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## Open Elective 3: Environmental

### Management Systems

(ISE - 1)

⇒ Types of Pollution

#### 1) Land pollution -

Def. Land pollution is the deterioration of the Earth's land surface caused by human activities and natural processes, leading to the contamination of soil and land resources. It reduces the productive capacity of land and affects human, plant & animal life.

#### Sources / Causes:

- Urbanization - Unplanned expansion of cities leads to dumping of waste.
- Agriculture - Excessive use of chemical fertilizers, pesticides and insecticides.
- Industrialization - Dumping of industrial solid waste like fly ash, Slag, and construction debris.
- Mining & Quarrying - Extraction of minerals leaves behind barren land and open pits.
- Deforestation - Removal of trees leads to soil erosion & desertification.

#### Effects:

- loss of soil fertility and reduction in agricultural output.
- Contamination of groundwater through percolation of harmful chemicals.

- Reduction of forest cover and loss of biodiversity.
- Health problems due to disease - spreading organisms in garbage dumps.
- Visual pollution and reduction in natural beauty of surroundings.

### Remedies:

- Scientific waste disposal - sanitary landfills & incineration.
- Recycling and reuse of plastics, metals, e-waste.
- Organic farming & controlled use of chemicals.
- Afforestation and soil conservation.
- Strict legislation for land use & proper treatment.

Case Study - The Ghazipur Landfill in Delhi has grown into a "mountain of garbage". It leaches toxic chemicals into soil & groundwater, affecting nearby villages. Case shows how improper waste management leads to severe land degradation.

## 2) Water pollution due to sewage

Def - Sewage water pollution refers to the contamination of water bodies due to untreated or partially treated domestic and municipal waste water, which contains organic matter.

### Sources / Causes -

- Discharge of untreated sewage into rivers.
- Leakage from septic tanks.
- Overflow of drains during monsoon.

- Lack of proper sewage treatment plants in cities.

### Effects -

- Depletion of dissolved oxygen in water bodies
- Spread of waterborne diseases like cholera, dysentery, typhoid.
- Eutrophication due to organic load.
- Loss of aquatic biodiversity & fish kills.
- Contamination of ground water.

### Remedies -

- Construction of sewage treatment plants (STPs)
- Proper sanitation infrastructure in rural & urban areas.
- Reuse of treated wastewater for irrigation & industry.
- Awareness campaigns about safe sanitation practices.

Case study - The Yamuna River in Delhi receives nearly 70% of untreated sewage from city, making it one of the most polluted rivers in India.

### 3) Industrial Effluents & Leachate -

Def - Industrial effluent pollution refers to contamination of water and soil due to liquid waste discharged from industries.

Leachate is toxic liquid that drains from landfills mixing harmful chemicals into soil & groundwater.

#### Sources / causes -

- Textile, paper, chemical & tannery industries discharging untreated wastewater.

- Heavy metals, dyes, acids, alkalis, rivers.

- Leachate from municipal solid waste landfills.

- Poor industrial waste management practices.

#### Effects -

- Poisoning of aquatic life due to heavy metals.

- Bioaccumulation of toxins in food chain.

- Cancer, skin diseases, and organ damage in humans.

- Soil infertility and groundwater contamination.

#### Remedies -

- Effluent treatment plants (ETP) at every industry.

- strict enforcement of pollution control norms.

- Use of cleaner production technologies.

- Leachate collection systems in landfills.

Case study - Kanpur Tanneries along the Ganga River discharge chromium-laden effluents, causing health hazards and ecological damage.

#### 4) Pollution due to Nuclear Power Plants -

Def - Nuclear pollution is caused by release of radioactive materials during nuclear energy generation, accidents or improper waste disposal.

##### Sources / causes -

- Leakage from nuclear reactors.
- Improper disposal of spent nuclear fuel.
- Accidents like Chernobyl (1986) and Fukushima (2011).
- Uranium mining & processing.

##### Effects:

- Severe radiation hazards causing cancer, genetic disorders, and birth defects.
- Long-term soil and water contamination.
- Permanent evacuation of human settlements.
- Damage to ecosystems and food chains.

##### Remedies -

- Safe reactor design and regular safety checks.
- Proper storage of radioactive waste in shielded containers.

- Use of alternative renewable energy sources.
- International monitoring & safety standards.

### Case study:

Chernobyl disaster (Ukraine, 1986) released large amounts of radioactive material, contaminating vast areas and affecting millions of people for decades.

### 5) Radioactive waste pollution -

Def - Radioactive waste pollution refers to environmental contamination by radioactive by-products from nuclear power plants, research labs, and medical facilities.

#### Sources/causes -

- Spent fuel rods from reactors.
- Radioisotopes from hospitals & research centers.
- Accidental leaks during transport and storage.
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#### Effects -

- Radiation, sickness, cancer & genetic mutations.
- Contamination of soil and water for thousands of years
- Long term ecological imbalance.

Remedies -

- Secure geological disposal (deep underground repositories).
- Development of advanced reprocessing technologies.
- International cooperation on safe handling.
- Strict monitoring during transport and disposal.

Case Study:

Hanford Site (USA) - One of the most contaminated nuclear waste sites, leaking radioactive material into soil and water.

### 6) Thermal pollution.

Def - Thermal pollution occurs when industries discharge hot waters into natural water bodies, raising their temperature.

Sources / causes -

- Power plants (coal, nuclear) using water as coolant.
- Industrial heating processes.
- Deforestation reducing natural shading of rivers.

Effects -

- Decrease in dissolved oxygen levels in water.
- Death of aquatic organisms sensitive to temperature.

- Disturbance in breeding cycles of fish.
- Algal blooms & ecological imbalance.

### Remedies -

- Cooling ponds, cooling towers to lower temp. before discharge.
- Recycling heated water in industries.
- Use of renewable energy to reduce dependence on thermal power.

### Case study -

Fossil-fuel plants near Godavari River have caused thermal pollution, affecting fisheries & biodiversity.

### 7) Noise pollution -

Def - Noise pollution is unwanted or harmful sound that disturbs normal environmental balance and causes health hazards. It is measured in decibels (dB).

### Sources / causes -

- Industrial machinery, construction activities.
- Traffic, horns, railway stations, airports.
- Loudspeakers, music, festivals, fireworks.
- Households, equipment (generators, mixers, ACs).

## Effects -

- Hearing loss, stress, hypertension, and sleep disorders.
- Reduced work efficiency & concentration.
- Disturbance to wildlife (migration & breeding).
- Irritation and reduction in mental well-being.

## Remedies -

- Monitoring noise levels using sound meters.
- Use of silencers in vehicles & machinery.
- Strict rules for use of loudspeakers & firecrackers.
- Green belts and trees to absorb noises.
- Public awareness about noise hazards.

## Case Study -

The supreme court of India has imposed restrictions on the use of loudspeakers and firecrackers after 10 PM to control noise pollution in cities.