

((FOUNDATIONS OF MEDICINE))

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AIR POLLUTION

Social & Economic Aspects of Air Pollution:

These comprise:

- A. Destruction of plant and animal life.
- B. Corrosion of metals.
- C. Damage to buildings.
- D. Cost of cleaning, maintenance and repairs nuisance.
- E. Air pollution also reduces visibility in towns.
- F. It can soil and damage clothings.

Major Air Pollutants:

Ozone, O₃:

Ozone is a gas, at ground level it is a hazard (bad ozone), however, in stratosphere it serves to absorb some of potentially harmful Ultra-Violet (UV) radiation from the sun, which is believed to cause skin cancer, among other things (good ozone) sources O₃ is not emitted into the atmosphere. O₃ is formed from O₃ Precursors, volatile organic compounds and nitrogen oxides.

Bad Ozone Effects:

- ◆ Diverse effects on human health.
- ◆ Ecological effects: damage vegetables and trees.

Major Nitrogen Containing Compounds:

N₂ is a dominant gas of the atmosphere 78% by volume. NO_x (Nitrogen oxides) are formed from N₂ and O₂ during high temperature combustion of fuel in cars.

NO_x Effects:

- ◆ Cause the reddish-brown haze in city air which contribute to heart and lung problems and may be carcinogenic.
- ◆ NO_x is an acid precursor which is a source of acid rain when: $\text{NO}_x + \text{H}_2\text{SO}_4 \rightarrow \text{HNO}_3$
- ◆ NO_x are the precursor of nitrate particulates.
- ◆ NO_x are major contributors to the formation of ground level bad ozone.

Major Sulfur Containing Compounds:

Sulfur dioxide SO₂ is a colorless gas with a sharp odor, primary pollutant has anthropogenic (man-made) and natural sources.

Sulfur is present in many fuels e.g. coal & crude oil over a wide range of concentration. Combustion causes its oxidation to sulfur dioxide.

SO₂ Effects:

- At a relatively high concentrations SO₂ causes severe respiratory problems.
- SO₂ is an acid precursor, which is a source of acid rain produced when SO₂ with water droplets form sulfuric acid H₂SO₄.
- Sulfur dioxide is a precursor of sulfate particulates.

Major Carbon Containing Compounds:

Carbon Monoxide is a colorless, odorless, flammable gas produced from incomplete combustion in petrol-engined motor cars & cigarette smoke.

CO Effects:

It is highly poisonous to human and most animals, CO reduces the ability of hemoglobin to attack oxygen. CO₂ is a key greenhouse gas.

Volatile organic compounds:

Organic gases are those that contain both hydrogen and carbon but may also contain other atoms. Hydrocarbons (HCs) are organic gases that contain only hydrogen and carbon, e.g. Methane CH₄.

Metals as pollutants: Lead is a highly toxic material.

Particulate matters (aerosols) are solid or liquid particles composed of one or several chemicals. E.g. dust, pesticides, pollen, bacteria cells, sulfate, nitrate.

Sources

Industrial and agriculture activities, Natural sources: dust storm.

Effects:

- ◆ Diverse health effect.
- ◆ Urban haze leading to visibility reduction.

WATER POLLUTION

Human impact on water cycle:

1. Polluting the water cycle.
2. Withdrawing water resources.

Consequences of overdrawing surface water:

- ◆ Inevitable shortage.
- ◆ Ecological effects.

Consequences of overdrawing ground water:

- ◆ Falling water tables and depletion.
- ◆ Diminishing surface water.
- ◆ Land subsidence.
- ◆ Salt water intrusion.

Chemical Pollutants of Water:

Organic Chemicals: Many of these compounds come from living things, while others are made in laboratories. Synthetic organic substances include: gasoline, oils, plastics, some pesticides and fertilizers, solvents, and wood.

Crude oil is one of the most common and dangerous organic pollutants. Crude oil enters surface water systems as a result of spills at drilling sites, or from shipwrecked or damaged oil tankers.

Inorganic Chemicals: Include acids, salts, and heavy metals. Examples of dangerous heavy metals: Mercury, Lead, Cadmium, Nickel, and Chromium. Heavy metal compounds are often by products of industrial processes such as metal treatment, paints, and plastic production. Factories sometimes discharge these materials directly into surface water. Heavy metals are poisonous, ingestion of these materials can cause brain, liver, and kidney damage.

Radioactivity:

Radioactive elements give off radiation when they decay. Radioactive elements such as Uranium 235 and Plutonium 239 are used as:

- ◆ Fuel in nuclear power plants.
- ◆ Others are used in medicine.
- ◆ Uranium mines and nuclear fuel.
- ◆ Refineries produce radioactive waste.

The disposal of radioactive waste both solid and liquid may result in water pollution.

Plants nutrients and cultural eutrophication:

Plants in water require a sufficient supply of nutrients to grow and mature properly. The most common nutrients found in our water are: Nitrogen, Phosphorous and Carbon. Large amount of nutrients can cause problems such as algae blooms.

Algae is a general term of small, chlorophyll containing plants such as seaweed. When a body of water has a high level of nutrients, aquatic plants will grow and reproduce quickly. If algae grow in high density it will block the sunlight from reaching plants at greater depth lead to death. When algae die, the decaying process uses oxygen in water decreasing O₂ dissolved, this will cause aquatic animals to die. The process of aquatic overgrowth of algae, followed by death, decay, and O₂ depletion is called **Eutrophication**, this can result from human influences on the chemicals that enter water. (This process causes an imbalance between plants & animals in the water)

Thermal pollution of water:

Power plants and other industrial facilities give off large amount of heat, which can pollute water.

A large increase in water temperature due to human activities is called thermal pollution. Thermal pollution usually occurs in lakes, rivers, or shallow bays located near power plants or industrial sites.

An increase in water temperature decreases the amount of dissolved oxygen the water can hold (BOD). The fish suffocate because they cannot get enough oxygen.

The increase in water temperature is also destructive to developing eggs and young fish.