

## Unit IV

### Soil pollution

Soil pollution refers to the contamination of soil with anomalous concentrations of toxic substances. It is a serious environmental concern since it harbours many health hazards. For example, exposure to soil containing high concentrations of benzene increases the risk of contracting leukaemia.

The root cause of soil pollution is often one of the following:

- Agriculture (excessive/improper use of pesticides)
- Excessive industrial activity
- Poor management or inefficient disposal of waste

#### SOURCES OF SOIL POLLUTION

Various sources of soil pollution are

1. **Industrial wastes:** There are two types of wastes produced from industrial activities i.e, unused chemicals and unwanted industrial garbage.
2. **Urban waste:** Urban wastes comprise is of both commercial and domestic wastes, consisting of dried sludge and sewage. Urban waste should be separately disposed of from industrial waste because it is not easily degraded.
3. **Biological agents:** soil gets a large amount of human, animal and bird excreta which constitute a major source of land pollution by biological agents.
4. **Agricultural practices:** Modern agricultural practices the soil to a large extent. With the advancing agro-technology, huge quantities of fertilizers pollute, pesticides, herbicides and weedicides are added to increase the crop yield.
5. **Radioactive pollutants:** Radioactive substances resulting from explosions of nuclear testing laboratories and industries give rise to nuclear dust radioactive wastes, penetrate the soil, and accumulate giving rise to land/soil pollution.

Radioactive contamination is defined as the deposition or introduction of radioactive substances into the environment, where their presence is unintended, or the levels of radioactivity are undesirable. Such type of pollution is harmful to life due to the emission of ionizing radiation. This type of radiation is potent enough to cause damage to tissues and DNA in genes.

Radioactive pollution occurs as a result of radioactive decay of radioactive elements during:

- nuclear explosions and testing
- disposal of nuclear waste
- mining radioactive ores
- accidents at nuclear power plants

At very high doses, radiation can impair the functioning of tissues and organs and produce acute effects such as nausea and vomiting, skin redness, hair loss, acute radiation syndrome, local radiation injuries (also known as radiation burns), or even death.

## **6. Plastic:**

Plastic bags are non-biodegradable in nature. It remains in the soil for a long period of time without getting decomposed. It prevents seeping of water into the soil and thus prevents the growth of plants. Thus, plastic bags pollute the soil and are considered bad for the soil.

The buildup of plastic waste in agricultural areas can have detrimental effects on biodiversity, soil health, and ecosystem function. Plastic waste can pollute the soil in agricultural areas, which will prevent plants from properly absorbing nutrients and thereby impede their growth.

Plastic pollution is a global problem. Every year 19-23 million tonnes of plastic waste leaks into aquatic ecosystems, polluting lakes, rivers and seas.

## **7. Heavy metals:**

Sources of heavy metals include mining, industrial production (foundries, smelters, oil refineries, petrochemical plants, pesticide production, chemical industry), untreated sewage sludge and diffuse sources such as metal piping, traffic and combustion by-products from coal-burning power stations.

Heavy metal poisoning (toxicity) is the result of exposure to heavy metals like lead, mercury and arsenic. Heavy metals bind to parts of your cells that prevent your organs from doing their job. Symptoms of heavy metal poisoning can be life threatening and they can cause irreversible damage.

The ecosystem is being ruined to the fact that the heavy metals are entering the food chain. Heavy metals also affect the biodegradability of organic pollutants, making them less degradable and thus causing double the effect of polluting the environment.

# **POISONING BY HEAVY METALS**

Heavy metal poisoning is caused by the accumulation of certain metals in the body due to exposure through food, water, industrial chemicals, or other sources.

While your body needs small amounts of some heavy metals to function normally — such as zinc, copper, chromium, iron, and manganese — toxic amounts are harmful.

If your body's soft tissues accumulate too much of these substances, the resulting poisoning can cause serious health problems.

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- Confusion

- Numbness
- Nausea
- Vomiting
- Falling into a coma

Long-term or chronic exposure to lower levels of heavy metals may cause symptoms that develop slowly over time. Symptoms may include:

- Headache
- Weakness
- Tiredness
- Muscle pain
- Joint pain
- Constipation

## **MINA MATHA AND ITAI-ITAI DISEASES**

Minamata disease is a methylmercury poisoning with neurological symptoms and caused by the daily consumption of large quantities of fish and shellfish that were heavily contaminated with the toxic chemical generated in chemical factories and then discharged into the sea.

Effects of Minamata disease include numbness of lips, tongue, deafness, diarrhea, blurring vision.

The disease was discovered in 1956. A local chemical plant was blamed for causing the disease by emitting untreated wastewater into Minamata Bay (Japan).

Itai-Itai disease - (it hurts-it hurts disease) is caused due to the poisoning of cadmium metal. Effects of itai itai disease include weak and brittle bones, spine and leg pain, coughing, anemia, and kidney failure are common.

## **CONTROL OF SOIL POLLUTION**

The following measures should be taken to prevention of soil pollution-

1. Use of pesticides should be minimized.
2. Use of fertilizers should be judicious.
3. Cropping techniques should be improved to prevent growth of weeds.
4. Special pits should be selected for dumping wastes.
5. Controlled grazing and forest management.
6. Wind breaks and wind shield in areas exposed to wind erosion.
7. Planning of soil binding grasses along banks and slopes prone to rapid erosion.

## **SOLID WASTE MANAGEMENT**

solid-waste management, the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful.

**Four most common types of waste managements are**

1. **Landfills:** A landfill is a specially designed pit or mound of earth where solid waste (trash, garbage, and other refuse) is buried.
2. **Recycling:** Recycling is one of the three components of the waste hierarchy, others including reusing and reducing. It is the process of converting used materials into new products to reduce the consumption of raw materials, energy, and water.
3. **Incineration:** Incineration is the burning of organic material (such as paper, plastic, or food) to reduce its volume and mass. It involves the burning of waste materials at high temperatures (up to 2200 F/1200C), producing heat energy and ash. The ash produced is then sent to a landfill, while the remaining heat energy can be used to produce steam.
4. **Composting:** Composting is the process of breaking down organic material, such as food scraps and yard waste, into a nutrient-rich soil amendment. It is a natural and efficient way to reduce the amount of waste that goes into landfills and incinerators while providing a nutrient-rich soil amendment for gardening and landscaping.

## **THERMAL POLLUTION**

Thermal pollution is any deviation from the natural temperature in a habitat and can range from elevated temperatures associated with industrial cooling activities to discharges of cold water into streams below large impoundments.

Causes of thermal pollution:

1. **Soil erosion:** When topsoil is removed due to heavy rain and wind because of deforestation the water becomes more exposed to the sun and the temperature of the water body is altered.
2. **Use of water as a cooling agent in industries and paper factories:** The water cools the machinery and returned back to the river with altered temperature.
3. **Natural causes:** Natural causes like volcanoes, geothermal vents, and hot springs can cause heat into water bodies.

## **HARMFUL EFFECT OF THERMAL POLLUTION**

Thermal pollution damages water ecosystems and reduces animal populations. Plant species, algae, bacteria, and multi-celled animals all respond differently to significant temperature changes. Organisms that cannot adapt can die of various causes or can be forced out of the area. Reproductive problems can further reduce the diversity of life in the polluted area.

### **1. Decreased dissolved oxygen**

Warm water holds less oxygen than cool water. If the oxygen level drops animals that cannot move to another area may begin to die.

## **2. Migration**

Fish and amphibians may move away from the warm water to a more-suitable location, disrupting the ecosystem for animals that remain.

## **3. Loss of Biodiversity**

The sudden heating can kill off vulnerable organisms or drive them away. This is one of many serious issues for threatened and endangered animal species. This loss can come from organisms dying from the hot water, being unable to reproduce as effectively as before, or simply leaving the area.

## **4. Reproductive effect**

A significant temperature increase in the water can cause reproductive problems. Warmer water can reduce the fertility of some organisms. Other species may suffer birth defects or lay deformed eggs because of chemical changes in the body caused by warmer water. Defective eggs and birth defects hurt the overall reproductive fitness of the animal population and can reduce the population.

## **5. Increased metabolic rate**

Warmer water may be good for cold-blooded fish and amphibians, but only for a limited time. One of many real problems that warm water may cause is faster metabolism, which means animals need more food. The local ecosystem may not be able to support a significant increase in food consumption.

# **PREVENTION OF THERMAL POLLUTION**

- 1. Closed-Loop Cooling Systems:** Industries and power plants can implement closed-loop cooling systems, which circulate cooling water within a closed system instead of continuously drawing water from a natural source and discharging it at a higher temperature. This significantly reduces the thermal impact on the environment.
- 2. Dry Cooling Systems:** Power plants and industrial facilities can switch to dry cooling systems that use air instead of water for cooling purposes. These systems are more water-efficient and reduce thermal pollution.
- 3. Effluent Temperature Regulations:** Governments can establish and enforce regulations that set maximum allowable effluent temperatures for industrial and power plant discharges into water bodies. These regulations help maintain safe water temperature levels.
- 4. Riparian Buffer Zones:** Creating and maintaining vegetative buffer zones along the banks of rivers and lakes helps provide natural shade and cooling. These zones can mitigate the effects of thermal pollution and protect aquatic ecosystems.
- 5. Water Recycling and Reuse:** Encourage industries to recycle and reuse cooling water rather than discharging it after a single use. This approach reduces the overall demand for water and minimizes thermal pollution by reducing the volume of heated water entering natural water bodies.