UNIT 1 UNDERSTANDING MAN-MADE DISASTERS

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1.0 LEARNING OUTCOME

After studying this Unit, you should be able to:

• Understand the meaning and nature of man-made disasters;
• Enumerate the various types of man-made disasters;
• Discuss the adverse effects of man-made disasters and typical post-disaster needs along with risk reduction and confidence building measures; and
• Appreciate the general concerns confronting the management of man-made disasters.

1.1 INTRODUCTION

Man-made disaster could be defined as a man-made event, sudden or progressive, which impacts with such severity that the affected community has to respond by taking immediate and exceptional measures including help from outside the community. These disasters could also be termed as human induced disasters or of anthropogenic origin. An even broader definition of human-made disaster acknowledges that all disasters are caused by humans, because they have chosen for whatever reason to be where natural phenomena occurs, which result in adverse impacts.

Hence, man-made disaster is an emergency situation of which the principal direct causes are identifiable human actions, deliberate or otherwise. Like all disasters, man-made disasters disrupt the normal pattern of life, affect people, impact on the social structures and wreak economic damage.
Distinction from Natural Disasters

In most cases of natural disasters, the hazard is directly attributable, however the main causes of man-made disasters are complex and inter-related. Except for accidents, man-made disasters have a slow onset, as the underlying cases would be brewing up over a period of time as for example, social problems lead to riots or terrorism. Man-made disasters could also result from natural disasters as, for example, earthquake may render large number of people homeless and without livelihood, which could lead to social and political consequences. Like all disasters, man-made disasters also exacerbate the vulnerabilities of an area and its people.

The manifestation of natural disasters like, droughts and floods could also be related to indiscriminate human activities which result in degradation of the environment and of the delicate natural infrastructure which is damaged. This causes imbalances in nature. Hence, to a certain extent, even natural disasters may sometimes be considered as human induced disasters. Areas with severe deforestation, erosion, over cultivation and over grazing tend to be hardest hit by disasters.

Causes of Man-made Disasters

Human induced disasters occur due to many and varied causes. They could arise from the indiscriminate industrialisation, over population, increased consumerism, use of hazardous substances or processes or simply accidents of various types. Negligence on the part of professionals as well as the public along with ignorance increases the possibility of man-made disasters.

Manmade disaster could also be caused due to unintentional or inadvertent activity, as a fall out of poor maintenance, low quality work or human error. On the other hand, they could also result from wilful, deliberate and intentional activity, such as sabotage, mischief, revenge, riots, mob fury or enemy attack. Sometimes, man-made disasters, especially those related to industrial and technological causes, are the results of system or process malfunctioning as in the case of nuclear radiation, gas leak, explosion and fire.

Nature of Man-made Disasters – Basic Facts

Notwithstanding what has been stated in the preceding paragraphs, man-made disasters have the following distinguishing features which are basic characteristics of man-made disasters:

i) Predictability is nil in most cases. Hence, forecasting and warning is not possible. Even in case of ecological disasters, while we know that we are on a disastrous path, yet the time and location when and where the hazard will turn into disaster cannot be predicted.

ii) No system is really fail-safe. The safety can definitely be improved through careful and timely maintenance and monitoring. Vigilance and monitoring tend to degenerate in the absence of a mishap. Furthermore, safety and evacuation plans are either non-existent or not enough. Practice drills are conspicuous by absence in most industrial or technological sites.

iii) Not only the “point-zero” and the immediate neighbourhood suffer, but the adverse effects are carried farther by wind, water or travellers.

iv) System failures or mere accidents occur due to (a) Technical Malfunction and / or (b) Human error/negligence.

v) Man-made disasters shall increase in number and magnitude as hazardous industries grow in number, size and technological complexity and spread into the countryside. The growing population in general and very large cities with multi-million inhabitants increase the vulnerability considerably.

vi) The awareness about the location of a serious man-made hazard in the neighbourhood of community is minimal. General public is ill-equipped mentally and physically to deal with
man-made disasters and it is generally too late by the time information goes out and outside help arrives.

1.2 CONCERNS IN DISASTER MANAGEMENT

Disasters are no strangers and occur quite frequently. Agencies responsible for managing these disasters have played crucial role and the outcome of their efforts continue to receive mixed reactions. The fact remains that there is need and scope for improving the disaster management systems including those for man-made disasters. The main concerns are discussed below.

i) **Weak Coordination**

A disaster cannot be managed by one single agency, particularly when the magnitude of impact is high. When more than one agency is involved in managing the disaster, the need for proper coordination between them cannot be overemphasised. Weak coordination between the agencies, or lack of it, render the rescue and relief operations ineffective.

ii) **Inadequate and / or Irregular Flow of Resources**

Adequate resources, such as materials, funds, trained manpower etc. need to be made available to effectively manage any disaster. Generally, the resources are inadequate, but at times some of the items may be in excess. The issue is how best the agencies can formulate resource plans and also ensure that the gap between the requirements and availability can be bridged.

iii) **Frequent Transfer of Trained Personnel**

The outcomes of disaster management efforts have a direct bearing on the availability of trained manpower. While there is a serious shortage of trained manpower to manage disasters at the place of occurrence, such resources are sometimes available elsewhere but not properly utilised. Their availability at the right place at the right time is a serious issue while managing disasters. Thus, many a times trained manpower remains unutilised. In public systems, an officer after getting trained in a particular discipline can be posted to a different place in due course.

iv) **Lack of Motivation among Personnel**

The personnel involved in disaster management must be motivated to be able to perform effectively. The extent of preparedness for man-made disasters gets affected wherever the officers show reluctance or are slow to proceed to the disaster prone or disaster affected area. Such an attitude towards the responsibilities assigned to them only shows low level of motivation among officers charged with the task of disaster management.

v) **Lack of Accountability**

The personnel in-charge of disaster management operations are generally not accountable to the victims of disaster or the public at large. When a road accident takes place the police and other department officers are responsible for recording the first information report, arranging for medical help for the victims, and clearing the road for traffic. However, in practice, the operations get delayed which cause all round hardship. It is also difficult in such circumstances to hold any one responsible.

vi) **Golden Hour Concept**

The time taken to respond to an emergency after its occurrence is termed as ‘Golden Hour’. This concept is much more valid in a man-made disaster. If the time span could be reduced, loss of life and damages to property could be minimised.
vii) Absence of Rewards and Punishments

The agencies associated with rescue and relief operations do not have a system of motivating the personnel through rewards. This is perhaps one of the reasons for low level of motivation. A scheme needs to be introduced to recognize the good performance with a reward system and at the same time punish those who fail to discharge their duties effectively and efficiently.

1.3 TYPES OF MAN-MADE DISASTERS

The man-made disasters can be broadly categorized in the following types:

a) Accidents: Road, rail, air, river, sea, transport of hazardous material, building collapse.

b) Fires: Buildings, coal mines, oil (exploration sites, refineries and storage depots), forest fires.

c) Industrial and technological mishaps: Leaks, fires, explosion, sabotage. Technical system failure, plant safety failure.

d) Nuclear Hazards: Radioactive leaks, thefts, transportation, waste disposal, Reactor meltdown.

e) Warfare: Conventional, Chemical, Biological and Nuclear.


g) Civil Conflicts: Arson, sabotage, terrorist and other criminal activities.

h) Ecological: Air pollution, water pollution, noise pollution, soil erosion and degradation, waste accumulation including toxic waste, disease and epidemics, loss of biodiversity, loss of habitat, deforestation, global warming, sea level rise, depletion of stratospheric ozone and increase in tropospheric ozone.

Needless to say, even this cannot be an exhaustive list because the possibility of man-made disasters in the high tech and fast speed societies of the present day is practically endless.

In the succeeding fifteen Units (Unit 2 to 16) of this course, we shall deal in some detail with the more important man-made disasters. It may be stated that these disasters in the succeeding Units are not arranged in any particular order because it would be difficult to have a consensus on the relative importance of a particular man-made disaster to individuals or a particular society.

While we shall deal with the prominent man-made disasters in the subsequent units in detail, it is considered advisable to discuss these in a general manner briefly in the following paragraphs in this Unit.

1.3.1 Industrial and Technological Disasters

In highly industrialised cities, industrial and technological accidents cannot be ruled out. Industrial development has led to concentration and localisation of industries in certain areas where attempts at regulating them are essential. These require strong legal framework with adequate institutional and implementation set-up.

Industrial disasters are caused due to malfunctions, failures, or unanticipated side effects of technological processes. Industrial hazards can occur at any stage in the production process comprising of extraction, processing, manufacture, transportation, storage, use, and disposal, like technical spills, radiation fallout, explosion and fires, structural failure and transportation mishaps may also bring these about.

Losses generally involve the release of damaging substances (e.g. chemicals, radioactivity, genetic materials) or damaging levels of energy from industrial facilities or equipment into surrounding environments. This usually occurs in the form of explosions, fires, spills, leaks, or wastes. Releases
may occur because of factors that are internal to the industrial system (e.g. engineering flaws) or they may occur because of external factors (e.g. extremes of nature). Releases may be sudden and intensive, as in a power-plant explosion, or gradual and extensive, as in the build-up of ozone-destroying chemicals in the stratosphere or the progressive leakage of improperly disposed toxic wastes.

All technological innovations have benefits but also certain amount of risks. A technological disaster is seen as a man made disaster because of failure of human being in one form or another. Threat of or actual impact of toxic chemical spills, radiation fallout explosions and fire, structural failure or transportation failure, aspects like toxic poisoning, radiation contamination, air degradation, industrial emissions, water pollution etc. Risk of accidents in various types of industries like manufacturing, power production, and in storage or transportation of various hazardous materials constitutes the hazard. These require developing counter measures to keep in check any type of casualty and have adequate safeguards to handle the associated risks.

The manufacturing, processing, transportation, distribution, storage and the application or use of the many products in the chemical or nuclear industries is hazardous and have multiple risks associated with them. Chemical disasters can be of the nature of fire, explosion, and toxic release or a combination of these. Such chemical emergencies can be clubbed under the following heads, so as to determine their emergency response procedures:

- Factories / Static Installation Emergencies;
- Transportation Emergencies;
- Environmental Emergencies;
- Pipeline Emergencies; and
- Distributed / Uncharted Emergencies.

An example of hazardous material disaster is Bhopal Gas Tragedy that occurred in December 1984. Approximately 2500 people died in this tragedy and thousands of people were directly or indirectly affected by this accident.

Another threat really being faced by disaster management is the threat from atomic and nuclear sources. This threat is really in the form of radiation of harmful rays. Problems like nuclear leaks are likely because of development programmes in this field. The possibility of global war may have receded over recent years but the possibility of nuclear weapons being used in some lesser form of conflict cannot be disregarded altogether. Even though a country is not directly involved in use of such nuclear activities or terrorism, it could well suffer severely from the radioactive side effects.

1.3.2 Fires

The occurrence of fire is heavily tilted towards urban conglomerations with high-rises and slums bunched into tight, flammable pockets, landfills with slow burning garbage, plastic discards and polythene bags, factories with inadequate fire protection. In the countryside, forest fires simmer unabated during hot summers ignited by locals clearing land, illegal loggers and poachers covering their track, or just carelessness. Fires are common phenomena usually happening during dry season, and could be grouped into various types like:

- Fire accidents in squatter settlements in the towns and cities.
- General fire accidents in cities.
- Industrial fire accidents.
- Coal Mine Fires.
- Forest fires.
Fires are not just physio-chemical phenomena but also related to social factors with varying frequency of fire incidents, loss pattern and extension techniques. The fire at Uphaar cinema hall in June 1997 was a great tragedy where everything that could have gone wrong did. In Asansol–Dhanbad-Jharia coal belts there is slow burn underground for decades in which thousands of tonnes of coal have burnt and much more to go as these old mines were abandoned without filling.

1.3.3 Environmental Disasters

Environmental degradation is a real threat to human lives and property in our country. One of the prices paid for development is some form of pollution. The environment degradation due to industrial effluents and civic waste could also be considered as man-made disaster. Environmental degradation is mostly borne by the poor who suffer from diseases, depletion of ground water, destruction of land and properties and other economical losses. The various causes for environmental problems are:

- Growth of population that increases demand on natural resources resulting in their unsustainable exploitation.
- Indifference of industries and municipalities towards environmental safety and protection aspects, leading to spread of unhealthy air, water and soil pollution.
- Increased energy consumption contributing to greenhouse gases.
- Low level of environmental awareness resulting in under-evaluation of economic and ecological aspects of bio-diversity causing extensive damage to life support systems.
- Inadequate environmental incorporated policies in development projects that do not consider long term ecological and social impact.

Many disasters are either caused or exacerbated by environmental degradation. The life of living creatures is governed by atmosphere, land and water and the natural resources directly related to environmental degradation are air, water, soil and forests. Deforestation leads to rapid rain run off, which contributes to flooding. The destruction of mangrove swamps decreases a coastline’s ability to resist tropical storm winds and storm surges. The creation of drought conditions– and the relative severity and length of time the drought lasts–is mainly a soil erosion and degradation phenomenon. Drought conditions may be exacerbated by: poor cropping patterns, overgrazing, stripping of topsoil, poor conservation techniques, depletion of both the surface and subsurface water supply, and, to an extent, unchecked urbanisation. Economic entitlements and ecological obligations should be mutually considered for lasting natural resource based economic progress. At micro-levels the causes of environmental hazards need to be identified.

1.3.4 Rail and Road Accidents

The disasters caused by various accidents are also a part of the enlarged scope of man-made disaster management. Various issues related to accident disaster are to be treated for each of these in a unique manner. The main issues in dealing with such disasters are:

- Fully effective systems are not in place due to procedural imbalances in terms of early warning, availability of appropriate equipment for rescue operations and inadequacy of coordination.
- There is no warning or very little indication of an impending disaster. There are a number of agencies that get involved in accidents relief and the coordination required between them has to be improved in order to save lives and to contain the damages.
- It has also been found that the time factor gets aggravated due to the procedures followed by certain departments and officials like accident casualties are not accepted by all hospitals and
this could cause a victim of an accident to lose life.

- Advance techniques available in the form of Satellite Aided Rescue systems could help in reducing the response time.
- Coordination between the various agencies / departments needs to be specially ensured.
- Non-availability of trained personnel reduces the efficiency at various levels.
- There is also a lack of proper motivation in the personnel involved in different activities. Invariably the tasks are unpleasant and are executed under a lot of stress and physical difficulties. Some incentives for good performance and at the same time punishment for omissions in the course of duty are to be considered.

i) Road accidents

Human road accidents are largely urban-centric while commercial road related accidents are predominantly highway nightmares. India has one per cent of the total number of vehicles in the world but records 6 per cent of the total road accidents in the world. The rate of road accidents on the Indian roads is increasing at an alarming rate of eight percent. Studies carried out indicate that out of the total accidents in a period of 25 years, the 23 Metro cities in India account for 57 per cent accidents. The road fatalities involving pedestrians and bicyclists are on the increase due to the spiralling increase in number of vehicles clogging the roads. Road accidents are caused by the negligence of the drivers, lack of proper road sense in the public and also by use of vehicles which are not fully road worthy.

ii) Rail accidents

Railway is the principal mode of transport for both passengers and goods in the country. The safety of railway operations is becoming all the more imperative in view of the railway endeavour to lift more passengers and freight traffic. Accordingly, high priority is being given to various safety measures to ensure greater safety in rail travel and transportation of goods. Factors contributing to occurrence of Rail Disasters are:

- Breaches of tanks due to heavy rains
- Cyclone/flash floods
- Human failures
- Equipment failures
- Heavy rains leading to washing away of the track / collapse of bridges
- Landslides
- Non-observance of section 131 of Motor Vehicle Act, 1988, by road users leading to unmanned railway level crossing accidents
- Sabotage
- Tampering with track

In areas prone to natural disasters, like cyclone and floods, Railways adopt measures to tackle problems. Weather warning is received through the meteorological department and is relayed. The track is patrolled on foot and the condition of track and bridges are observed and special watch is kept at vulnerable locations.

Bomb blasts or anonymous calls are dealt with the help of the concerned government, railway police/ state police who rush to the spot and conduct checks. The Accident Relief Train and Medical Relief Train are moved to the site.
Accidents at Unmanned Level Crossings occur mainly due to non-observance of safety precautions mentioned in section 131 of motor vehicle act - 1988 by the road users while crossing the unmanned railway crossing in the face of an approaching train.

1.3.5 **Air and Sea Accidents**

Transportation by air and sea is an increasing requirement in the world as the world gets interlinked. With increased traffic of aircrafts and ships, the possibility of accidents also becomes greater than before. These require stringent adherence to safety and security procedures along with a well-established international response network.

i) **Air accidents**

Air accident is an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked. Accident to aircraft can occur at any time and anywhere; however, majority of them occur during takeoffs and landings. These occur within the airport boundary or a short distance away. All airports should have contingency plans to deal with the accidents including the air safety guidelines issued by the Director General of Civil Aviation. An accident can occur at any phase of operation at ground, en-route and landing. The type of accident indicates the immediate circumstances under which the accident occurs, e.g. in air, where it may be a collision or engine tear away, a wheels-up accident during the take-off, or a nose-down type of accident.

The responsibility of aircraft accident investigation within the Indian territory and its territorial waters lies with the Air Safety Directorate of the Director General of Civil Aviation. For accidents beyond Indian territorial limits, the responsibility for carrying out the investigation rests with the State of Registry of the aircraft or the country where the accident occurs.

ii) **Sea accidents**

With increased volume of ships and sea fishing in recent times, boat capsising is a distinct possibility. The factors, which contribute to this disaster have been identified as partly due to natural hazards such as cyclones or floods and in greater measure, due to man made causes such as over loading of the boat, poor quality of equipment in the boat, poor maintenance and consequent breakdown and of course human error of judgment.

The areas prone to such type of accidents could be as fishing boats operating within 5 miles of coastline or near harbours and at high seas, fishing trawlers/crafts operating deep inside the sea. The factors, which will contribute towards causing sea accident, are as follows:

a) Natural conditions
b) Machinery breakdown.
c) Overloading of boat.
d) Poor quality of equipment used onboard.
e) Poor maintenance of machinery and life saving equipment.
f) Human error.

Search and Rescue Operations in waters surrounding the Indian Coast is the responsibility of the Indian Coast Guard. Indian Navy, however, under the Charter of Duties, ‘Aid to Civil Power’ and ‘Safety of Life at Sea’, has a Search and Rescue Plan. There is coordination between Coast Guard, Civil Aviation Department, Port Authorities, Mercantile Marine Department and Director General of Shipping as member of the Regional Contingency Committee and with naval commands and authorities, Indian Air Force, Police and Customs Organisations for supplementing naval
efforts at sea and for assistance over land in case of an aircraft in distress. On receiving the distress call, information is immediately communicated to the nearest naval authority who immediately passes the distress message to the appropriate naval authority for activation of assistance procedure. Normally a duty ship is detailed for search and rescue duties.

Oil spill related disaster with damage to the oil tanker/facilities occur due to natural calamities, tanker collision off the coast, defect or malfunctioning of oil extension pipe line, possibility of oil tankers running aground along the coast, discharge of the bilge water mostly containing oil, danger of oil spillage when the oil is being transferred from the offshore terminal to the ship and from the ship to shore facilities in various ports.

1.3.6 Complex Disasters

Situations entirely due to human element, such as, famines; wars that may be conventional, guerrilla, etc.; unrest or riots having political undertone; and terrorism are complex disasters. Apart from technological disasters, human-made disasters many times involve situations in which civilian population suffer casualties, loss of property, basic services and means of livelihood as a result of war, civil strife, other conflict or policy implementation. In many cases people are forced to leave their homes, giving rise to congregations of refugees or externally or internally displaced persons.

The trend towards growing urbanisation, in the midst of high-density areas with poorly built and maintained infrastructure, subjects the inhabitants to greater risks in the event of a disaster. The chaotic growth of massive urban conglomerations makes them ill equipped to deal with exponential population accumulations. The failure of urban local bodies and other institutional set-ups expose these areas not only to epidemics, fires, gas leaks and accidents, but also in the context of increasing unemployment and social tensions turn them into ethnic and communal tinderboxes.

Another type, where the situations become worse for want of rational policies or lackadaisical enforcement, is commonly observed and could be referred as policy disasters. These result from sale of harmful drugs, banned pesticides, excessive displacement of people due to development projects, systemic failure in civic services, exploitive trade and business practices, dumping of hazardous and dangerous waste products, etc.

War and civil strife are also regarded as man-made disasters, that is, extreme events that produce disasters. These often result in displaced people, a major cause of human suffering in the world. The impacts of war and civil strife include competition for scarce resources, religious or ethnic intolerance, and ideological differences.

1.4 RESPONSE TO MAN-MADE DISASTERS

There is very little scope for forecasts or warnings in case of man-made disasters, which makes advance preparedness difficult. For example, accidents like fires, boat and road accidents, railway accidents, air crash cannot be predicted, and only after they occur they can be attended to and managed. Thus, these disasters invariably belong to the categories in which no prior warning could be issued to support preparations for managing the disasters.

Each type of these disasters are dealt separately as each has its own peculiarities and do not lend themselves to be treated alike. However, some of the issues of concern are:

i) Resource mobilisation is essential. Good communication of the specific requirement of each type of accident is considered essential for being able to respond at the earliest to any of the accidents. This also calls for a greater coordination not only within the department directly concerned with the accident but also with the help of other supporting departments/ agencies to deal effectively with the experiences of accidents occurred in the past.
ii) The time taken to respond to the victims of a disaster is a factor of paramount importance. This time taken to respond is appropriately known as ‘Golden Hour’, that provides opportunities to undertake timely rescue and relief operations, often, this opportunity is lost due to the cumbersome rules and regulations.

iii) The details of the support systems that are available both in terms of technical and organisational nature must be known. These could be technical support like satellite aided search and rescue system and the rules relating to policies in every disaster. The factors that contribute to the occurrence of accidents, the areas where each of the accidents take place frequently, the approaches followed, resources for tackling the events along with constantly improving the system must be planned.

iv) Most of the accidents that occur are due to human error. In most of the cases and in a few cases it is due to malfunctioning of both men and machine, which are again due to lack of proper maintenance and monitoring by the persons responsible. Therefore, awareness and implementation of the safety, and preventive measures, importance accorded to maintenance at the individual level and observation of the codes for safety at the organisational level are to be ensured.

v) The checks and balances instituted by government agencies for the purpose of monitoring the adherence of codes for safety must be strictly implemented.

**Specific Risk Reduction and Preparedness Measures**

Apart from the above mentioned items of general response, it is essential to institute specific risk reduction and preparedness measures as an inescapable part of response to man-made disasters. Such measures will be specific to the particular hazard(s) at that site. But we have to remember that the resultant impact of a man-made disaster depends both on the type of hazard and the vulnerability of the people and property, that is, likely to be impacted. Therefore, the preparedness measures have to be (a) source-specific, i.e., the source of hazard whether gas leak or radioactive emission or accident prone site, and (b) target specific, i.e., the vulnerability of the site, property and people. In other words, the preparedness plans should be made, publicised and practiced both for on-site and off-site emergencies likely to result from a potential disaster source.

**Typical Post-Disaster Needs**

As already mentioned, there is no forecast or warning in most cases of man-made disasters and disaster management caters to post-disaster scenario. This requires a realistic appreciation of typical post-disaster needs, which are as listed below:

a) Evacuation;
b) Medical attention to survivors and arrangement for water and food;
c) Search and Rescue;
d) Clean-up;
e) Identification, legal action and disposal of dead;
f) Remedial action;
g) Rehabilitation and Reconstruction; and
h) Monitoring environment effects – both short-term and long-term.

**1.5 CONCLUSION**

A disaster not only impedes progress but also sometimes disrupts the entire life stream and causes deaths and/or injuries, along with damage to property. The heterogeneity of human induced causes
indicates the variety of non-conventional disasters raising complex issues of responding to man-made disasters. Such disasters, though localised, tend to occur frequently and often with great intensity. Promoting measures that ensure safety from such hazards are challenges to technology and management. This introductory Unit has listed man-made disasters, briefly described them, discussed their adverse effects and typical post-disaster needs. The general concerns confronting the management of man-made disasters have also been brought out.

1.6 KEY CONCEPTS

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<th>Concept</th>
<th>Description</th>
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<tr>
<td>Man-made hazard</td>
<td>It derives from technological processes, human interactions with environments, or relationships within and between communities.</td>
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<tr>
<td>Population displacements</td>
<td>These are usually associated with crisis-induced mass migration in which large number of people are forced to leave their homes to seek alternative means of survival and habitation. Such mass migrations normally result from the effects of conflict, severe food shortages or collapse of economic support systems.</td>
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<tr>
<td>Technological disasters</td>
<td>Situations in which large number of people, property, infrastructure, or economic activity are directly and adversely affected by major industrial accidents, severe pollution incidents, nuclear accidents, air crashes, major fires or explosions.</td>
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1.7 REFERENCES AND FURTHER READING


1.8 ACTIVITIES

1) Prepare a list of significant causes of man-made disasters. Please explain any three with the help of examples.

2) Enlist the impacts of man-made disasters, and discuss the important issues concerning disaster management.