

Soil Pollution, Solid Waste, Hazardous Waste & E-Waste

Soil Pollution

Definition

Soil pollution refers to the **addition of toxic substances** (chemicals, salts, radioactive materials, pathogens) into soil, adversely affecting its **physical, chemical and biological properties**, thereby reducing productivity.

Causes & Sources

1. Plastic Waste

- Non-biodegradable → remains for centuries
- Prevents seed germination
- Burning releases:
 - Dioxins
 - Furans
 - Phosgene
 - CO, CO₂
- Blocks soil porosity → reduces groundwater recharge

2. Industrial Sources

- Fly ash
- Heavy metals: Lead, Mercury, Cadmium, Chromium
- Acids, alkalis, cyanides
- Nuclear wastes

3. Pesticides & Fertilisers

- Chlorohydrocarbons (DDT, Endosulfan, Heptachlor)
- Cause **biomagnification**
- Excess fertilisers:
 - Reduce soil microbes
 - Increase salinity & alkalinity
 - Reduce nitrogen fixation

4. Other Sources

- Acid rain

- Weathering of toxic rocks
- Radioactive leakage

Effects of Soil Pollution

- Reduced fertility
- Increased salinity & alkalinity
- Loss of nitrogen-fixing bacteria
- Soil erosion
- Siltation in reservoirs
- Health hazards
- Ecological imbalance

Solid Waste

Definition

Municipal Solid Waste (MSW) includes:

- Paper
- Plastics
- Food waste
- Glass
- Metals
- Rubber
- Textiles

Problems with Solid Waste

1. Open Dumps

- No segregation
- Disease breeding grounds
- Groundwater contamination

2. Landfills

- Risk of **leaching**
- Methane emission
- Limited space

3. Sanitary Landfills

- Lined with impermeable materials
- Expensive but safer

Waste Treatment Methods

1. Incineration

- Burning at high temperature
- Produces toxic ash
- Last resort (used for biomedical waste)

2. Pyrolysis

- Combustion in the absence of oxygen
- Produces fuel gas, charcoal, and tar

3. Composting

- Aerobic decomposition
- Produces nutrient-rich humus

4. Vermiculture

- Earthworms convert waste into compost

Plastic Waste Issues

- Releases **dioxins (POPs)**
- Blocks drains
- Causes animal deaths
- Reduces soil fertility

Dioxins are part of “Dirty Dozen” under: **Stockholm Convention on Persistent Organic Pollutants**

Plastic in Road Construction

- Polyblend + Bitumen
- Improves water resistance
- Increases road life 3×
- Example of circular economy

Waste Minimization Circles (WMC)

- For SMEs
- Assisted by World Bank
- Implemented via National Productivity Council
- Based on 1992 Policy Statement for Abatement of Pollution

Hazardous Waste

Definition

Waste exhibiting:

- Toxicity
- Ignitability
- Corrosivity
- Reactivity

Sources:

- Industry
- Hospitals
- Agriculture
- Construction
- Power plants

Important International Conventions

Stockholm Convention on Persistent Organic Pollutants

- Eliminates/restricts POPs
- Includes DDT, Aldrin, PCBs

Basel Convention

- Controls transboundary movement of hazardous waste
- Prevents dumping in developing countries

Rotterdam Convention

- Prior informed consent for hazardous chemicals trade
- Promotes information sharing

Electronic Waste (E-Waste)

Definition

Discarded electronic products:

- Computers
- TVs
- Mobiles
- Appliances

Safe if:

- Scientifically recycled

Hazardous if:

- Informally dismantled

Major Toxic Components

Metal	Source	Health Effect
Lead	Solder, CRT	Neurological damage
Cadmium	Chips	Kidney damage
Mercury	Switches, displays	Brain & foetal damage
Chromium VI	Corrosion protection	DNA damage
Beryllium	Motherboards	Lung cancer
Barium	CRT panel	Brain swelling

E-Waste in India

- ~18.5 lakh MT annually (older data; rising trend)
- Major states:
 - Maharashtra
 - Tamil Nadu
 - Andhra Pradesh
 - UP
 - Delhi

Major cities:

Mumbai, Delhi, Bengaluru, Chennai, Kolkata

Challenges:

- Informal recycling sector
- Worker exposure
- Export dumping

Heavy Metal Toxicity

Lead

- Source: Petrol (TEL), batteries
- Causes:
 - Neurological damage
 - Developmental disorders
 - Lung & kidney cancer

Mercury

- Example: Minamata Disease (Japan)
- Causes:
 - Brain damage
 - Foetal deformities

Arsenic

- Found in groundwater
- Causes:
 - Melanosis
 - Keratosis
 - Skin cancer

Cadmium

- Itai-Itai disease (Japan)
- Causes:
 - Brittle bones
 - Kidney damage

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