ENVIRONMENTAL MANAGEMENT

Module 2: Global Environmental Concerns

Ozone Layer

The ozone layer is mainly found in the lower portion of the earth's atmosphere. It has the potential to absorb around 97-99% of the harmful ultraviolet radiations coming from the sun that can damage life on earth. If the ozone layer was absent, millions of people would develop skin diseases and may have weakened immune systems.

1. OZONE LAYER DEPLETION

Ozone layer depletion is the gradual thinning of the earth's ozone layer in the upper atmosphere caused due to the release of chemical compounds containing gaseous bromine or chlorine from industries or other human activities.

The main reasons for the ozone hole are chlorofluorocarbons, carbon tetrachloride, methyl bromide and hydro chloro fluorocarbons. . Such compounds are known as Ozone Depleting Substances (ODS).

Causes of Ozone Layer Depletion

Ozone layer depletion is a major concern and is associated with a number of factors. The main causes responsible for the depletion of the ozone layer are listed below:

1. Chlorofluorocarbons or CFCs are the main cause of ozone layer depletion. These are released by solvents, spray aerosols, refrigerators, air-conditioners, etc.The molecules of chlorofluorocarbons in the stratosphere are broken down by ultraviolet radiations and release chlorine atoms. These atoms react with ozone and destroy it.

2. Unregulated Rocket Launches - Researches say that the unregulated launching of rockets results in much more depletion of the ozone layer than the CFCs do. If not controlled, this might result in a huge loss of the ozone layer by the year 2050.

3. Nitrogenous Compounds-The nitrogenous compounds such as NO_2, NO, N_2O are highly responsible for the depletion of the ozone layer.

4. Natural Causes-The ozone layer has been found to be depleted by certain natural processes such as Sun-spots and stratospheric winds. But it does not cause more than 2% of the ozone layer depletion.

Ozone Depleting Substances (ODS)

"Ozone-depleting substances are the substances such as chlorofluorocarbons, halons, carbon tetrachloride, hydrofluorocarbons, etc. that are responsible for the depletion of the ozone layer." Following is the list of some main ozone-depleting substances and the sources from where they are released:

Ozone-Depleting Substances	Sources
1.Chlorofluorocarbons (CFCs)	-Refrigerators, air-conditioners, solvents, etc.
2.Halons	-Fire-extinguishers
3.Carbon tetrachloride	-Fire extinguishers, solvents
4.Methyl chloroform	-Adhesives, aerosols
5.Hydrofluorocarbons	-fire extinguishers, air-conditioners, solvents

Effects Of Ozone Layer Depletion

The depletion of the ozone layer has harmful effects on the environment. Let us see the major effects of ozone layer depletion on man and environment.

1. Humans will be directly exposed to the harmful ultraviolet radiation of the sun due to the depletion of the ozone layer. This might result in serious health issues among humans, such as skin diseases, cancer, sunburns, cataract, quick ageing and weak immune system.
2. Direct exposure to ultraviolet radiations leads to skin and eye cancer in animals.
3. Strong ultraviolet rays may lead to minimal growth, flowering and photosynthesis in plants. The forests also have to bear the harmful effects of the ultraviolet rays.
4. Effects on Marine Life-Planktons are greatly affected by the exposure to harmful ultraviolet rays. These are higher in the aquatic food chain. If the planktons are destroyed, the organisms present in the food chain are also affected.

Solutions or Control Measures

The depletion of the ozone layer is a serious issue and various programmes have been launched by the government of various countries to prevent it. However, steps should be taken at the individual level as well to prevent the depletion of the ozone layer.

Following are some points that would help in preventing this problem at a global level:

1. Avoid Using Ozone Depleting Substances

2. Reduce the use of ozone depleting substances. E.g. avoid the use of CFCs in refrigerators and air conditioners, replacing the halon based fire extinguishers, etc.

3. Minimise the Use of Vehicles -The vehicles emit a large amount of greenhouse gases that lead to global warming as well as ozone depletion. Therefore, the use of vehicles should be minimised as much as possible.

4. Use Eco-friendly Cleaning Products-Most of the cleaning products have chlorine and bromine releasing chemicals that find a way into the atmosphere and affect the ozone layer. These should be substituted with natural products to protect the environment.

5. Use of Nitrous Oxide should be Prohibited

The government should take actions and prohibit the use of harmful nitrous oxide that is adversely affecting the ozone layer. People should be made aware of the harmful effects of nitrous oxide and the products emitting the gas so that its use is minimised at the individual level as well.

2. GLOBAL WARMING:

Global warming is the phenomenon of a gradual increase in the temperature near the earth's surface. This phenomenon has been observed over the past one or two centuries. This change has disturbed the climatic pattern of the earth. However, the concept of global warming is quite controversial but the scientists have provided relevant data in support of the fact that the temperature of the earth is rising constantly.

Causes of Global Warming

Man-made Causes of Global Warming

1. **Deforestation** - Plants are the main source of oxygen. They take in carbon dioxide and release oxygen thereby maintaining environmental balance. Forests are being depleted for many domestic and commercial purposes. This has led to an environmental imbalance, thereby giving rise to global warming.

2. **Use of Vehicles** - The use of vehicles, even for a very short distance results in various gaseous emissions. Vehicles burn fossil fuels which emit a large amount of carbon dioxide and other toxins into the atmosphere resulting in a temperature increase.

3. **Chlorofluorocarbon** - With the excessive use of air conditioners and refrigerators, humans have been adding CFCs into the environment which affects the atmospheric ozone layer. The ozone layer protects the earth surface from the harmful ultraviolet rays emitted by the sun. The CFCs have led to ozone layer depletion making way for the ultraviolet rays, thereby increasing the temperature of the earth.

4. **Industrial Development** - With the advent of industrialization, the temperature of the earth has been increasing rapidly. The harmful emissions from the factories add to the increasing temperature of the earth.

5. **Overpopulation**-An increase in population means more people breathing. This leads to an increase in the level of carbon dioxide, the primary gas causing global warming, in the atmosphere.

6. **Volcanoes** - Volcanoes are one of the largest natural contributors to global warming. The ash and smoke emitted during volcanic eruptions goes out into the atmosphere and affects the climate.

7. **Water Vapour** -Water vapour is a kind of greenhouse gas. Due to the increase in the earth's temperature, more water gets evaporated from the water bodies and stays in the atmosphere adding to global warming.

8. **Forest Fires** - Forest blazes or forest fires emit a large amount of carbon-containing smoke. These gases are released into the atmosphere and increase the earth's temperature resulting in global warming.

Effects of Global Warming

Following are the major effects of global warming:

1. Global warming has led to an incredible increase in earth's temperature. Since 1880, the earth's temperature has increased by ~1 degrees. This has resulted in an increase in the melting of glaciers, which have led to an increase in the sea level. This could have devastating effects on coastal regions.

2. Global warming has affected the coral reefs that can lead to the loss of plant and animal lives. Increase in global temperatures has made the fragility of coral reefs even worse.

3. Global warming has led to a change in climatic conditions. There are droughts at some places and floods at some. This climatic imbalance is the result of global warming.

4. Global warming leads to a change in the patterns of heat and humidity. This has led to the movement of mosquitoes that carry and spread diseases.

5. Due to an increase in floods, tsunamis and other natural calamities, the average death toll usually increases. Also, such events can bring about the spread of diseases that can hamper human life.

6. A global shift in the climate leads to the loss of habitats of several plants and animals. In this case, the animals need to migrate from their natural habitat and many of them even become extinct.

Control global warming

1. The release of carbon dioxide and other greenhouse gases into the atmosphere is the major cause of global warming.

2. It can be reduced by setting a high price of carbon

3. Increasing the biofuels production from organic waste, use of renewable energy like solar and wind power, safeguarding forests and improving energy efficiency and vehicle fuel economy.

3. ACID RAIN:

Acid rain is made up of highly acidic water droplets due to air emissions, most specifically the disproportionate levels of sulphur and nitrogen emitted by vehicles and manufacturing processes. It is often called acid rain as this concept contains many types of acidic precipitation.

Causes of Acid Rain

The causes of acid rain are Sulphur and Nitrogen particles which get mixed with the wet components of rain. Sulphur and Nitrogen particles which get mixed with water are found in two ways either man-made i.e as the emissions that are given out from industries or by natural causes like lightning strike in the atmosphere releasing nitrogen oxides and volcanic eruptions releasing sulphur oxide.

Acid rain is essentially a by-product of human activities which emit oxides of nitrogen and sulphur in the atmosphere. Example – the burning of fossil fuels, unethical waste emission disposal techniques.

Sulphur dioxide and nitrogen dioxide undergo oxidation, and then they react with water resulting in the formation of sulphuric acid and nitric acid, respectively. The following reaction will clarify the acid formation reaction:

$$2SO_2\,(g) + O_2\,(g) + 2H_2O\,(l) \rightarrow 2H_2SO_4\,(aq)$$
$$4NO_2\,(g) + O_2\,(g) + 2H_2O\,(l) \rightarrow 4HNO_3\,(aq)$$

Effects of Acid Rain

1. It causes respiratory issues in animals and humans.
2. Acid rain is very harmful to agriculture, plants, and animals. It washes away all nutrients which are required for the growth and survival of plants. Acid rain affects agriculture by the way it alters the composition of the soil.
3. When acid rain falls down and flows into the rivers and ponds it affects the aquatic ecosystem. It alters the chemical composition of the water, to a form which is actually harmful to the aquatic ecosystem to survive and causes water pollution.
4. Acid rain also causes the corrosion of water pipes, which further results in leaching of heavy metals such as iron, lead and copper into drinking water.
5. It damages the buildings and monuments made up of stones and metals.

Example:

Taj Mahal, one of the 7 wonders of the world, is largely affected by acid rain. The city of Agra has many industries which emit the oxides of sulphur and nitrogen in the atmosphere. People

continue to use low-quality coal and firewood as a domestic fuel, adding to this problem. Acid rain has the following reaction with the marble (calcium carbonate):

$$CaCO_3(s) + H_2SO_4(l) \rightarrow CaSO_4(s) + H_2O(l) + CO_2(g)$$

Prevention of Acid Rain

- The only precaution that we can take against acid rain is having a check at the emission of oxides of nitrogen and sulphur.
- Acid rain is harmful to animals, plants and the monuments.
- Being responsible citizens, one should be aware of the harmful effects they cause and of the industries which give out nitrogen and sulphur compound wastes unethically.

4) Loss of Biodiversity

Biodiversity- Biodiversity is the variation among living organisms from different sources including terrestrial, marine and desert ecosystems, and the ecological complexes of which they are a part."

Importance:

1. Maintaining the balance of the ecosystem: Recycling and storage of nutrients, combating pollution, stabilizing climate, protecting water resources, forming and protecting soil and maintaining eco-balance
2. Provision of biological resources: Provision of medicines and pharmaceuticals, food for the human population and animals, ornamental plants, wood products, breeding stock and diversity of species, ecosystems and genes.
3. Social benefits: Recreation and tourism, cultural value and education and research.

Loss of Biodiversity

It is referred to as the extinction of several different species along with the local reduction or loss of species in a certain habitat, which results in the loss of biological diversity.
Biodiversity Loss is termed as a decrease in biological diversity within a species, ecosystems, places and the earth as a whole. If there is a loss of a species in a given area or loss in the number and genetic variability of any area, it is often described as a loss in Biodiversity.

- About three-fourth of the human population resides in the Tropical regions which occupy only about one-fourth of the total area of the world.
- The tropical rain forests contain 50 percent of the species on the earth.
- The excessive population is one of the causes that have led to biodiversity loss that has resulted in the rampant exploitation of resources and deforestation.
- The destruction of the Tropical regions has resulted in the loss of natural habitats which is catastrophic for the whole biosphere.
- Natural calamities like forest fires, droughts, floods, volcanic eruptions, earthquakes, etc. cause damage to both flora and fauna of the earth.
- Pesticides and other pollutants like toxic heavy metals and hydrocarbons destroy the feeble and sensitive species.
- The loss of biodiversity will adversely impact the health of the human race . It will increases the number of disease carrying animals in local populations.

Biodiversity Loss – Vulnerable Species

- This comprises the species which are probable to be in danger of extinction in near the future if the factors threatening to their extinction continue.
- Vulnerability is mainly caused by habitat loss or destruction of the species home. Vulnerable habitat or species are monitored and can become increasingly threatened.

Biodiversity Loss – Rare Species

- The population of these species is very small in the world and they are restricted to limited areas or thinly scattered over a wider area.

Causes of biodiversity loss

The five major causes of loss in biodiversity are: (explain each in two sentences)

- Climate change
- Deforestation and habitat loss
- Overexploitation
- Invasive species
- Pollution

Control measures:

The right Government restrictions and policies can help in stopping the biodiversity loss:

- Education
- Protection of species
- Protection of habitats
- Stop deforestation
- Prevent overhunting and overfishing
- Prevent species invasion
- Stop pollution

5) **Endangered species**

Endangered species are the organisms whose number have reduced drastically and if not conserved will become extinct. An endangered species is a type of organism that is threatened by extinction.

Dinosaurs, for instance, lost their habitat about 65 million years ago. The examples of endangered species are Amur tiger, red panda and Asiatic elephant.

Due to severe poaching – hunted especially in the princely states of India for their pelts – and habitat loss, the **blackbuck, or Indian antelope**, is now one of the most endangered species in India.

Causes:

1. Species become endangered for two main reasons: loss of habitat and loss of genetic variation. A loss of habitat can happen naturally.
2. Habitat loss is the primary cause of higher extinction rates.
3. Over-exploitation of wildlife for commercial purposes
4. the introduction of harmful nonnative species,
5. Pollution
6. The spread of diseases.

6) **Man-made disasters/ Industrial**

Disaster is an unexpected accident or natural disaster that can inflict significant damage and maybe death. Disasters can lead to human, material, economic or environmental hardships, which can be beyond the bearable capacity of the affected society.

Human-induced disasters are very dangerous catastrophes caused by humans. They are caused by human activity.

An industrial disaster was defined in this review as an event which causes widespread destruction or distress and usually occurs suddenly or over a short period of time and is limited to fires or explosions in industrial settings or to chemical or radioactive releases from industrial point sources.

Example (important, mention in answer, can add more examples)

The Bhopal gas tragedy
The **Bhopal disaster** was a chemical leak that occurred on December 3, 1984, in the Indian city of Bhopal. It killed an estimated 15,000 to 20,000 people. At the time, it was the worst industrial accident in history.

The following are the examples of man made disaster:

- Chemical spills
- hazardous material spills
- explosives
- chemical or biological attacks
- nuclear blasts
- rail accidents, airline crashes
- groundwater poisoning are all instances of man-made disasters

The other basic causes of industrial accidents are:

- Inherent Hazards or Nature of Job: There are many jobs in industries which are highly prone to accidents
- Slipping, Tripping or Falling on the Floor
- Collision and Obstruction
- Equipments and Machines
- Fire hazards
- Unsafe Acts
- Miscellaneous Causes

Effects

- It may cause property damage
- Injury

- loss of life.
- Disability
- Spread of diseases
- Psychological problem
- In addition, those hazards may degrade the environment
- Disrupt society and the economy.

7) Atomic Hazards

Definition

Risk or danger to human health or the environment posed by radiation emanating from the atomic nuclei of a given substance, or the possibility of an uncontrolled explosion originating from a fusion or fission reaction of atomic nuclei.

Causes

A major environmental concern related to nuclear power is the creation of radioactive wastes such as uranium mill tailings, spent (used) reactor fuel, and other radioactive wastes. These materials can remain radioactive and dangerous to human health for thousands of years.

- Nuclear Accidents From Nuclear Energy Generation Plants
- The Use of Nuclear Weapons as Weapons of Mass Destruction (WMD)
- Use of Radioisotopes.
- Mining
- Spillage of Radioactive Chemicals
- Tests on Radiation
- Cosmic Rays and Other Natural Sources
- Nuclear Waste Handling and Disposal.

Effects

The principal initial effects are **blast and radiation**. Blast causes damage to lungs, ruptures eardrums, collapses structures and causes immediate death or injury.
Thermal Radiation is the heat and light radiation, producing extensive fires, skin burns, and flash blindness.
Exposure to very high levels of radiation, such as being close to an atomic blast, can cause acute health effects such as skin burns and acute radiation syndrome ("radiation sickness").
It can also result in long-term health effects such as cancer and cardiovascular disease.

Some cautions

1. Monitoring radioactivity around the disposal sites.
2. Prevention of erosion of radioactive waste disposal sites.
3. Prevention of any drilling activity in and around the waste disposal site.
4. Periodic and long-term monitoring of such disposal sites and areas of naturally occurring uranium rich rocks.

Biological hazards

also known as biohazards, refer to biological substances that pose a threat to the health of living organisms, primarily that of humans. This can include samples of a microorganism, virus or toxin that can affect human health.

Biological health hazards include bacteria, viruses, parasites and moulds or fungi. They can pose a threat to human health when they are inhaled, eaten or come in contact with skin. They can cause illness such as food poisoning, tetanus, respiratory infections or parasite infection.

The most common routes of entry for biological hazards are inhalation and absorption from direct contact. Inhalation is a common way for biohazards to get into the body

Some ways to prevent biological hazards in the workplace include:

1. Providing workers with PPE such as gloves, gowns, and masks.
2. Implementing engineering controls such as ventilation and air filtration.
3. Establishing safe work practices such as proper handwashing.
4. Disinfecting surfaces and equipment.

MODULE 3

What are limiting factors?