

Block

# 1

## **INTRODUCTION TO DISASTER MANAGEMENT**

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**Hazard, Risk, Vulnerability and Capacity Analysis** **5**

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**Types of Disaster-I (Hydro-meteorological Disasters and Geo-hazards)** **21**

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# COURSE INTRODUCTION

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In this course on 'Disaster Management' there are four blocks.

**Block 1** deals with "Introduction to Disaster Management". In this block we discuss about the meaning of hazard, risk, vulnerability and capacity with respect to disaster management. We also explain the various types of disasters, viz. hydro-meteorological disasters, geo-hazards and other human made disasters. Finally the block focuses on the institutional mechanism for disaster management.

**Block 2** is on "Mitigation and Preparedness". In this block we discuss the concepts of community-based disaster management and early warning. The block also explains in detail the structural and non-structural mitigation measures and the gender issues in Disaster Management.

**Block 3** deals with "Emergency Response in Disaster Management". In this block we discuss about the processes of managing relief, the overall disaster health care management system in India and the role of the Incident Command System in disaster situations.

**Block 4** is on "Recovery and Reconstruction in Disaster Management". This block brings in a systematic learning about the process of disaster assessment and its relevance in the recovery and rehabilitation process. In this block, we also discuss the process of disaster recovery planning, analyze the linkages between physical recovery and development and provide an overview of disaster psycho-social care in India.

This course will give you a comprehensive understanding of the vulnerabilities and risks associated with disasters and the various ways to handle disaster situations.

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# BLOCK INTRODUCTION

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Welcome to block 1 of the course entitled ‘Disaster Management’. This block on “Introduction to Disaster Management” is the first block of MSWE-003. It is comprised of four units.

**Unit 1** on ‘Hazards, Risk, Vulnerability and Capacity Analysis’, explains the meaning of hazard, risk, vulnerability and capacity with respect to disaster management. The unit describes the relationship between hazard, vulnerability, risk and capacity and discusses the various models of Disaster Management.

**Unit 2** is on ‘Types of disaster-I (hydro-meteorological disasters and geo-hazards)’. This unit focuses on definition of disasters and different types of disasters, viz. water and climate related disasters, geological disasters, biological disasters, chemical/ industrial/ nuclear disasters, accident related disasters etc.

**Unit 3** on ‘Types of Disaster-II (Other Including Human Made)’ examines the implications of man-made disasters viz. chemical, biological, nuclear and other human induced disasters. The various threat perceptions of human induced disasters and the preparedness, mitigation measures and response strategy for combating such man-made disasters have been discussed in detail.

The **last unit** on ‘Institutional Mechanism for Disaster Management’ focuses on the administrative process of dealing with disasters in our country and the organizations operating at various levels. This unit discusses the evolution of the Disaster Management system in India since Independence, describes the new initiatives with respect to the global developments, and identifies the organizations for managing disasters at the national, state and district levels.

On the whole, this block provides you an overview of the various concepts related to disaster management.

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# UNIT 1 HAZARD, RISK, VULNERABILITY AND CAPACITY ANALYSIS

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## Structure

- 1.0 Objectives
- 1.1 Introduction
- 1.2 Terminology
- 1.3 Disaster Crunch Model
- 1.4 Disaster Pressure and Release Model
- 1.5 Hazard Assessment
- 1.6 Vulnerability and Capacity Assessment (VCA)
- 1.7 Risk Assessment
- 1.8 Let Us Sum Up
- 1.9 Further Readings and References

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## 1.0 OBJECTIVES

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India, with its vast territory, large population and unique geo-climatic conditions, has experienced many extreme hazardous events that have turned into disasters in the last few decades. Floods, droughts, cyclones, earthquakes and landslides are recurrent phenomena in the country. Susceptibility to such extreme natural events is compounded by frequent occurrences of human made disasters such as fire, epidemics, stampedes, chemical leakages etc. This Unit aims at providing you with a comprehensive understanding of terminology and concepts used in the management of disasters and their relationship with each other. You will also learn about the linkage of the process of disaster management with developmental planning. After reading this Unit, you should be able to:

- explain the meaning of hazard, risk, vulnerability and capacity with respect to disaster management;
- describe the relationship between hazard, vulnerability, risk and capacity;
- discuss various models of Disaster Management; and,
- illustrate the tools used in hazard, vulnerability, risk and capacity analysis.

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## 1.1 INTRODUCTION

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We live in a world where there are sources of potential harm or situations with a potential to cause loss all around us. We could be living close to a coastline that is prone to cyclones, tsunami or the mountainous regions vulnerable to earthquakes. On the other hand, we maybe living close to an industry which could be dangerous or there maybe communal tension prevailing in the area. Disasters have been mankind's constant companion since time immemorial. They strike unabated and leave a profound trail of deaths, injuries, damage to infrastructure and development and causing immense trauma to the affected community.

As far as India goes, about 60% of the landmass is prone to earthquakes of various intensities; over 40 million hectares is prone to floods; about 8% of the total area

is prone to cyclones and 68% of the area is susceptible to drought (BMTPC, 2006). In the decade 1990-2000, an average of about 4344 people lost their lives and about 30 million people are affected by disasters every year (World Disaster Report, 2004). As examples, the Orissa super cyclone in 1999 killed thousands and destroyed more than one million hectares of crops. The Gujarat earthquake in 2001 and Kashmir earthquake in 2005 claimed thousands of lives, left millions of people homeless and ruined public infrastructure worth hundreds of millions of dollars. Another major event that shook the Nation was the occurrence of Tsunami in 2004, which badly affected many coastal Indian states. Floods, droughts, cyclones and earthquakes are a recurrent phenomenon all across the globe. Susceptibility to disasters is compounded by frequent occurrences of manmade disasters such as fire, epidemics etc. Even though significant achievements have been made to reduce the loss of life resulting from natural hazards, their impacts remain considerable. Statistics published by the International Disaster Database (EM-DAT) (<http://www.em-dat.net>) and the International Federation of the Red Cross and Red Crescent Societies (IFRC) in the *World Disasters Report* (IFRC, 2002; 2003; 2004) reveal that the number of people killed during disasters is still high and that the number of people affected and associated economic losses have increased substantially since the 1970s. The geophysical setting along with unplanned and inadequate developmental activity is a cause for increased losses during disasters. In the case of India, the contribution of over-population to high population density has added to the cause resulting in escalating losses.

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## **1.2 TERMINOLOGY**

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This section will explain the meaning of the following terms used in disaster management.

- 1) Hazard
- 2) Vulnerability
- 3) Capacity
- 4) Risk

### **Hazard**

Hazards are defined as physical phenomena that pose a threat to the people, structures or economic assets and which may cause a disaster. Generally speaking, there are two types of hazards, namely:

- Natural - These are hazards caused by nature such as floods, droughts, earthquake cyclones, tsunami, landslides etc
- Human made - These are hazards that are caused by human beings either deliberately or by accident such as industrial and chemical accident, road and railway accidents, aviation disasters, fire, building collapse, communal violence, bomb blasts etc.

More and more, the distinction between natural and human made hazards is becoming harder to delineate. Some hazards are natural in nature but are exacerbated due to human activities such as flooding and drought. These can be caused due to deforestation, unplanned development, improper drainage system etc. For example, flooding may be increased through landfill, drainage or groundwater extraction; storm surge may be worsened by the destruction of mangroves.

However, the High Powered Committee on Disaster management that was constituted in August 1999 under the Chairmanship of Shri J.C. Pant identified

five major groups of hazards in its final report. This exhaustive classification of over thirty hazards is as follows:

**Group 1: Water and Climate related Hazards**

- 1) Floods and Drainage Management
- 2) Cyclones
- 3) Tornadoes and Hurricanes
- 4) Hailstorm
- 5) Cloud Burst
- 6) Heat Wave and Cold Wave
- 7) Snow Avalanches
- 8) Droughts
- 9) Sea Erosion
- 10) Thunder and Lightning

**Group II: Geologically related Hazards**

- 1) Landslides and Mudflows
- 2) Earthquakes
- 3) Dam Failures/Dam Bursts
- 4) Mine Fires

**Group III: Chemical, Industrial and Nuclear Hazards**

- 1) Chemical and Industrial Disasters
- 2) Nuclear Disasters

**Group IV: Accident related Hazards**

- 1) Forest Fires
- 2) Urban Fires
- 3) Mine Flooding
- 4) Oil Spill
- 5) Major Building Collapse
- 6) Serial Bomb Blasts
- 7) Festival related disasters
- 8) Electrical Disasters and Fires
- 9) Air, Road and Rail Accidents
- 10) Boat Capsizing
- 11) Village Fires

**Group V: Biologically related Hazards**

- 1) Biological Disasters and Epidemics

- 2) Pest Attacks
- 3) Cattle Epidemics
- 4) Food Poisoning

### **Vulnerability**

It is the extent to which a community, structure, service or geographic area is likely to be damaged or disrupted by the impact of a particular hazard on account of its nature, construction, and proximity to hazardous terrain or a disaster prone area. It is the likely extent of damage due to a hazard.

In the face of a particular hazard, it is important to determine how each hazard interacts with each and every dimension of vulnerability. Therefore, a study of vulnerability is a study of what might happen to people or communities and while it is not certain that a crisis might occur; it definitely affects different populations in a different manner. Vulnerability represents the interface between exposure of any physical threats to human well-being and the capacity of people and communities to cope with those threats. Threats may arise from a combination of social and physical processes. Human vulnerability thus integrates many environmental concerns and may undermine the entire sustainable development process in developing countries.

#### **Bhopal Gas Tragedy**

If we look at the vulnerability of that incident, the people living in the vicinity of the factory were poor. They lacked education about the kind of hazard the factory posed to their lives. They did not have the skills or training to know how to cope with a gas leak. There was a high density of population and urbanization around the factory. The location was dangerous and the infrastructure was fragile in terms of maintenance and it led to a technological accident killing over 2000 people and another 700,000, who continue to be affected even today. So one can see how vulnerability can lead to a disaster of grave consequences.

The extent to which a population is affected by a calamity does not purely lie in the physical components of vulnerability, but is contextual also to the prevailing social and economic conditions and its consequential effect on human activities within a given society. Research in areas affected by earthquakes indicates that single parent families, women, handicapped people, children, aged and poor people are particularly vulnerable social groups. For example: coastal communities are more likely to experience cyclone induced flooding than communities in other parts. However, amongst the same coastal communities, some families have strong houses that can withstand the impact of floods better or are aware of upcoming floods so they can relocate temporarily. Others, after having their houses destroyed by floods, may be able to rebuild more quickly because of their savings, innovations, family or other external support but, the poorest tend to live in the most exposed places, have the weakest houses, and have least assets to rebuild and therefore, are likely to be the most vulnerable. It captures people's inadequate options or ability to protect them against possible damage or recover from the consequences of natural phenomena without outside help.

Vulnerability can be of varied types like:

- 1) **Physical vulnerability:** Depending on physical location of people and elements at risk and technical capacity of buildings, structures, and infrastructure. It varies according to construction techniques, materials used and location.



- 2) **Economic vulnerability:** Poor people are considered to be more vulnerable as their houses are built of weak material and in dangerous areas. They do not have the essential safety nets to recover as the affluent population. Their loose the essential tools and equipments of their livelihood as well.
- 3) **Social Vulnerability:** Some sections of the population are more vulnerable than the others like women, children, elderly, physically and mentally challenged and those dependent on critical facilities.
- 4) **Other types of vulnerability:** Some other types of vulnerability have also been identified like Environmental vulnerability, Cultural vulnerability, Educational vulnerability, Attitudinal vulnerability and Political vulnerability.

## Disaster

As per the Disaster Management Act, 2004 disaster is defined as a catastrophe, mishap, calamity or a grave occurrence in any area arising out of natural or man made causes, or by accident or negligence, which results in substantial loss of life and human suffering or damage to, or destruction of, or degradation of environment, and is of such a nature, or magnitude as to be beyond, the coping capacity of the affected community of the affected area. The term Disaster Management is a collective term referring to all aspects of planning and responding to disasters, including both pre and post disaster activities. It may refer to the management of both the risks and consequences of disasters.

When a hazard is not managed properly, it turns into a disaster. So, while hazards can be considered natural, disasters are generally human made. Earthquakes, cyclones, etc are all natural hazards and we can prevent them from becoming disasters.

## Relationship between hazard, vulnerability and disaster

A disaster happens when a hazard impacts on a vulnerable population and causes damage, casualties and disruption. An earthquake in an uninhabited desert cannot be considered a disaster, no matter how strong the intensity might be. An earthquake is disastrous when it affects people, infrastructure and activities.

- *hazard × vulnerability = disaster*

When extent of hazard and vulnerability is low, the resulting disaster will also be of small magnitude.

- *HAZARD × vulnerability = disaster*

When extent of hazard is high but vulnerability is low then the disaster will be of small magnitude.

- *Hazard × VULNERABILITY = disaster*

When vulnerability is high but extent of hazard is small then the resulting disaster will also be of small magnitude.

- *HAZARD × VULNERABILITY = DISASTER*

When extent of hazard is very high and the vulnerability is also high then it will result in a huge disaster.

## Capacity

Vulnerability is one side of a coin; the other side representing the resources people have to resist, cope with, or recover from a hazard, or “capacities”. Vulnerability is about “not having” while capacities are about “having”. Capacity is knowledge, skills, resources, abilities and strength, present in individuals, households and the

communities, which enable them to prevent, prepare for, stand against, survive and recover from a disaster.

People's capacities are also highlighted by what are known as "coping strategies". These are responses linked to capacities (or resources) which, in the face of a hazard determine how vulnerable or resilient an individual or household becomes.

Some examples of capacity are:

- Permanent houses
- Adequate food and income sources
- Fire stations
- Developed health infrastructure,
- Good Community Networks for support
- Local knowledge
- Strong community leadership and organizations

$$\text{Capacity} = 1/\text{Vulnerability}$$

### **Risk**

Risks have always been part of daily life for humans. However, both the level of acceptance and the perception of risk vary from one individual to another. Perception also varies between regions, societies and cultures and therefore, there is no universally valid definition of risk. Risk is the expected damage or loss due to the combination of vulnerability and hazards. People are considered at 'risk' when they are unable to cope with a hazard. A disaster occurs when a significant number of vulnerable people experience a hazard and suffer from severe damage and/or disruption of their livelihood system in such a way that recovery is unlikely without external assistance.

Risk is the *probability* of harmful consequences or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interaction between natural or human-induced hazards and vulnerable conditions (HPC Report, 2001).

As far as disaster risk is concerned, it refers to the probability of the occurrence of a disaster. It is a subject to the extent of hazard, vulnerability and capacity. In relation to disasters, Kotze and Holloway (1996) define risk as the expected losses (lives lost, persons injured, damage to property and disruption of economic activity or livelihood) caused by a particular phenomena.

Risk is a function of hazard occurrence and the projected losses. A societal element is said to be 'at risk' or vulnerable when it is exposed to hazards and is likely to be adversely affected by the impact of those hazards if and when they occur, especially in situations of limited capacity.

It can be best explained by

$$\text{Disaster Risk} = \frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity}}$$

The relationship between these four components, indicate that each of the three variables that define risk - the hazard, the elements exposed and their vulnerability - are of equal value. Reducing any one or more of the three contributing variables will lessen the risk to a community. In reality, however, there is little opportunity to reduce the hazard component, therefore, only the vulnerability and the elements

at risk will vary. When hazard and vulnerability are high, it will cause disaster but when capacity is present, it will decrease the impact. Hence, to reduce the risk of a disaster,

- 1) Decrease the vulnerability of the community; and
- 2) Increase the capacity of the community.

**Check Your Progress I**

**Note:** Use the space provided for your answer

- 1) List the major natural hazards affecting your region and describe in what way these hazards can affect your city/region/country?

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- 2) What are the various types of vulnerability?

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- 3) Describe the relationship between hazard, risk, vulnerability and capacity.

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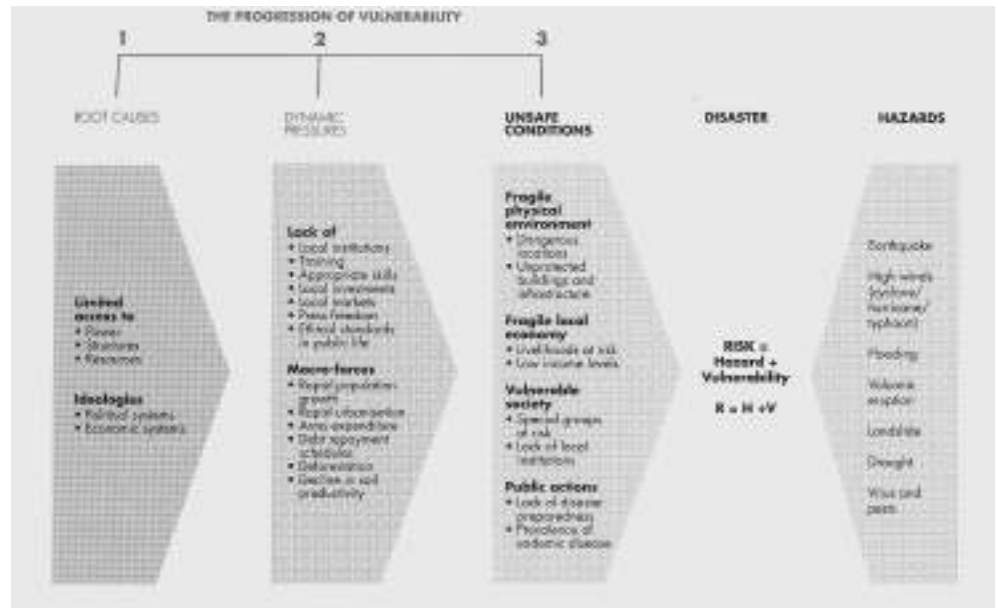
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**1.3 DISASTER CRUNCH MODEL**

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The “Disaster Crunch Model” (Blaikie et al, 1994) is a pressure and release model which shows that vulnerability (pressure) which is rooted in socio-economic and political processes has to be addressed (released) for disaster risk reduction. The progression of vulnerability helps us in understanding the complexity of vulnerability, especially its underlying conditions and root causes that may be quite remote from the disaster itself.

The model proceeds from the assumption that a disaster happens when, a hazard affects a vulnerable community. A natural phenomena by itself is not a disaster. Similarly, a population may be vulnerable to a disaster for many years, yet without a trigger event, there is no disaster. A disaster happens when these two come together.



A hazard is the *'trigger event'* which causes a disaster. It could be an earthquake, landslide, floods, communal violence etc. The *'unsafe conditions'* are the vulnerable context where people and property are exposed to the risk of disaster. Vulnerable physical environment and unstable economy are some of the factors influencing these conditions.

The *'dynamic pressures'* within the society are the immediate causes of 'Unsafe Conditions'. They are the processes and activities that have translated the effects of root causes into unsafe conditions. They answer the question of how unsafe or dangerous conditions have arisen.

Beneath the dynamic pressure are the *'underlying causes'* which make the community and structure to be unsafe and vulnerable. They are the basic fundamentals or ideologies on which society is built. Vulnerability develops from a progression of underlying conditions to dynamic pressures and finally creating unsafe conditions. The underlying causes answer the question as to why the unsafe conditions persist. The fundamental causes of disaster risk have to be addressed so that the disaster does not repeat itself.

## 1.4 DISASTER PRESSURE AND RELEASE MODEL

Disaster Crunch Model helps us to understand how vulnerability is built up whereas the Disaster Release Model helps us to understand how the risk of disaster can be reduced.

The first stage is to examine the disaster event itself. Natural phenomena cannot be prevented but their risk of getting out of control and causing damage and loss of life can be reduced. Measures can be undertaken to modify or reduce the hazards. For example, to reduce the risk of river flooding, protective dikes or bunds can be built and the system of river control can be linked to flood warning systems. If 'unsafe conditions' are to be turned into 'safe conditions', then it is necessary to adopt activities, which will lessen the 'dynamic pressures'. For Example, Mitigation measure for an earthquake prone area can include providing incentives to encourage

the community to strengthen their homes, to vacate particularly dangerous house locations or to build new houses in a safe manner to resist local hazards.

The next step is to reduce pressures that directly or indirectly contribute to the growth of vulnerability. For an earthquake prone area, the basic developmental activities can be undertaken to significantly reduce lives lost or damage to property for future disasters.

**Introduction of disaster preparedness plans:**

- Building or strengthening of local institutions.
- Education of local builders and masons
- Initiation of income generating activities

**Check Your Progress II**

**Note:** Use the space provided for your answer.

1) Explain 'Disaster Crunch Model'.

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2) What are the 'unsafe conditions' and 'dynamic pressures' operating in your area?

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3) Explain 'Disaster Release Model'.

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**1.5 HAZARD ASSESSMENT**

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A hazard is measured and defined by its nature (type of hazard), location and extent, scope and intensity (damage potential) and its probability of occurrence, duration and frequency (repetition cycles). Hazard analysis refers to prioritizing disasters based on its frequency and analysis of the estimated losses. This can be carried out by taking the help of elderly people of the village. The community can

analyze the losses that they had incurred during various disasters and learn the best practices carried out. This is an important activity as it forms the basis for preparedness and mitigation plans.

The community can be asked to *review and analyze* the occurrence of past disasters and hazards. Group discussions along with the elderly population, teachers and children can be held focusing on the disasters and hazards faced by the community for the past one year to past fifteen years, kind and nature of disasters and hazards faced, experience in the last hazard faced, warning issued, damage caused, response to the disaster, relief and rehabilitation process, traditional methods of coping of the community, gaps in management of the hazard, lessons learnt. It can be useful in understanding the nature, intensity and behavior of the past disasters and hazards. The elderly population can share vital information and experience about the past while the presence of children in the *group discussion* can ensure that the experience is passed on to the next generation.

The community can identify both natural as well as human made hazards to which there area is prone to. Natural hazards may include floods, drought, earthquake, cyclone, sandstorm, cloudburst etc. Human made hazards for the community may include industrial and chemical accidents, road and railway accidents, fire, epidemic, building collapse, communal/caste violence etc.

***Tools for Hazard Analysis***

Some of the tools that can be used for hazard analysis are as follows:

- 1) ***Hazard Mapping:*** It is a visual representation of the village by the community. It is a rough spatial overview and sketch of the area and specific locations, which are vulnerable to various hazards. The main feature of hazard mapping is to facilitate discussion on issues pertinent to hazards. It is made by men and women, who know the area and are willing to share their experiences on large sheets.
- 2) ***Historical Profile or Timeline:*** This tool is used to gather information about what happened in the past. It helps in getting an insight in past hazards, changes in their nature, intensity and behaviour. It helps to understand the present situation in the community and establish the link between hazards and vulnerabilities. The community may also become aware of the changes that have taken place over the past through historical profile or timeline.
- 3) ***Seasonal Calendar:*** It involves making a calendar showing different events primarily the time of occurrence of hazards throughout the annual cycle. It helps to identify the periods of stress and prepare for the specific stress in normal times before the threat of hazard looms large on the community. The facilitator can arrange sessions for the community members focusing on the issue.

<b>Hazard</b>	<b>J</b>	<b>F</b>	<b>M</b>	<b>A</b>	<b>M</b>	<b>J</b>	<b>J</b>	<b>A</b>	<b>S</b>	<b>O</b>	<b>N</b>	<b>D</b>
Flood												
Drought												
Epidemic												
Any Other												

- 4) ***Hazard Matrix:*** This tool aims at gathering comprehensive information about the past hazards. It helps in having an insight about the future hazards on the basis of gaps and lacunae in the management of past hazards and disasters.

Hazard	Intensity	Early Warning Given or not	Warning sign	Speed of onset	Frequency	Time	Duration	Impact
Flood								
Earthquake								
Drought								
Industrial Hazard								
Epidemic								
Any Other								

## 1.6 VULNERABILITY AND CAPACITY ASSESSMENT (VCA)

VCA is very crucial for disaster preparedness and mitigation measures as it gives an insight about the means people employ to cope, and this is the firmest basis on which we can build appropriate and cost-effective actions for preparedness and mitigation. Finally, and very importantly, the process of a VCA, if properly conducted, confers advantages to vulnerable people in terms of raising public awareness, sensitizes a community and empowers them by giving the community knowledge of risks and capacities. A vulnerability and capacity assessment should be an ongoing process which must address risk and those long term factors which make people more vulnerable to a hazard. It can be carried out at “pre-disaster” stage as a technique of disaster preparedness and made an integral element in the wider process of risk assessment.

The process of vulnerability assessment would involve asking the community two major questions namely;

- 1) Who is vulnerable?
- 2) What is vulnerable?

The community would be asked to identify the more vulnerable population, identify the location of women, (pregnant, lactating, widows, single), children, old aged, physically challenged, mentally challenged, those dependent on life support systems and medicines, poor people living by the sea or kutcha houses, livestock and cattle etc. The community would also be asked to identify the vulnerable infrastructure like buildings, low lying areas, areas near the water bodies such as the sea and river and direction of wind, livelihood assets such as boats and nets, documents, weak structures, drinking water resources, communication lines, roads, telephone lines etc.

### *Tools for Vulnerability Assessment*

The various tools for vulnerability analysis are as follows:

- 1) **Transect Walk:** The process involves taking a systematic Walk with key informants through the community to explore spatial differences, land use zones by observing, asking, listening, informal interviews and producing a transect diagram.
- 2) **Problem Tree:** The tool involves drawing a tree which shows relationship between different aspects of vulnerability. It involves identifying major problems and vulnerabilities as well as root causes and their effects. The trunk

represents the problems, the root depict the causes while the leaves signify the effects.

- 3) **Livelihood Analysis:** The tool focuses on the studying the vulnerability of the livelihood of the community to various disasters. The tool analyzes the various livelihood activities that are spread over the year and the impact of hazards on the livelihood activities. It also focuses on understanding livelihood strategies, behaviour, decisions and perceptions of risk, capacities and vulnerabilities from different socio-economic background.
- 4) **Vulnerability Assessment:** The vulnerability assessment would focus on the vulnerable community and the vulnerable infrastructure. It assesses and maps the more vulnerable population and the assets of the community.

<b>More Vulnerable Population</b>	<b>Vulnerable Infrastructure</b>
<ul style="list-style-type: none"> <li>● Women</li> <li>● Elderly</li> <li>● Children</li> <li>● Physically handicapped</li> <li>● Mentally challenged</li> <li>● Dependent on life support systems, medicines</li> <li>● Poor people living by the sea, kutcha houses etc.</li> </ul>	<ul style="list-style-type: none"> <li>● Kutcha houses</li> <li>● Low lying areas</li> <li>● Livelihood assets such as boats, nets,etc</li> <li>● Documents,</li> <li>● Houses and weak structure</li> <li>● Crops and horticulture</li> <li>● Drinking water resources</li> <li>● Communication lines, road, telephone lines</li> </ul>

Capacity Assessment focuses on identifying locally available assets and resources that can be utilized for building the capacities of the community during and after disasters. The local community has a lot of inbuilt strength and capacity for handling the disasters. It is important to capture the capacity and strength of the community in resource analysis. Apart from infrastructure and funds, it could be individuals with specific skills, local institutions and people’s knowledge as all these have the capacity to create awareness and bring about changes in the community. Capacity Assessment, is therefore, not limited to a map depicting the available resources but also plotting of the distribution, access and its use by taking into consideration prevailing sensitiveness within the community .Thus assessment of resources would involve two components:

- 1) Human Resource Assessment
- 2) Material Resource Assessment

The process would involve identifying safe houses and buildings for shelter, strong buildings, elevated uplands and structures, safe evacuation routes, health, medical and sanitation facilities, swimmers, doctors, nurses, sources of funds to carry out preparedness activities, volunteers for task force etc

***Tool for Capacity Assessment***

One of the tools that can be used for capacity assessment is as follows:

- 1) **Social and Institutional Analysis:** The tool focuses on identifying various government, non-government and private organizations working in the field of disaster management in the local as well as neighbouring area. Various other aspects can also be studied such as the role played by the institutions,



their area of interest, their importance in the management of disasters, capabilities of such institutions and the perceptions people have about them.

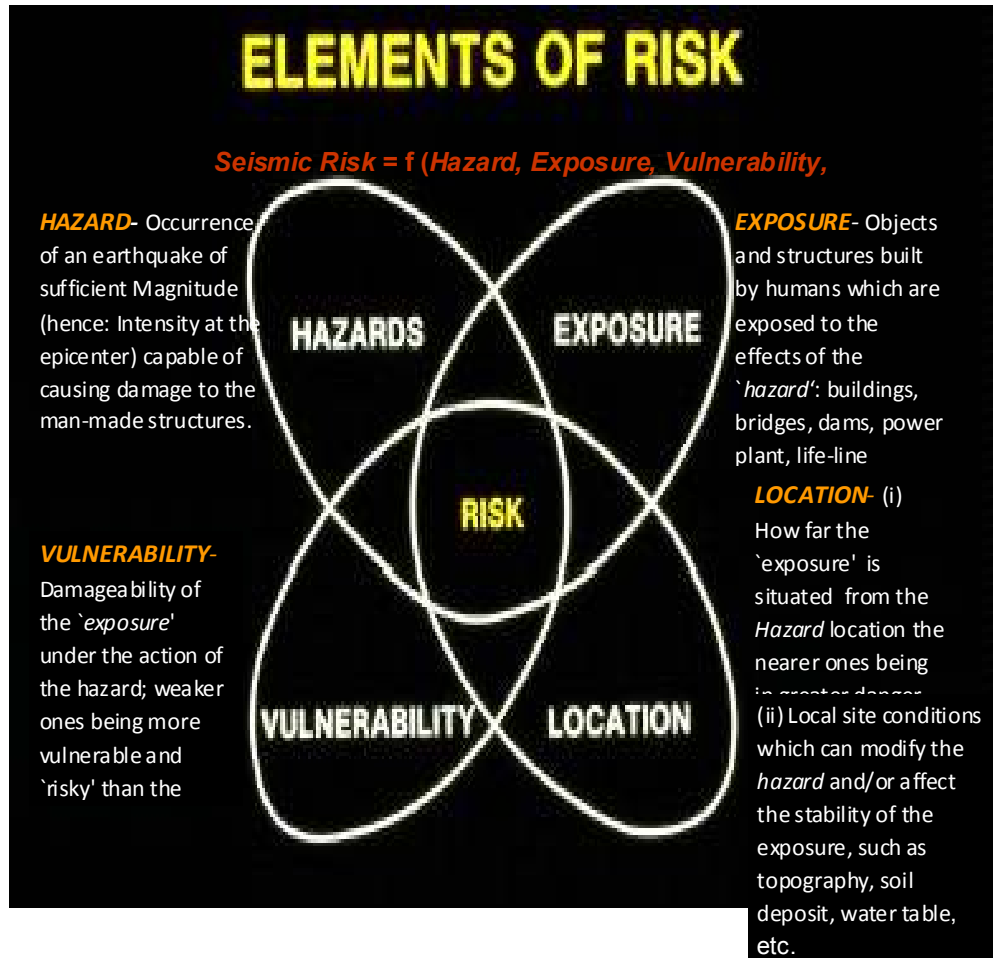
List of Organizations	Ranking	Scope	Interest	Capability
Government				
Non-Government				
Private				

## **1.7 RISK ASSESSMENT**

Risk assessment is necessary so as to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend. A risk assessment provides the factual basis for activities proposed in any strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. Risk assessment is a necessary first step for any serious consideration of disaster reduction strategies. Its relevance for planning and development of disaster risk reduction strategies was explicitly addressed during the International Decade for Natural Disaster Reduction.

**Risk Identification:** This includes activities like hazard data collection and mapping to determine the frequency, magnitude and location of any hazard event; vulnerability assessment of the populations and the assets exposed and risk assessment to determine the probability of expected losses.

**Risk Reduction/Mitigation:** Consists of measures taken to reduce the physical, social and environmental vulnerability and have been achieved through a number of ongoing schemes on resource conservation and management like Integrated Wasteland Development Program (IWDP), Drought Prone Area Program (DPP), Flood Control Programs, National A-forestation and Eco Development Program (NA and ED), Accelerated Rural Water Supply Program (ARWSP), Crop Insurance, and Mahatma Gandhi National Rural Employment Guarantee Yojana (MGNREGY) etc. Mitigation measures may include structural and non-structural measures like construction of cyclone/temporary shelters; plantation of mangroves and coastal forests along the coast line as these fall under the non-structural mitigation measures; construction of location specific sea walls and coral reefs in consultation



with experts; development of break waters along the coast to provide necessary cushion against cyclone and tsunami hazards; development of tsunami, cyclone detection, forecasting and warning dissemination centers etc.

**Risk Transfer:** Policies that govern the relief expenditure are based on the recommendations of successive financial commissions. The Calamity Relief Fund (CRF) and the National Calamity Contingency Fund (NCCF) were two main sources for meeting the relief expenses. Added to these are funds from international or multilateral donor agencies like World Bank, USAID and International and National/Local NGOs for relief and rehabilitation measures apart from government policies on risk insurance and micro-finance and micro-credit schemes.

**Early Warning and Forecasting:** There are two distinct types of tsunami warning system - the International tsunami warning systems, and Regional warning systems to detect hazards like cyclones and tsunamis and to issue warning to reduce the loss of life and property.

### **Tool for Risk Assessment**

One of the tools that can be used for risk analysis is as follows:

- 1) **Risk Analysis:** The tool is based on determining the risk by analyzing the vulnerabilities and capacities of the community related to each hazard. On the basis of analysis the risk is determined for a particular hazard in a ranking order. While conducting the risk assessment one should keep the following points in mind:
  - Determine the risk by ranking
  - Ask the community about the hazard which poses the highest risk.
  - Explore the reasons due to which a particular hazard poses the risk.

**Check Your Progress III**

**Note:** Use the space provided for your answer

1) Explain various tools that can be used for hazard analysis.

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2) How will you assess the vulnerability of your area?

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3) Which tool will you use to analyze the risk of your area?

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**1.8 LET US SUM UP**

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India, with its vast territory, large population and unique geo-climatic conditions, has experienced many extreme hazardous events that have turned into disasters in the last few decades. While hazards are defined as physical phenomena that pose a threat to the people, structures or economic assets which may cause a disaster, vulnerability is referred to as the extent to which a community, structure, service or geographic area is likely to be damaged or disrupted by the impact of a particular hazard on account of its nature, construction, and proximity to hazardous terrain or a disaster prone area. When a hazard is not managed properly, it turns into a disaster. So, while hazards can be considered natural, disasters are generally human made. Earthquakes, cyclones, etc are all natural hazards and we can prevent them from becoming disasters. Capacity is knowledge, skills, resources, abilities and strength, present in individuals, households and the communities, which enable them to prevent, prepare for, stand against, survive and recover from a disaster. Risk refers to the probability of the occurrence of a disaster. Risk to any disaster can be reduced by decreasing the vulnerability of the community and increasing

the capacity of the community. There are varied tools for carrying out hazard, risk, vulnerability and capacity assessment. Hazard analysis can be done through hazard mapping, historical profile, seasonal calendar and developing a hazard matrix for review of past disasters. Vulnerability assessment can be done by taking a transect walk, making a problem tree, conducting a livelihood analysis, and making an assessment about who and what is vulnerable in the community. Social and Institutional analysis is one of the tools for capacity assessment while risk can be determined by ranking the various hazards according to their risk on the basis of vulnerability and capacity assessment.

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# UNIT 2 TYPES OF DISASTER-I (HYDRO-METEOROLOGICAL DISASTERS AND GEO-HAZARDS)

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## Structure

- 2.0 Objectives
- 2.1 Introduction
- 2.2 Perspectives on Disasters
- 2.3 Types of Disasters
- 2.4 Let Us Sum Up
- 2.5 Further Readings and References

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## 2.0 OBJECTIVES

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This unit focuses on definition of Disasters and different types of Disasters. By the end of this unit, you should be able to:

- define Disasters;
- describe perspectives on Disaster; and
- describe different types of Disasters.

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## 2.1 INTRODUCTION

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The English term ‘disaster’ traces its origin to the French word ‘Deseastre’ a combination of two words ‘des’ meaning evil and ‘astre’ meaning ‘star’ or ‘evil-star’. There is no clear and universally accepted definition of a disaster. United Nations Disaster Relief Organization UNDR0 (1984) defines disaster as:

“An event, concentrated in time and space, in which a community undergoes severe danger and incurs such losses to its members and physical apparatuses that the social structure is disrupted and the fulfillment of all or some of the essential functions of the society are prevented”. Modern Dictionary of Natural Disasters (2005) defines disaster as:

- 1) A situation resulting from an environmental phenomenon or armed conflict that produces stress, personal injury, physical damage, and economic disruption of great magnitude.
- 2) The occurrence of widespread, severe damage, injury, or loss of life or property, with which the community cannot cope, and during which the affected society undergoes severe disruption.
- 3) A hazardous event which affects a community in such an adverse way that essential social structures and functions are disrupted.
- 4) The result of vast ecological breakdown in the relations between man and his environment, a serious and sudden event (or slow, as in drought) on such a scale that the stricken community need extraordinary efforts to cope with it, often with outside help or international aid.

There is no clear and universally accepted definition of when an accident becomes disaster and the distinction between an accident and a disaster is subjective. Most of the definitions however describe a disaster in following context:

- 1) Large number of deaths or serious injuries occurring more or less simultaneously for which there is no one obvious human agent.
- 2) Considerable loss of life, livelihood, hardship, resources crunch, property damage and adverse impact on health such as spread of disease or epidemics.
- 3) Severe disruption of normal life pattern.
- 4) Considerable disruption of community resources and needs such as shelter, food, clothing, medical assistance.
- 5) Disruption and damage to infrastructure such as buildings, communications and other essential services.

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## **2.2 PERSPECTIVES ON DISASTERS**

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Although there is no single universally acceptable definition of a disaster, however the broadly disasters have been described along following lines:

### **The magnitude of the Damage Produced by the Event**

Human losses, number of injured persons, material and economic losses and the harm produced to the environment are often considered in order to define a disaster. For some like Dombrowsky (1998) the number of 25 deceased has to be exceeded; for others like Sheehan (1969) this figure has to be higher, more than 100 deceased and more than 100 injured or losses worth more than one million US dollars; or even higher Tobin (1997) an event leading to 500 deaths or 10 million US dollars in damages. According to Wright (1997) experience shows that when an event affects more than 120 persons, except for cases of war, non-routine interventions and coordination between different organizations are needed something which is already pointing out another important characteristic of a disaster. For German insurance for example damages greater than one million marks or more than 1000 deceased are needed, these figures are obviously given in order to limit responsibilities of insurance policies. To define a disaster by the magnitude of the damage caused however has many inconveniences. First, it may be difficult to evaluate the damages, especially in the initial stages. Second, such definitions are of no use for comparative studies in different countries or social situations and are affected by inflation, Dynes (1998). Third, disasters have a different impact in different environments: an earthquake of intensity may cause fright in Japan but may be a catastrophe in case of India or any other developing country.

### **Exceptional External Agent**

Disasters are often considered as events from the physical environment which are harmful for human beings and are caused by forces which are unfamiliar to them, in other words what has been described as 'acts of God' or 'Divine punishment'. Disasters are normally unforeseen and catch the populations and administrations affected off-guard. However, there are disasters that repeat themselves, for example in areas affected by flooding and others which are persistent, as in many forms of terrorism. In these cases a culture of adaptation and resignation to disasters develop.

Disasters are normally considered as events that occur 'by chance' and therefore unavoidable.

## **The Nature of the Agent**

Human-made disasters are normally distinguished from those which are consequences of inclemency of nature. Among the first sort, some are not intended, i.e., they are the consequences of human error. In this case, the responsibility is considered to be institutional, and compensations from insurance companies or governments are granted.

There are also human-made disasters that are the consequences of clear intention, as in the case of conventional war. In these cases, individuals are able to start up more or less legitimate or efficient coping or defense mechanisms to confront the aggression.

On other occasions, violence is due to terrorist attacks, assaults by rapists or similar events. This is an anonymous violence whose goal is to cause harm to whomever, something that prevents the people affected from developing any kind of defence. This kind of violence may affect any person, in any place of the world, at any time.

In disasters produced by the inclemency of nature, the kind of disaster normally determines the way the pain is perceived and the quantum of guilt. Some more foreseeable, as for example in hurricane areas, volcano eruptions or floodings, and others are not so foreseeable, as in some earthquakes or massive fires.

## **Threat to the Social System**

Definitions of disasters based on the idea of an exceptional agent are not fully satisfying. In fact, when reviewing them, other elements appear which are related to social conditions. The flooding of an uninhabited non-cultivable plain with no ecological value is not a disaster, human presence is needed. United Nations Coordinating Committee for Disasters (UNDRCO, 1984) stipulates that a disaster, seen from a sociological point of view, is an event located in time and space, producing conditions under which the continuity of the structures and of the social processes becomes problematic. The American College of Emergency Medicine (ACEM, 1985) points out that a disaster is a massive and speedy disproportion between hostile elements of any kind and the available survival resources. The same appears in a definition by the World Health Organization (WHO, 1991): 'A disaster is a severe psychological and psycho-social disruption that largely exceeds the ability to cope of the affected community'.

In summary, disasters are events affecting a social group which produce such material and human losses that the resources of the community are overwhelmed and, therefore, the usual social mechanisms to cope with emergencies are insufficient.

Therefore, three levels of disasters have been described: Level I (a localized event with few victims; with local health resources available, adequate to screen and treat; and with transportation means available for further diagnosis and treatment); Level II (there are a lot of victims and resources are not enough; help coming from various organisms at a regional level is needed– the definition varies according to the size and kind of territorial organization of the country); Level III ( the harm is massive; local and regional resources available are insufficient; and the deficiencies are so significant that national or international help is needed).

Disasters induce huge social mobilizations and solidarity (Blocket, et al. 1991). Sometimes a great part of this help is counter-productive, creating the so-called social problems of the 'second disaster', when excessive and unorganized help arrives causing a slowdown in recovery and interfering with the long-term evolution.

Several things are needed in order to produce a disaster: an extraordinary event capable of destroying material goods, of causing the death of persons or of

producing injuries and suffering (Cohen, 1999), or an event in the face of which the community lacks adequate social resources to react (Anderson, 1968). This leads to the need for intervention and external support, to a personal sensation of helplessness and threat, to tensions between social systems and individuals (Schulber, 1974), and to a deterioration of the links that unite the population and that generate the sense of belonging to the community (Erikson, 1976).

### **Social Vulnerability**

Disasters do not only affect social functioning; they are also the consequence of a certain social vulnerability hardly perceived until they occur. They reveal previous failures.

Vulnerability decreases with the degree of development of civilization, which in essence precisely aims to protect human beings from the negative consequences of their behavior and from the forces unleashed by nature (Gilbert, 1958).

This social vulnerability is present even in the pathological reactions to disasters. Among the risk factors for post-traumatic stress disorders mostly identified are women, children, elderly, and those belonging to lower socio-economic stratum.

### **Scapegoating in Disasters**

Disasters are a great opportunity to appoint scapegoats; efforts to lay the burden of guilt on a person or groups are constant. According to Allinson (1993), "Whenever a single cause for any event is sought in the human realm, it is thus very natural for one to look for who, as a singular agent, is responsible. If the event in question is a disaster, then the first inclination is to look for whose fault it is. Once blame can be assigned, the existence of the disaster will have been explained. Finding the guilty party or parties solves the disaster 'problem'. Of course it does not. What it does do, however, is to create the appearance of a solution, and this appearance of a solution cannot assist".

### **A Disaster Unmasks False Myths**

A disaster is an empirical falsification of human action, the proof of the incorrectness of human being's conceptions on nature and culture (Sheeshan, 1969). Not only structures and social functioning are affected; many mental schemes also break down. All of a sudden the loss of sense of invulnerability becomes obvious (Lifton, 1979).

Disasters are often considered as events from the physical environment which are harmful for human beings and are caused by forces which are unfamiliar.

### **Hazards, Disasters and Catastrophe**

A hazard, or natural hazard, is any natural process that poses a threat to human life or property. The event itself is not a hazard; rather, a process becomes a hazard when it threatens human interests.

A disaster, or natural disaster, is the effect of a hazard on society, usually as an event that occurs over a limited time span in a defined geographic area. The term disaster is used when the interaction between humans and a natural process results in significant property damage, injuries, or loss of life.

A catastrophe is a massive disaster requiring significant expenditure of time and money for recovery.



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## 2.3 TYPES OF DISASTERS

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A disaster as mentioned earlier is natural because any disaster event by definition requires interaction either with man, his built environment, or both. It is possible, and is often the case, that human actions exacerbate the effect of these natural processes, such as increased flooding after the destruction of wetlands, or landslides on slopes where anchor vegetation has been removed. This section identifies the most common of these.

### Types of Hazards

- **Natural Hazards** – Natural processes or phenomena occurring in the biosphere that may constitute a damaging event. Hazardous events can vary in magnitude or intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing. Natural hazards can be classified into Geological hazards, Hydro-meteorological hazards and Biological hazards
- **Technological Hazards** – Danger originating from technological or industrial accidents, dangerous procedures, infrastructure failures or certain human activities, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

**Some examples:** industrial pollution, nuclear activities and radioactivity, toxic wastes, dam failures; transport, industrial or technological accidents (explosions, fires, spills).

According to the High Powered Committee, appointed by Government of India in 1999 at the behest of the Prime Minister to look into the issue of Disaster Management Planning at National, State and District levels, various types of hazards prevailing in India can be classified into the following groups:

- **Water and Climate Related Disasters** – Floods, Droughts, Cyclones, Tornadoes, Hurricanes, Cloud burst, Snow Avalanches, Heat & Cold Waves
- **Geological Disasters** – Earthquakes, Landslides, Mudflows, Sea Erosion, Dam Bursts & Dam Failures.
- **Biological Disasters** – Biological Disasters, Epidemics, Cattle Epidemics
- **Chemical/Industrial/ Nuclear Disasters** – Chemical and Industrial Disasters, Forest Fires, Oil Spill Fires, Mine Fires and Mine Flooding, Nuclear Disasters
- **Accident Related Disasters** – Road, Rail and other Transportation accidents including Waterways (Boat Capsizing), Major Building Collapse, Serial Bomb Blasts, Festival related Disasters

The natural hazards/disaster can be further classified as:

- **Hydro-meteorological Hazards** – Natural processes or phenomena of atmospheric, hydrological or oceanographic nature, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hydro meteorological hazards include: floods, debris and mud floods; tropical cyclones, storm surges, thunder/hailstorms, rain and wind storms, blizzards and other severe storms; drought, desertification, wild land fires, temperature extremes, sand or dust storms; permafrost and snow or ice avalanches.
- **Geological Hazards** – Geological hazard includes internal earth processes or tectonic origin, such as earthquakes, geological fault activity, tsunamis, volcanic activity and emissions as well as external processes such as mass movements,

landslides, rockslides, rock falls or avalanches, surfaces collapses, expansive soils and debris or mud flows.

(*Source:* Annual Disaster Statistical Review 2008 The Numbers and Trends, Centre for Research on Epidemiology of Disasters).

<b>Natural Disasters</b>			
<b>Geophysical</b>	<b>Hydrological Hydro-meteorological</b>	<b>Meteorological</b>	<b>Biological</b>
<b>Earthquake*</b>	<b>Avalanches*</b>	<b>Storm</b>	<b>Epidemic</b>
Landslides* Debris Flow*	Floods* Desertification* Tsunamis*	<ul style="list-style-type: none"> <li>● Tropical*</li> <li>● Cyclone</li> <li>● Local Storm</li> <li>● Tornadoes*</li> <li>● Hailstorms*</li> <li>● Ice storms*</li> <li>● Monsoons*</li> </ul>	<ul style="list-style-type: none"> <li>● Viral infections</li> <li>● Bacterial infections etc.</li> </ul>
			<b>Climatologically</b>
			<b>Extreme Temperature</b> <ul style="list-style-type: none"> <li>● Heat wave</li> <li>● Cold wave</li> <li>● Extreme winter condition</li> <li>● Drought*</li> <li>● Wildfire</li> <li>● Forest Fire</li> <li>● Land Fire</li> </ul>
* Disasters used in this publication			

**Tsunamis**

A series of waves generated by an undersea disturbance such as an earthquake, pronounced as ‘soo-nah-mee’, the word is Japanese in origin represented by two characters ‘*tsu*’ meaning harbor and ‘*nami*’ meaning waves. Tsunamis are often incorrectly referred to as tidal waves. There are many events that result in the generation of a tsunami, but earthquakes are the most usual. Other forces that generate the great waves include landslides, volcanic eruptions, explosions etc. Tsunamis are generated when a large area of water is displaced, either by a shift in the sea floor following an earthquake, or by the introduction of mass from other events. Waves are formed and the displaced water mass attempts to regain its equilibrium. It is important to note that not all earthquakes generate tsunamis; to do so, earthquakes must occur underneath or near the ocean, be large in magnitude, and create movements in the sea floor. While all oceanic regions of the world can experience tsunamis, the countries lying in the Pacific Rim region face a much greater frequency of large, destructive tsunamis because of the presence of numerous large earthquakes in the seismically active ‘ring of fire’.

The waves that are generated travel outward in all directions from the area of the disturbance. The time between wave crests can range from as little as 5 minutes to as much as 90 minutes, and the wave speed in the open ocean averages a staggering

450 miles per hour. Wave heights of more than 100 feet have been recorded. In the open ocean, tsunamis are virtually undetectable to most ships in their path. As the waves approach the shallow coastal waters, they appear normal but their speed decreases significantly. The compression of the resulting from the decrease in ocean depth causes the wave to grow higher and crash onto land -often resulting in great destruction, injuries and death.

Strange phenomenon that precede a tsunami, such as the ocean receding for hundreds of feet, exposing the ocean floor, have resulted in death of those who ventured out to explore, only to be drowned by the water's sudden return. Most deaths, during a tsunami result from drowning. Other risks associated with the tsunami hazard include flooding, polluted water supplies, destruction of crops, business interruption, loss of infrastructure (roads, electrical lines etc) tend to be the most dangerous, because they can reach a nearby shore in less than 10 minutes. Even with the advent of tsunami warning systems, that is too short a time for local authorities to issue a warning.

### **Earthquakes**

An earthquake is a violent shaking of the earth's crust due to breaking and shifting of rocks beneath its surface. Earthquakes are considered to be one of the most dangerous and destructive natural hazards. It is difficult to make a prediction about the exact location and time of occurrence as well as its magnitude. A very large number of earthquakes occur every year but only a limited number of them are centered near populated areas or are having sufficient strength to cause damage to built environment.

About 60% of total land area of India is prone to seismic activity of varying intensities. Most of the vulnerable areas are generally located in Himalayan and sub-Himalayan regions, and in Andaman and Nicobar Islands. India has a long history of earthquakes occurrence. Several great earthquakes having magnitude more than 8.0 on Richter scale have taken place here.

An earthquake hazard zoning map has been standardized by the special committee of experts constituted by the Bureau of Indian Standards. According to this map entire country has been divided into four seismic zones based on seismic intensity, V, IV, III, and II. Zone V have an area of 12% and this area can face an earthquake of intensity IX or more. Similarly, Zone IV, III and II have an area of 18%, 29% and 41%; these areas can face an earthquake of Intensity of VIII, VII and VI respectively.

Earthquakes cause a variety of impact on the crust of earth. Various hazards associated with an earthquake are:

- i) **Ground shaking** - caused due to the arrival of different types of waves at a location.
- ii) **Fault rupture** - differential movement of a fracture results in heavy damage of the structures located over it.
- iii) **Soil liquefaction** - a process by which water saturated sediments temporarily losses strength and start acting like a liquid. Under certain geological/soil conditions liquefaction may take place during an earthquake causing damage to structures in that area.
- iv) **Landslides**
- v) **Post earthquake fires**
- vi) **Tsunamis**

Due to various hazards associated with an earthquake, number of impacts observed include building collapse, rupture of pipelines and other utilities, and, floods from dam failure. However, the nature of damage during an earthquake depends on various factors:

- Earthquakes parameters like magnitude, intensity, duration and ground acceleration. Higher value of these parameters results in higher resultant damage.
- Local site conditions play a critical role in determining the damage pattern due to an earthquake. For example, the hilly terrains are more at risk due to topography which may lead to after-effect like landslides, road blockage, damming of rivers flows and damage to dams etc.
- Construction Practices followed in an area are very important parameter in determining the level of risk due to an earthquake.
- Other factors like density of population, time of occurrences, community preparedness play very important role in reducing the resultant damages due to an earthquake.

### **Earthquake Risk Mitigation Strategy**

It is well established that it is poorly built structures, not earthquakes that kill people. It is also a well known fact that most earthquake related deaths, and most of the financial losses, are due to the structural collapse of houses and other buildings. The impact of earthquake on a structure is greatly influenced by the building material used, shape of the building and techniques employed for construction. In general houses built with mud, adobe, burnt brick and stone are poor against seismic forces.

The proactive measures for earthquake risk reduction may be earthquake safe construction, proper land use planning and community preparedness through awareness generation. The only way is through earthquake resistant design and construction of buildings as per the guidelines/codes available for this purpose. Bureau of Indian Standards has formulated nine standards for designing quake resistant buildings. Standards have also been laid for repairing, strengthening and improving old buildings of low strength masonry. These codes must be used for constructed all new buildings/structures, while existing ones should be retrofitted to acquire appropriate strength to resist the seismic forces.

High-risk areas like soft soils or land fills sites must be avoided to reduce the impact of an earthquake. Such sites attract more seismic forces in comparison to a site on hilly terrain to overcome this problem microzonation of cities must be made available to all concerned.

Community is the first responder to any emergency situation in wake of any disaster like earthquake. Community involvement in preparedness programmes is the key to mitigating the impact of an earthquake. A properly trained society performs better during situations arising due to severe earthquake. For achieving the desired results community action plans must be prepared to mitigate the problems associated with earthquake hazards.

### **Landslides**

India has a vast hilly terrain spread in north, north east and southern parts of the country. Majority of Indian mountain systems are relatively young, in geological sense, making their rock structure highly fragile. Combined with other natural phenomenon like rainfall, earthquakes etc., these terrains are highly prone to landslides, posing a great challenge to environment, human lives, settlements and infrastructure in the hilly terrains of the country. Landslide is defined as a process

involving the downward and outward movement of a part of the slope forming material, composed of mainly natural rock, soil, artificial fill or combination of these, due to the action of gravity. The term landslide defines many other types of similar processes and phenomenon like rock falls, mud or debris flows etc. under the influence of gravity.

Landslides affect at least 15 per cent of the land area of India. In all, 23 States and the Union Territories of India are affected by landslides hazard, mostly during the monsoon season. The regional variation in the incidences of landslides at national level can be seen in the following table. A landslide hazard map has been standardized, which indicates the hazard prone areas of the country. (Figure 3.1).

<b>Region</b>	<b>Incidences of Landslides</b>
Himalayas	High to very High
North eastern Region	High
Western Ghats and Nilgiris	Moderate to High
Kerala, Eastern Ghats and Vindhya	Low

Various causes of landslide occurrence can be classified into the following categories:

- Natural physical processes like earthquakes, volcanoes, heavy rainfall etc.
- Poor ground conditions like deposition of weak material, presence of geological features like joints, fissures etc.
- Morphological causes like weakening of rock due to weathering, removal of vegetative cover due to deforestation, forest fire etc., loading on the crest of the slope. Some of these causes are aggravated due to human action over the slopes like mining, excavation, irrigation, etc. for developmental gains.

**Landslide Risk Mitigation Strategy:**

- The landslides are causing considerable damage to human settlements throughout the world. The impact not only results in damage to housing but also wipe out infrastructure like roads, highways and railways, electricity transmission lines, water supply, hydro power plants, water supplies source, forests, dams etc. Temporary damming due to landslides results in the flooding of large upstream areas and in case of dam failure; it causes flash flooding leading to huge devastation in downstream areas. The major impact of the landslides in terms of degradation due to loss of trees, fertile covers etc.
- To carryout the risk mitigation work, a team of cross-sectoral and interdisciplinary professionals which include geologists, engineers, architects, physical planners, public/community, disaster managers, policy and decision makers have to play a proactive role. ***The mitigation and management strategy must have a combination of features like:***

Early Warning for Landslides needs to develop on most disaster prone areas. Early warning systems elsewhere in the world have been developed by the real-time monitoring of landslides. This includes the continuous real time monitoring of various parameters including mass movements. The data so collected is transmitted through a telemetric system at regular time intervals. At the initiation of an event, radio signals are transmitted and alarm signals are sent to the relevant authority regarding the impending danger and probable time of occurrence of a landslide.

Based on the forecasts, early warning messages to evacuate the community may be initiated.

Structural measures are those measures which include physical construction to reduce or avoid possible impact of hazards. These measures include engineering solutions, such as

- Drainage control measures through provisions of surface and sub-surface drains.
- Retaining and reinforcement structures.
- Deflection spurs at the toe to avoid erosion from the rivers.
- Landslide treatment methods like shotcreting, grouting, netting, wire-meshes and sealing of cracks / fissures on the hills.
- Adopt remedial techniques like buttresses, shear keys, sub-drains, soil reinforcement, retaining walls, etc.
- Construction of retaining walls.

Non-Structural Measures are all such measures where efforts are made to mitigate the impact of landslides without construction of disaster resistant features. Methods may include:

- Hazard mapping and proper land use planning - landslide hazard maps will identify the critical areas ultimately leading to avoidance of critical zones where settlements could not be developed. Such areas preferably used for permanent vegetation only.
- Surface drainage control works will lead to minimizing the seepage of water during heavy rains, which will ultimately lead to restrict the movement of landslide.
- Reforestation of the areas will help in restricting landslides through binding the top soil and restricting erosion and run-off.
- Monitoring of landslide prone areas for impending disasters and forewarning the people of possible landslide problems.
- Construction of engineering structures like retaining walls, piling, bolting of rocks, putting nets arrest the landslides etc.
- Community participation and creation of public awareness about the sustainable development and landslide mitigation techniques etc. through the involvement of the local administration and non-government organizations.
- Forestation of landslide prone areas using appropriate species of plants can help in solving the problem up to certain extent.
- Education and awareness generation among the masses residing in areas prone to landslides

### **Drought**

Drought is temporary reduction in water or moisture availability significantly below the normal or expected amount for a specific period. This condition occurs either due to inadequacy of rainfall or lack of irrigation facilities. Droughts are faced by most of countries. In India, about 68 percent of total sown area of the country is drought prone. Western and southern parts are highly prone to droughts with small impact in the northern and central parts. Drought like situations keep on occurring in the states of Bihar, Gujarat, Haryana, Jammu and Kashmir, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal,

Jharkhand and Chhattisgarh. Figure 2.1 shows the drought prone areas of the country.

### Types of Droughts

Drought can be classified into following three major categories:

- **Meteorological Drought** - It is a situation where there is reduction in rainfall for a specific period (days, months, season or year) below a specific amount (long term average for a specific time). It is the least severe form and occurs as a result of any relatively unexpected shortfall of precipitation.
- **Hydrological Drought** - It is a situation which reflects a reduction in water resources (stream flow, lake level, ground water, underground aquifers) below a specified level for a given period of time. It occurs as a result of marked reduction in natural stream flow or groundwater levels, plus the depletion of water stored in surface reservoirs and lakes for water supply purposes.
- **Agricultural Drought** - An agricultural drought occurs when soil moisture is insufficient to maintain average crop growth and yields. Agricultural droughts result due to the imbalance between soil moisture and evapotranspiration needs of a crop for a fairly long period, causing damage to the standing crops and reduction in crop yield.

### Causes for Drought:

Three drought types discussed above are completely different from one another. There are several causes due to which drought can occur. Some of the main causes are, :

- *Monsoon variations* - failure or erratic behaviour of monsoon can cause considerable amount of pressure; such situations may create drought like situations



Fig. 2.1: Drought Prone Areas of the Country

- *Overexploitation of surface and ground water* - inadequate water conservation measures may result in situations where water availability reduced considerably during summers, which may lead to drought like situations
- *Changing agricultural practices* may also lead to drought like situations. When cropping patterns change from low to moderate water demand crops to high demand crops, water consumption increases to grow the crops exerting pressure on existing meager irrigation facilities and other available resources of water supply.
- *Over exploitation and mismanagement or poor management of water resources* for residential and irrigational purpose may lead to such situations.

### **Impacts of Drought:**

Drought cause considerable amount of problem in the affected regions. The impacts of droughts can be classified into following categories:

- **Environmental Impact:** Under this category problems associated due to scarcity of water supply for drinking, irrigations and other uses pose tremendous discomfort not only to the society but also on the forest and aqua-culture habitat.
- **Economic Impact** - Drought pose tremendous economic impact on the affected society in terms of loss of livelihoods / employment opportunities, Increased prices of Food / Fodder, falling of current agricultural and non-agricultural wages and loss from diary / fishery / other livestock production
- **Social Impact** - drought put tremendous pressure on the social fabric of the society in terms of Migration of people in search of alternative livelihood results in break up of communities and families, Loss of Human Life (heat stress / suicides / starvation deaths / unhygienic conditions in the working areas), Distress sale of assets (movable and non-movable), Increased inequity among social groups, Increased conflicts - water user's conflicts, political conflicts and other social conflicts. It creates Negative impacts on nutritional status, Increased mental and physical stress (*e.g. anxiety, depression, loss of security, domestic violence etc.*) and morbidity. It increases crime rate.
- Inability of certain group within the population to afford increased food prices results in switch to cheaper and sometimes less preferred foods / reduction in overall food intake etc.
- Loss of education due to reduction in school attendance by children lacking energy and / or money for fees, and increase in child labour.

### **Drought Management Practices**

Conditions like drought are not new in the country. The concerted efforts to mitigate and manage the recurring drought situations, can be dated back to 1878 A.D, when the first Famine Commission was appointed and on the basis of its suggestions Famine Codes were formulated in 1883. These famine codes provide the guidelines for managing the droughts.

Effective disaster management entails an in-depth analysis of the vulnerability in all its ramifications. Vulnerability to a particular hazard should be seen as a measure of risk combined with the level of social and economic ability to cope with the disaster to resist major disruption or loss. Thus greater attention needs to be given to the marginal segment of society like the poor, women and senior citizens. Thus vulnerability to any hazard should be considered in tandem with the existing social and economic conditions of the people for a clearer direction to future policy and planning.



The strategy for this management is three fold as follows:

- Close monitoring of emerging drought scenario so as to develop an advance warning system.
- Relief measures required for providing immediate succour to affected population and the upkeep of cattle wealth. If possible, to integrate it with long term objectives.
- Coming with an alternative crop strategy for maximum possible retrieval of Kharif crop and a better ensuing Rabi crop.

**Warning and Dissemination** - Weather-Watch-Group in Ministry of Agriculture meets every week to take stock of the rainfall progress, its effect on the crops from sowing to harvesting during Kharif season. Weekly inputs from Indian Metrological Department (IMD) give an early warning about the impending drought. States are accordingly informed as and when symptoms of drought are known.

### **Improved water management Practices**

Various different measures for combating drought include:

- Judicious use of water for irrigation and other purposes.
- Adopting rain water harvesting methods utilizing traditional and conventional techniques.
- Recharging water table through the use of infiltration tanks, check dams, injection wells etc.

**Adopting Alternative Crop Strategy** - The water availability in 47 major reservoirs in the country is checked at the commencement of most critical period in January/February. If the IMD also predicts less rainfall, alternative crop strategy is implemented in different states by providing extra power, getting seeds for alternative crops and fertilizers. The farmers are informed before hand and advised for alternative crop. Seeds and fertilizers are given on subsidized rates. This helps in possible retrieval of Kharif crop and a better ensuing Rabi crop, if rains came in later half.

**Employment Generation Programmes** - Generation of additional employment through labour intensive works, like desilting dried ponds, and constructing tanks for rain water harvesting. The projects, which can be taken up on short notice, should be kept ready by District Administration before the monsoons each year. Various Central and State government schemes targeting development work are used for getting useful employment to the affected community. A paradigm of relief-cum-development would be more appropriate.

**Health and Public Health Measures** - People should be accustomed to live on rational water. This should be taught in schools. However nutritional requirement of all children, expectant nursing mothers should be taken care of. Disinfect drinking water sources to prevent spread of water borne diseases and plans to cope up with likely epidemic. Immunization and surveillance of public health measures be taken.

**Cattle Care** - Cattle are most affected during droughts. It may not be possible to supply fodder or take medical care of cattle, however cattle camps on village basis can be opened to take complete care of cattle population. Some other measures are:

- Assessment of fodder requirement on district basis in affected area and import fodder from outside.
- Monitor prices of fodder in selected market places.

- State Forest Department to arrange for cutting and bailing of grasses in the forest.
- Fodder cultivation to be encouraged.
- Ensure supply for molasses to cattle feed plants.

With modern methods of cultivation and continued good monsoons, the droughts are now becoming rare. However, we must be prepared to face them and hence the need to understand them.

### **Desertification**

It is a creeping hazard that can be caused by natural processes, human or animal pressures or as a secondary hazard associated with drought. The world's great deserts came into being long before man and have grown and shrunk according to natural long-term climatic changes affecting rainfall and groundwater patterns. However, since the appearance of man, desert growth has changed significantly, and has become a major concern for many of the world's governments and non-governmental organizations focused upon environmental health and development.

Poor land management is the primary cause of anthropomorphic desertification. Increased population and livestock pressure on marginal lands accelerate the process. In some affected areas, nomads trying to escape the desertified land from less arid regions exacerbate the problem by placing excessive pressures on land that cannot handle it. The process of desertification is not one that is easily predictable, nor can it be mapped along expected patterns or boundaries. Areas of desert land can grow and advance in erratic spurts and can occur great distances from natural, known deserts. Often, a geographic area suffering from desertification is widely recognized only after significant damage has occurred. It is still unknown if global-change patterns associated with desertification are permanent, nor are the processes required to stop or reverse desertification well understood.

Droughts are a cause of desertification, but not all droughts automatically result in the creation of desert conditions. In fact, well-managed lands can recover from drought with little effort when rains return.

### **Debris flows**

These hazards also referred to as mudflows or mudslides, are less common than landslides but often much more destructive. Debris flows are dependent upon the introduction of great amounts of water from prolonged rainfall, flash flooding, or very rapid snowmelt. The lubrication provided by the liquid content of the debris allows for much faster descent down the affected slope and, likewise, greater overall distances traveled from the source of the flow.

### **Avalanches**

Avalanches, or snow slides, are movements of debris composed of snow, ice earth, rock and any other material that is picked up as they progress down the affected slopes. An avalanche occurs when the gravitational stress pulling downward on the snow exceeds the ability of the snow cover to resist it. Four factors are required for an avalanche to occur:

- A steep slope
- Snow cover
- A weak layer in the snow cover
- A trigger

Common triggers are heavy alternating periods of snowfall, rain, and melting or an external increase in pressure (such as skiers, animals or explosions). About 90% of all avalanches start on slopes of 30-45 degrees. Failures on slopes of less than 20 degrees rarely occur; on slopes above 60 degrees, the snow rarely accumulates to critical mass. It is estimated that over 1 million avalanches occur each year worldwide. They typically follow the same paths year after year, leaving scarring along their course. Trained experts thus can easily identify, with a high degree of accuracy, areas that are prone to this hazard. However unusual weather conditions can produce new paths or cause avalanches to extend beyond their normal paths, and identifying these risk areas takes greater expertise and speculation.

### **Meteorological Hazards**

Meteorological Hazards are related to atmospheric weather patterns or conditions. These hazards are generally caused by factors related to precipitation, temperature, wind speed, humidity, or other more complex factors. As all the world's people are subject to the erratic nature of weather, there exists no place on Earth that is truly safe from the effects of at least one or more forms of meteorological hazard. The greatest range of natural hazard types falls under this general category.

### **Monsoons**

These are seasonal winds that exist throughout the world, and reverse in direction at predictable intervals each year. They are often associated with heavy rainfall when they cross over warm ocean waters before heading to cooler landmasses. As the wind blows over the warm water, the upward convection of air draws moisture from the ocean surface. When it passes over the cooler landmass, the moisture condenses and is deposited in heavy rainfalls that can last for weeks or months.

Monsoons are most marked and most intimately associated with the Indian subcontinent, which truly depends upon the annual cycle of winds for relief from the long, dry winter months. Without the monsoons, the agriculture and much other basic life process would be impossible. The monsoons in this region have two distinct seasons: a dry season that runs from September to March, blowing from the north-east, and a wet season that runs from June to September, blowing from the south-west. During the wet summer monsoon in India receives 50-90% of its annual rainfall, depending upon the location.

Disasters related to monsoons are associated with secondary effects from either monsoon failure or excessive monsoon rainfall. During years of monsoon failure, severe drought can ensue, leading to famine in the lesser-developed countries. Crops struggle or fail and without implementation of a pre-established emergency plan, food shortages may follow. In years of excessive monsoon rainfall, severe flooding may result, leading to drowning, homelessness, and the destruction of infrastructure, property and agriculture.

### **Tornadoes**

Also called funnel clouds, are rapidly spinning columns of air (vortexes) extending downward from a cumulonimbus cloud (clouds that cause rainfall). Thousands of tornadoes are formed throughout the world each year but, thankfully, most don't touch ground and therefore remain harmless. The United States is the country most susceptible to these atmospheric hazards, with approximately 1000 occurring each year.

Tornadoes form when warm, moist air meets cold, dry air, though the presence of these factors in on way guarantees that a tornado will form. Disasters caused by tornadoes are caused by the damaging winds they generate. Most of the deaths associated with tornadoes are caused by secondary hazards, such as debris missiles and large hail.

**Ice Storm**

They are the precipitation events involving freezing rain that accumulates on exposed surfaces to a thickness greater than one-quarter of an inch. These storms can extend for hundreds of square miles, and are highly destructive due to the damage caused by the weight of the accumulated ice. The damage associated with ice storms results from the weight of the ice accumulation, which causes tree limbs to break, power lines to fall, and roofs to collapse. Icy roads lead to transportation accidents. Power outages can lead to people being exposed to extremely cold temperatures, and can have economic impacts, as business is interrupted and agriculture damaged.

**Hailstorms**

Meteorological events characterized by the precipitation of balls or lumps of clear ice and compact snow. Cold ground temperatures are not necessary for hailstorms to occur, and these events commonly occur throughout the world, including in the tropics. The process by which hailstones form and grow is not entirely understood, but it is believed that ice crystals form within a cloud and then are covered in layer upon layer of frozen water and suspended in strong updrafts until the holding capacity of the cloud is exceeded. Hailstorms are generally spherical or irregularly spherical and generally vary in diameter from pellet size to half inch. On rare occasions, giant hailstones have formed, some up to 5 inches in diameter.

The primary negative consequence of hail is damage and injury to crops. Livestock also are at risk due to injuries and fatalities they sustain during the storms. Humans usually escape death but can be injured by hail falling. Property (buildings and cars) often sustains severe damage, and roof collapses are common when the heavy hailstones accumulate quickly. Airplanes have also been reported damaged by storms containing hail.

When the focus of the earthquake is along a fault under a large body of water and the movement causes a major deformation of Earth's surface, the water's resulting movement can result in a tsunami thousands of miles away. A single high magnitude earthquake off the coast of Indonesia caused the 2004 tsunami events throughout Asia.

**Check Your Progress I**

**Note:** Use the space provided for your answer.

1) Define Disasters.

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2) Highlight different perspectives on Disasters.

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3) Describe different types of Disasters.

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### Cyclones

Cyclonic storms are among the most destructive natural disaster, more pronounced in the coastal states. India as a whole is highly prone to cyclones. The Indian Ocean region is one of the six highest cyclone prone regions of the world. Here, cyclones usually occur between May-June and between October-November.

A number of hazards are associated with the cyclones, which are responsible for large damages to life, property and agriculture are:

- i) *Gales and Strong winds*: Uproot large number of trees and cause serious damages to the engineered and not- engineered structures such as houses, lifeline infrastructure such as power and communication towers, hospitals, food storage facilities, roads, bridges, culverts, crops, etc.
- ii) *Torrential Rains*: Sewerage and drainage systems may block, severe flooding may devastate the crops and roads and railway lines may be washed away.
- iii) *Storm surges or tidal waves*: Storm surge is the most devastating feature associated with the cyclones. Storm surge inundates low-lying areas in the coastal areas resulting in loss of life and destruction of property, besides eroding beaches and embankments, destroying vegetation and reducing soil fertility.

Besides the loss of lives and livestock, cyclones have high destructive potential due to the strong winds that damage structures, and heavy rainfall which causes floods and storm surge that inundates low-lying coastal areas.

The public health aspects come under stress during and after the storm. The casualties due to storm surges are quite high in comparison to strong winds where more injuries due to flying debris take place. Water borne diseases and epidemics like Malaria etc. are very common due to water contamination and water logging in a cyclone hit area. Transportation and communication networks also get severe to very severely damages in the aftermath of a cyclone.

### Cyclone Risk Mitigation Strategy

It is not possible to completely avoid natural disasters like cyclones; however, their effects can be minimized by taking some known long- and short- term structural and non-structural mitigation measures. Few of very common measures prevalent and adopted for cyclone risk mitigation include:

- Establishing proper early warning systems,
- creating awareness among all stakeholders at all levels,
- coastal afforestation,
- construction of shelters, embankments, dykes, coastal roads, bridges, canals, etc.,
- through better preparedness, mitigation measures and improved response mechanisms.

## Cyclone Warning Network in India

Cyclone warning is the responsibility of India Meteorology Department (IMD). The warning system in India is based on a network of Area Cyclone Warning Centres (ACWC) of IMD. During the cyclone situations, the ACWC generate special warning bulletins and transmit them every hour in the local languages. There is a network of 252 stations involved on East and West Coast of India. The state-wise distribution of such stations is as West Bengal (31), Orissa (35), Andhra Pradesh (81), Tamil Nadu (60), Kerala (5), Karnataka (including one at Hassan) (6), Goa (1), Maharashtra (8), Gujarat (19), Daman and Diu (3), Puducherry (3).

A *four-stage cyclone warning system* is in place for issuing cyclone warning, which is based on:

- i) At the first stage, *Pre-Cyclone Watch* is issued containing early potential indications about the development of a cyclonic disturbance, its possible development into a cyclone and adverse weather that specific areas of the coastal belt are likely to experience.
- ii) At the second stage, a *Cyclone Alert message* is issued 48 hours prior to the expected time of commencement of adverse weather over the specific coastal areas.
- iii) A Cyclone Warning is issued 24 hours in advance of the cyclone's landfall in order to cover the devastating impact of cyclones over inland areas.
- iv) Finally, a *Post Landfall Outlook* is issued 12 hours before the landfall and continues till such time as cyclone force gusty winds are expected to prevail over the interior areas.

## Non-Structural Measures

Land use planning in the coastal areas is an important and effective tool for the loss reduction due to cyclones. The land use planning emphasizes the placement of least critical activities like parks and parking etc. in the most vulnerable areas. The improvement in the vegetation cover for the cyclone mitigation is an attractive option. The shelter protection plantation belt of *casuria trees* which are fast growing and recyclable have substantially helped to protect the human settlement built on the leeward side. The improved vegetation may also help in improving the water infiltration capacity of the soil, keeping the soil intact preventing erosion. The use of trees planted in rows also act as wind break near houses and compounds or may be planted around towns. Other than this regulatory control for keeping new settlements at a certain distance away from the coast line is also considered as a precautionary measure.

The community preparedness may result in a very positive public response to warnings and other preparedness measures like evacuation etc. The community should be aware about various hazards associated with the cyclone, the impact of these hazards and the vulnerability of the people to the hazards. The people must be aware about the specific actions required after receiving the warning. The community preparedness needs to be done at various levels and through different means. The various methods for promoting community preparedness are as:

- *Public dissemination of information* through mass media, posters in local languages and leaf lets etc. The people must be aware regarding the do's and don'ts for cyclone and specific preparedness measures.
- *Educational programmes* designed for different age groups with formal education system.
- *Training* for the government officials in charge of cyclone management. The training should be on the cyclone mitigation, preparedness and post-cyclone management aspects.

## Structural Measures

A majority of losses during a cyclonic storm are caused by damages to the built environment. The cyclone resistant design can play a crucial role in reducing the associated damages. Building codes, standards and guidelines are available for designing and construction of cyclones safe structures. The National Building Code and Indian Road Congress (IRC) specifications have detailed out the requirements for the design and construction of structures, taking into account the different hazards associated with the cyclonic storm like wind load etc.

One of the successful measures being adopted in the country is to evacuate and shelter the people likely to be affected by cyclones. These evacuees are kept into the specially designed and constructed multi-purpose cyclone resistant community relief shelters, for providing safe and secure accommodation during the cyclone. This is done through construction in a phased manner, of a network of such cyclone relief shelters along the coast line, so as to be within reachable distances from the affected settlements. New initiatives have been taken to develop a low cost, anti-cyclone core unit for each family to provide secure deposit of personal belongings during cyclones in the existing villages. When the families, evacuate, the personal belongings can be stored in the anti-cyclone core unit located in the base villages. This would help them to resume economic activity and livelihood soon, on return from the relief shelters.

## Floods

Among all disasters that occur in the country, river floods are the most frequent and often the most devastating natural phenomenon ravaging the country from time immemorial. In recent times with population increase and accelerated development activities with economic pressures, the impact of floods is being felt quite seriously. The cause for floods is mainly the peculiarities of rainfall in the country. Out of the total annual rainfall of the country, 80% is concentrated over a short monsoon season of three to four months. As a result there is a very heavy discharge into the rivers during this period causing widespread floods.

Flood is defined as a body of water, which rises to overflow land not normally submerged. This situation usually arises when a river carries a flow in excess of its transporting capacity. Floods are caused due to various reasons; few of most common causes are listed as following:

- ***Deforestation***
- ***Riverbed silting***
- ***Drainage improvement works***
- ***Obstruction due to development activities***

There are several factors influencing the characteristic of a flood. These factors determine the status of the risk associated with floods. Following are few of such factors:

- Depth of water - crucial for buildings and crops
- Duration of inundation - influence the damage to crops, buildings, infrastructure, etc.
- Reduction of water absorbing capacity (or moderating capacity) of land.
- Velocity of flow - high velocity flood waters are more dangerous.
- Frequency of occurrence - influence the decision regarding the placing of critical facilities.
- Time of occurrence - pre-seasonal floods are more harmful to crops.

The flood generally results in loss to housing units specially low cost Katcha houses, epidemics spread, shortage of drinking water, essential commodities and medicines etc. At national level flood are causing considerable impact; following Table indicates the highlights of the flood damages at national level:

**Table: Flood impact at National level in India**

	<b>Maximum (year)</b>	<b>Average (1953-2005)</b>
Area affected (in lakh hectares)	175 (1978)	75.1
Crop area affected (in lakh hectares)	101.5 (1988)	35.1
Population affected (in crores)	7.045 (1978)	3.284
Houses damaged (in lakhs)	35.1 (1978)	12.2
Cattle heads lost	618248 (1979)	94830
Human lives lost	11316 (1977)	1587
Damage to public utilities (in Rs. crores)	5604.46 (1998)	820.67
Total damages (in Rs. crores)	8864.54 (1998)	1805.18

**Source:** NDMA Guild lines on Floods (2008)

Damages related to flood hazards can be minimized by adopting appropriate preparedness and mitigation programmes. The flood hazard mitigation programme can broadly be divided into two categories:

- **Structural measures**
- **Non-structural measures**

Under structural measures, the basic approach is to prevent flood waters to the potential damage sites. To achieve this, a number of structural measures need to be designed and constructed. Few of the prominent structural measures adopted include:

- **dams and reservoirs**
- **embankments or dykes**
- **natural detention basis**
- **channel improvement works**
- **drainage improvement works**
- **diversion of excess flood waters**

It is observed that most common problem causing floods in the non-cleanliness and maintenance works before monsoon seasons. To achieve the maximum benefit out of different structural measures, it is mandatory to carryout pre-monsoon special checks and maintenance.

The approach adopted for non-structural measures, aims at modifying the susceptibility to flood damage and to reduce the losses. There are several methods adopted under this category as well. Few of such methods include:

- Flood plain zoning
- Flood forecasting and warning



- Flood proofing including disaster preparedness and response planning
- Post flood relief measures

There are certain other techniques like watershed management, hazard resistant construction and land use planning through which losses associated with floods can be reduced considerably. Land use regulations ensure that flood risks are not made worse by ill conceived new land uses.

**Check Your Progress II**

**Note:** Use the space provided for your answer.

- 1) Discuss hydro-meteorological disaster and geological hazards.  
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- 2) Describe the general characteristics of cyclones. How to mitigate the risk of cyclone hazards?  
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- 3) Discuss the general characteristics of drought. How to classify droughts? How to manage drought like situations?  
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- 4) What do you understand by floods? Discuss about the flood problems in India. How to reduce the risk of flood disasters?  
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- 5) Discuss the general characteristics of landslides. Which areas in India are prone to landslides? How to mitigate the impact of landslides?  
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6) Discuss about the earthquake problem in India. What are the hazards associated with the earthquakes? Please explain the factors influencing the damage pattern due to an earthquake.

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7) What is the earthquake risk mitigation strategy?

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## **2.4 LET US SUM UP**

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The trend over the last three decades shows a sharp increase in the number and frequency of natural disasters significantly increasing in the number of affected populations. Developing countries are most vulnerable to natural disasters. The recent research shows that natural disasters are a major threat to sustainable development. The imbalance in impact between developed and developing countries is due partly to geography. However, geography does not explain the disparity alone, the United States also experiences most of the above; therefore, the resilience of a country's economy, society and institutions must be taken into account as well. Research has shown that in general, it is the weaker groups in society that suffer worst from disasters, especially the poor, the very young and the very old, women, the disabled and those marginalized by caste, ethnicity or race.

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# UNIT 3 TYPES OF DISASTER-II (OTHER INCLUDING HUMAN MADE)

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Types of Disaster-II  
(Other Including Human Made)

## Structure

- 3.0 Objectives
- 3.1 Introduction
- 3.2 Nuclear Disasters
- 3.3 Forest Fires
- 3.4 Stampede
- 3.5 Epidemics
- 3.6 Accidents
- 3.7 Terrorism
- 3.8 Biological Disasters
- 3.9 Chemical Disasters
- 3.10 Short Case Studies
- 3.11 Let Us Sum Up
- 3.12 Further Readings and References

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## 3.0 OBJECTIVES

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After reading this unit, you should be able to:

- explain the salient features of man-made disasters;
- describe the implications of Chemical, Biological, Nuclear and other human induced disasters;
- explain the general threat perceptions of man-made disasters;
- list various preparedness and mitigation measures for combating such man-made disasters;
- chalk out response strategy for such disasters; and
- list down Do's and Don'ts for man-made disaster emergencies.

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## 3.1 INTRODUCTION

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In the decade 1990-2000, an average of about 4344 people lost their lives and about 30 million people were affected by disasters every year. A Hazard is a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation (DM Act, 2005) and these hazards can include conditions that may lead to future threats and can have different origins:

- Natural (geological, hydro-meteorological)
- Induced by human process or man-made (environmental degradation and technological hazards)

A Disaster is an event of nature (hazard) or man-made cause that leads to sudden disruption of normal life of society, causing damage to life and property, to such an extent that normal social and economic mechanisms available are inadequate to restore normalcy (DM Act, 2005). Floods, droughts, cyclones, earthquakes, landslides and avalanches are some of the major natural disasters that repeatedly and increasingly affect globally. On the other hand, the fast pace of growth and expansion without preparedness has brought forth a range of different kinds of issues which seek urgent attention at all levels. In the absence of such preparedness measures, the growing numbers in our population are at a risk of prospective hazards such as air, rail or road accidents, boat capsizing, building collapse, electric fires, festival related disasters, forest fires, mine flooding, oil spills and serial bomb blasts besides nuclear, chemical and biological threats which are apparent in the present scenario. Considering the above, In India, a High Power Committee (HPC) was constituted at the behest of the Prime Minister by the Ministry of Agriculture in August 1999 under the Chairmanship of Shri J.C. Pant and had members from various Ministries, States, NGOs and experts from relevant fields. It was the first attempt in India towards evolving a systematic, comprehensive and holistic approach towards all disasters. Classifications of disasters identified by this HPC (HPC Report 2001) are as follows:

**a) *Water and Climate related disasters:***

Floods and Drainage Management, Cyclones, Tornadoes and Hurricanes, Hailstorm, Cloud Burst, Heat Wave and Cold Wave, Snow Avalanches, Droughts, Sea Erosion and Thunder and Lightning.

**b) *Geologically related disasters:***

Landslides and Mudflows, Earthquakes, Dam Failures/ Dam Bursts, Mine Fires.

**c) *Chemical, Industrial and Nuclear related disasters:***

Chemical, Industrial and Nuclear Disasters.

**d) *Accident related disasters:***

Forest and Urban Fires, Mine Flooding, Oil Spill, Major Building Collapse, Serial Bomb Blasts, Festival related disasters, Electrical Fires, Air, Road and Rail Accidents, Boat Capsizing and Village Fire.

**e) *Biologically related disasters:***

Biological Disasters and Epidemics, Pest Attacks, Cattle Epidemics, Food Poisoning.

**Types of Man-made disasters and concerned Nodal Ministry**

<b>Man-made Disaster</b>	<b>Nodal Ministry</b>
Air Accidents	Ministry of Civil Aviation
Civil Strife	Ministry of Home Affairs
Railway Accidents	Ministry of Railways
Chemical Disasters	Ministry of Environment and Forests
Biological Disasters	Ministry of Health
Nuclear Accident	Dept. of Atomic Energy
<b>Natural Disasters</b>	<b>Ministry of Agriculture</b>

(Source: HPC Report; GoI, 2001)

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## 3.2 NUCLEAR DISASTERS

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The occurrence of nuclear or radiological disaster is of the great concern. It is accompanied with sudden release of huge amount of harmful radiations or radioactive materials (Isotopes of Cesium, Cobalt, Iridium, Iodine, Strontium, Uranium, Plutonium etc.) or both together in environment in a small area. It is described as a disaster caused due to an extraordinary emission of radioactive material or radiation either through explosion of a nuclear bomb or in the operation of nuclear reactors and other nuclear related activities (Simone, 2006).

### Causes

***Intentional Use of Nuclear Weapons in the event of war:*** With the advancement of scientific research, several countries have acquired the technology to produce Nuclear Arms, which are more destructive and harmful than the atom bomb used more than half a century ago. Nuclear bombs have openly been used twice, both times by the United State against Japan during World War II (1939-1945). On August 6, 1945, the city of Hiroshima was almost completely destroyed, and three days later the city of Nagasaki was bombed.

***Accidental Explosion of Nuclear Weapons:*** Nuclear weapons are designed with great care to explode only when deliberately armed and fired. Nevertheless, there is always a possibility that, as a result of accidental circumstances, an explosion will take place inadvertently and such accidents might occur in areas where weapons are assembled and stored, during the course of loading and transportation on the ground, or when actually in the delivery vehicle, e.g., an airplane or a missile.

***Accidents in Nuclear Power Project:*** There is also a risk of accidental exposure to harmful radiation from the several nuclear reactors used for generation of power. The potential threat from an accident at a nuclear power plant is exposure to radiation which would occur from the release of radioactive material into the environment and the area affected would depend on the amount of the release, wind direction and speed and weather conditions.

***Terrorist Attacks or Dirty Bombs:*** Through use of 'Radiological Dispersion Device' (ROD), an expedient weapon, wherein radioactive material is disseminated by using conventional explosives and debris is subsequently scattered across the targeted area. Also through other modes like attack of the nuclear power plant or facility using or processing radioactive material via air craft strike or bombardment with heavy munitions or sabotage (Source: India Disaster Knowledge Network Portal, 2008 <http://192.168.0.118/idknnew/>).

### Response

The emergency response actions will focus on reducing the effects of immediate effect that shall comprise- fire, destruction, damaged vegetation, dead, wounded human beings and animals, psychological phobia. This demands judicious planning, and multi-faceted preparations that shall include store management, training, communication and command, etc surmount the nuclear emergency.

### Do's and Don'ts

#### ***Do's:***

- Plug ears, save skin from heat, put on head gear, know the explosion site and go away from ground zero, breath normally, stay calm.
- Lie down on ground with face down - head away from ground zero, cover face with handkerchief. It will avoid internal contamination

- If in shelter, close doors/windows, switch off AC and remain inside, evacuate, relocate, fallout may continue for more than 24 hours depending upon weather.
- Go underground to reduce external radiation and avoid external contamination. (Wet sand and 30 cm earth give 20 P.F.).
- If contaminated, remove clothes and put them in poly bags, take showers, stay in tunnels, trenches, foxholes, tents vehicles decontaminate food or areas. (Covered items like bread, butter, jam can be consumed after removing wrapper.
- Put on mask to avoid inhaling contaminated air.
- Put on protective suits, if available help injured. Become part of rescue team.
- Consume Bio-protectors like KI, KIO<sub>3</sub>, Beer, Tulsi, Arnica, Caffein, Diltiazem, Vitamin C/E, podophylum.
- Get treatment for burn, cut and other injuries.
- Keep monitoring radiation level/radiation dose

***Don'ts:***

- Do not look at blinding flash, don't go in to cloud/rain/fog.
- Do not run or get panicky.
- Do not spread rumours.
- Do not crowd the site: Keep away.
- Do not crowd hospitals/road/areas.
- Know the explosion site and do not go in downwind direction.
- Do not go to radioactive contaminated area.
- Do not remain in open air. Water is a good neutron shield.
- Do not spread radioactive contamination (External and Internal).

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### **3.3 FOREST FIRES**

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The word “wildfire” originated as a synonym for Greek fire, a napalm-like substance used in medieval Europe as a naval weapon. Forests face many hazards but the most common hazard is fire. They pose a threat not only to the forest wealth but also to the entire regime of fauna and flora seriously disturbing the bio-diversity, the ecology and environment of a region. During summer, when there is no rain for months, the forests become littered with dry senescent leaves and twigs, which would burst into flames ignited by the slightest spark. The Himalayan forests particularly Garhwal Himalayas of Uttaranchal State have been burning regularly during the last few summers, with colossal loss of vegetation cover of that region. Forest fires can be either natural or controlled and caused by heat generated in the litter and other biomes in summer through carelessness of people (human neglect). Sometimes, forest fires are intentionally or purposely caused by local inhabitants for their selfish motives.



**Vulnerable Himalayan States of India towards Forest Fire (\*ha- Hectares)**

S.No.	State	Total land Area (ha*)	Forest area Recorded (ha*) %	Total cropped area (ha*)
1	Manipur	2211000	602000 (27.23)	186000
2	Arunchal Pradesh	8374300	5154000 (61.55)	167369
3	Himanchal Pradesh	3367600	1046900 (31.09)	974800
4	Assam (Hill Distt)	1522200	296200 (19.46)	169300
5	Sikkim	710000	257000 (58.95)	152000
6	Meghalaya	2243000	940000 (41.91)	241000
7	Mizoram	2102000	1303000 (61.99)	65000
8	Tripura	1049169	606168 (57.78)	456000
9	Nagaland	1513774	862532 (56.98)	200500
10	Uttaranchal	5358595	3424857 (63.91)	1099306
11	Jammu & Kashmir	4505000	2747000 (60.98)	1066000

\* *Source:* Manual on Natural Disaster Management in India, NDM Division, IIPA, GoI, 2005

**Causes**

Forest Fires are, not an unusual phenomenon, they occur regularly, especially in summers, throughout the world. Forest fires can broadly be classified into three categories:

- Natural or controlled forest fires.
- Forest fires caused by heat generated in the litter and other biomes in summer through carelessness of people (human neglect) and
- Forest fires purposely caused by local inhabitants.

Many forest fires start from natural causes such as “Lightning” which set trees on fire. Periodic lightning induced fires have been recorded throughout history from India, South eastern and Central United States, Australia, Finland and Eastern and Southern Africa. Most forest fires are the result of human neglect caused by casual throwing away of a smoldering bidi, cigarette butt or a spark from a picnicker's open hearth in a desiccated forest can often be sufficient to start a fire in summer. Such fires usually start on the ground as the dry litter (senescent leaves and twigs) catches fire easily. Then, flamed by strong winds, the flames soon engulf vast tract forest turning them to ashes and, therefore, cause extensive damage unless controlled in time (Luna, 2007).

**Types of Forest Fire**

Forest fires differ depending upon its nature, size, spreading speed, behavior etc. basically this can be sub-grouped into four types depending upon their nature and size as follows (Source: Manual on Natural Disaster Management in India, NDM Division, IIPA, GoI, 2005):

- 1) **Underground Fire:** Underground fire is the fire of low intensity consuming the organic matter beneath and the surface litter of forest floor is sub-grouped as underground fire. In most of the dense forests occurring in the wetter parts

of Himalayas, a thick mantle of organic matter is found on top of the mineral soil. This fire spreads in by consuming such materials. These fires usually spread entirely underground and burn for some meters below the surface and spreads very slowly and in most cases it becomes very hard to detect and control such type of fires. They may continue to burn for months and destroy vegetative cover of the soil. The other terminology for this type of fire is *Muck fires* while in some countries; it is referred to as *Ground fires*.

- 2) **Surface Fires:** Surface fire is the most common forest fires that burn undergrowth and dead material along the floor of the forest. In general it is very useful for the forest growth and regeneration. If grow in size this fire not only burns ground flora but also results to engulf the undergrowth and the middle story of the forest. Surface fires spread by flaming combustion through fuels at or near the surface- grass, dead and down limbs, forest needle and leaf litter, or debris from harvesting or land clearing. Thus a surface fire is “A fire that burns surface litter, other loose debris of the forest floor and small vegetation. This is the most common type of fire in timber stand of all species. It may be a mild, low-energy fire in sparse grass and pine needle litter, or it may be a very hot, fast moving fire where slash, flammable under story shrubs or other abundant fuel prevails. A surface fire if spreads, may burn up to the taller vegetation and tree crowns as it progresses”.
- 3) **Ground Fires:** There is no clear distinction between underground and ground fires. The smoldering for sometime under ground fires changes into Ground fire. This fire burns root and other material on or beneath the surface i.e. burns the herbaceous growth on forest floor together with the layer of organic matter in various stages of decay. They are more damaging than surface fires and they can destroy vegetation completely. These fires are fires in the sub-surface organic fuels, such as duff layers under forest stands, Arctic tundra or taiga, and organic soils of swamps or bogs. Ground fires burn underneath the surface by smoldering combustion and are most often ignited by surface fires. Thus a Ground Fire consumes the organic material beneath the surface litter of the forest floor and fighting such fires is very difficult and tedious job.
- 4) **Crown Fires:** Crown fire is the most unpredictable fire, which burns the top of trees and spread rapidly by wind. In most of the cases surface fires invariably ignite these fires. Thus a Crown Fire is a fire that advances from top to top of trees or shrubs more or less Independently of the surface fire. In dense conifer stands on steep slopes or on level ground, with a brisk wind, the crown fire may race ahead of the supporting surface fire. This is most spectacular kind of forest fire. Since it is over the heads of ground force it is uncontrollable until it again drops to the ground, and since it is usually fast moving it poses grave danger to the fire fighters becoming trapped and burned.
- 5) **Firestorms:** Among the forest fire, the fires spreading most rapidly are the firestorm, which is an intense fire over a large area. As the fire burns, heat rises and air rushes in, causing the fire to grow. More air makes the fire spin violently like a storm. Flames fly out from the base and burning ember spew out the top of the fiery twister, starting smaller fires around it. Temperatures inside these storms can reach around 2,000 degrees Fahrenheit.

#### **Do's and Don'ts:**

##### ***What to do BEFORE and DURING Fire:***

- Try to maintain FOREST BLOCKS to prevent dry litter from forests during summer season.
- Try to put the fire out by digging or circle around it by water, if not possible to call a Fire brigade.

- Move farm animals and movable goods to safer places.
- During fire listen regularly to Radio for advance information and obey the instructions cum advice.
- Forests Officials, Local people and Tribals living in Forests should play a constructive role before, during and after the fire of the Forest.
- Follow the effective monitoring and warning systems (including remote sensing for curing or drying out of vegetation).
- Teach the causes and harm of fire to your family and others.
- Do not be scared when a sudden fire occurred in the Forest, be calm, encourage others and community to overcome the problem patiently.
- Do apply seasonal mitigation measures i.e. Fuel reduction.

***What one should not do:***

- One should not throw smoldering cigarette butt or bidi in the forests.
- Do not leave the burning wood sticks.
- Don't enter the forest during the fire.
- Do not leave the dry litter during summer season.
- Tribals should not use Slash and Burn method indiscriminately on large scale.

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### **3.4 STAMPEDE**

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A stampede is an act of mass impulse among a crowd of people in which the crowd collectively begins running with no clear direction or purpose. Stampedes are believed to originate from biological responses in the brains and endocrine systems of the crowd and this large stampede will frequently destroy anything in its way. By an analogy, the term human stampede is applied to a sudden rush of a crowd of people, usually resulting in many injuries and death from suffocation and trampling. In stampede the term mob or crowd is used to refer to a congregated, active, polarized aggregate of people, which is basically heterogeneous and complex. Its most salient features include homogeneity of thought and action among its participants and impulsive and irrational actions by its participants. The two major behavioral reasons of any stampede are anxiety and panic. They are manifestation of our inborn “flight or fight” system, which is essential to our survival. Just as physical pain alerts us to diseases, so anxiety, panic and alarm alerts us to any sign of danger. Panic can appear to come from nowhere at all, but all that stampede needs is a small trigger caused by panic, such as feeling loneliness and helpless in a crowd, or trapped in an auditorium, staircase etc resulting in a truly horrible feeling which has an immediate effect on bodily functions. Nervousness can act as an addendum for such acts whereby people act baselessly seeing others rather than thinking for themselves.

#### **Types of Stampede**

Incidents of stampedes can occur in numerous socio-cultural situations. The causes and gravity of these situations vary from each other. The following list provides a fair idea about various types of situations where stampedes can occur:

- Air raid shelter
- Entertainment events

- Escalator and moving walkways
- Food distribution
- Funeral procession
- Natural disasters
- Power failure
- Religious events
- Fire incidents in religious/other events
- Riots
- Sports events
- Weather related

### **Causes**

Causes of stampedes can be better understood through the FIST MODEL, which describes the primary elements involved in crowd disasters. In other words, the elements provide a model for understanding the causes of crowd disasters, means of prevention, and possible mitigation of an ongoing crowd incident. The acronym “FIST” is defined as follows: FORCE (F) of the crowd, or crowd pressure; INFORMATION (I) upon which the crowd acts or reacts, real or perceived, true or false; SPACE (S) involved in the crowd incident, standing area, physical facilities - stairs, corridors, escalators; TIME (T) duration of incident, event scheduling, facility processing rates.

### **Dos’ and Don’ts:**

- One must be very alert to the fact that some pilgrims of certain nationalities come in bunches and batches and push their way through. Pilgrims should not get into their way or try to stop them as one could get harmed in the process. It will be more sensible to avoid their path and wait till they get out.
- It is advisable to move in groups from the camps with the assistance of the controlling authority or group leader or police person.
- Do not try to go against the direction of the crowd. Move with the crowd.
- Do not lose temper and do not fight with others. If required, pilgrims can retrace steps after the rush has passed.
- Understand the evacuation routes, emergency exits and layout of the place of event.
- Keep calm. Don’t panic.
- In case of emergency do not run.
- Think before you do. Do not just blindly follow others.
- Open area is safer. On exit try to get away in diverse directions.
- Follow instructions given by the authorities, public address system etc.
- Do not spread rumors.
- Assist and collaborate with the organizers, authorities, fire services. Police etc.
- Try to help others in your best capable way.

### 3.5 EPIDEMICS

The prevalence of a disease is the number of diseased individuals at any one time (point prevalence) or over a given period (period prevalence). Individual cases of disease in widely separated geographic areas or otherwise independent cases are said to be sporadic. The term epidemic has been derived from two Greek words, “Epi” means “upon” and “Demos” means “people”. Thus, an epidemic of an infectious disease is the occurrence of a number of cases of a disease, known or suspected to be of infectious origin, that is unusually large or unexpected for the given place or time. An epidemic often evolves rapidly and requires a susceptible human population, the presence of a disease agent, and the presence of a mechanism or mode of large-scale transmission (e.g. contaminated water supply, poor sanitation and vector population). This definition covers the usual epidemic diseases such as, measles, chickenpox, and cholera, which are compressed in time, but also the modern “slow” epidemics of non-communicable diseases like diabetic, heart attacks, and depression. Common cold is endemic in northern latitudes. Cholera and malaria are endemic diseases in some parts of India. Infectious diseases are major causes of morbidity and mortality in many parts of our country.

#### Types of Epidemics

There are two major types of infectious diseases which can develop into epidemics: “*common source*” and “*host-to-host*”. Common source epidemics arise from a contaminated source, such as water or food, while host-to-host infections are transmitted from one infected individual to another via various, perhaps indirect routes. Common source epidemics usually produce more new cases earlier and faster than host-to-host epidemics. Host-to-host epidemics are slower to grow and slower to diminish. Anything causing disease is called a *pathogen*. A vector is an organism that serves as an intermediary in the transmission of a host-to-host disease. For instance, many infections are transmitted by mosquitoes, fleas, ticks, etc. to people. A fomite is any inanimate object that adheres to or transmits infectious material, e.g., bedding, clothing, surgical instruments, etc.

#### Check Your Progress I

**Note:** Use the space provided for your answer.

- 1) List two or three different communicable diseases and categorize them based on source or point-to-point epidemics

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#### Impact

Epidemics and outbreaks of different communicable diseases have plagued mankind since time immemorial. According to estimates made by World Health Organization, worldwide 17 million deaths were attributed to infectious diseases during 1997;

hundreds of million were disabled and incapacitated with economic loss that defies any precise calculations. Advances in public health and medicine, sanitation and vector control have led to considerable prevention and control of these diseases in some countries, but have had minimal impact in the majority of developing countries of the world due to lack of funds. Moreover, within a country, there continues to be enormous disparities in mortality, disability and exposure to infection among social classes with the poor, socially backwards and children suffering extremes of ill-health in all societies.

Increased rates of morbidity and mortality due to communicable diseases occur more frequently in association with complex emergencies than other disasters. In many of these settings, especially those occurring in developing countries, between 60% and 90% of deaths have been attributed to one of four major infectious causes: measles, diarrhoea, acute respiratory infections and malaria. Acute malnutrition is often associated with increased case fatality rates of these diseases, especially among young children. There have also been outbreaks of other communicable diseases, such as meningococcal meningitis, yellow fever, viral hepatitis and typhoid, in certain settings.

### **Mitigation Measures**

Significant improvements have taken place in health services in India during the past 58 years.

***Current system of surveillance and mechanism to control the outbreak of endemic diseases:*** For diseases with significant mortality and morbidity, the federal government has launched national Programmes which include malaria, tuberculosis, leprosy etc. Though the funding, technical designing as well as monitoring is done by the Central Government, the responsibility of implementation of these programmes rests with the respective state governments.

***National Programme for Surveillance of Communicable Diseases (NPSCD):*** Efforts have already been made by the Government of India to strengthen the health machinery for early detection of epidemic-prone diseases under its National Programme for Surveillance of Communicable Diseases. The Government of India has launched National Surveillance Programme for Communicable Diseases (NSPCD) during 1997-98 as Central Scheme. The main objective of this programme is capacity building at the state and district levels for early identification of outbreaks of communicable diseases and appropriate and timely response to these outbreaks. The programme is being implemented by the state governments through their existing infrastructure. Under the programme, the surveillance system is strengthened through training of medical and paramedical personnel, dissemination of technical information and guidelines, up-gradation of laboratories, modernization of communication and data processing systems.

A strong public health and surveillance system is required for quick detection and control of communicable diseases. At present the public health infrastructure in India is inadequately prepared to sense early warning signals of outbreak of an epidemic and to respond in time.

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## **3.6 ACCIDENTS**

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### **Air Accidents**

Air accidents are by and large of three types; mid-air collisions, forced landings, crash due to technical snags and air-crash in mountainous terrain due to poor visibility. While air accidents can occur at any time and at any place, areas within about 30 - 40 kms radius of airports are most vulnerable. Past experience shows

that majority of air accidents occur either during take-off or landing near about major airports where flight paths get congested. In addition, air accidents also take place at remote inaccessible places like forests, hilly and mountainous regions, high seas, etc. Causes of air accidents are either human failure of pilots, air traffic controllers or technical failures of on board, landing instruments. In rare cases it may also be the result of terrorist activities.

### **Boat Accidents**

With the increase in volume of inland boats and sea fishing, boat capsizing 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 greater part has been the 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. Boat accidents are found to occur mainly during the flood season, more so during bad weather and also under conditions of impaired visibility. Boats are more vulnerable during large gatherings such as melas, festivals etc. especially during their opening time when people want to reach early before its start or at closing time when there is a rush of people wanting to return home before night fall. Poor visibility at the time has also contributed to boat accidents especially those cases that take place due to collision. In many cases large number of boats gather during festivals, resulting in inadequate space for maneuvering the boat. Sometimes it may not be possible for authorities concerned to exercise full control on the river boat traffic due to non- availability of adequate security staff, logistic and other problems.

### **Oil Spills**

Today the sea is being a key source of food, fresh water, and minerals including oil and natural gas and renewable energy. The rapid industrial growth in recent years and the tremendous increase in human population are generating huge quantities of waste materials to be disposed off from land. Thus, the use of marine environment as a dumping ground of waste material has been constantly on the increase and this has caused pollution of the marine environment. In addition to industrialization and increase in population, urbanization, deforestation, increase in number and size of ships, demand for oil, oily wastes arising from ships, tankers and offshore installation, chemicals and dangerous goods, dumping of nuclear waste and leakage of under water pipelines is a long list being one of the causes of marine pollution in our coastal waters. Areas having off shore oil installations, under sea pipelines, sea routes traversed by oil tankers, refineries and under ground pipelines for oil transportation are vulnerable to oil spills.

### **Rail Accidents**

The Indian railways, is the largest railway system in Asia and the first largest railway system under a single management in the world. Railways is the principal mode of transport for both passengers and goods in the country. Railway is the life line of the nation particularly amongst the developing countries like India where infrastructure developments are accorded high priority to boost the nations wealth. The success of any transport organization is gauged by the parameters such as punctuality, reliability, safety, frequency and adaptability. In the course of the working, the railways are confronted with disasters arising out of cyclone, floods, fires, bomb blasts and accidents etc., involving trains. While a railway accident can occur at any stretch of railway track, experience has shown that portion of railway track having double line sections are particularly vulnerable to serious rail accidents.

## Road Accidents

Both National and State Highways are particularly vulnerable to serious road accidents since it is on these stretches that high speed accidents occur. Apart from these, roads in hilly sections and ghat areas are also vulnerable to road accidents due to road vehicles falling into pits. The problem of road traffic accident has assumed alarming proportion with ever increasing number of motor vehicles competing for the limited paved space. The resultant congestion in traffic is inevitable and the consequences of congestion are road accidents. It is observed that loss of life and injuries in road accidents are high in developing countries as compared to the developed countries. It is interesting to note that while there is a reduction of deaths due to road accidents in the developed countries the picture emerging from the developing countries shows an abnormal increase. Road safety, as a problem, has been analyzed in many different ways. Prominent amongst them are the four basic elements; **1) Machine Factor, 2) Human Factor, 3) Engineering Factor and 4) Environment Factor.**

### Causes

**Air Accidents:** Causes of air accidents are either human failure of pilots, air traffic controllers or technical failures of on board, landing instruments. In rare cases it may also be the result of terrorist activities.

**Boat Accidents:** Boat accidents occur mainly due to overloading, overcrowding, unruly behavior, panic amongst passengers and capsizing. Overloading of the boat results in very low freeboard allowing water to enter the boat easily. Flash-floods and strong currents in the river also result in boat accidents, especially in cases where there are no proper communication available with boat operators regarding the weather. A major cause for boat accidents is lack of safety consciousness on the part of crew, which leads to unsafe situations such as overloading, overcrowding, sailing in adverse weather and collision.

**Oil Spills:** Causes of oil spills are invariably leakage somewhere in the pipeline. Leakage in the pipeline in turn can be due to a variety of reasons such as sub-standard pipes, corrosion of metal, pipes having outlived their life, poor maintenance etc. Factors that contribute to oil spills are: **(a) Collision at sea:** Due to transit of number of tankers in the area to transport oil from oil extraction platforms, the eventuality of tanker collision off the coast resulting in spill and turning into major oil spill catastrophe cannot be ruled out, **(b) Oil extraction activities:** Defect/malfunctioning of oil extension pipe line/oil spill in the vicinity of oil extraction platform is ever present. The chances of these oil rigs coming under the attack of our enemies during the hostility further enhances the chances of oil spill disaster scenario. **(c) Grounding:** There have been number of instances where due to Navigational errors number of ships have run aground, **(d) Tanker routes pumping out of bilges:** Due to various oil tankers transiting, accidental discharge on the oil route can not be ruled out. Number of ships also find it convenient to pump out from bilges in Open Ocean and the bilges mostly contains the oil and **(e) Danger of spillage while transferring oil from ship to shore facilities:** Danger of oil spillage always loom large when the oil is being transferred from the offshore terminal to the ship and from the ship to shore facilities in various ports.

**Rail Accidents:** Causes in most cases are human failure. Factors that contribute to Rail accidents 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
- Land slides
- Breach of rules on unmanned railway level crossing
- Sabotage
- Tampering with track
- Act of God

**Road Accidents:** Causes in most cases are human failures and in a few rare cases these are caused by technical failures such as failure of brakes etc. Road accidents also occur under conditions of impaired visibility, slippery road surface etc.

### Response Action

Accident victims succumb to injuries due to shock, bleeding and head injuries. If necessary first aid and replacement of fluid can be arranged within the first hour of injury many lives could be saved. *“The first hour is called the golden hour”*. Common injuries include crush injuries, fractures, bleeding and victims in a state of shock. In case of all accidents involving casualties and injuries:

- Inform the nearest traffic police station, post through passing vehicles on either side.
- Look for and rescue the injured or those still trapped inside.
- Arrange for transport of the injured to the nearest medical care center by first available means.
- Place dead bodies on one side to avoid obstructions.
- Traffic control should be organized locally using available manpower to avoid traffic jams.
- Discourage people from crowding near the accident spot.
- Prevent people from looting goods from the accident site.

**Air Accidents:** In cases where the accident occurs beyond visual contact of the Aerodrome Control Tower, information of such accident is preceded by information of aircraft missing or contact having been lost with the Air Traffic Control. Search operations are initiated with the help of the State Administration and local police of the area where the aircraft was last reported. In case of a mid-air collision or an air crash into mountainous terrain, not much rescue work is possible since most passengers on board would have perished instantaneously. In case of forced landing, some amount of rescue work would still be possible by means of evacuating passengers from the crippled air-craft and moving them to safety.

**Boat Accidents:** Rescue boat passengers, give first aid and rush to nearby hospitals. In situations, where it is not possible to provide rescue, relief operations at short notice, it becomes necessary that administrative authorities concerned should periodically review logistics and other arrangements that may be required for such operations. In cases, where the number of crew members on the boat and life saving equipments like life jackets, inflatable rafts etc. are inadequate, it forces the passengers to either swim or else wait for some form of rescue team to arrive from close by locations so, under these conditions, the only response possible has to be provided by local people living nearby in immediate vicinity of the waterway.

**Oil Spills:** Once an oil spill is reported, members of response and base team shall be notified and base control room should be established and contact numbers of base control room should be reported to all concerned for effective co-ordination. On-scene coordinator who should be a senior level executive trained in oil spill management must immediately take charge of base control room after reporting of spill.

**Rail Accidents:** The guard and driver of the train should inform the local divisional control office regarding occurrence of the above accident. Divisional office in turn must organize rescue and relief work by way of ordering Accident Relief Medical Van and Accident Relief Train to be rushed to the site of accident. Normally, it takes railway's medical and rescue teams 3 to 4 hours time to arrive at the accident site. During this initial period, it is the local population that helps organize rescue and relief work along with railway staff traveling on the accident affected train.

**Road Accidents:** In such cases involving passenger carrying vehicles: Inform the nearest traffic police station and fire brigade; Look for and rescue the injured or those trapped in vehicles; Arrange for transport of the injured to the nearest medical center, Place dead bodies on one side to avoid obstructions; Traffic control should be organized locally using available manpower to avoid traffic jams; Discourage people from crowding near the accident spot, In case such accidents involve hazardous chemical, do not go anywhere near the accident spot since contents may explode or catch fire and prevent people at the accident site from lighting matches for cigarettes etc.

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### **3.7 TERRORISM**

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Terrorism is the use of force or violence against persons or property in violation of the criminal laws for purposes of intimidation or ransom. Terrorists often use threats to: Create fear among the public, Try to convince citizens that their government is powerless to prevent terrorism, Get immediate publicity for their causes. Acts of terrorism include threats of terrorism; assassinations; kidnappings; hijackings; bomb scares and bombings; cyber attacks (computer-based); and the use of chemical, biological, nuclear and radiological weapons (Robert, 2003). **Terrorism:** "An act intended to cause death or serious bodily harm to civilians or non-combatants with the purpose of intimidating a population or compelling a government or an international organization to do or abstain from doing any act." (UN Panel on Terrorism)

#### **What is Terrorism?**

- A complicated phenomenon
- Specialized form of political violence
- Viscous species of psychological warfare
- The target is different from the intended audience
- The goal is not to kill, but to make an impact

#### **Classification of Terrorism:**

**International Terrorism:** Acts of violence by nationals of one country against the citizens / state of another country (*Al-Qaeda, LeT, JEM, Hezbollah*).

**State:** The state uses weapons of the state against its own people. Acts of violence and intimidation by the state against its own population e.g. Argentina's 'Dirty War' (*Hitler, Saddam Hussein*).

**State-supported:** The state uses its weapons to attack other country acts of violence supported by an or funded by external state actors (Proxy war). Eg. RUF in Sierra Leone.

**Sub-state:** A small group within the state is trying to use violence to accomplish its own goal.

**Domestic:** Acts of violence by non-state actors against domestic political opponents. Domestic terrorism is of two types:

- Ideological (e.g. Marxist, Islamist)
- Ethnic e.g. ETA (Spain), GIA (Algeria)

**Social revolutionary:** rebel against corrupt old ways (e.g. Baader- Meinhof gang in Germany)

**National Separatists:** Trying to carry on the family mission (E.g. Palestinian Terrorists, Northern Irish).

**Religious Fundamentalists:** they kill in the name of God. (E.g. Usama Bin Laden, abortion clinic bombers).

**New Religion:** The cults defending new religions (e.g. Shinrikyo in Japan (sarin gas in subway)).

**Right Wing:** They see the government as the enemy and illegitimate. (E.g. Neo-Nazis, Timothy McVeigh, Klu Klux Klan).

**Single Issue:** (e.g. animal rights, ecologic terrorism (Usually single people willing to kill)).

### Check Your Progress II

**Note:** Use the space provided for your answer.

- 1) Briefly list down the major terrorist activities in India in the last 10 years.

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## 3.8 BIOLOGICAL DISASTERS

Biological Disaster may be described as a disaster caused due to natural outbreaks of epidemics or intentional use of biological agents (Viruses/bacteria etc.) through dissemination of micro-organism or toxins in food or water or insect vector or by aerosol to harm human population, food crops and livestock to cause outbreaks of diseases. Biological agents are living organisms or their toxic products that can kill or incapacitate people, livestock, and plants. Biological weapons are referred to as a “poor man’s bomb” because they are easy to manufacture, can be deployed

without sophisticated delivery systems, and have the ability to kill or injure hundreds of people (Roberts, 1993) Simple devices such as crop dusting airplanes or small perfume atomizers are effective delivery systems for biological agents.

**Causes**

**Natural outbreaks:** Natural outbreaks of disease may become epidemics and assume disastrous proportion if not contained in the initial stages.

**Use of Biological Agents by Terrorists:** Use of biological agents to cause death, disability or damage mainly to human beings to prevail mass panic and slow mass casualties and an intentional use of biological agents to cause disease or death through dissemination of micro-organism or toxins in food or water or insect vector or by aerosol to harm human population, food crops and livestock.

**Mode of Delivery**

Biological agents can be dispersed by spraying them into the air, by infecting animals that carry the disease to humans, and by contaminating food and water.

- a) **Aerosols** - biological agents are dispersed into the air, forming a fine mist that may drift for miles. Inhaling the agent may cause epidemic diseases in human beings or animals.
- b) **Animals** - some diseases are spread by insects and animals, such as fleas, mice, flies, mosquitoes, and livestock.
- c) **Food and water contamination** - some pathogenic organisms and toxins may persist in food and water supplies. Most microbes can be killed, and toxins deactivated, by cooking food and boiling water. Most microbes are killed by boiling water for one minute, but some require longer.
- d) **Person-to-person** - spread of a few infectious agents is also possible. Humans have been the source of infection for smallpox, plague, and the Lassa viruses.

**Impact**

Even a small-scale biological attack with a weapon grade agent on an urban center could cause massive morbidity and mortality, rapidly overwhelming the local medical capabilities. For example, an aerosolized release of little as 100kg of anthrax spores upwind of a metro city of a size of Washington DC has been estimated to have the potential to cause up to three millions of deaths.

**Agents likely to be used for Bio-terrorism**

Sl. No.	Disease	Agent
1.	Anthrax	Bacillus Anthracis
2.	Plague	Yersenia pestis
3.	Q fever	Coxiella brunetii
4.	Botulism	Clostridium botulinum
5.	Cholera	Vibrio cholerae
6.	Shiegellosis	Shigella dysenteria (causes severe disease), flexneri, boydii, sonnei (short clinical course)
7.	Small Pox	Variola virus
8.	Viral Haemorrhagic fever	Ebola virus, Marburg virus, Lassa virus

## Do's and Don'ts

A biological attack is the release of germs or other biological substances. The germs must be inhaled, enter through a cut in the skin or be eaten to make you sick. Some biological agents can cause contagious diseases, others do not. Further, a biological attack may or may not be immediately obvious. One may probably learn of the danger through an emergency radio or TV broadcast. In rural areas, a loudspeaker or other methods such as used for a cyclone warning may be used to warn you.

**Before:** Children and older adults are particularly vulnerable to biological agents. Ensure from a doctor/the nearest hospital that all the required or suggested immunizations are up to date.

**During:** In the event of a biological attack, public health officials may not immediately be able to provide information on what you should do. It will take time to determine what the illness is, how it should be treated, and who is in danger. Watch television, listen to radio, or check the internet for official news and information including signs and symptoms of the disease, areas in danger, if medications or vaccinations are being distributed, and where you should seek medical attention if you become ill. The first evidence of an attack may be when you notice symptoms of the disease caused by exposure to an agent and be suspicious of any symptoms you notice, but do not assume that any illness is a result of the attack.

**After:** Pay close attention to all official warnings and instructions on how to proceed. The delivery of medical services for a biological event may be handled differently to respond to increased demand. The basic public health procedures and medical protocols for handling exposure to biological agents are the same as for any infectious disease. It is important for you to pay attention to official instructions via radio, television, and emergency alert systems.

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## 3.9 CHEMICAL DISASTERS

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Industrial disasters are disasters caused by chemical, mechanical, civil, electrical or other process failures due to accident, negligence or incompetence, in an industrial plant which may spill over to the areas outside the plant or with in causing damage to life, property and environment. Chemical disasters are occurrence of emission, fire or explosion involving one or more hazardous chemicals in the course of industrial activity (handling), storage or transportation or due to natural events leading to serious effects inside or outside the installation likely to cause loss of life and property including adverse effects on the environment. These accidents involved chemicals like chlorine, ammonia, LPG and other Hazardous chemicals. Following the Bhopal Gas Disaster in 1984, major incidences of chemical disasters in India include:

- A fire in an oil well in Andhra Pradesh (2003).
- A vapour cloud explosion in the Hindustan Petroleum Corporation Limited Refinery (HPCL), Vishakhapatnam (1997).
- An explosion in the Indian Petrochemicals Corporation Limited (IPCL) Gas Cracker Complex, Nagothane, Maharashtra (1990).

### Causes

Industrial (chemical) hazards are threats to people and life-support systems that arise from the mass production of goods and services. When these threats exceed human coping capabilities or the absorptive capacities of environmental systems

they give rise to industrial disasters. Industrial hazards can occur at any stage in the production process, including extraction, processing, manufacture, transportation, storage, use, and disposal. 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 (Simone, 2006).

### **Causes of Chemical Disaster**

A number of factors could trigger chemical accidents, some of which are Process and Safety Control System Failures: (1) Technical errors (2) Human errors, Natural calamities: For example, Release of acrylonitrile at Bhuj, during earthquake in 2001, and damage to Phosphoric acid sludge containment during Orissa Supercyclone in 1999 and Terrorist attacks/Sabotage (Source: Strategy Document on Chemical Disaster Management, MoEF, GoI; 2005).

### **Sources of Chemical Disasters**

The sources could be Manufacturing and Formulation Facility (including during Commissioning and Process Operation, Maintenance, Disposal and Waste Management), Material Handling and Storage, Bulk Storages in manufacturing facilities and isolated storages (including tank farms in Ports and Docks), Storages of Small Containers. In manufacturing facilities, in isolated warehouses and godowns, Storage of Fuels (LPG Depots etc.) and Pipelines, and Transportation (road, rail, air and waterways)

### **Impact**

The impact from such emergencies may range from death, injury, physiological health effects and losses, damage to environmental resources, like land/soil, land-use, water bodies/resources, air-quality and movements, local-climate, crops/forests and bio-products, disruption of environmental services, e.g. water supply, aesthetic and recreation, environmental and public health, sanitation, garbage management, damage and losses to structures, buildings, machines/equipment, facilities, psychological trauma, stress and lack of well-being, insurance losses, and economic losses related to disruption of productivity, wages, remuneration, incentives, increase in vulnerability to other hazards including natural and environmental exposures and/ or law and order instability, community outcries, litigations and public governance disruption (Simone, 2006).

### **Preparedness Strategies**

Chemical disaster management has two major components, viz. (a) Disaster Risk Reduction and Management and (b) Emergency Preparedness, Response and litigations. In order to effectively organize the preparedness and responses to likely chemical emergencies, an objective, systematic, written and applicable plan need to be in place at different levels, viz. the industry, local, district, state and Central level. Development of policy directives, guidelines and strategic tools, e.g. assessments (EIA, Audit, LCA, Risk Analysis, Multi-hazard vulnerability analysis), fiscal (PLI, Cess, Levi), market based (labeling, ISO), planning (on-site and off-site, carrying capacity based developmental planning, land-use governance, industrial estate planning, site selection), enforcement (law, rules, protocols), policy (industrial ecology,) and voluntary arrangements are to be made more integrated, practical and effective.

A holistic risk management framework for chemical-disaster prevention and management, thus, is a multi-disciplinary state of affairs, involving expertise from hard and soft disciplines of environmental studies; as mentioned below:

**Off-site perspectives:** geo-hydrology, atmospheric science, geography/land-use/regional planning, geo-informatics, disaster risk mitigation, environmental law, emergency planning, emergency medicine system, socio-psychological and trauma care, emergency communication, etc.

**On-site perspectives:** environmental system, chemistry, process engineering, incident-control system, fire, occupational health care and emergency medical system, internal transport, communication, etc.

(Source: National Disaster Management Guidelines)

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## 3.10 SHORT CASE STUDIES

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### Bhopal Gas Leak

The gas leak incidence at the Union Carbide Chemical Plant in Bhopal, Madhya Pradesh was the worst possible industrial disaster that occurred on the unforgettable night of 2-3 December 1984. Over 40 tons of Methyl Iso-cyanate (MIC) and other lethal gases including hydrogen cyanide leaked from Union Carbide Chemical plant, and caught people unawares, immediately killing 8000 people. It has affected thousands of people who till this day are experiencing the deadly after effects of the gas leak to which they had been exposed. More than 25 Research studies have been conducted so far which state that the health of more than 530,000 people has been severely affected causing multi-systemic injuries. Death toll has crossed 20,000 and 15 years after the disaster, 10-15 people continue to die every month. The Union Carbide Chemical (UCC) Plant had been set up in the year 1969 as an outcome of the Indian Governments move towards the 'Green Revolution' and were committed to increase India's agricultural productivity through mechanized agricultural techniques, construction of dams, and production of chemicals and fertilizers. The gas leak has had the most catastrophic effect on the health of the people who have been exposed and has affected people over a large area. 36 municipal wards were affected by the carbide gas leak. The poisonous gas was absorbed into the blood stream of the people, which has caused lasting and damaging effect to the lungs, brain, kidney, reproductive as well as the immune system of the victims. Even after 10 years of the carbide gas leak, in 1992, exposed people continue to suffer menstrual irregularities, abortions, and neurological disorders and mental abnormalities. The cases of respiratory problems, early eye cataract, still birthrates have all increased three folds. Expectant women, who were exposed to the gas leak, gave birth to children who had delayed motor and language sector development.

### Surat Plague

Surat, India's diamond city, so called because of its flourishing diamond industry, can be cited as a classic example of disaster due to environmental neglect and degradation. On the 22nd of September 1994, hospitals in the city started reporting deaths due to plague. Within forty-eight hours over 600,000 people had fled the city. With these people the suspected plague germs also spread to other parts of the country and the world, giving rise to international panic. The plague of Surat could have been predicted and avoided through timely action of cleaning up the city of its garbage dumps and unsanitary conditions. Yet people continued to live quietly amidst the filth till they were given some cause for concern by the dying rats, and it finally took human toll to get the residents and the government into action for cleaning up the city.

### Uphaar Cinema Fire

Fifty-nine people were killed and more than 100 injured in a fire that broke out in a packed Uphaar grand cinema theater in Green Park Extension in South Delhi in 1997. Most of the victims, including a number of children, teenagers and women died of asphyxiation. The rest were trampled in the stampede as people tried to escape the thick black smoke engulfing the four storey theatre. An electric transformer in the basement burst during the movie show with more than 1000 viewers. Spewing boiling oil, the transformer burst caused mayhem in the ground floor car parking area. The petrol tanks of some vehicles exploded stoking the fire, and the smoke soon filled the theater. Fire safety norms were violated through the installation of a transformer within the building. Many shopkeepers and passers-by launched rescue operation. Some used cellular phones to alert the police. Angry people said that the first fire engine arrived about 45 minutes after the first call. "We got stuck in the narrow lanes and heavy traffic in the area," said a fire official. Scores of policemen and firemen in gas masks took over. Using three 100-foot hydraulic snorkels, firemen brought out unconscious persons from upper floors. It took almost 2 hours, interspersed with heart rending scenes of comatose children being brought out, to completely evacuate the theatre, with police gypsies and ambulances rushing the victims to the nearby hospitals.

### 3.10.4 The Chernobyl Accident

On 26th April 1986, the world's most severe nuclear accident had occurred at Chernobyl, USSR (now Ukraine). When operators tested the capability of the plant's electrical back-up system, at that time part of the plant was shut down for routine maintenance. There was no exchange of communication and coordination between the Testing Team and Team responsible for operation and safety. In addition, the enormity of the accident was compounded by reactor design drawbacks. Soon the sudden and uncontrollable power surge was triggered; it resulted into violent explosion and almost destruction of the reactor. About 120 million curies of radioactivity and about 6-7 tons of materials were released contaminating more than 210,000 square kilometer area of Ukraine, Belarus and Russian Federation. Within 2 hours and 45 minutes, 40,000 persons were evacuated from when radiation dose was about 1 rad/hr. As on 1.1.95 145,000 km<sup>2</sup> has more than 1 Ci/km<sup>2</sup> on which 7 million people live. 800,000 people were involved in the accident, 116,000 persons were evacuated until mid August 1986 and additionally 52,000 in Ukraine, 106,00 in Belarus and 47,500 in Russian Federation were resettled. 237 persons were hospitalize due to over exposure and first degree burns. 134 persons were diagnosed for Acute Radiation Syndrome (ARS), 56 got radiation burn injuries including 2 with additional skin injuries. Of the 31 deaths, 28 persons died of over exposure, 2 persons due to explosion and 1 person due to prospective coronary thrombosis. 5 persons died between 1987 -90 and nine from 1992-96 due to ARS. A total of almost 17 million people, including 2.5 million younger than 5 years of age, were exposed to excess radiation.

#### Check Your Progress III

**Note:** Use the space provided for your answer.

- 1) Briefly describe a man-made disaster event known to you and also write its impact and any preparedness strategy/ policies/ guidelines laid down to combat it in future.

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### 3.11 LET US SUM UP

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Floods, droughts, cyclones and earthquakes are a recurrent phenomenon all across the globe. Susceptibility to disasters is compounded by frequent occurrences of manmade disasters such as fire, epidemics etc. The changing topography due to environmental degradation has also increased the vulnerability. In the last two decades, over 3 million people have been killed in natural disasters. According to statistical evidence, there have been three times as many losses resulting from disaster events in the past ten years than was the case in the 1960s. Disasters whether natural or man-made present considerable challenges for poverty reduction and sustainable development because they affect a wide range of social and ecological systems. Man-made disasters can be grouped into Chemical, Industrial and Nuclear related disasters, Accident related disasters like Forest and Urban Fires, Stampede, Mine Flooding, Oil Spill, Major Building Collapse, Serial Bomb Blasts, Festival related disasters, Electrical Fires, Air, Road and Rail Accidents, Boat Capsizing and Village Fire and Biologically related disasters like Epidemics, Pest Attacks and Food Poisoning etc.

The time has come to bring the full force of scientific and technological advances to the reduction of human tragedy and economic losses from natural and man-made disasters. We must take an Integrated Approach to disaster reduction, bringing new emphasis to research on disasters, on pre-disaster planning, on prevention or preparedness, identifying their causes and subsequent impact while we sustain our post-disaster relief capabilities and enhance the response and mitigation strategies and strictly follow the Dos' and Don'ts'.

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# UNIT 4 INSTITUTIONAL MECHANISM FOR DISASTER MANAGEMENT

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## Structure

- 4.0 Objectives
- 4.1 Introduction
- 4.2 Evolution of Disaster Management System in India
- 4.3 The Paradigm Shift
- 4.4 The Disaster Management Act 2005
- 4.5 Mandates of the DM Act - Institutional Mechanism at the National Level
- 4.6 Mandates of the DM Act - Institutional Mechanism at the State Level
- 4.7 Mandates of the DM Act - Institutional Mechanism at the District Level
- 4.8 Mandates of the DM Act - Financial Provisions
- 4.9 Let Us Sum Up
- 4.10 Further Readings and References

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## 4.0 OBJECTIVES

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Disasters affect all sections of society, causing loss of life, assets and livelihood. Recovering from such events also require huge efforts of the administrative system as well as the affected community. This Unit aims to give you an understanding of the administrative process of dealing with disasters in our country and the organizations operating at various levels. After studying this Unit, you will be able to:

- describe the evolution of the Disaster Management system in India since Independence;
- discuss the new initiatives with respect to the global developments;
- identify the organizations for managing disasters at the national, state and district levels; and
- discuss the financial instruments laid down for implementing the Disaster management system.

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## 4.1 INTRODUCTION

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India has been identified as a “global disaster hotspot”, signifying a country “with relatively high risk of adverse impacts from one or more natural hazard events.” (The World Bank, 2005). The variable geo-climatic conditions, sub-continental proportions and a huge population have combined to form a highly vulnerable country. The primary responsibility of ensuring the safety of the people rests with the government, therefore a mechanism of dedicated organizations at all levels has been set up to deal with disasters. This formalized, coordinated system is called the institutional mechanism for disaster management.

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## 4.2 EVOLUTION OF DISASTER MANAGEMENT SYSTEM IN INDIA

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India and its people have coped with disasters since time immemorial. The present disaster management system in India has its roots in drought response and famine management in the late eighteenth century. In response to the famine in large parts of India in 1877-78, that killed an estimated 5-6 million Indians, Lord Lytton set up a Famine Commission in May 1878. The Commission issued its report in 1880, determining the principles and practices to be followed in future famines. The report identified the criteria for gratuitous relief, outlined the government's role in relief distribution and suggested use of railway construction and irrigation projects for relief works. A Famine Insurance Fund was developed, which set aside £1000,000 a year for famine relief. In 1883, the first modern codification of famine response was framed, which classified situations of food scarcity according to a scale of intensity, and it laid out a series of steps that governments were obligated to take in the event of a famine. The code continues to influence contemporary policies through the well-entrenched relief management mechanism of India.

**Source:** <http://www.britannica.com/EBchecked/topic/1481489/Indian-Famine-Code>

### **Institutional Structure 1947 - June 2002**

After Independence, in 1947, the initial focus was on food scarcity and famine; so the Scarcity Relief Division within the Ministry of Agriculture was delegated the nodal charge of drought and scarcity management. Armed with the experience of managing drought hazards, the Scarcity Relief Division was gradually given the responsibility of managing all natural disasters and upgraded to **Natural Disaster Management Division** (NDM Division) within the Ministry of Agriculture. This Division managed high-impact disaster events like Uttarkashi and Latur Earthquakes of 1991 and 1993 respectively, flash flood and landslides at Malpa in 1998, Orissa Supercyclone of 1999 and Bhuj Earthquake of 2001. However, it was felt that each disaster created complex emergencies that call for a broader and more holistic approach for effective management. As a result, the subject of disaster management excluding drought was shifted to the Ministry of Home Affairs in June 2002.

In the federal structure of the Indian administration, disaster management has been the responsibility of the states; with the national government performing a supportive role. The basic responsibility for undertaking rescue, relief and rehabilitation measures in the event of natural disasters is that of the concerned State Governments, particularly the district administration. The supportive role of the Central Government refers to assistance in warning, transport, inter-state movement of food grains, financial assistance etc.

### **Institutional Structure after 2002**

The frequent disasters and relief-centric approach ensured that India developed a well-structured response system after Independence. At the national level, the Ministry of Home Affairs is entrusted with the nodal responsibility of managing disasters. However, in view of the highly technical and specific nature of response of technological disaster events like aviation disasters, rail accidents, chemical disasters etc, ministries dealing with the particular subject have the nodal responsibility of handling that particular disaster.

The policy and institutional system for managing disasters has been well established over time. The Ministry of Home Affairs coordinates all matters concerning disaster management at the national level through the following officials/institutions:

**Nodal Officer in MHA:** Within the Ministry of Home Affairs, the Central Relief Commissioner (CRC) is the nodal officer to coordinate relief operations for natural

disasters. The CRC receives information on Early Warning and forecasting from the India Meteorological Department (IMD) and Central Water Commission (CWC) on a continuing basis.

**Table: Nodal Ministries for Managing Different Types of Disasters**

Type of Disaster/ Crisis	Nodal Ministry
Earthquakes and Tsunami	MHA/Ministry of Earth Sciences/India Meteorological Dept
Floods	MHA/ Ministry of Water Resources/Central Water Commission
Cyclones	MHA/ Ministry of Earth Sciences/India Meteorological Dept
Drought	Ministry of Agriculture
Biological Disasters	Ministry of Health and Family Welfare
Chemical Disasters	Ministry of Environment and Forests
Nuclear Disasters	Ministry of Atomic Energy
Air Accidents	Ministry of Civil Aviation
Railway Accidents	Ministry of Railways

*Source: National Disaster Management Authority, www.ndma.gov.in*

**Crisis Management Group:** Along with the nodal ministry, the Crisis Management Group (CMG), under the Home Secretary coordinates management of any crisis situation including calamities in the country. The group constitutes all ministries/ departments/organizations concerned with primary and secondary functions relating to the management of disasters. A nodal officer, nominated from each ministry/ department is responsible for preparing the sectoral action plan/ Emergency Support Function Plan for managing disasters. The CMG's functions are to review the Contingency plans, identify measures required for dealing with natural disasters, coordinate the activities of the Central Ministries and State governments in relation to disaster management and relief. In the event of a disaster, the CMG meets frequently to review the relief operations and extend all possible assistance required by the affected states to overcome the situation effectively. However after the passage of the Disaster Management Act 2005 the CMG has been subsumed into the National Executive Committee under the Home Secretary with all line ministries as members with a mandate of planning and implementation of all guidelines, thus widening the mandate to mitigation and prevention in addition to earlier responsibilities of preparedness and response (refer section 1.5).

At a higher level, the **National Crisis Management Committee (NCMC)** is headed by the Cabinet Secretary, who is the highest executive officer. Secretaries of all concerned ministries/departments are members of NCMC, which gives directions to the CMG as deemed necessary. The NCMC can give directions to any ministry/ department/organization for specific action needed for meeting the crisis situation.

At the apex level, there are two Cabinet Committees viz. the Cabinet Committee on Natural Calamities and the Cabinet Committee on Security. Major issues relating to natural disasters are placed before the **Cabinet Committee on Natural Calamities. In case of calamities which impinge on internal security** or which may be caused due to use of nuclear, biological and chemical weapons/materials, the matter is required to be placed before the Cabinet Committee on Security.

At the State level, Relief Commissioners are in charge of the relief and rehabilitation measures in the wake of natural disasters in their respective States. The Chief Secretary is in overall charge of the relief operations in the State. The Relief Commissioner and the Additional Relief Commissioners function under his direction and control. In many states, Secretary of Department of Revenue is also in-charge of Relief.

The District Magistrate / Collector holds the responsibility for overall management of disasters. All the disaster management activities are undertaken by state and district administration and are operationalized on the basis of provisions laid down in the Relief Codes or Manuals. In the event of a disaster, a District Collector has the authority to mobilize the response machinery immediately and enjoys absolute financial autonomy to draw money under the existing provisions of the General Financial Rules. Other bodies such as the Armed Forces and non-government organizations supplement the efforts of the state government. The Armed Forces are able to mobilize and coordinate rescue and relief in the shortest possible time and the non-government organizations become useful instruments of communication with the community providing succor at the much needed hour.

It is therefore clear that despite the country being hit by frequent and devastating disasters, the orientation towards their management has been, by and large, relief oriented. During a disaster, relief distribution was of primary importance, once this phase got over it was time for development works to resume. The administration was also traditionally relief oriented. Even the nomenclature of nodal departments and officials dealing with disaster management focused on post-disaster relief viz. Relief Commissioners and Departments of Relief point to the significance of relief in the administrative system.

However, the scenario has changed to a great extent with the passage of the Disaster Management Act 2005 in India. The Act has mandated creation of specialized organizations to focus on mitigation and prevention, while retaining synergic linkages with the established system, which has proved to be effective for response. This change was possible due to a chain of events across the globe, led by the United Nations in providing a focus on disaster prevention and mitigation. The following section gives a brief overview of the global chain of events that led to comprehensive actions in India.

**Check Your Progress I**

**Note:** Use the space provided for your answer

- 1) Describe the first initiative of disaster management in India. Why is it important in the history of disaster management of the country?

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- 2) Who holds the primary responsibility of disaster management in the Indian administrative system? What are the roles of the Central and State Governments for managing disasters?

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3) Describe the structure for managing disasters at the national level with respect to the nodal ministries, coordination mechanism between various ministries and the committees.

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### **4.3 THE PARADIGM SHIFT**

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The relief-centric orientation towards managing disasters underwent a significant change during the 1990s, due to the International Decade for Natural Disaster Reduction (IDNDR) observed by the United Nations. On 11 December 1987 at its 42nd session, the General Assembly of the United Nations designated the 1990's as the International Decade for Natural Disaster Reduction (IDNDR). The basic idea behind this proclamation of the Decade was the unacceptable and rising levels of losses which disasters continued to incur on the one hand, and the existence, on the other hand, of a wealth of scientific and engineering know-how which could be effectively used to reduce losses resulting from disasters. The objective of the IDNDR was to “reduce, through concerted international action, especially in developing countries, the loss of life, property damage and social and economic disruption caused by natural disasters.” The same resolution designated the second Wednesday of October as International Day for Natural Disaster Reduction

During the IDNDR, the Yokohama Conference was organized in 1994 to review the accomplishments and plan the future course of action and also to promote awareness. The event, attended by governments, NGOs, scientists, researchers, international humanitarian organizations and media raised a collective voice for disaster risk reduction and adopted the Yokohama Strategy and Plan of Action for a Safer World. It strongly advocated development of a global Culture of Prevention through efficient early warning measures, capacity building of disaster managers and vulnerable communities, integrating prevention, mitigation, preparedness and relief in development policy and planning, environmental protection and international cooperation. Few high-impact disasters around the world like Kobe Earthquake (Japan, 1995), Northridge Earthquake (California, USA 1994), Latur earthquake (India, 1993), Bangladesh Cyclone (1991), Kocaeli Earthquake (Turkey, 1999), Orissa Supercyclone (India, 1999) also pushed global attention to pre-disaster mitigation and prevention approach of IDNDR.

At the end of the IDNDR, in order to continue the global momentum created by it, the International Strategy of Disaster Reduction (ISDR) was formed as a multi-disciplinary and multi-stakeholder platform to enable societies to increase their resilience to natural, technological and environmental disasters and to reduce associated environmental, human and economic and social losses. ISDR organized the World Conference on Disaster Reduction in January, 2005 at Kobe, Japan and represents a landmark in worldwide understanding and commitment to implement a disaster risk reduction agenda. This commitment was captured in the Hyogo Declaration and the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters adopted at the WCDR. The Framework details three strategic goals for disaster risk reduction and a set of five priority areas for action; and assigns tasks to stakeholders at different operational levels to reach the expected outcome.

### **Paradigm Shift in India**

In India the worldwide attention on IDNDR resulted in concern over the huge developmental losses from disasters, which a country like India could barely afford. A series of disasters like the Uttarkashi Earthquake 1991, Latur Earthquake 1993, Jabalpur Earthquake 1997, Malpa Landslide 1998, mega floods of 1998, Chamoli Earthquake of 1999, Orissa Supercyclone of 1999 followed by the Bhuj Earthquake of 2001 hit the country during this time causing the general thinking to shift towards a prevention and mitigation regime. The need to prevent such devastation from happening by preparing in advance began to gain prominence.

This felt need resulted in some concrete mitigation actions like preparation of the Vulnerability Atlas of India, establishment of training and capacity building facilities on disaster management at the Centre and states, upgradation of early warning system etc. The High Powered Committee (HPC) on Disaster set up in 1999 focused on the need for a holistic effort, considering all disasters within a coordinated system of governance. The HPC also focused on instilling a Culture of Prevention. The Tenth Five Year Plan also added a separate chapter on Disaster Management - The Development Perspective "with the objective to inform, guide and provide specific strategies to all State Governments in disaster management."

The last two devastating calamities viz the Bhuj Earthquake 2001 and the Asian Tsunami 2004 gave a momentum to this paradigm shift because it focused on the fact that the apparent loss of human life, assets and property hides insurmountable losses in livelihood, social capital and economic development. The cost of rehabilitation and reconstruction of a shattered infrastructure and economy are indeed enormous, carried over for years. The hard facts that showed how the nation was losing the gains of development with average annual deaths of 4350 people, 40000 animals, damage of 2.5 million houses and crop loss over 1.5 million hectares, accounting for 2.25% of Gross Domestic Product (GDP).

A comprehensive framework for disaster management was then developed in a multi-sectoral and multi-disciplinary format. This approach proceeds from the conviction that development cannot be sustainable unless disaster mitigation is built into the development process and investments in mitigation are much more cost-effective than expenditure on relief and rehabilitation. The underlying premise within which this framework has been formulated is that while hazards are inevitable, they need not convert into disasters every time. Another corner stone of the approach is that mitigation has to be multi-disciplinary spanning across all sectors of development. A coordinated mechanism of preparedness, prevention, response and rehabilitation involving all stakeholders would be instrumental in bringing about the Culture of Prevention. One of the most significant changes was brought about through a Central legislation on disaster management.



**Check Your Progress II**

**Note:** Use the space provided for your answer

- 1) What was the idea behind the proclamation of IDNDR? What were its main objectives?

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- 2) List the major initiatives taken by India during IDNDR for disaster risk reduction

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- 3) Describe the main features of the comprehensive and holistic approach taken by India after the paradigm shift.

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**4.4 THE DISASTER MANAGEMENT ACT 2005**

The Disaster Management Act 2005 (henceforth DM Act 2005) was one of the most significant initiatives taken by the Government of India for putting in place an institutional system dedicated to disaster management. Notified on 26 December, 2005, exactly a year after the Indian Ocean Tsunami, the Act was the first acknowledgement of the Government of India of the need for legislative backup to the governance system. Comprising of 79 sections and 11 chapters, the Act provides for the “effective management of disasters and for matters connected therewith or incidental thereto.” Enacted by Parliament, it automatically extends to the entire Indian territory for dealing with disasters.

According to the Act, a disaster is “a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence, which results in substantial loss of life, or human suffering, or damage to, and destruction of property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.”

The Act defines disaster management as “a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for:

- i) prevention of danger or threat of any danger
- ii) mitigation or reduction of risk of any disaster or its severity or consequences
- iii) capacity building
- iv) preparedness to deal with any disaster
- v) prompt response to any threatening disaster situation or disaster
- vi) assessing the severity or magnitude of effects of any disaster
- vii) evacuation, rescue and relief
- viii) rehabilitation and reconstruction”

The Act, therefore, attempts to define and deal with disasters in a holistic way, linking causes, both natural and man-made, impacts, including life, property and environment, and developing a management plan that includes not only the post disaster aspects of response, relief and reconstruction, but also the pre-disaster aspects of prevention, mitigation and preparedness.

**Box**

**Mitigation:** measures aimed at reducing the risk, impact or effects of a disaster or a threatening disaster situation,

**Preparedness:** a state of readiness to deal with a threatening disaster situation or disaster and the effects thereof

**Reconstruction:** construction or restoration of a property after disaster.

**Capacity Building:**

- i) identification of existing resources and resources to be acquired or created.
- ii) acquiring or creating those resources identified.
- iii) organization and training of personnel and coordination of such training for effective management of disasters.

The DM Act 2005 is an attempt at setting up and institutionalising a dedicated system for disaster management. To this end, it mandates the setting up of key institutions at the national, state and district levels. The Act aimed towards creating a hierarchy of institutions for policy and planning, implementation, capacity building, response force, thereby ensuring a holistic effort towards disaster management. By setting up specific institutions, the Act has cleared the uncertainty regarding the exact division of responsibilities and duties between various tiers of government.

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## 4.5 MANDATES OF THE DM ACT - INSTITUTIONAL MECHANISM AT THE NATIONAL LEVEL

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The Disaster Management Act 2005 has created a hierarchy of institutions at the national, state and district levels for holistic management of disasters. In doing so, the Act has formally abandoned the earlier notion that disaster management is the sole responsibility of the states with the Central Government only playing a supportive role. The definite role of Central Government is ensured through the formation of a number of organizations at the Central level. The national level organizations created as per the Act are:

**National Disaster Management Authority (NDMA)** - With the Prime Minister as Chairperson and 9 other members the National Authority (NDMA) is entrusted with the responsibility of laying down the policies, plans and guidelines for ensuring timely and effective response to disasters. More specifically, the National Authority is mandated to lay down policies, approve the national plan, approve plans of other ministries/departments, lay down guidelines for the states, coordinate implementation of policies and plans, recommend mitigation funding provisions and coordinate bilateral support to other affected countries during disasters. The National Authority is also expected to frame guidelines for provision of minimum standards of relief, special provisions to be extended to widows and orphans and ex-gratia assistance for restoration.

The NDMA is authorized to constitute an Expert Committee consisting of experts in the field of disaster management and having practical experience of disaster management at the national, state and district levels to suggest and recommend measures for different aspects of disaster management.

**National Executive Committee (NEC):** The Act provides for the constitution of a National Executive Committee under the chairmanship of the Home Secretary to assist the Authority in performance of its functions. The Committee will assist the NDMA and ensure compliance and implementation of the directions of government and NDMA. The National Executive Committee would comprise of the Secretaries to the ministries/departments of agriculture, defence, drinking water supply, environment and forests, finance (expenditure), health, power, rural development, telecommunication, space, science and technology, urban development, water resources and the Chief of the Integrated Defence Staff of the Chiefs of Staff Committee. The National Executive Committee is mandated to assist the Authority in the discharge of its functions, implement the policies and plans of the NDMA and ensure the compliance of directions issued by the Union Government for the purpose of disaster management in the country.

A National Plan for Disaster Management shall be prepared by the National Executive Committee in consultation with the State Governments and other expert bodies/organizations. This plan has to be approved by the NDMA. The National Plan shall include the disaster prevention and mitigation measures to be taken at the national level, measures for integration of such measures into the development plans, preparedness and capacity building measures to effectively respond to disasters and the roles and responsibilities of the various ministries and departments for delivering these activities. The National Executive Committee has recently initiated the process of preparation of the National Plan.

**National Institute of Disaster Management (NIDM):** NIDM was founded from its predecessor National Centre for Disaster Management (NCDM) with an aim of creating an Institute of excellence in disaster management studies in India. As per provisions of the Act, NIDM is required to design, develop and implement training programmes, undertake research, formulate and implement a comprehensive human

resource development plan, provide assistance in national policy formulation, assist other research and training institutes, state governments and other organizations for successfully discharging their responsibilities, develop educational materials for dissemination and promote awareness among stakeholders in addition to undertake any other function as assigned to it by the Central Government. NIDM is also required to network with various research and training institutions for sharing of knowledge and resources.

**National Disaster Response Force:** The National Disaster Response Force (NDRF) has been constituted by upgradation/ conversion of 8 standard battalions of the Central Para-military Forces as specialist force to respond to disaster situations. The NDRF has been carved out 2 battalions each from Border Security Force (BSF), Indo-Tibetan Border Police (ITBP), Central Industrial Security Force (CISF) and Central Reserve Police Force (CRPF). Based on the vulnerability profile of different regions of the country, these battalions are stationed at 9 different locations to be deployed, in the event of any serious threatening disaster situation, to provide instantaneous response. Each battalion will provide 18 self-contained specialist search and rescue teams of 45 personnel each including engineers, technicians, electricians, dog squads and medical/paramedics. The total strength of each battalion will be approximately 1,158. Four battalions will be trained specifically for responding to man-made disasters. Units of this force will work under the general superintendence, direction and control of the NDMA. They will maintain close liaison with the state governments and will be available to them proactively. Their role in responding to Bihar Floods of 2008 has been greatly appreciated and 2 more battalions have been sanctioned recently.

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## **4.6 MANDATES OF THE DM ACT - INSTITUTIONAL MECHANISM AT THE STATE LEVEL**

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A similar institutional structure has been created at the State level with each state to have the following set up:

**State Disaster Management Authorities (SDMA):** State Disaster Management Authorities under the chairpersonship of the Chief Minister are mandated by the Act for laying down disaster management plans and policies of the state, coordinate implementation, lay down guidelines, recommend provision of funds for mitigation and preparedness, review the measures taken for preparedness, mitigation and disaster risk reduction. 23 states have already notified their SDMAs.

**State Executive Committee:** The State Government is empowered to constitute the State Executive Committee under the chairpersonship of the Chief Secretary and four secretaries of relevant departments. This Committee is responsible for implementing the national Plan and the State Plan and act as the coordinating and monitoring body for management of disasters in the state. The Committee will prepare the State Disaster Management Plan as per the guidelines laid down by the National Authority after consultation with local authorities, departments and people's representatives, as the Committee may deem fit.

**State Disaster Response Forces (SDRFs) -** The states have been advised to set up their own Specialist Response Forces for disaster response. The existing resources of the state armed police, fire and rescue services, Home Guards, Civil Defence, etc., would be the sources from which the SDRFs may be constituted to generate specialist response. They will also include women members for looking after the needs of women and children. NDRF battalions and their training institutions will assist the states/UTs in this effort.

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## 4.7 MANDATES OF THE DM ACT - INSTITUTIONAL MECHANISM AT THE DISTRICT LEVEL

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Most of the disaster management initiatives are operationalized at the district level. Recognizing the need to create a strong implementing and coordinating body at the district level, the Act has provided for the creation of a District Disaster Management Authority (DDMA) in each of the six hundred plus districts of the country.

**District Disaster Management Authorities:** Every state will constitute a District Disaster Management Authority under the co-chairpersonship of the District Magistrate and the President of the Zilla Parishad, providing for integration of the executive and legislative focal points at the district level. The District Disaster Management Authorities shall act as the district planning, coordinating and implementing body for disaster management. Their major responsibilities would include inter alia:

- i) preparation of district disaster management plan including district response plan,
- ii) coordination and monitoring implementation of the national and state policies and plans and
- iii) to take requisite measures for disaster prevention and mitigation in the vulnerable areas of the district,
- iv) to give directions to concerned departments for putting in place risk reduction measures,
- v) to organize capacity building of the staff,
- vi) to facilitate community training and awareness,
- vii) to coordinate early warning and dissemination mechanisms,
- viii) to establish stockpiles of relief and rescue materials
- ix) to ensure regular rehearsals, drills etc. and
- x) communicating with their State Authority for effective disaster management.

The process of notifying the District Authorities is currently under way in most states.

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## 4.8 MANDATES OF THE DM ACT - FINANCIAL PROVISIONS

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The financial provisions of the Act are in keeping with the underlying aim of addressing disaster risk reduction through effective response and sustained prevention and mitigation measures in a holistic framework. The Act has made clear demarcations between response and mitigation funding, thereby acknowledging the inherent difference between expenditure needs for response during disaster situations and those of mitigation during normal times.

**National Funds:** the DM Act has provided for two funds viz. National Disaster Response Fund and National Disaster Mitigation Fund. **The National Disaster Response Fund**, as specified in the Act, would be used for “meeting any threatening disaster situation or disaster.” The Fund will comprise of two components, the majority from a corpus deposited by the Government and any other grants, donations

made by any person or institution for the purpose of disaster management. The Response Fund would be available with the National Executive Committee, who would use it towards meeting the expenses for **emergency response, relief and rehabilitation** according to the guidelines laid down by the Government, in consultation with the National Authority.

**The National Disaster Mitigation Fund** has been provided **exclusively for the purpose of mitigation** and would be used only for mitigation projects. The corpus of the fund would be provided by the Central Government after due appropriation made by Parliament, by law. This fund would be applied by the National Authority.

**State Funds:** Similar funds are to be provided at the state and district levels. The Act enjoins the State Governments to create Response and Mitigation Funds at the state and district levels. The **State Disaster Response Fund**, available with the State Executive Committee, would be available for emergency response, relief and rehabilitation at the state level, while the **State Disaster Mitigation Fund**, to be made available to the State Disaster Management Authority for mitigation projects.

**District Funds:** At the district level, the State Government has to create similar funds for the district level. The **District Disaster Response Fund** and the **District Disaster Mitigation Fund** would be made available to the District Authorities for response and mitigation purposes respectively.

**Check Your Progress III**

**Note:** Use the space provided for your answer

- 1) How does the DM Act 2005 define disaster? What objective does the Act aim to achieve?

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- 2) Name the national level institutions that the Act has helped create. Describe the functions of any two.

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**4.9 LET US SUM UP**

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India is affected by frequent and devastating disasters. Its vast expanse and varied geo-climatic features add to the wide variety of disasters that strike our land. Initially disasters were considered to be interruptions in the process of development, so they were managed after occurrence in the form of relief distribution, reconstruction and rehabilitation. Pre-disaster efforts for prevention, mitigation and preparedness were almost absent in any form of government. The institutional system for disaster management was entirely geared towards response, with the states sharing the

major responsibility and the Central Government playing a supportive role. The Relief Commissioners at the Centre and States were nodal officers concerning disaster management and response. When a disaster happened, the National Crisis Management Committee (NCMC) and the Crisis Management Group (CMG) coordinated with the states and gave directions.

During the 1990s, with the United Nations declaration of the International Decade for Natural Disaster Reduction (IDNDR), the orientation towards the world began to change from a post-disaster response to a pre-disaster prevention and mitigation approach. Two global events, one in 1994 in Yokohama and the second in 2005 in Kobe Japan brought the world attention to the need to look at disasters from both pre-disaster and post-disaster perspectives. Both the World Conferences have come out with a specific agenda and plan of action for the nations to follow.

India has also taken great strides in disaster preparedness and risk reduction. As a partner in the worldwide movement to usher a Culture of Prevention, India has taken strong steps to move from relief based response to equal emphasis on prevention, mitigation, preparedness, relief, response, reconstruction and rehabilitation. The nodal ministry has shifted from the Ministry of Agriculture to the Ministry of Home Affairs in 2002.

The most significant change has been brought about by the passage of the Disaster Management Act 2005. It has ensured joint responsibility of both Central and State Governments for managing disasters and provided for a dedicated institutional mechanism and funding at the national, state and district levels. The Act has provided for Disaster Management Authorities at the national, state and district levels, national and state executive committees for implementation and specialized response forces at the national and state levels. India is thus going through a phase of intense preparedness for all disasters. The aim of these initiatives is to usher in a Culture of Prevention across the spectrum of stakeholders in the short and long run. The mission is to build a Disaster Resilient Community who will be empowered with the capacity to deal with hazards, without succumbing to its devastation and the new institutional mechanism provided by the Act aims to facilitate this process.

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