanides, cyanates, iron salts, ores and coke.
3.	Cotton Industry	Sodium, organic matter, colour, high pH and fibres.
4.	Metal Plating	Metallics, toxic cyanides, cadmium, chromium, zinc, copper, aluminium and low pH.
5.	Iron Foundry	Coal, clay, suspended solids and iron.
6.	Pesticides	Aromatic compounds, acidity and high organic matter.
7.	Acids	Low pH and organic content.
8.	Tanneries	Calcium, chromium, high salt content, colour, dissolved and suspended matter.
9.	Explosives	Alcohol, metals, TNT and organic acids.

#### **2.4.2 Control (or) Preventives measures of soil pollution**

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

1. Population growth.
2. Decrease of the available farm land due to urbanization.

##### **1. Control of Soil erosion**

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

Example:

- (a) Trees may be planted on barren slopes.
- (b) Contour cultivation and strip cropping may be practiced instead of shifting cultivation.
- (c) Terracing and building diversion channels may be undertaken.



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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.

### **2. Proper dumping of unwanted materials**

Excess of waste products by man and animals cause chronic disposal problem. Open dumping is most commonly practiced method. Recently controlled tipping is followed for solid waste disposal. The surface so obtained then can be used for housing (or) sports field.

### **3. Production of natural fertilizers**

Excessive use of chemical fertilizers and insecticides should be avoided. Biopesticides should be used in place of toxic chemical pesticides.

**Example:** Organic wastes contained in animals dung can be used for preparing compost manure and biogas rather than throwing them wastefully polluting the soil.

### **4. Proper Hygienic condition**

People should be trained regarding the sanitary habits.

**Example:** Lavatories should be equipped with quick and effective disposal methods.

### **5. Public Awareness**

Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental pollution.

**Example:** Mass media, educational institutions and voluntary agencies can achieve this.

### **6. Recycling and Reuse of wastes**

To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc., should be recycled and reused.

**Example:** Industrial wastes should be properly treated at source. Integrated waste treatment method should be adopted.

### **7. Ban on Toxic Chemicals**

Ban should be imposed on chemicals and pesticides like DDT, BHC etc., which are fatal to plants and animals. Nuclear explosions and the improper disposal of radioactive wastes should be banned.