

Environmental Toxicity



Dr Muhammad Al Shorbagy, PhD
muhammad.alshorbagy@pharma.cu.edu.eg

Environmental Toxicology

Air pollutants

Ambient (outdoor)

Primary

CO₂

NO₂

SO₂

Air-borne particulates

Pb

Organic compounds

Silica

Asbestos

Secondary (ozone)

Indoor

Combustion by-products

Microorganisms & allergens

Formaldehyde

Tobacco smoke

Water pollutants

Biological pollutants

Water-borne diseases

Water-contact diseases

Water-insect-related diseases

Water-wash diseases

Chemical pollutants

Organic contaminants

Volatile compounds & pesticides

Oil

Detergents in fresh water

Sewage effluents

Inorganic contaminants

Heavy metals

Radioactive waste

Fertilizers

Acidity

I. Primary pollutants

1. **CO₂: ↓ O₂ delivery forming CoHb**
2. **NO₂: lung irritation + ↑ lung infections**
3. **SO₂: respiratory illness – aggravation of respiratory & CVS disease – damage to crops (acidic rain).**
4. **Air-borne particulates:**
 - a. **Pb → accumulates in blood & bone**
 - b. **Organic cmpds → HCHO/vinyl Cl- (↑ cancer risk)**

Air pollution

Ambient (outdoor)

I. Primary pollutants

4. Air-borne particulates:

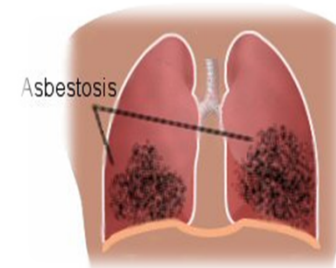
C. Silica:

- **Silica dust → “Silicosis”**
- **Occurs due to failure to travel along lymph channels by phagocytic cells → collect as silicotic nodules.**



D. Asbestos:

- **Workers show ↑ lung cancer**
- **Dangerous if asbestos is friable (shedding) → “Asbestosis”**



II. Secondary pollutants

- Results from interaction between primary pollutants.
- May be more toxic than the original ones.

Ozone:

- **Air** (*NO₂/aldehydes/ketones/unsaturated HC*) –(sun light)→
O₃ (strong oxidant – damages lungs)
- **Especially affects asthmatics**
- **Causes agricultural crop loss**
- **Only dangerous when near the ground**

<http://www.majidali.com/ozoneis.htm>

Air pollution

Indoor (sick building syndrome)

1. **Combustion byproducts: CO_2 -CO-SO₂-HCHO**
2. **Microorganisms & allergens:**
Source: Humidifiers – A/C-pets – ventilation ducts (insects-pollens-molds-mites..etc)
3. **HCHO:**
 - **Building materials/furnishing/foam insulation**
 - **Low conc → eye discomfort**
 - **High conc → pulmonary edema – anxiety**
4. **Tobacco smoke:**
Nicotine-polycyclic aromatic HC-CO-acrolein

Water pollution

Biological pollution

1. **Water-borne:** ingestion of water that contains the causative m.o. (typhoid/cholera/hepatitis)
2. **Water-contact:** contact m.o. in water (bilharzias/guinea worm disease)
3. **Water-insect:** water serves as habitat for disease transmitter (malaria/yellow fever)
4. **Water-wash:** lack of water for personal hygiene (shigellosis/trachoma/conjunctivitis)

Water pollution

Chemical pollution

A. Organic contaminants

- 1. Volatile organic compounds and pesticides:** may leak into water from improper storage contaminating it
- 2. Oil:** oil floats on the water surface, thus preventing oxygen from reaching marine organisms. These die and decompose, consequently birds and other marine animals are killed)

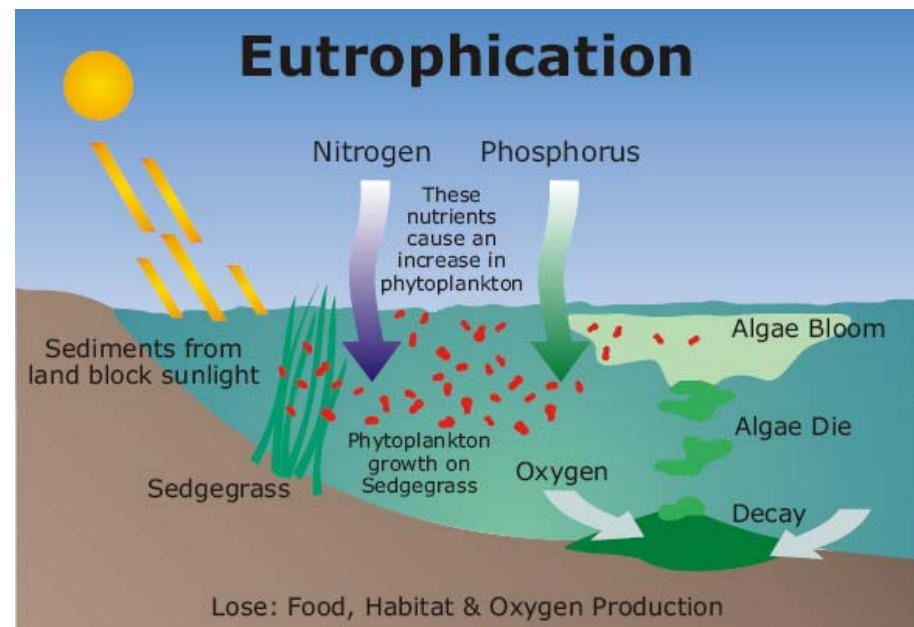
Water pollution

Chemical pollution

A. Organic contaminants

3. Detergents in fresh water: **Phosphates in detergents can lead to freshwater algal blooms, i.e. eutrophication, that releases toxins and deplete oxygen in waterways.**

- Detergents → damage external mucus layer that protect fish from bacteria.
- They kill fish eggs.
- They lower water surface tension → toxic organic chemicals are easily absorbed



Water pollution

Chemical pollution

A. Organic contaminants

4. Sewage effluents:

- It is the greatest source of organic materials discharged to freshwaters
- Organic pollution affects the organisms living in a stream by lowering the available oxygen in the water → asphyxiation

Water pollution

Chemical pollution

B. Inorganic contaminants

1. Heavy metals: Hg – Pb – Cd – As (discussed)
2. Radioactive waste:
 - Radioactive isotopes of (I₂-radon-uranium-cesium-thorium)
 - Discharged from nuclear power plants
 - Genetic mutations – miscarriages - birth defects – cancer

B. Inorganic contaminants

3. Fertilizers:

- **Eutrophication**
- **Consumption of water that contains excess level of nitrates → MetHb**

3. Acidity:

Acidity is caused by industrial discharges especially sulfur dioxide from power plants