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Lecture Eleven

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What Is Air pollution: is the contamination of air due to the presence of substances called pollutants in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate or to materials.^[1] It is also the contamination of the indoor or outdoor environment either by chemical, physical, or **biological agents** that alters the natural features of the atmosphere. There are many different types of air pollutants, such as gases (including **ammonia**, **carbon monoxide**, **sulfur dioxide**, **nitrous oxides**, **methane** and **chlorofluorocarbons**), **particulates** (both organic and inorganic), and **biological molecules**. Air pollution can cause diseases, allergies, and even death to humans; it can also cause harm to other living organisms such as animals and crops, and may damage the natural environment (for example, **climate change**, **ozone depletion** or **habitat degradation**) or **built environment** (for example, **acid rain**). Air pollution can be caused by both human activities and natural phenomena.

Air quality is closely related to the **Earth's climate** and **ecosystems** globally. Many of the contributors of air pollution are also sources of **greenhouse emission** i.e., burning of **fossil fuel**.

Air pollution is a significant risk factor for a number of **pollution-related diseases**, including **respiratory infections**, **heart disease**, **chronic obstructive pulmonary disease** (COPD), **stroke**, and **lung cancer**.^[5] Growing evidence suggests that air pollution exposure may be associated with reduced IQ scores, impaired cognition,¹ increased risk for psychiatric disorders such as **depression**^[7] and detrimental **perinatal** health. The human health effects of poor air quality are far reaching, but principally affect the body's respiratory system and the **cardiovascular system**. Individual reactions to air pollutants depend on the type of pollutant a person is exposed to, the degree of exposure, and the individual's health status and **genetics**:

What Is A primary pollutant: is an air pollutant emitted directly from a source.

What is A secondary pollutant: is not directly emitted as such, but forms when other pollutants (primary pollutants) react in the atmosphere.

Examples of a secondary pollutant include ozone, which is formed when hydrocarbons (HC) and nitrogen oxides (NOx) combine in the presence of

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sunlight; NO₂, which is formed as NO combines with oxygen in the air; and acid rain, which is formed when sulfur dioxide or nitrogen oxides react with water.

What is photochemical smog? Photochemical smog is a mixture of pollutants that are formed when nitrogen oxides and volatile organic compounds (VOCs) react to sunlight, creating a brown haze above cities. It tends to occur more often in summer, because that is when we have the most sunlight. Primary pollutants.

Ozone layer: The ozone layer, which exists between 15 and 30 kilometers above the earth in the stratosphere, protects us and all living creatures from the sun's harmful ultraviolet rays. The depletion of the ozone layer may have serious consequences for human health and the environment.

1. The stratosphere is the layer of the earth's atmosphere where the ozone layer is found, and in the lower section of the stratosphere, most commercial airplanes travel.
2. The stratosphere's ozone layer protects a part of the sun's energy, blocking it from hitting the planet's surface.

Ozone Depletion in the stratosphere:

1. Ozone molecules get destroyed when chlorine and bromine particles come into touch with them in the stratosphere.
2. Before it has been evacuated from the stratosphere, each chlorine atom may damage over 100,000 ozone molecules.
3. Ozone may be destroyed faster than it can be formed.
4. Whenever some substances are exposed to high UV radiation in the stratosphere, they emit chlorine or bromine.
5. These chemicals are known as ozone-depleting substances (ODS) because they contribute to ozone depletion.
6. Ozone-depleting substances include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons etc

What is Soil Pollution?

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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. An image detailing the discolouration of soil due to soil pollution is provided below.

It is important to understand that all soils contain compounds that are harmful/toxic to human beings and other living organisms. However, the concentration of such substances in unpolluted soil is low enough that they do not pose any threat to the surrounding ecosystem. When the concentration of one or more such toxic substances is high enough to cause damage to living organisms, the soil is said to be contaminated.

What is domestic wastes?

Domestic wastes include food waste, paper, glass, metals, plastics, textiles, etc. A large part of domestic wastes consists of plant and animal waste such as vegetables, fruit peel, bone and meat waste, and chicken and fish waste, which are considered as wet wastes.

Municipal waste

Municipal waste is defined as waste collected and treated by or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, as well as yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste if managed as household waste. The definition excludes waste from municipal sewage networks and treatment, as well as waste from construction and demolition activities. This indicator is measured in thousand tonnes and in kilograms per capita.

Industrial waste is the waste produced by industrial activity which includes any material that is rendered useless during a manufacturing process such as that of factories, mills, and mining operations. Types of industrial waste include dirt and gravel, masonry and concrete, scrap metal, oil, solvents, chemicals, scrap lumber, even vegetable matter from restaurants. Industrial waste may be solid, semi-solid or liquid in form. It

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may be hazardous waste (some types of which are toxic) or non-hazardous waste. Industrial waste may pollute the nearby soil or adjacent water bodies, and can contaminate groundwater, lakes, streams, rivers or coastal waters. Industrial waste is often mixed into municipal waste, making accurate assessments difficult. An estimate for the US goes as high as 7.6 billion tons of industrial waste produced annually, as of 2017. Most countries have enacted legislation to deal with the problem of industrial waste, but strictness and compliance regimes vary. Enforcement is always an issue.

agricultural waste IS classified into four types: crop waste (rice husk, wheat straws, sugarcane bagasse), animal waste (animal excreta, dead animals), processing waste (packaging material, fertilizer cans) and hazardous waste (pesticides, insecticides).

Radionuclides (radioactive materials)

Radionuclides (or radioactive materials) are a class of chemicals where the nucleus of the atom is unstable. They achieve stability through changes in the nucleus (spontaneous fission, emission of alpha particles, or conversion of neutrons to protons or the reverse). This process is called radioactive decay or transformation, and often is followed by the release of ionizing radiation (beta particles, neutrons, or gamma rays).

Biological agents include bacteria, viruses, fungi, other microorganisms and their associated toxins. They have the ability to adversely affect human health in a variety of ways, ranging from relatively mild, allergic reactions to serious medical conditions—even death. Some organisms, including various types of mold and Legionella bacteria, are found readily in the natural and built environment. Many are capable of spreading from person to person (e.g., bloodborne pathogens and influenza viruses), either directly or indirectly; some, including Zika virus, are transmitted by insect vectors. In some forms, biological agents can also be weaponized for use in bioterrorism or other crimes.