UNIT IV

Disaster Management.

Disaster is any sudden event of calamity which causes great effect on the human population, plants, animals and property. Disasters are of two types

- Natural
- Man made

Natural Disasters

1. Earthquakes. Sudden tremors of the earth's surface ar produced due to movement of tectonic plates under the earth. This displacement of earth's crust releases energy stored within the earth's interior which produces vibratory waves. The intensity of earthquake is measured by Richter, Scale which ranges from 0 to 9. The point from which the earthquake originates is called as epicentre.

Prevention, Control & Mitigation

(i) Constructing earthquake resistant building in the known earthquake prone zones e.g. wooden houses are preferred in Japan.

(ii) Installation of earthquake study centres studying seismic ;activities and analysis of seismic zones.

(iii) There must be insurance policies for earthquake victims o rehabilitate them.

(iv) Creation of special task forces, fully trained and equipped, to manage such calamities within shortest possible time.

2. Tsunami. The impact of earthquake is high at sea area of origin. In this, most serious form of earthquake, giant seismic tidal waves of as high as 10 metre or more travel at the speed of 1,000 km/hour or faster, away from the epicentre of, the earthquake. Tsunamis may also be caused due to underwater volcanic eruptions or seafloor slumping.

Prevention, Control & Mitigation

(i) Planting more trees on the coastal areas.

(ii) Timely warning and speedy evacuation of people.

(iii) Conservation of mangroves in the coastal areas.

(iv) Construction of embankments in inhabitable areas.

(v) Immediate relief and rehabilitation to the affected people.

3. Drought. A drought is the drying up condition of the land due to insufficient or absence of rainfall for a long period affecting the vegetation1 animal and human life.

Control Measures

(i) Rain water harvesting and canal irrigation.

(ii) Improvement of agricultural practices like dry land forming to conserve water in drought prone areas.

(iii) Stopping paddy cultivation in areas of water scarcity and growing drought resistant variety of crops.

(iv) Promoting social forestry and wasteland reclamation, growing species according to the ecological requirements of the area.

(v) Supplying food, fodder and water to drought-hit people and their rehabilitation with all essential requirements of life.

4. Flood. A flood occurs due to continuous heavy rainfall in an area, overflowing of rivers and submerging the surrounding areas damaging life and property.

Control

(i) Various preventive measures are proper embankment of water bodies, building check dams on flood-prone streams, prohibiting cultivation in flood plain of rivers and growing forests and perennial trees,

interlinking of river of the country and constructing houses on raised platforms and supported by reinforced stilts.

(ii) Floods can be controlled by collecting data from meteorological department and alerting the people of affecting area.

(iii) Educating the people about the steps to be taken in the event of disaster.

(iv) Hill slopes and catchment areas of rivers must be afforested and reforested.

5. Cyclones. A cyclone is powerful circular or oval swirling storm of high velocity wind in the coastal regions of Indian ocean. It is called hurricane in Atlantic ocean, typhoon in Western Pacific and Willy-willy in sea around Australia.

Control

(i) Afforestation of coastal areas is the best measure.

(ii) Construction ol'dams, embankments, wind breakers etc.

(iii) Conservation of mangrooves in coastal plains.

(iv) Better forecast, warning systems with the help of remote sensing satellites.

(v) Construction of cyclone proof houses and building in coastal areas.

6. Landslides. Landslide is the sudden downslope movement of a mass of rock or soil due to gravitational pull, generally in the rainy season.

Control

(i) Afforestation and reforestation in the landslide prone areas is the best measure.

(ii) There should be no construction activity in slopy areas.

(iii) Proper drainage of surface and sub surface water.

(iv) Making concrete support at the base of slope along the road.

(v) Construction of curved stone blocks in the risky areas.

Air pollution Act1981 and Environment Act 1986

- The main objective of this Act is to provide the protection and improvement of environment (which includes water, air, land, human being, other living creatures, plants, micro-organism and properties) and for matters connected therewith. There is a constitutional provision also for the environment protection. Article 48A, specify that the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country and every citizen shall protect the environment (51 A). The Environment (Protection) Act is applicable to whole of India including Jammu & Kashmir.
- Environment: It includes water, air, and land and the inter-relationship which exists among and between water, air and land and human beings, other living creatures, plants, micro-organism and property.
- Environmental Pollution: It means any solid, liquid or gaseous substances present in such concentration as may be or tend to be injurious to environment and human being are known as pollutant and presence of any pollutant in the environment in such proportion and concentration that has bearing on health and environment is termed as "Environmental Pollution".
- Handling: In relation to any substance, it means the manufacturing, processing, treatment, packaging, storage, transportation, use, collection, destruction, conversion, offering for sale, etc.
- Occupier: It means a person who has control over the affairs of the factory or the premises, and includes, in relation to any substance, the person in possession of the substance.
- The Act provide power to make rules to regulate environmental pollution, to notify standards and maximum limits of pollutants of air, water, and soil for various areas and purposes, prohibition and restriction on the handling of hazardous substances and location of industries (Sections 3-6).

- The Central Government is empowered to constitute authority or authorities for the purpose of exercising of performing such of the powers and functions (Sec 3), appoint a person for inspection (Sec 4), for analysis or samples and for selection or notification of environmental laboratories. Such person or agency has power to inspect or can enter in the premises or can take samples for analysis (Secs 10, 11).
- According to the section 5, the Central Government may issue directions in writing to any person or officers or any authority to comply. There could be closure, prohibition of the supply of electricity or operation or process; or stoppage or regulation of the supply of electricity or water or any other service. Section 6 empowers the government to make rules to achieve the object of the Act.
- Persons carrying on industry, operation etc. not to allow emission or discharge of environmental pollutants in excess of the standards (Sec 7). Persons handling hazardous substances must comply with procedural safeguards (Sec 8) and occupiers must furnish the information to authority.

  Penalty
- Whoever Person or Owner/Occupier of companies, factories or whichever source found to be the cause of pollution may be liable for punishment for a term which may extend to five years or with fine which may extend to one lakh rupees or both (Sec 15, 16, 17). If not comply fine of Rs. 5000 per day extra and if not comply for more than one year then imprisonment may extend up to 7 years. Section 17 specify that Head of the department/ in-charge of small unit may be liable for punishment if the owner /occupier produce enough evidence of innocence. The CPCB or state boards have power to close or cancel or deny the authorisation to run the factory/institution/hospital whichever is causing pollution. No suit, prosecution or other legal proceedings shall lie against govt. officer who has exercise power in good faith in pursuance of this Act (Sec 18).

WATER CONSERVATION

Water conservation refers to reducing use of fresh water, through technological or social methods.
Over the years rising populations, growing industrialization, and expanding agriculture have pushed up the demand for water. Efforts have been made to collect water by building dams and reservoirs and digging wells; some countries have also tried to recycle and desalinate (remove salts) water. Water conservation has become the need of the day. The idea of ground water recharging by harvesting rainwater is gaining importance in many cities.

RAINWATER HARVESTING

In urban areas, the construction of houses, footpaths and roads has left little exposed earth for water to soak in. In parts of the rural areas of India, floodwater quickly flows to the rivers, which then dry up soon after the rains stop. If this water can be held back, it can seep into the ground and recharge the groundwater supply.
The goals of water conservation efforts include:

- Sustainability - To ensure availability for future generations, the withdrawal of fresh water from an ecosystem should not exceed its natural replacement rate.
- Energy conservation - Water pumping, delivery, and wastewater treatment facilities consume a significant amount of energy. In some regions of the world (for example, California [1]).
- Habitat conservation - Minimizing human water use helps to preserve fresh water habitats for local wildlife and migrating waterfowl, as well as reducing the need to build new dams and other water diversion infrastructure.

Some of the benefits of rainwater harvesting are as follows
- Increases water availability
- Checks the declining water table

- Is environmentally friendly
- Improves the quality of groundwater through the dilution of fluoride, nitrate, and salinity
- Prevents soil erosion and flooding especially in urban areas

GREEN HOUSE GASES

A **greenhouse gas** is a gas in an atmosphere that absorb and emit radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. The primary greenhouse gases in the Earth's atmosphere are water vapor, carbon dioxide, methane, nitrous oxide, and ozone. In the Solar System, the atmospheres of Venus, Mars, and Titan also contain gases that cause greenhouse effects. Greenhouse gases greatly affect the temperature of the Earth; without them, Earth's surface would be on average about 33 °C (59 °F) colder than at present.

Global warming is the process wherein the average temperature of the Earth's near surface air increases, owing largely to various anthropogenic activities. Though there are some natural causes for this rise in temperature, they stand to be insignificant when compared to the anthropogenic causes. Understanding global warming causes and effects can give us a brief idea of the dreadful phenomena our future generations may have to face. Here are some of the prominent global warming causes and effects. .

Causes of Global Warming

The causes of global warming are broadly divided into two categories - natural causes and anthropogenic (man-made) causes.

Natural Causes

Natural causes of global warming include the release of methane gas from arctic tundra and wetlands, climate change, volcanoes etc. Methane, a greenhouse gas which traps the heat within the earth's atmosphere, is let out in large quantities in the arctic tundra and wetlands. In case of volcanoes, when a volcano erupts, tons of ash is let out into the atmosphere. Even though nature contributes to global warming, this contribution is very insignificant when compared to human contribution for this hazard.

Anthropogenic Causes

Anthropogenic causes for global warming are those which are caused due to human activities. The most prominent cause being man-made pollution. A large part of this pollution can be attributed to the burning of fossil fuels. This includes burning coal to produce electricity as well as burning gasoline to power internal combustion engine vehicles. When these fossil fuels are burnt, they let out carbon dioxide, which is yet another greenhouse gas which traps heat within the atmosphere of the Earth and contributes to global warming. Secondly when the Earth is dug to extract these fossil fuels in the process known as mining, the methane inside the Earth's crust escapes into the atmosphere and adds to other greenhouse gases such as carbon dioxide. If we start investigating the anthropogenic causes of global warming, we zero in on one of the most important cause of global warming - population. More population means more requirements, which includes food, electricity and transport. In order to fulfill these requirements, more fossil fuels are consumed, which eventually leads to global warming. Humans breathe out carbon dioxide, and with an increasing population, the amount of carbon dioxide humans breathe out also increases and leads to global warming. Even agriculture contributes to global warming, owing to the extensive use of fertilizers, and the dung produced by cattle which is another prominent source of methane.

Effects of Global Warming

The effects of global warming range from a rise in sea levels to the extinction of certain species of flora and fauna. Basically, global warming means an increase in temperature of the Earth's atmosphere. This increase in temperature will trigger a series of events which can cause a lot of destruction on the planet.

Changes in the Global Sea Level

As the temperature will increase, the ice cover on the planet will start melting. The water from these melting glaciers will end up in the oceans, which will lead to a rise in the sea level. Over the last century, sea levels have increased by 4 to 8 inches, and by 2100, it's expected to increase to 35 inches. An additional 2 degree rise in global temperature will lead to the complete melting of the Greenland ice cap,

which will cause the sea level to rise by 5 to 6 meters. Such a rise will cause many of the low lying areas, such as the US Gulf Coast and Bangladesh, as well as islands, such as Lakswadweep, to submerge underwater. If the whole of the Antarctic ice sheet melts, the global sea level is expected to rise by 10.5 meters.

Drastic Changes in Climate Patterns

Global warming will alter the climatic patterns of the planet. As far as precipitation is concerned, it will increase in equatorial, polar and sub-polar reasons, and decrease in subtropics. This change in precipitation pattern will trigger a drought in some regions, while floods in other regions. Warming of the atmosphere will increase the temperature of ocean waters, which will continue being warm for a few centuries. Warm water will lead to frequent natural disasters like hurricanes. Overall, the planet will experience extreme weather conditions, characterized by flood and droughts, heat waves and cold waves, and extreme storms like cyclones and tornadoes.

Widespread Extinction of Flora and Fauna

A rise in global temperature will also hamper the rich biodiversity of various ecosystems. According to the Intergovernmental Panel on (IPCC), an increase in global temperature by 1.5 to 2.5 degrees will make 20 to 30 percent of species vulnerable to extinction, while a rise of about 3.5 degrees will make 40 to 70 percent species vulnerable to extinction. Climate change will result in loss of habitat for many animal species like polar bears and tropical frogs. More importantly, any change in the climate patterns will seriously affect the migration patterns of various bird species. Irregular patterns of precipitation will affect animals and humans alike.

Global Warming and Humans

In case of humans, global warming will affect our food and water supplies as well as our health conditions. Changes in precipitation will affect basic necessities such as agriculture, power production etc. Increase in the temperature of ocean waters will hamper fisheries. The sudden change in climate patterns will have a hazardous effect on the human body which won't be able to endure the extreme conditions, a hint of which can be seen in form of frequent heat waves and cold waves. Increase in natural calamities such as storms, will lead to heavy human causalities. Infectious diseases will rise to a great extent as disease transmitting insects will adapt to wet, hot conditions. Many people will die of malnutrition as food production will decrease due to frequent droughts and floods.

These were just a few of the numerous global warming causes and effects. Many people argue that global warming is a slow process, and will take centuries for all these devastating effects to take place. But they forget that the factors which cause global warming are rapidly rising. The rate at which we are contributing to global warming has rose considerably, and is expected to rise at a faster rate in the future. We have already done enough of damage, and hence it's high time we understand the global warming causes, effects and the future repercussions and work out some global warming solutions at the earliest. We may not live to face the dreaded consequences of global warming, but if we don't act fast, it will be our future generations who will have to bear the brunt.

FOREST CONSERVATION ACT

Forest (conservation) Act, 1980

It deals with conservation of forest and includes reserve forest, protected forest and any forest land irrespective of ownership.

Salient features

1. State government can use forest only forestry purpose.
2. Provision for conservation of all types of forests. Advisory committee appointed for funding conservation
3. Illegal non-forest activity within a forest area can be immediately stopped under this act.

Non forest activity means clearing land for cash-crop agriculture, mining etc.

However construction in forest for wild life or forest management is exempted from non forestry activity.

1992 Amendment:

1. This amendment allows transmission lines, seismic surveys, exploration drilling and hydro electric project in forest area without cutting trees or with limited cutting of trees – prior approval CG to be sought.
2. Wild life sanctuaries, National parks etc. are prohibited from exploration except with CG prior approval.
3. Cultivation of coffee, rubber, tea (cash crop), fruit bearing trees, oil yielding trees, trees of medicinal values are also prohibited in reserved forest area with out prior approval from CG. Has this may create imbalance to ecology of the forest.
4. Tusser (a type of silk yielding insect) cultivation in forest area is allowed since it discourages monoculture practices in forests and improves biodiversity.
5. Plantation of mulberry for rearing silk worm is prohibited.
6. Proposal sent to CG for non-forestry activity must have a cost benefit analysis and environmental impact statement (EIS).

Wild life protection act 1972

■ WILDLIFE (PROTECTION) ACT, 1972

The act, a landmark in the history of wildlife legislation in our country, came into existence in 1972. Wildlife was transferred from State list to concurrent list in 1976, thus giving power to the Central Govt. to enact the legislation.

The **Indian Board of Wildlife (IBWL)** was created in 1952 in our country, which after the enactment of the Wildlife (Protection) Act actively took up the task of setting up wildlife National Parks and sanctuaries. The major activities and provisions in the act can be summed up as follows:

(*i*) It defines the wild-life related terminology.

(*ii*) It provides for the appointment of wildlife advisory Board, Wildlife warden, their powers, duties etc.

(*iii*) Under the Act, comprehensive listing of endangered wild life species was done for the first time and prohibition of hunting of the endangered species was mentioned.

(*iv*) Protection to some endangered plants like Beddome cycad, Blue Vanda, Ladies Slipper Orchid, Pitcher plant etc. is also provided under the Act.

(*v*) The Act provides for setting up of National Parks, Wildlife Sanctuaries etc.

(*vi*) The Act provides for the constitution of Central Zoo Authority.

(*vii*) There is provision for trade and commerce in some wildlife species with license for sale, possession, transfer etc.

(*viii*) The Act imposes a ban on the trade or commerce in scheduled animals.

(*ix*) It provides for legal powers to officers and punishment to offenders.

(*x*) It provides for captive breeding programme for endangered species.

Several Conservation Projects for individual endangered species like lion (1972) Tiger (1973), Crocodile (1974) and Brown antlered Deer (1981) were started under this Act. The Act is adopted by all states in India except J & K, which has it own Act.

Some of the major drawbacks of the Act include mild penalty to offenders, illegal wild life trade in J & K, personal ownership certificate for animal articles like tiger and leopard skins, no coverage of foreign endangered wildlife, pitiable condition of wildlife in mobile zoos and little emphasis on protection of plant genetic resources.

Forest conservation act 1980

FOREST (CONSERVATION) ACT, 1980

This Act deals with the conservation of forests and related aspects. Except J & K, the Act is adopted all over India. The Act covers under it all types of forests including reserved forests, protected forests or any forested land irrespective of its ownership.

The salient features of the Act are as follows:

(*i*) The State government has been empowered under this Act to use the forests only for forestry purposes. If at all it wants to use it in any other way, it has to take prior approval of Central government, after which it can pass orders for declaring some part of reserve forest for non-forest purposes (e.g. mining) or for clearing some naturally growing trees and replacing them by economically important trees (reforestation).

(*ii*) It makes provision for conservation of all types of forests and for this purpose there is an advisory committee which recommends funding for it to the Central government.

(*iii*) Any illegal non-forest activity within a forest area can be immediately stopped under this Act.

Non-forest activities include clearing of forest land for cultivation of any type of plants/crops or any other purpose (except re-afforestation). However, some construction work in the forest for wildlife or forest management is exempted from non-forest activity (e.g. fencing, making water-holes, trench, pipelines, check posts, wireless communication etc.)

SUSTAINABLE DEVELOPMENT

Development: True development does not mean a high standard of living with all benefits accompanied with an increase of GNP (Gross National Product) of a few countries. But it should bring benefits to all, not only for the present generation, but also for the future generations.

SUSTAINABLE DEVELOPMENT

Definition: G. H. Brundtland,, Prime Minister of Norway and Director of World Health Organization [WHO] defined as **"meeting the needs of the present without compromising the ability of future generation to meet to meet their own needs".**

Is it true sustainable development?

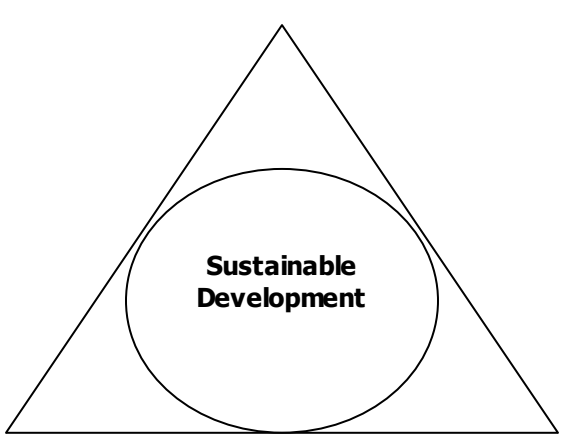
A handful of developed countries have reached the greatest heights of scientific and technological development. However the air we breathe , the water we drink and the food we eat all have been badly polluted. Our natural resources are just dwindling due to over exploitation. Hence this is not true sustainable development.

True sustainable development: True sustainable development should aim at optimum use of natural resources with high degree of reusability, minimum wastage, least generation of toxic by-products and maximum productivity.

World Summit on sustainable Development

Rio De Jenario in Brazil has been the venue for the UN Conference on Environment and Development (UNCED), also known as Earth Summit, held in 1992. there has been an extensive discussion on sustainable development. The conference at Rio made a declaration that **"a new and equitable global partnership through the creation of new levels of cooperation among the states."** Out of the 5 very significant agreements arrived at this summit **Agenda – 21** proposes a global programme of action on sustainable development in social, economic and environmental context for the 21^{st} century.

Dimensions of sustainable development: sustainable development is a multi dimensional concept aiming at benefits derived from the interactions between society, economic and environment.



Aspects of Sustainable Development

(a) Inter-generational equity: This states that we should hand over a safe, healthy and resourceful environment to our future generations.

(b) Intra-generational equity: This states that the technological development of rich countries should support the economic growth of the poor countries and help in narrowing the wealth gap and lead to sustainability.

Approaches For Sustainable Development: The following approaches (or) methods are proposed for the build up of Sustainable Development.

1. Developing appropriate technology: it is the one approach which is locally adaptable, eco-friendly, resource-efficient and culturally suitable. It uses local labours, less resources, and produces minimum waste.

2. Reduce, Reuse, Recycle (3 – R) approach: This approach insists on optimum use of natural resources, using it again and again instead of throwing it on wasteland or water and recycling the material into further products. It reduces pressure on our natural resources and reduces waste generation and pollution.

3. Providing environmental education and awareness: By providing environmental education and awareness, the thinking and attitude of people towards our earth and the environment can be changed.

4. Consumption of Renewable resources: In order to attain sustainability, it is very important to consume the natural resources in such a way that the consumption should not exceed the regeneration capacity.

5. Conservation of non-renewable resources: For sustainability non-renewable resources should be conserved by recycling and reusing.

6. Population control: Sustainable development can be made by controlling population growth.

URBAN PROBLEMS RELATED TO ENERGY

Urbanization: Urbanization is the movement of human population from rural areas to urban areas for the want of better education, communication, health, employment etc.

Causes of urbanization: Cities are the main centres of economic growth, trade, transportation, education, medical facilities and employment. Hence rural people move to cities.

Urban Sprawl: Nearly 50% of the world's population lives in urban areas and people from rural area continue to move to cities for employment. Thus the urban growth is so fast that it is difficult to accommodate all the commercial, industrial, residential and educational facilities within a limited area. As a result there is enlargement of city areas into suburban or rural areas. This phenomenon is called urban sprawl.

Energy Demanding Activities: In the developing countries simultaneously urban growth as well as population growth are very fast. The population growth is not only fast but also unplanned and hence uncontrollable. When compared to rural people urbanites consume a lot more of energy and materials and also generate a lot of waste. This is owing to the higher standard of living the urban population and all this demands more and more energy inputs.

Examples of energy demanding activities:

1. Residential and commercial lightings.
2. Transportation means including motor cycle, car and public transport for moving from residence to work place
3. Industries using a large proportion of energy
4. Modern life style using a large number of electrical appliances (fans, refrigerator, washing machines, air-conditioners, , water heaters etc.) in every day life.
5. Control and prevention of pollution need more energy dependent technologies.

Thus due to high population growth and high energy demanding activities, the urban problems related to energy are more and more magnified in comparison with rural population.

Solution for urban energy problem:

1. Urban people should be encouraged to use public transport instead of individual transport modes like cars or motor cycles.
2. Even high level officials also could be educated into forming groups and using single- good and comfortable – transport instead of individual limousines.
3. Energy consumption must be minimized.
4. Energy production capacity may be increased.
5. Use of energy efficient technologies adopted.
6. Usage of Solar energy and wind energy should be encouraged.
7. Apart from encouraging energy saving methods strict laws and penalties have to be imposed together with energy audit.

GLOBAL WARMING

Global warming is the increase in the average temperature of Earth's near-surface air and oceans since the mid-20th century and its projected continuation. Global surface temperature increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the 20th century. Most of the observed temperature increase since the middle of the 20th century has been caused by increasing concentrations of greenhouse gases, which result from human activity such as the burning of fossil fuel and deforestation. Global dimming, a result

of increasing concentrations of atmospheric aerosols that block sunlight from reaching the surface, has partially countered the effects of warming induced by greenhouse gases.

The greenhouse effect is the process by which absorption and emission of infrared radiation by gases in the atmosphere warm a planet's lower atmosphere and surface The question in terms of global warming is how the strength of the presumed greenhouse effect changes when human activity increases the concentrations of greenhouse gases in the atmosphere.

Naturally occurring greenhouse gases have a mean warming effect of about 33 °C (59 °F). The major greenhouse gases are water vapor, which causes about 36–70 percent of the greenhouse effect; carbon dioxide (CO_2), which causes 9–26 percent; methane (CH_4), which causes 4–9 percent; and ozone (O_3), which causes 3–7 percent. Clouds also affect the radiation balance, but they are composed of liquid water or ice and so have different effects on radiation from water vapor.

OZONE DEPLETION

Ozone depletion describes two distinct, but related observations: a slow, steady decline of about 4 percent per decade in the total volume of ozone in Earth's stratosphere (the ozone layer) .Ozone can be destroyed by a number of free radical catalysts, the most important of which are the hydroxyl radical ($OH\cdot$), the nitric oxide radical ($NO\cdot$), atomic chlorine ($Cl\cdot$) and bromine ($Br\cdot$). All of these have both natural and manmade sources; at the present time, most of the $OH\cdot$ and $NO\cdot$ in the stratosphere is of natural origin, but human activity has dramatically increased the levels of chlorine and bromine. These elements are found in certain stable organic compounds, especially chlorofluorocarbons (CFCs), which may find their way to the stratosphere without being destroyed in the troposphere due to their low reactivity. Once in the stratosphere, the Cl and Br atoms are liberated from the parent compounds by the action of ultraviolet light, e.g. ('h' is Planck's constant, 'ν' is frequency of electromagnetic radiation)

$$CFCl_3 + h\nu \rightarrow CFCl_2 + Cl$$

The Chlorine and Bromine atoms can then destroy ozone molecules through a variety of catalytic cycles. In the simplest example of such a cycle, a chlorine atom reacts with an ozone molecule, taking an oxygen atom with it (forming ClO) and leaving a normal oxygen molecule. The chlorine monoxide (i.e., the ClO) can react with a second molecule of ozone (i.e., O_3) to yield another chlorine atom and two molecules of oxygen. The chemical shorthand for these gas-phase reactions is:

$$Cl + O_3 \rightarrow ClO + O_2$$

$$ClO + O_3 \rightarrow Cl + 2\,O_2$$

Effects:

Increased UV

Ozone, while a minority constituent in the Earth's atmosphere, is responsible for most of the absorption of UVB radiation. The amount of UVB radiation that penetrates through the ozone layer decreases exponentially with the slant-path thickness/density of the layer. Correspondingly, a decrease in atmospheric ozone is expected to give rise to significantly increased levels of UVB near the surface.

Increases in surface UVB due to the ozone hole can be partially inferred by radioactive transfer model calculations, but cannot be calculated from direct measurements because of the lack of reliable historical (pre-ozone-hole) surface UV data, although more recent surface UV observation measurement programmed exist .Because it is this same UV radiation that creates ozone in the ozone layer from O_2 (regular oxygen) in the first place, a reduction in stratospheric ozone would actually tend to increase photochemical production of ozone at lower levels (in the troposphere), although the overall observed trends in total column ozone still show a decrease, largely because ozone produced lower down has a naturally shorter photochemical lifetime, so it is destroyed before the concentrations could reach a level which would compensate for the ozone reduction higher up.

THE ENVIRONMENT (PROTECTION) ACT, 1986

An Act to provide for the protection and improvement of environment and for matters connected there with:

WHEREAS the decisions were taken at the United NationsConference on the Human Environment held at Stockholm in June, 1972, in which India participated, to take appropriate steps for the protection and improvement of human environment;

AND WHEREAS it is considered necessary further to implement the decisions aforesaid in so far as they relate to the protection and improvement of environment and the prevention of hazards to human beings, other living creatures, plants and property;

BE it enacted by Parliament in the Thirty-seventh Year of the Republic of India as follows:-

a. SHORT TITLE, EXTEND AND COMMENCEMENT

(1) This Act may be called the Environment (Protection) Act, 1986.

(2) It extends to the whole of India.

(3) It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint and different dates may be appointed for different provisions of this Act and for different areas.

b. DEFINITIONS

In this Act, unless the context otherwise requires,--

(a) "environment" includes water, air and land and the inter- relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property;

(b) "environmental pollutant" means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to environment;

(c) "environmental pollution" means the presence in the environment of any environmental pollutant;

(d) "handling", in relation to any substance, means the manufacture, processing, treatment, package, storage, transportation, use, collection, destruction, conversion, offering for sale, transfer or the like of such substance;

(e) "hazardous substance" means any substance or preparation which, by reason of its chemical or physico-chemical properties or handling, is liable to cause harm to human beings, other living creatures, plant, micro-organism, property or the environment;

(f) "occupier", in relation to any factory or premises, means a person who has, control over the affairs of the factory or the premises and includes in relation to any substance, the person in possession of the substance;

(g) "prescribed" means prescribed by rules made under this Act.

c. POWER OF CENTRAL GOVERNMENT TO TAKE MEASURES TO PROTECT AND IMPROVE ENVIRONMENT

(1) Subject to the provisions of this Act, the Central Government, shall have the power to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing controlling and abating environmental pollution.

(2) In particular, and without prejudice to the generality of the provisions of sub-section (1), such measures may include measures with respect to all or any of the following matters, namely:--

(i) co-ordination of actions by the State Governments, officers and other authorities--

(a) under this Act, or the rules made thereunder, or

(b) under any other law for the time being in force which is relatable to the objects of this Act;

(ii) planning and execution of a nation-wide programme for the prevention, control and abatement of environmental pollution;

(iii) laying down standards for the quality of environment in its various aspects;

(iv) laying down standards for emission or discharge of environmental pollutants from various sources whatsoever: Provided that different standards for emission or discharge may be laid down under

this clause from different sources having regard to the quality or composition of the emission or discharge of environmental pollutants from such sources;

(v) restriction of areas in which any industries, operations or processes or class of industries, operations or processes shall not be carried out or shall be carried out subject to certain safeguards;

(vi) laying down procedures and safeguards for the prevention of accidents which may cause environmental pollution and remedial measures for such accidents;

(vii) laying down procedures and safeguards for the handling of hazardous substances;

(viii) examination of such manufacturing processes, materials and substances as are likely to cause environmental pollution;

(ix) carrying out and sponsoring investigations and research relating to problems of environmental pollution;

(x) inspection of any premises, plant, equipment, machinery, manufacturing or other processes, materials or substances and giving, by order, of such directions to such authorities, officers or persons as it may consider necessary to take steps for the prevention, control and abatement of environmental pollution;

(xi) establishment or recognition of environmental laboratories and institutes to carry out the functions entrusted to such environmental laboratories and institutes under this Act;

(xii) collection and dissemination of information in respect of matters relating to environmental pollution;

(xiii) preparation of manuals, codes or guides relating to the prevention, control and abatement of environmental pollution;

(xiv) such other matters as the Central Government deems necessary or expedient for the purpose of securing the effective implementation of the provisions of this Act.

(3) The Central Government may, if it considers it necessary or expedient so to do for the purpose of this Act, by order, published in the Official Gazette, constitute an authority or authorities by such name or names as may be specified in the order for the purpose of exercising and performing such of the powers and functions.

d. APPOINTMENT OF OFFICERS AND THEIR POWERS AND FUNCTIONS

(1) Without prejudice to the provisions of sub-section (3) of section 3, the Central Government may appoint officers with such designation as it thinks fit for the purposes of this Act and may entrust to them such of the powers and functions under this Act as it may deem fit.

(2) The officers appointed under sub-section (1) shall be subject to the general control and direction of the Central Government or, if so directed by that Government, also of the authority or authorities, if any, constituted under sub- section (3) of section 3 or of any other authority or officer.

e. POWER TO GIVE DIRECTIONS

Notwithstanding anything contained in any other law but subject to the provisions of this Act, the Central Government may, in the exercise of its powers and performance of its functions under this Act, issue directions in writing to any person, officer or any authority and such person, officer or authority shall be bound to comply with such directions.

Explanation--For the avoidance of doubts, it is hereby declared that the power to issue directions under this section includes the power to direct--

(a) the closure, prohibition or regulation of any industry, operation or process; or

(b) stoppage or regulation of the supply of electricity or water or any other service.

f. RULES TO REGULATE ENVIRONMENTAL POLLUTION

(1) The Central Government may, by notification in the Official Gazette, make rules in respect of all or any of the matters referred to in section 3.

(2) In particular, and without prejudice to the generality of the foregoing power, such rules may provide for all or any of the following matters, namely:--

(a) the standards of quality of air, water or soil for various areas and purposes;[4]

(b) the maximum allowable limits of concentration of various environmental pollutants (including noise) for different areas;

(c) the procedures and safeguards for the handling of hazardous substances;[5]

(d) the prohibition and restrictions on the handling of hazardous substances in different areas;[6]

(e) the prohibition and restriction on the location of industries and the carrying on process and operations in different areas;[7]

(f) the procedures and safeguards for the prevention of accidents which may cause environmental pollution and for providing for remedial measures for such accidents.[8]

g. PREVENTION, CONTROL, AND ABATEMENT OF ENVIRONMENTAL POLLUTION

i) Persons carrying on industry operation, etc., not to allow emission or discharge of environmental pollutants in excess of the standards

ii) Persons handling hazardous substances to comply with procedural safeguards

iii) Furnishing of information to authorities and agencies in certain cases

iv) Powers of entry and inspection

v) Power to take sample and procedure to be followed in connection therewith

vi) Environmental laboratories

(1) The Central Government may, by notification in the Official Gazette,--

(a) establish one or more environmental laboratories;

(b) recognise one or more laboratories or institutes as environmental laboratories to carry out the functions entrusted to an environmental laboratory under this Act.[16]

(2) The Central Government may, by notification in the Official Gazette, make rules specifying--

(a) the functions of the environmental laboratory;

(b) the procedure for the submission to the said laboratory of samples of air, water, soil or other substance for analysis or tests, the form of the laboratory report thereon and the fees payable for such report,

(c) such other matters as may be necessary or expedient to enable that laboratory to carry out its functions.

vii) Government analysts

The Central Government may by notification in the Official Gazette, appoint or recognise such persons as it thinks fit and having the prescribed qualifications[19] to be Government Analysts for the purpose of analysis of samples of air, water, soil or other substance sent for analysis to any environmental laboratory established or recognised under sub-section (1) of section 12.

viii) Penalty for contravention of the provisions of the act and the rules, orders and directions

a) Offences by companies

(1) Where any offence under this Act has been committed by a company, every person who, at the time the offence was committed, was directly in charge of, and was responsible to, the company for the conduct of the business of the company, as well as the company, shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly:

Provided that nothing contained in this sub-section shall render any such person liable to any punishment provided in this Act, if he proves that the offence was committed without his knowledge or that he exercised all due diligence to prevent the commission of such offence.

(2) Notwithstanding anything contained in sub-section (1), where an offence under this Act has been committed by a company and it is proved that the offence has been committed with the consent or connivance of, or is attributable to any neglect on the part of, any director, manager, secretary or other officer of the company, such director, manager, secretary or other officer shall also deemed to be guilty of that offence and shall be liable to be proceeded against and punished accordingly.

Explanation--For the purpose of this section,--

(a) "company" means any body corporate and includes a firm or other association of individuals;

(b) "director", in relation to a firm, means a partner in the firm.

b) Offences by government departments

(1) Where an offence under this Act has been committed by any Department of Government, the Head of the Department shall be deemed to be guilty of the offence and shall be liable to be proceeded against and punished accordingly.

Provided that nothing contained in this section shall render such Head of the Department liable to any punishment if he proves that the offence was committed without his knowledge or that he exercise all due diligence to prevent the commission of such offence.

(2) Notwithstanding anything contained in sub-section (1), where an offence under this Act has been committed by a Department of Government and it is proved that the offence has been committed with the consent or connivance of, or is attributable to any neglect on the part of, any officer, other than the Head of the Department, such officer shall also be deemed to be guilty of that offence and shall be liable to be proceeded against and punished accordingly.

WATERSHED MANAGEMENT

Watershed is defined as a land area from which water drains under gravity to a common drainage It is a delineated area with a well defined topographic boundary and one water outlet.

Objectives of watershed management:

Rational utilization of land and water resources for optimum production causing minimum damage to the natural resources.

Minimize the risk of floods.

Manage watershed for beneficiary activities.

Watershed Management Practices

Water harvesting

Afforestation and agroforestry

Mechanical measures for reducing soil erosion

Scientific mining

Public participation.

NUCLEAR ACCIDENTS AND HOLOCAUSTS

Nuclear holocaust refers to a possible nearly complete annihilation of human civilization by nuclear warfare. Under such a scenario, all or most of the Earth is made uninhabitable by nuclear weapons in future world wars.

Nuclear physicists and others have speculated that nuclear holocaust could result in an end to human life, or at least to modern civilization on Earth due to the immediate effects of nuclear fallout, the temporary loss of much modern technology due to electromagnetic pulses, or nuclear winter and resulting extinctions.

Atomic bombings of Hiroshima and Nagasaki

During the final stages of World War II in 1945, the United States conducted two atomic bombings against the Japanese cities of Hiroshima and Nagasaki, the first on August 6, 1945, and the second on August 9, 1945. These two events are the only use of nuclear weapons in war to date.[15]

For six months before the atomic bombings, the United States intensely fire-bombed 67 Japanese cities. Together with the United Kingdom and the Republic of China, the United States called for the unconditional surrender of Japan in the Potsdam Declaration issued July 26, 1945. The Japanese government ignored this ultimatum. By executive order of President Harry S. Truman, the U.S. employed the uranium-type nuclear weapon code named "Little Boy" on the city of Hiroshima on Monday, August 6, 1945,[16][17] followed three days later by the detonation of the plutonium-type weapon code named "Fat Man" over the city of Nagasaki on August 9.

Within the first two to four months after the bombings, acute effects killed 90,000–166,000 people in Hiroshima and 60,000–80,000 in Nagasaki,[18] with roughly half of the deaths in each city occurring in the first 24 hours. The Hiroshima prefectural health department estimates that - of the people who died on the day of the detonation - 60% died from flash or flame burns, 30% from falling or flying debris, and 10% from other causes. During the following months, large numbers died from the chronic effects of burns,

radiation sickness, and other injuries, compounded by illnesses. In a U.S. estimate of the total immediate and short-term causes of death, 15–20% died from radiation sickness, 20–30% from flash burns, and 50–60% from other injuries, compounded by illnesses. In both cities, most of the dead were civilians.

EARTHQUAKES

Earthquakes. Sudden tremors of the earth's surface ar produced due to movement of tectonic plates under the earth. This displacement of earth's crust releases energy stored within the earth's interior which produces vibratory waves. The intensity of earthquake is measured by Richter, Scale which ranges from 0 to 9. The point from which the earthquake originates is called as epicentre.

Prevention, Control & Mitigation

(i) Constructing earthquake resistant building in the known earthquake prone zones e.g. wooden houses are preferred in Japan.

(ii) Installation of earthquake study centres studying seismic ;activities and analysis of seismic zones.

(iii) There must be insurance policies for earthquake victims o rehabilitate them.

(iv) Creation of special task forces, fully trained and equipped, to manage such calamities within shortest possible time.

Effects of Earthquake:

Shaking and ground rupture

Shaking and ground rupture are the main effects created by earthquakes, principally resulting in more or less severe damage to buildings and other rigid structures. The severity of the local effects depends on the complex combination of the earthquake magnitude, the distance from the epicenter, and the local geological and geomorphological conditions, which may amplify or reduce wave propagation.[46] The ground-shaking is measured by ground acceleration.

Ground rupture is a visible breaking and displacement of the Earth's surface along the trace of the fault, which may be of the order of several metres in the case of major earthquakes. Ground rupture is a major risk for large engineering structures such as dams, bridges and nuclear power stations and requires careful mapping of existing faults to identify any which are likely to break the ground surface within the life of the structure.[47]

Landslides and avalanches

Earthquakes, along with severe storms, volcanic activity, coastal wave attack, and wildfires, can produce slope instability leading to landslides, a major geological hazard. Landslide danger may persist while emergency personnel are attempting rescue.[48]

Fires

Earthquakes can cause fires by damaging electrical power or gas lines. In the event of water mains rupturing and a loss of pressure, it may also become difficult to stop the spread of a fire once it has started. For example, more deaths in the 1906 San Francisco earthquake were caused by fire than by the earthquake itself.[49]

Soil liquefaction

Soil liquefaction occurs when, because of the shaking, water-saturated granular material (such as sand) temporarily loses its strength and transforms from a solid to a liquid. Soil liquefaction may cause rigid structures, like buildings and bridges, to tilt or sink into the liquefied deposits. For example, in the 1964 Alaska earthquake, soil liquefaction caused many buildings to sink into the ground, eventually collapsing upon themselves.[50]

Tsunamis

Tsunamis are long-wavelength, long-period sea waves produced by the sudden or abrupt movement of large volumes of water. In the open ocean the distance between wave crests can surpass 100 kilometers (62 mi), and the wave periods can vary from five minutes to one hour. Such tsunamis travel 600-800 kilometers per hour (373–497 miles per hour), depending on water depth. Large waves produced by an earthquake or a submarine landslide can overrun nearby coastal areas in a matter of minutes. Tsunamis can also travel thousands of kilometers across open ocean and wreak destruction on far shores hours after the earthquake that generated them.[51]

Floods

A flood is an overflow of any amount of water that reaches land.[52] Floods occur usually when the volume of water within a body of water, such as a river or lake, exceeds the total capacity of the formation, and as a result some of the water flows or sits outside of the normal perimeter of the body. However, floods may be secondary effects of earthquakes, if dams are damaged. Earthquakes may cause landslips to dam rivers, which collapse and cause floods.[53]

The terrain below the Sarez Lake in Tajikistan is in danger of catastrophic flood if the landslide dam formed by the earthquake, known as the Usoi Dam, were to fail during a future earthquake. Impact projections suggest the flood could affect roughly 5 million people.[54]

Human impacts

An earthquake may cause injury and loss of life, road and bridge damage, general property damage, and collapse or destabilization (potentially leading to future collapse) of buildings. The aftermath may bring disease, lack of basic necessities, and higher insurance premiums.

12 PRINCIPLES OF GREEN CHEMISTRY

1. Prevention. It is better to prevent waste than to treat or clean up waste after it is formed.
2. Atom Economy. Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.
3. Less Hazardous Chemical Synthesis. Whenever practicable, synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. Designing Safer Chemicals. Chemical products should be designed to preserve efficacy of the function while reducing toxicity.
5. Safer Solvents and Auxiliaries. The use of auxiliary substances (solvents, separation agents, etc.) should be made unnecessary whenever possible and, when used, innocuous.
6. Design for Energy Efficiency. Energy requirements should be recognized for their environmental and economic impacts and should be minimized. Synthetic methods should be conducted at ambient temperature and pressure.
7. Use of Renewable Feedstocks. A raw material or feedstock should be renewable rather than depleting whenever technically and economically practical.
8. Reduce Derivatives. Unnecessary derivatization (blocking group, protection/deprotection, temporary modification of physical/chemical processes) should be avoided whenever possible .
9. Catalysis. Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.
10. Design for Degradation. Chemical products should be designed so that at the end of their function they do not persist in the environment and instead break down into innocuous degradation products.

11. Real-time Analysis for Pollution Prevention. Analytical methodologies need to be further developed to allow for real-time in-process monitoring and control prior to the formation of hazardous substances.

12. Inherently Safer Chemistry for Accident Prevention. Substance and the form of a substance used in a chemical process should be chosen so as to minimize the potential for chemical accidents, including releases, explosions, and fires.

NON- GOVERNMENTAL ORGANIZATION AND THEIR ENVIRONMENTAL MANAGEMENT

Non- Governmental Organization (NGO) are those organization that act independently out side formal government sectors. They may include groups with wide interest such as conservation, religion, human right and research. NGOs may adopt a national or a local character, by operating at the national or local level respectively.

THE ROLE OF NGOS IN THE DEVELOPING WORLD:

Until recently, NGOs here were not primarily concerned with environmental issues. But they were concerned about water, land/soil erosion and forest destruction and related issues. Environmental action is generally tied to people's survival needs and activities; a lot of effort targets the promotion of community development and empowerment**.**

ROLE OF NGO IN ENVIRONMENTAL AWARENESS

- NGOs have a vital role to play in creating environmental awareness at all levels. NGOs are voluntary groups, often set up by committed individuals, who want to make positive change in society. Normally, an NGO focuses on a particular field that is often concern to founder – women's development, eradication of child labour, home of street children and orphans, education of the poor and underprivileged, welfare of the handicapped, etc. India has a large network of NGOs, which are involved in spreading the massage of sustainable development to the people.

Functions of environmental Non-Governmental organizations

1. To develop civic and environmental consequences among the public;
2. To educate the students about the pollution problem and the harmful effect of pollution;
3. To organize civic amenities and sanitary facilities on a self help basis
4. To describe and discuss the common characteristics of environmental issues in the given socio- economic, socio- cultural, political and ecological settings;
5. To high light and delineate crucial factors responsible for the environment degradation and to undertake, as the most challenging evdeavour, effective and efficient environmental education and awareness service provisions in the community;
6. To act as a catalyst in bringing about local initiative and community participation in overall improvement in quality of life;
7. To take initiatives for enactment of suitable legislation for the betterment of civic standard and environmental protection i8n order to achieve a cleaner and healthier environment;
8. To organization of rallies for protection and preservation of nature.
9. To launch campaign to minimize the use of plastic cover for different purposes;

10. To motivate people to buy only environment friendly products, i.e. the products which are not reducing the natural resources;
11. To make people understand that not to waste water for various for various purposes;
12. To plant and grow trees in the house garden;
13. To motivate research on different measures to be taken to solve environmental problems;

Suggestions for Improvement

- It has become necessary to know the extent of involvement of NGOs in the environmental activities in our country. The Department of Environment and Forests, Government of India should prepare a Directory of NGOs in the field of environment.
- All NGOs should include environmental education in their package of activities.
- NGOs should catalyse public involvement in environmental programme.
- NGOs should being a decade of consumer and environmental education and involve youth organization in their work.
- NGOs should harmonise their activities with government bodies.
- NGOs can and should undertake environment based adult education.
- The department of Environment and Forests should provide a nodal print for NGO activities and act as a clearinghouse for information on Ngo work in environmental education, action and programmes.
- A newsletter of NGO efforts in the environmental field should be oublished.
- Information package on environmental theme should be brought in different languages by NGOs with the help from the Department of Environment and Forests.

International Environmental Organizations

- Campaign for Nuclear Disarmament:
- Climate Action Network:
- Conservation International:
- Earth Island Institute:
- Earthwatch:
- Food First:
- Friends of The Earth:
- Genetic Resources Action International:
- Global Common Institute:
- Greenpeace
- International Ocean Institute:
- International Union for Conservation of Nature and Nature Sources:
- Natural Resources Defense Council:
- One World:
- Rainforest Action Network:
- Rainforest Alliance:
- Sierra Club:
- Toxics Link:
- Union of Concerned Scientists:
- World resources Institute:

- Worldwide Fund for Nature:
- Worldwatch Institute:
- Youth Water Action Team:
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