UNIT 3 MAN-MADE DISASTERS

Structure

3.1 INTRODUCTION

In Unit 2, you have studied the environmental calamities caused by natural disasters like earthquakes, floods, droughts, cyclones, etc. bringing miseries to life and wreaking havoc on properties. In the present unit, we focus on man-made disasters. Man-made disasters are major causes of premature death, impaired health status and diminished quality of life. You have learnt that a disaster can be defined as an occurrence that causes damage, ecological disruption, loss of human life or deterioration of health on a large scale sufficient to warrant an extra ordinary response from outside the affected community or area. A hazard is any phenomenon that has the potential to cause a disaster or cause disruption or damage to people and environment. There are many types of disasters beyond those that are usually considered “natural”. The relative number of injuries and deaths differ, depending on a number of factors such as type of disaster, the density and distribution of population, condition of environment, degree of preparedness and the opportunity of warning.

Objectives

After studying this unit, you should be able to:

- distinguish between natural calamities and man-made disasters;
- give examples of man-made disasters and list preventive measures; and
- explain the impact of man-made disasters on people.

3.2 MAN-MADE DISASTERS

Man-made disasters may be classified into three types:

i) Sudden disasters,
ii) Insidious and continuing disasters, and
iii) War and civil conflicts.

Sudden disasters are those in which human factors are responsible, rather than natural factors. The release of methyl isocyanate at the pesticide plant in Bhopal, India in 1984, and the leakage of radio active substances following an explosion at the Chernobyl nuclear power reactor in the Soviet Union in 1986 are a couple of examples of sudden disasters. Sudden disasters that are considered ‘natural’ may often be caused by preceding human activities. Mining catastrophes, earthquakes, sudden floods, and landslides may be the result of indiscriminate deforestation or of construction of dams or by seemingly unrelated human activity. Of late, landslides

have been occurring at frequent intervals in the hilly terrains of India especially in the Uttaranchal region. The effects of landslides, both natural and man-made, are devastating. The road widening activities have greatly damaged the fragile environment of the region thereby disrupting the human settlements apart from causing enormous damage to transport and communication networks. Development and installation of appropriate precautionary systems will enable in reducing the risks against the landslide hazards.

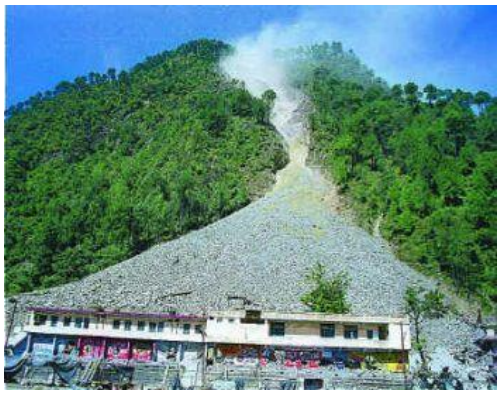

Fig.3.1: Landslides in Uttaranchal
(**Source:** http://www.hinduonnet.com/)

Insidious and continuing disasters include examples like the leakage of toxic chemicals from a dump site at Love Canal in Buffalo; the tainting of the soil in Times Beach with dioxin oils sprayed on the roads and leakage of radio active materials dumped at wastage dumps at nuclear weapons production facilities. Some natural phenomenon like prolonged drought may be examples of continuing disasters. Disasters like global warming or the green house effect caused by heat trapping gases in the atmosphere released by burning of fossil fuels, use of chlorofluorohydrocarbons in aerolised perfumes and acid precipitation also come under the disasters under this category.

Since World War II, there have been about 127 wars and civil conflicts resulting in 21.8 million deaths involving more than 50 percent of civilians. The proportion of civilian casualties has been increasing in the wide ranging air strikes and modern warfare tactics putting entire populations at risk. Disrupting food production, imperilling fragile ecosystem and forcing native populations to flee from their natural habitats, have been the results of war and civil conflicts.

Consequences of Man-made Disasters

Man-made disasters can cause short term morbidity and mortality, and damage the quality of life and cause premature deaths. The causes of short term morbidity result in injuries, emotional stress, epidemics and increase in indigenous diseases. One glaring example is that of forest fires. Every year millions of tons of forest all around the world are being destroyed and many animals and plant species are disappearing due to deforestation and fires, both a result of human activity.

Fig.3.2: Forest fires

Drastic reduction in forests has significant effects on the delicate global ecosystem. The public health response to man-made disasters is the primary prevention, i.e., the prevention of the occurrence of the disaster. Tighter safety regulations of chemical production facilities of hazardous substance would reduce the hazards substantially. Locating these facilities away from populated areas and human habitats would reduce the loss of human life and property. Built-in mechanisms to counter human errors, ensuring safety regulations with quality inputs in engineering and technological safety measures as well as early warning system would result in reducing these disasters, if not completely eliminate them.

Fig.3.3 gives a general spectrum of environmental calamities and man-made disasters. The degree of human responsibility for a calamity/disaster increases from geophysical calamities to society induced disasters like smoking.

It may be inferred that except natural disasters all other disasters can be prevented. It has been estimated that the number of man-made disasters are more in developing countries (in Asia and Africa) than in developed countries (in Europe and America). One of the causes for man-made disasters is the emergence of free market global economies in which economic factors play a central role in decision making in the production, use of resources and treatment of wastes. This also results in short time horizon over which decisions are taken for profit maximization at the cost of safety standards.

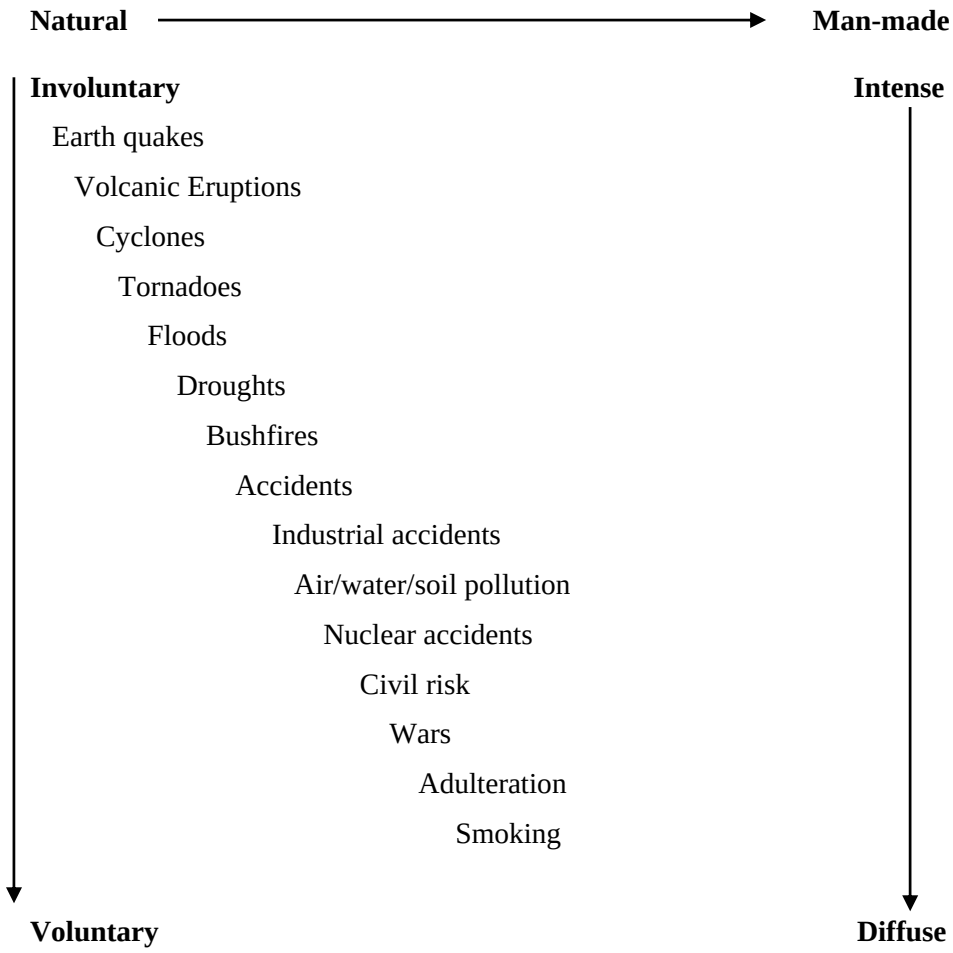

Fig.3.3: General spectrum of environmental calamities and man-made disasters

SAQ 1

Describe any man-made disaster that has occurred in your region in the recent past. Analyse the steps taken to handle its consequences.

3.3 TOXIC WASTES

The peculiar nature of human beings is that they change their environment to suit their biological and social needs. In this transaction they utilize the material necessities (resources) and produce worthless and some times harmful by-products. These by- products are termed as wastes and may be in the form of gases, liquids or solids. Direct or indirect exposure to toxic wastes and hazardous chemical agents has been implicated in numerous adverse effects on humans from cancer to birth defects. The old pollutants like lead, mercury, industrial solvents and pesticide residues, are of great concerns in many parts of the world. There is a reasonable level of understanding of their effects on human health. Although protective measures are not always adequately implemented, there are provisions to reduce their harmful effects on human health and environment. But each day newer and newer industrial toxics are found in several household products, chemicals and pharmaceuticals. There is far less knowledge about the long term toxicological effects on human health and environment. It has become a common occurrence of accidents in the transportation

of industrial and hazardous waste products and inadequate management of disposal of these wastes.

So important was the problem of avoiding dumping hazardous wastes in the backyards of poor countries that two important conventions were held and the member countries signed the agreements. The first one was ***Basel convention on the control of trans-boundary movements of hazardous wastes and their disposal (1989) and the second was Bamako convention on the ban of the import into Africa and the control of trans-boundary movement and management of hazardous wastes within Africa (1991)***.

India is increasingly becoming a dumping ground for toxic industrial wastes from developed countries, which can pose serious threats to public health and the environment. While the developed countries ban the use of hazardous substances and even the processes that generate them, the governments of developing nations like India seem to think that they need every dollar and every job that the processing of such substances creates. Thus, brain-damaging mercury and toxic electronic and plastic wastes from the United States; cancer-causing asbestos from Canada; defective steel and tin plates from the European Union, Australia and US; toxic waste oil from the United Arab Emirates, Iran and Kuwait; toxic zinc ash, residues and skimmings; lead waste and scrap; used batteries; and waste and scrap of metals such as cadmium, chromium, cobalt, antimony, hafnium and thallium from Germany, Denmark, Netherlands, United Kingdom, Belgium and Norway are all dumped in India.

Hazardous substances are those that are ignitable, corrosive, reactive or toxic. According to studies, including those by environmental activist groups such as Greenpeace and Toxic Link, every year over 1,00,000 tonnes of hazardous wastes enter India in gross violation of the 1997 Supreme Court order banning such import. Lately, the developed countries have gone another step forward, by shifting production processes that generate hazardous wastes to developing countries. With 101 countries prohibiting waste imports (up from 3 in 1989), South Asian Countries, particularly India, with their lax laws and regulations, are becoming the preferred dumping ground for hazardous wastes. It is not as if there are no laws or international instruments to regulate trade in hazardous wastes. In India, there are the Hazardous Waste Act, 1989, and the May 1997 Supreme Court ruling banning the import of hazardous wastes followed by the orders of February 1998 disallowing auction of hazardous waste stocks in ports and container depots but these legal instruments were never practised. The solution lies in making industries accountable, maintaining precautionary principle, refusing waste from other countries and strengthening local initiatives.

Source: http:// www.flonnet.com/fl2025/stories/200312190019086000.htm

Fig.3.4: Several tonnes of highly toxic mercury waste dumped by Hindustan Lever, a subsidiary of Anglo-Dutch multinational Unilever (owners of Lipton Tea and Dove soap) in the densely populated tourist resort of Kodaikanal and the surrounding protected nature reserve of Pambar Shola, in Tamilnadu, Southern India. (**Source**: www.greenpeace.org.uk/)

3.3.1 Disposal of Toxic Wastes

The output of hazardous wastes worldwide was about 400 million tons in 1990s of which 300 million tons were produced by the OECD countries. These wastes are derived mainly from chemical industries, energy production industries, pulp and paper producing factories, mining industries and leather tanning processes. Though tighter regulatory controls are enforced on these industries in developed countries, resulting in an increased cost of waste treatment and disposal, the developing countries and countries with no stringent control measures have become a haven to shift the production operations from developed countries to the developing countries. Officially, less than 1000 tons of wastes a year are traded to developing countries; the illegal traffic in hazardous wastes poses a serious threat to environment and human health in the developing countries.

One way of combating such illegal trade is through a system called Prior Informed Consent (PIC) for certain hazardous substances in International Trade. Operated by FAO and UNEP, PIC is a procedure that helps the participating countries learn more about the characteristics of potentially hazardous chemicals that may be supplied to them. This in turn generates the necessary public opinion world over to put pressure on the governments to act in a responsible way. The procedure would also help the dissemination of information to other countries and promote a shared responsibility.

Though all wastes are disposed off into the environment, some wastes enter the environment in a controlled manner than others. Some wastes are treated before disposal and others are disposed directly from the source. Wastes produced from the combustion of fuel by motor vehicles are emitted directly into the atmosphere, and sewage wastes are disposed into rivers and oceans. Since air, rivers and oceans are global commons, this common ownership has facilitated unregulated disposal of wastes.

One of the consequences of Technological Revolution in agricultural production processes has been the release of refuse and residual chemicals into the environment. Chemical fertilisers, hybrid feeds for poultries, slaughter house wastes, salt and silt drained from irrigated lands as sediments have been causing irreparable damage to the fertile lands.

Several disposal techniques had been in vogue to manage the hazardous wastes, the most popular being landfills and underground deposits. A case in point was the disposal of water waste contaminated in the production of chemical warfare agents like mustard gas, white phosphorus and napalm outside Denver, Colorado during 1960s. The geology of the area beneath the site looked suitable to dig a disposal well over 3500 m deep to deposit the liquid waste. Soon after, a series of minor earthquakes were detected in the area which had no known history of seismic activity or instability. Between March 1962 and November 1965, over 700 minor earthquakes were monitored in the area. The geologists established direct link of the underground disposal of liquid wastes with the occurrence of earthquakes resulting in the stoppage of this method in 1996.

There is no doubt that the best way to manage the waste is to prevent it at the source wherever possible. The argument that prevention is better than cure is put by the UNEP's Industry and Environment Programme Activity Centre:

> When end-of-pipe pollution controls are added to industrial systems, less immediate damage occurs. But these solutions come to increasing monetary costs to both society and industry and have not been proven to be optimal from an environmental aspect. End-of-pipe controls are also reactive and selective. Cleaner production, on the other hand, is a comprehensive preventable approach to environmental protection.
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> **(UNEPIE/PAC, 1993:1)**

Cleaner production is achieved by examining all phases, of a product's life cycle, from raw material extraction to its ultimate disposal and reducing the wastage at any particular phase. Thus, cleaner production encompasses:

- Conservation of energy and raw materials,
- Reduction in the use of toxic substances,
- Reduction in the quantity and toxicity of wastes, and
- Extension of product durability.

These measures combined with Equalisation, Neutralisation, Physical, Chemical and Biological treatment of toxic wastes would reduce their adverse effects in their disposal into the environment.

SAQ 2

Discuss the problem of disposal of hazardous waste in your region in the context of globalisation.

3.4 WARS AND POPULATION DISPLACEMENT

Aggression appears to be a fundamental characteristic of human race and violence has been used to resolve disputes since pre-historic times. If a war is defined as a conflict resulting in 1000 or more deaths, there have been 471 wars since 1700

resulting in 100 million fatalities. More than 90 percent of the war deaths in these three centuries have occurred in the twentieth century alone.

Since the end of the Second World War, more than 130 wars and violent internal conflicts have raged in more than 80 countries, most of these being in the developing world. Arms imported by developing countries, half of which are financed by export credits, have resulted in 30 percent debt burden on these countries. The scale of military spending and trade offs with social and environmental priorities as quoted by Tolba (1992) are:

- UNEP spent US$450 million in the decade 1980 – 90 which is less than five years worth of global military spending of a few nations.
- One Apache helicopter costs US$12 million – a sum that could pay for installing 80 thousand hand pumps to give the Third World access to safe water.
- One day expenditure on the 1991 war over Kuwait could have funded a five year global child immunisation programme against six deadly diseases saving one million children a year.

War is no more confined to war zones only or those fighting the war directly. In recent times there have been more civilian deaths than military deaths and hundreds and thousands of people are being displaced as refugees. A high percentage of those dying or affected in these conflicts are children. Air power and wide ranging nature of modern war put entire population at risk, disrupting food production, imperilling fragile ecosystems and forcing entire populations to flee from their natural habitats. The geography of warfare has also changed radically. In recent times most of the wars are fought in developing countries with indirect and covert involvement of major powers.

During the past five decades civil wars representing power conflicts within nations have increased sharply. Though these are termed as civil conflicts or civil disturbances, powerful weaponry with tacit support of global industrial nations is being used resulting in high casualties and public health risks.

3.4.1 Direct and Indirect War-time Impacts

The relationship between people and their environment can be changed significantly during wartime. Priorities are altered; certain resources are used more rapidly to fuel the war effort. In the time of Henry VIII, for example, many of England's oak trees were cut down to build war ships. During prolonged trench warfare in the coastal plains of France and Belgium, most of the forests were destroyed, resulting in the destruction of agricultural land and wood land.

Fig.3.5: Gruinard

Deliberate destruction and manipulation of environment has been used by armies to gain military advantage. 'Scorched earth' policies in which vegetation and crops are deliberately destroyed to prevent their use by the enemy have been one of the age-old military tactics. In Afghanistan, the deliberate and inadvertent destruction of forest lands reduced the forest cover to alarming proportions in the past two decades. Long lasting adverse environmental effects are attributed to areas where biological weapons are developed and tested. A classic example is the island of Gruinard, off the West Coast of Scotland, which was the site of experiments with highly contagious anthrax spores during the Second World War. The island remained uninhabited by government decree until 1988, but even now a complete decontamination is difficult to guarantee (Szasz, 1995).

Weapons of mass destruction are indiscriminate, killing, maiming and injuring entire populations, destroying and contaminating ecosystems transcending geographical and natural boundaries. Various medical responses after the use of such weapons in a war could neither restore life to the millions nor restore biotic and abiotic environment.

Since the World War II, an estimated US$16 trillion has been spent on the production of military hardware. Several industrialised nations spend huge amounts of their resources on arms production. They are the main suppliers of arms to the developing

nations, depleting the latter's revenues from spending on areas of health, education and well being. Along with the diversion of revenue to military research, arms-spending diverts scientists from working to improve health and quality of life. It is an irony that the world expenditure on weapons research far exceeds the combined spending on the development of cleaner energy technologies, improvement of health standards, increased agricultural productivity and control of hazardous pollutants.

3.4.2 Nuclear Weapons

A massive and unprecedented change in the potential consequences of wars began with the development of nuclear weapons. In the years since their use on Hiroshima and Nagasaki in 1945, the expenditure on nuclear weapons and the number of arms in the world's nuclear arsenals has grown tremendously by according to a conservative estimate.

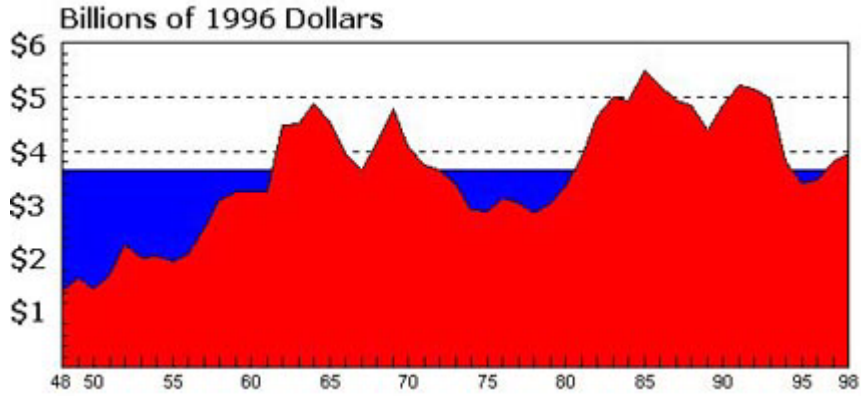


Fig.3.6: Average annual spending for nuclear weapons research, development, testing, and production by the Atomic Energy Commission and the Department of Energy (DOE) of USA during the Cold War (1948 to 1991) was $3.64 billion (blue area)
(**Source**: www.brook.edu/fp/projects/ nucwcost/fpoldoe2.gif)

Though there is not much direct information on the possible environmental effects of a nuclear war, some insight can be gained from the detonation of only two nuclear devices used in warfare to date, in Japan at the end of Second World War. These nuclear devices were relatively very small compared to the sophistication and the yield of present day weapons. The destruction caused by the devices of 1945 make one frightful of the consequences should today's devices are to be used. Let us look at the following data:

	Hiroshima	**Nagasaki**
Date of detonation	6 Aug 1945	9 Aug 1945
Type	Uranium 235	Plutonium
Height of explosion	580 meters	503 meters
Yield	12.5 kiloton TNT	22 kiloton TNT
Total area demolished	13 km^2	6.7 km^2
Buildings completely destroyed	67.9%	25.3%
Buildings partially destroyed	24%	10.8%
Number of people killed (by Dec 1945)	70,000	90,000 –120,000

The most important cause of death and physical destruction was the combined effects of the blast and thermal energy. The fire ball created by the blast was so intense that it evaporated all life at the epicentre and burnt human skin up to 4 km away. The effects of radiation were felt by the people of the successive generations as well.

The production and testing of nuclear devices would affect the environment adversely. Underground testing of nuclear devices has triggered earthquakes in a number of places. The radioactive fall out has endangered all living organisms. One of the greatest environmental threats of the 1980s was the prospect of a nuclear winter triggered by detonation of nuclear devices during war. Apart from the

destruction of human life and properties, massive clouds would blot out sun light from large areas for many weeks, triggering atmospheric and climatic changes which would result in a colder world climate after any nuclear detonation.

Limiting the Effects

Numerous treaties, conventions and agreements have been adopted to prevent utter human and environmental devastation in the use of nuclear weapons, their testing and their destruction. But the effectiveness of such agreements and treaties, as a deterrent on non compliance is difficult to evaluate and enforce. Even the Arctic is not spared nuclear pollution. For example, the Russian naval authorities have been dumping nuclear liquid wastes and buried solid nuclear wastes from their submarines along the eastern coast of Novaya Zemlya and in the Barents and Kara seas. It is observed (AMAF 1997) that these sites represent an important potential threat of nuclear contamination.

3.5 INDUSTRIAL ACCIDENTS

Most of the industrial accidents are avoidable if proper safety standards and protocols are implemented and followed. The dangerous gas and hazardous substances released during the accidents affect life forms across the boundaries of neighbouring states and countries. In Seveso, Italy, in 1976 an explosion in a chemical plant released dioxin into the air killing hundred thousands of animals and contaminating 5000 area of land. The 1984 explosion at Bhopal, India, released nearly 40 tons of Methyl Isocyanate (MIC) which had a devastating effect on human life resulting in long term ill health and disability.

Fig.3.7: The methyl isocyanide tank at Union Carbide Corporation's factory in Bhopal, which leaked in December 1984 causing a major disaster. Waste material dumped in and around the factory is now feared to cause soil and groundwater contamination in the neighbourhood of the site. (**Source:**http://www.flonnet.com/)

The convention on the transboundary effects of Industrial Accidents (1992) made it obligatory on the signatories among other things:

- The parties shall ensure that adequate information is given to the public in the areas likely to be affected by an industrial accident.
- The parties shall establish and operate a compatible and efficient industrial accident notification system to contain and minimise adverse effects.

Though the Hague declaration of 1989 outlawed the use of “poisonous gases” in war, chlorine, phosgene, mustard gas, tear gas are still produced and used in covert operations. Some poor nations which cannot afford the most sophisticated weapons consider these chemical weapons as ‘poor nations nuclear weapons’, thereby creating demand for the production of dangerous chemicals.

Emergency planning, emergency preparedness and emergency prevention would, to a large extent, reduce the vulnerability of populations to the industrial accidents.

In addition to the man-made disasters described so far, human activities are contributing to environmental problems like global warming and ozone layer

depletion. Both these problems have the making of a disaster and we have discussed them in detail in MED-001. Here we take them up briefly for the sake of completeness.

3.6 GLOBAL WARMING

You have learnt that an increase in global temperatures is likely to affect many atmospheric parameters like precipitation and wind velocity resulting in an incidence of extreme weather conditions. Indiscriminate burning of fossil fuels, emissions of pollutants from motor vehicles, emission of poisonous gases from chemical industries contributes to global warming. The effect is accelerated more by industrial and developed nations and the effect will be acutely felt by all the nations for no fault of theirs.

The background to international cooperation on climate change

Scientists began to attract the attention of policy-makers to global warming as an emerging global threat in the early 1970s (SCEP 1970). However their appeals were originally ignored and, as economies grew, more fossil fuels were burnt, more forested areas were cleared for agriculture and more halocarbons were produced. It took a further 20 years of continuous effort by scientists, NGOs, international organisations and several governments to get the international community to agree to coordinated action to address climate change.

The Stockholm Conference is generally regarded as the starting point for international efforts on climate variations and climate change (UN 1972). In 1979, the first World Climate Conference in Geneva expressed concern about the atmospheric commons. This event was attended primarily by scientists and received little attention from policy-makers. In the 1980s, a series of conferences and workshops were held in Villach, Austria, where scenarios for future emissions of all of the significant greenhouse gases were considered. At the 1985 Villach meeting, an international group of scientific experts reached a consensus on the seriousness of the problem and the danger of significant global warming (WMO 1986).

As a result of growing public pressure and the implications of the Brundtland Commission (WCED 1987), the problem of global climate change moved onto the political agenda of several governments. A diplomatic breakthrough came at the 1988 Toronto Conference on the Changing Atmosphere from which emerged a recommendation calling on developed nations to reduce CO_2 emissions by 20 percent from 1988 levels by the eyar 2005. A few months later, IPCC was jointly established by WMO and UNEP to review knowledge of the science, impact, economics of and the options for mitigating and/or adapting to climate change. The IPCC studies, especially the three extensive Assessment Reports in 1990, 1995 and 2001, covered all the different facets of climate change.

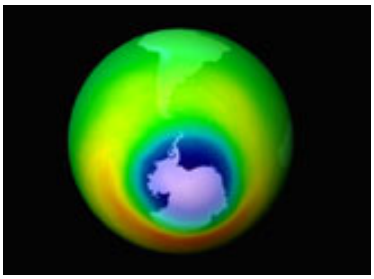
Source: WCED (1987) Our Common Future, The World Commission on Environment and Development, Oxford University Press, Oxford.

The United Nations Framework Convention on Climate Change (1992) acknowledging that human activities have been substantially increasing the atmospheric concentrations of greenhouse gases, determined to protect the climate system for the present and the future generations. The signatories agreed to promote and cooperate in education training and public awareness on various aspects related to climate change and as described above encourage widest participation in this process including that of non governmental organisations.

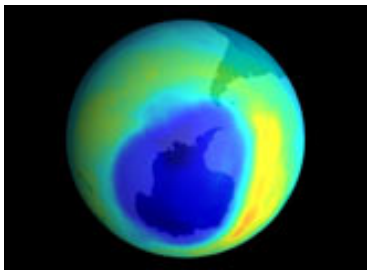
3.7 OZONE DEPLETION

When five decades ago inert gases like chlorofluorocarbons were discovered to be used in refrigeration as coolant, scientific community thought it was a scientific breakthrough in the service of humanity. These inert gases are being used extensively in refrigeration fluids, blowers in foam making, aerosol propellants, solvents and in fire extinguishers. It is now established that each CFC molecule that escapes into atmosphere sets in chain reaction combining with ozone molecule a chemical reaction that destroys thousands of ozone molecules. These irreversible chemical reactions are

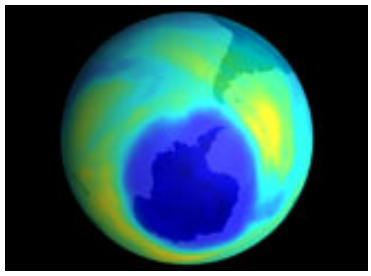
observed to occur at middle and high latitudes with ozone depletion depending on both the season and latitude.



October 1999 (average)
Historically, the Antarctic ozone hole is largest during October. This image shows the data from the Total Ozone Mapping Spectrometer (TOMS) Earth Probe, for the month of October 1999



September 3rd 2000
The ozone hole grew quicker than usual and exceptionally large. By the first week in September the hole was the largest ever at that time 11.4 million square miles. For the first time it reached towards South America and to regions of high population.



September 17th 2001
Satellite data show the area of the 2001 Antarctic ozone hole peaked at a size roughly equal to that of recent years about the same area as North America. Researchers have observed a levelling-off of the hole size and predict a slow recovery.

Fig.3.8: The ozone hole at different times (**Source:** http://www.coolantarctica.com/)

As you know, the ozone layer screens out lethal ultraviolet (UV) radiation. Depletion of ozone layer allows more ultra violet radiation to reach the Earth resulting in a great threat to life on earth. The developed and industrialised nations have been using these ozone depleting chemicals and the developing nations were rather late entrants in using this technology.

You have learnt that there have been several conventions and protocols starting with (i) Vienna convention for the protection of ozone layer (1985) and (ii) Montreal Protocol on substances that deplete the ozone layer (1987), (1990) and (1992). Though the international community was successful to an extent in its approach to addressing the problem of protecting the stratospheric ozone layer there is a need to have a new kind of global diplomacy to tackle such global ecological threats.

- Scientists must play an unaccustomed but critical role in the international environmental negotiations.
- Governments must act responsibly balancing the risks and costs for acting or not acting.
- Multilateral diplomacy involving coordinated negotiations among many government agencies.
- Educate and mobilise opinions essential to put pressures on hesitant governments and private companies.
- Economic and structural inequalities among countries to be adequately reflected in any international regulatory regime.
- Market incentives must be given to stimulate technological innovations.

With this brief recapitulation on ozone layer depletion, we end the discussion on man-made disasters and summarise the unit.

3.8 SUMMARY

- The short term and long term effects of man-made disasters on environment have been some of the global concerns. Even some of the ‘natural environmental calamities’ are the results of preceding human activities. Devastating fire accidents, eruptions and explosions, mining accidents, pollution of global commons, nuclear and industrial accidents, wars and civil conflicts are some of the examples of man-made disasters. These disasters may be classified into three types: sudden, insidious and wars.

- One of the main causes for the occurrence of these disasters has been the laxity in enforcing safety standards and the motive for short term profit

maximisation. Apart from the damage to the atmosphere through emission of pollutants and release of effluents, industrial accidents, accidents in the transportation of toxic wastes for disposal, radiation leakages from nuclear facilities have become increasingly common. Production and storage of chemical, biological and nuclear weapons by the industrialised nations and their import by the developing nations have been at the cost of providing health and education to the people. Imagine that today's Sahara desert was a fertile land just about 6000 years ago.

- The release of green house gases would result in climatic changes that can alter fertile green lands into arid lands. Ozone depletion that results in the penetration of ultraviolet rays into the Earth's atmosphere has been the result of escape of inert gases like halons and CFCs into the atmosphere.

- There have been several conventions, agreements and protocols between countries on several issues that cause environmental disasters as a result of human actions. But the implementation and effectiveness of these agreements have been peripheral. Unless a strong public opinion is built up which will make the governments hear the voice of people, nothing tangible can be achieved. Making education on environment and development available to all people of all ages in all sectors of society would sensitise the people to these issues.

3.9 TERMINAL QUESTIONS

1. Explain briefly some of the causes of man-made disasters and possible preventive measures.

2. Examine the issues involved in dealing with the disposal of toxic wastes.

3. Discuss the impact of wars on environment.

4. Describe the effects of industrial accidents on human life.

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