WHITE BOOK

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DISASTER MANAGEMENT

FOR CIVIL SERVICES EXAMINATION

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Saarthi

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Mentored 250+ Successful Aspirants over a period of 12+ years for Civil Services & Judicial Services Exams at both the Centre and state levels.

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Mentored 100+ Successful Aspirants over a period of 9+ years for Civil Services Exams at both the Centre and state levels.

DISASTER MANAGEMENT

Classification of Disasters and Disaster Management

The United Nations International Strategy for Disaster Reduction (UNISDR) (2009) defines disaster as:

- "A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources."

Disaster (As per DM Act, 2005)

- **Meaning:**
  A *catastrophe / mishap / calamity / grave occurrence* in any area.
- **Causes:**
  - **Natural** (e.g., flood, cyclone, earthquake)
  - **Man-made** (industrial accidents, conflicts, etc.)
  - **Accident or negligence**
- **Consequences:**
  - Substantial **loss of life**
  - **Human suffering**
  - **Damage / destruction of property**
  - **Damage or degradation of environment**
- **Key Condition:**
  - Must be of **such nature/magnitude** that it is **beyond the coping capacity of the affected community**.

- UNISDR considers disaster to be a result of the combination of many factors such as
  - exposure to hazards;
  - conditions of vulnerability that are present, and
  - insufficient capacity or measures to reduce or cope with the potential negative consequences.

Disaster impacts everyone differently. Some of the them are as under:

Individual	Psychological and emotional trauma. Injuries, disease and other negative effects on human physical, mental and social well-being
Physical Infrasturctural	Damage to property and destruction of assets
Human Infrasturctural	Loss of life.
Governance	Loss of services and administration problems

Social	Social and economic disruption – Worst hit are Women, Children and old age as they are most vulnerable groups.
Environmental	Environmental degradation

Disaster Matrix

- Identification and classification of disaster is being considered as an effective and scientific step to deal promptly and efficiently with the disaster.
- Primarily disasters are triggered by natural hazards or human induced, or result from a combination of both.
- In particular, human-induced factors can greatly aggravate the adverse impacts of a natural disaster.
- These disaster situations and their specific features are captured in a 'Disaster management matrix' shown in Table.

Disaster Management Matrix

Disaster caused by →	Natural Events						Accidents			Biological Events	Hostile Elements		Disruption of essential services	Large gatherings getting unruly
	Climatic				Geological									
Specific Features	Drought	Cyclone	Tsunami	Flood	Earthquake	Landslide	Industrial	Nuclear	Fire	Epidemics	Extremism	Terrorism		
Early Warning Possible?	Yes	Limited	Very Limited	Limited	No	No	No	No	No	Yes	Limited	No	Limited	Limited
Level of Community Preparedness	Some Extent	Some Extent	Nil	Some Extent	Nil	Nil	Nil	Nil	Limited	Nil	Nil	Nil	Limited	Nil
Duration of Disaster	A Few Months	A Few Days	A Few Hours	A Few Days	A Few Minutes	A Few Minutes	A Few Days	Prolonged	A Few Hours	Prolonged	Days to Months	Instanta-neous	A Few Days	A Few Hours
Whether Building Structures Important	No	Yes	Yes	Yes	Yes	Limited	No	No	Yes	No	Yes	No	No	No
Area Affected	Large	Large	Large	Medium	Large	Limited	Limited	Medium	Limited	Medium	Large	Limited	Large	Limited
Whether Mitigation Measures Possible?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Whether Rescue Required	No	Yes	Yes	Yes	Large Scale	Yes	Yes	Yes	Yes	Generally No	Yes	Yes	No	Limited

Classification of Natural Hazards

The widely accepted classification system classifies disasters arising from natural hazards into five major categories:

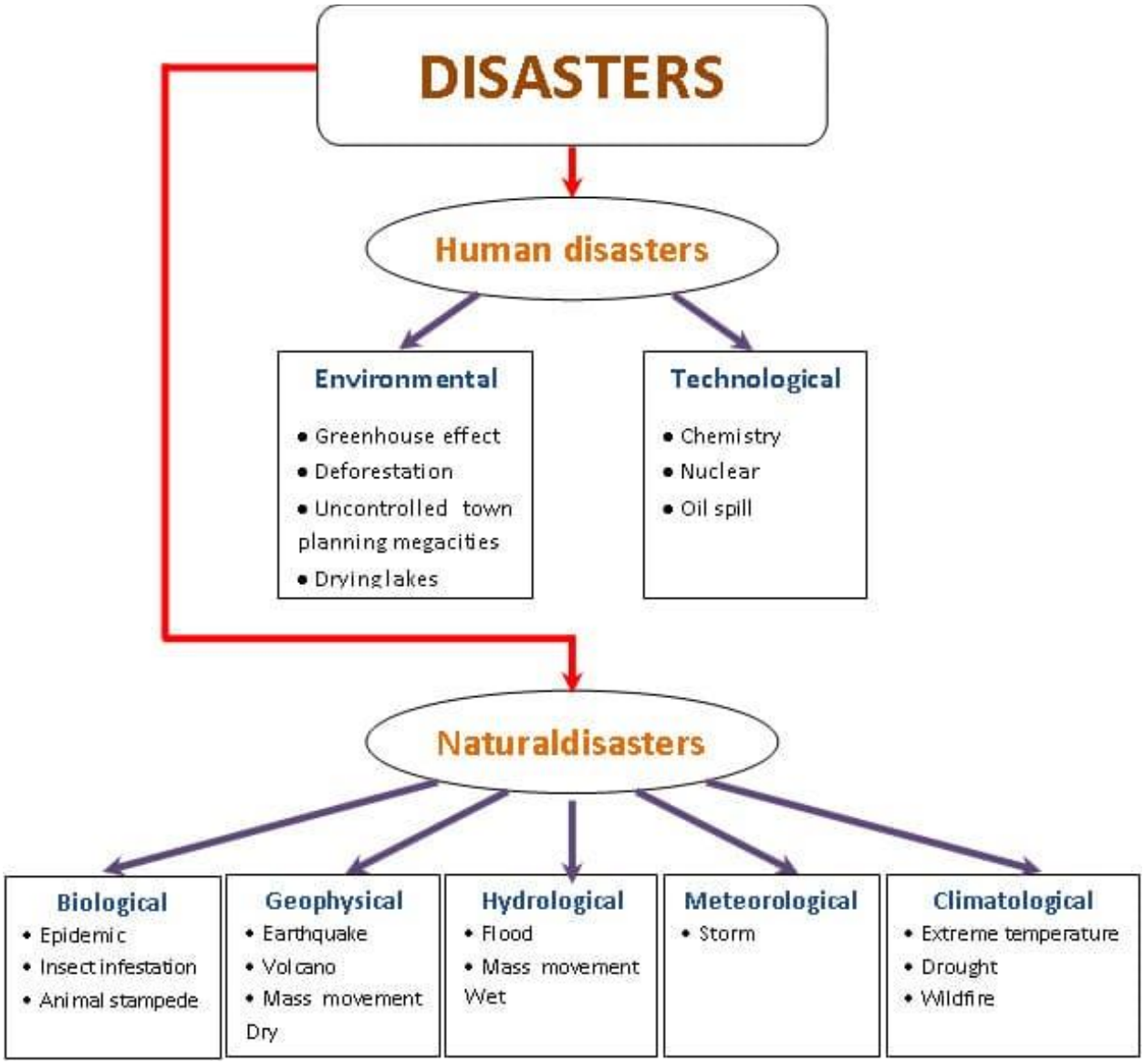
1. **Geophysical:** Geological process that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

    - Hydrometeorological factors are important contributors to some of these processes.

2. **Hydrological:** Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up.
3. **Meteorological:** Events caused by short-lived/small to meso-scale atmospheric processes.
4. Climatological: Events caused by long-lived meso to macro-scale processes.
5. **Biological:** Process or phenomenon of organic origin or conveyed by biological vectors,including exposure to pathogenic micro-organisms, toxins and bioactive substances that may cause loss of life, injury, illness or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

A brief description of the five major categories of the disasters arising from natural factors with the subcategories is given in the table.

Classification of Disasters and its Consequences



Geophysical

Earthquake/Mass movement of earth materials

- Landslide following earthquake;
- Urban fires triggered by earthquakes;
- Liquefaction – the transformation of (partially)water-saturated soil from a solid state to a liquid state caused by an earthquake.
- Mass movement of earth materials, usually down slopes.
- Surface displacement of earthen materials due to ground shaking triggered by earthquakes.

Volcano

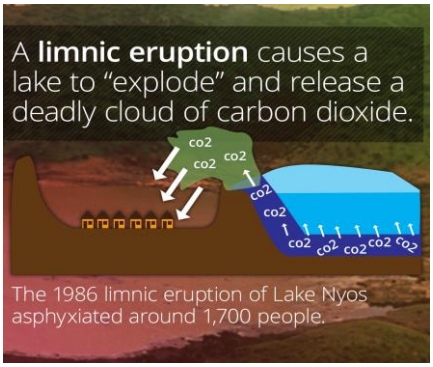
- Surface displacement of earthen materials due to ground shaking triggered by volcanic eruptions
- A type of geological event near an opening/vent in the Earth's surface including volcanic eruptions of lava, ash, hot vapour, gas, and pyroclastic material.
- Ash fall; Lahar – Hot or cold mixture of earthen material flowing on the slope of a volcano either during or between volcanic eruptions;
- Lava Flow
- Pyroclastic Flow – Extremely hot gases, ash, and other materials of more than 1,000 degrees Celsius that rapidly flow down the flank of a volcano (more than 700 km/h) during an eruption.

Tsunami

- A series of waves (with long wavelengths when traveling across the deep ocean) that are generated by a displacement of massive amounts of water through underwater earthquakes, volcanic eruptions or landslides.
- Tsunami waves travel at very high speed across the ocean but as they begin to reach shallow water, they slow down and the wave grows steeper .

Limnic eruption / lake overturn

- **Dissolved CO2 suddenly erupts from deep lake waters, forming a gas cloud suffocating wildlife, livestock, and humans**.
- Scientists believe earthquakes, volcanic activity, and other explosive events can serve as triggers for limnic eruptions.
- Lakes in which such activity occurs are referred to as **limnically active lakes** or **exploding lakes**. Some features of limnically active lakes include:
  - CO_2-saturated incoming water
  - A cool lake bottom indicating an absence of direct volcanic interaction with lake waters
  - An upper and lower thermal layer with differing CO_2 saturations
  - Proximity to areas with volcanic activity
  - Lanke Monoun (Cameroon)



- Now there is concern about lake Kivu (Border of Rwanda in Congo)

Hydrological

Floods, Landslides, Wave action

- **Avalanche:** A large mass of loosened earth material,snow, or ice that slides, flows or falls rapidly down a mountainside under the force of gravity.
- **Coastal Erosion:** The temporary or permanent loss of sediments or landmass in coastal margins due to the action of waves, winds, tides, or anthropogenic activities
- **Coastal flood:** Higher-than-normal water levels along the coast caused by tidal changes or thunderstorms that result in flooding, which can last from days to weeks
- **Debris Flow, Mud Flow, Rock Fall:** Types of landslides that occur when heavy rain or rapid snow/ice melt send large amounts of vegetation, mud, or rock down slope by gravitational forces.
- **Flash Flood Hydrological:** Heavy or excessive rainfall in a short period of time that produce immediate runoff, creating flooding conditions within minutes or a few hours during or after the rainfall
- **Flood Hydrological:** A general term for the overflow of water from a stream channel onto normally dry land in the floodplain (riverine flooding), higher-than normal levels along the coast and in lakes or reservoirs (coastal flooding) as well as pending of water at or near the point where the rain fell (flash floods).
- **Wave Action:** Wind-generated surface waves that can occur on the surface of any open body of water such as oceans, rivers and lakes, etc.
- The size of the wave depends on the strength of the wind and the travelled distance (fetch).

Meteorological

Hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that may last for minutes to days:

- Cyclone, Storm Surge, Tornado, Convective Storm, Extratropical Storm, Wind
- Cold Wave, Derecho
- Extreme Temperature, Fog, Frost, Freeze, Hail, Heat-wave
- Lightning, Heavy Rain
- Sand-Storm, Dust-Storm
- Snow, Ice, Winter Storm, Blizzard.

Climatological

Unusual, extreme Weather conditions related to longlived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multidecadal (long-term) climate variability

- Drought
- Extreme hot/cold conditions Forest/Wildfire Fires Glacial Lake Outburst Subsidence

Biologcal

Exposure to germs and toxic substances:

- Epidemics: viral, bacterial, parasitic, fungal, or prion infections
- Insect infestations
- Animal stampedes

Natural Disasters and Hazards in India

Earthquake

Earthquake is the shaking of the earth's crust caused by sudden release of energy in its interior. Its sudden impact provide very less response time and make its prediction impossible.

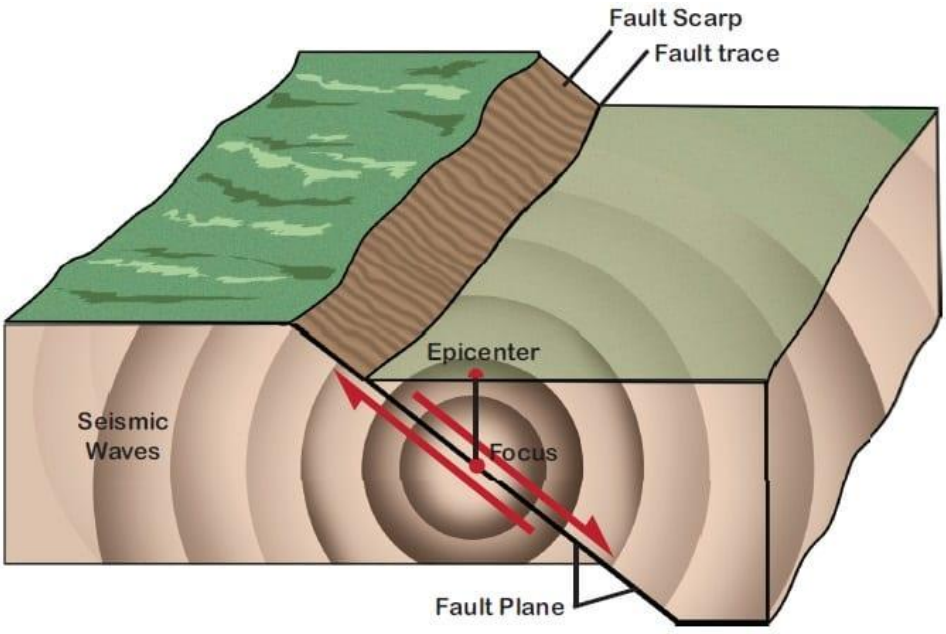


Figure 3.22 Parts of an Earthquake

- **Causes:** It is a well known fact that Indian Plate is moving at a speed of 1 cm per year towards the north and North Eastern direction and this movement of plates is being constantly obstructed by The Eurasian plate from the north.

- As a result of this, both the plates are said to be locked with each other resulting in accumulation of energy at different points of time.
- Excessive accumulation of energy results in building up of stress which ultimately leads to the breaking up of the lock and sudden release of energy causing earthquakes along the Himalayan arch.
- The emergence of a fault line and energy buildup along the fault line represented by the river Bhima and the possible breaking down of the Indian Plate is also one of the reason for some of the recent earthquakes.

Regions of Earthquake Zones

- Nearly 60 percent of India's territory is vulnerable to earthquakes.
- Some of the most vulnerable states are Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Darjeeling and subdivision of West Bengal and all the seven states of the northeast.
- However for a better understanding, they are divided into following earthquake zones which is represented by the map given below:

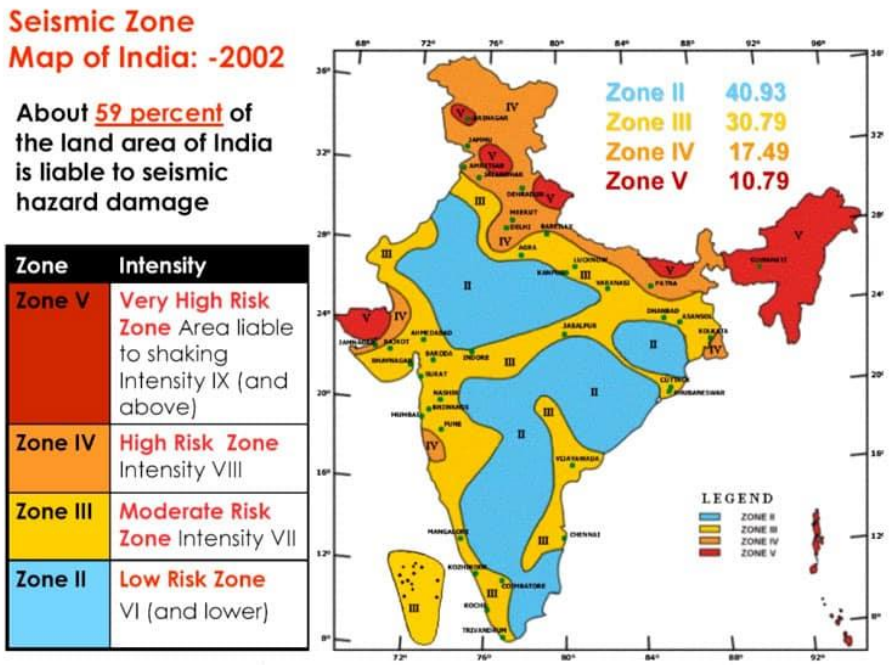


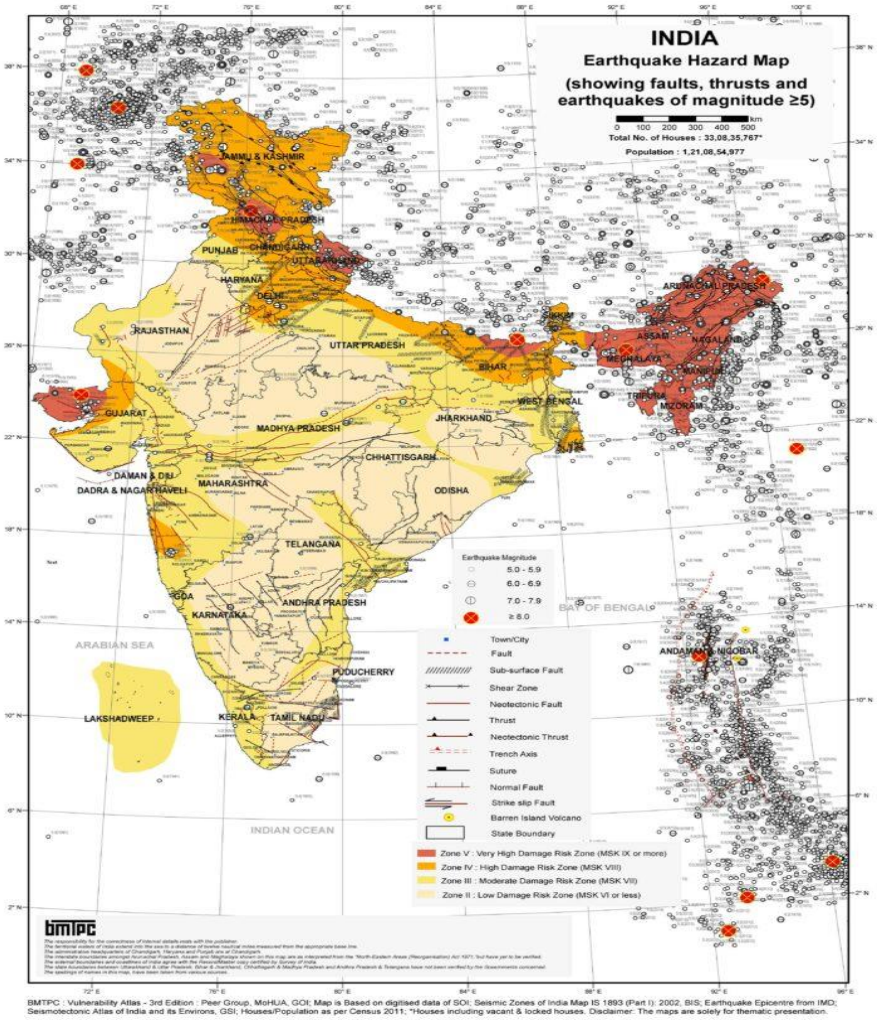
Fig. 1 Seismic zonation and intensity map of India

Consequences of Earthquakes

- Surfaces seismic waves produce fissures on the upper layer of the earth's crust through which water and other volatile materials gush out, inundating the neighbouring areas.
- Earthquakes are also responsible for landslides.
- The earthquakes cause obstructions in the flow of rivers and channels resulting in the formation of reservoir.
- Sometimes rivers also change their course causing floods and other calamities in the affected areas.

Earthquake Hazard Mitigation

- It is not possible to prevent the occurrence of an earthquake and hence the better option is to prepare for the disaster and have some mitigation strategy rather than curative measures such as:
- Establishing earthquake monitoring centres for regular monitoring and fast dissemination of information among the people in the vulnerable areas.
- Preparing a vulnerability map of the country and dissemination of vulnerability risk information among the people.
- Educating people about the ways and means minimising the adverse impact of disasters.
- Modifying the house types and building designs in the vulnerable areas. Also discouraging construction of high rise buildings, large Industrial establishments and big urban centre.
- Making it mandatory to adopt earthquake resistant design and use light materials in major construction activities in the vulnerable areas.
- Making use of indigenous technical knowledge and locally available materials in the construction of earthquake -resistant houses like the Bhongas in the Kutch (Gujarat), Dhajji Diwari (Jammu & Kashmir) and Ekra constructions made of bamboo in Assam.



BMTPC : Vulnerability Atlas - 3rd Edition : Peer Group, MoHUA, GOI; Map is Based on digitised data of SOI; Seismic Zones of India Map IS 1893 (Part I): 2002, BIS; Earthquake Epicentre from IMD; Seismotectonic Atlas of India and its Environs, GSI; Houses/Population as per Census 2011; *Houses including vacant & locked houses. Disclaimer: The maps are solely for thematic presentation.

Tsunami

- Tsunamis can be triggered off by an underwater earthquake, a volcanic eruption, a submarine rock slide, or rarely by an asteroid or meteorite crashing into water from space.

- Most Tsunamis are caused by underwater earthquakes, but not all underwater earthquakes cause tsunamis.
- Tsunami is a series of ocean waves that sends surges of water, sometimes reaching height over 30 meters on the land.
- These walls of water can cause widespread destruction when they crash ashore.

Tsunami Vulnerable Areas

- Tsunamis are frequently observed along the Pacific Ring of Fire, particularly along the coast of Alaska, Japan, Philippines, and other islands of Southeast Asia, Indonesia, Malaysia, Myanmar, Sri Lanka and India.
- The tsunami that occurred on 26th December 2004 caused great damage to India especially in the regions of Tamil Nadu, Puducherry, Kerala, Andhra Pradesh and Andaman and Nicobar Islands.

Areas of Tsunami

- Tsunamis are frequently observed along the Pacific Ring of Fire , particularly along the coast of Alaska, Japan, Philippines, and other island of Southeast Asia Indonesia ,Malaysia .
- Myanmar, Sri Lanka and India. India has been greatly affected by tsunami specially in the region of Tamil Nadu, Puducherry, Kerala, Andhra Pradesh and Andaman and Nicobar Islands.

Impact of Tsunami

Release of Energy:

- On reaching the coast, tsunami waves **release enormous stored energy**.

Turbulent Water Flow:

- Water flows violently onto land.
- Causes widespread destruction in **port cities, towns, buildings, and settlements**.

High Vulnerability of Coastal Areas:

- Coastal zones are **densely populated** worldwide.
- Centres of **intense human activity** (trade, fishing, tourism, industry).

Comparative Impact:

- Loss of **life and property** is **much higher** in tsunamis than in other coastal natural hazards.

Tsunami Hazard Mitigation

- It is not possible to prevent a the occurrence of tsunami. However some measures can be taken to reduce the damage caused by Tsunami. Some of the measures are :
  - Provide a shelf of comprehensive solutions for improving the vulnerability reduction of coastal areas like development of bioshield, like mangrooves and shelter belt plantation.
  - Chalk out strategies for strengthening education, research and documentation for strengthening tsunami risk management preparedness measures by academic and professional institutes.
  - Early warning accompanied by thorough evaluation of risk zones.

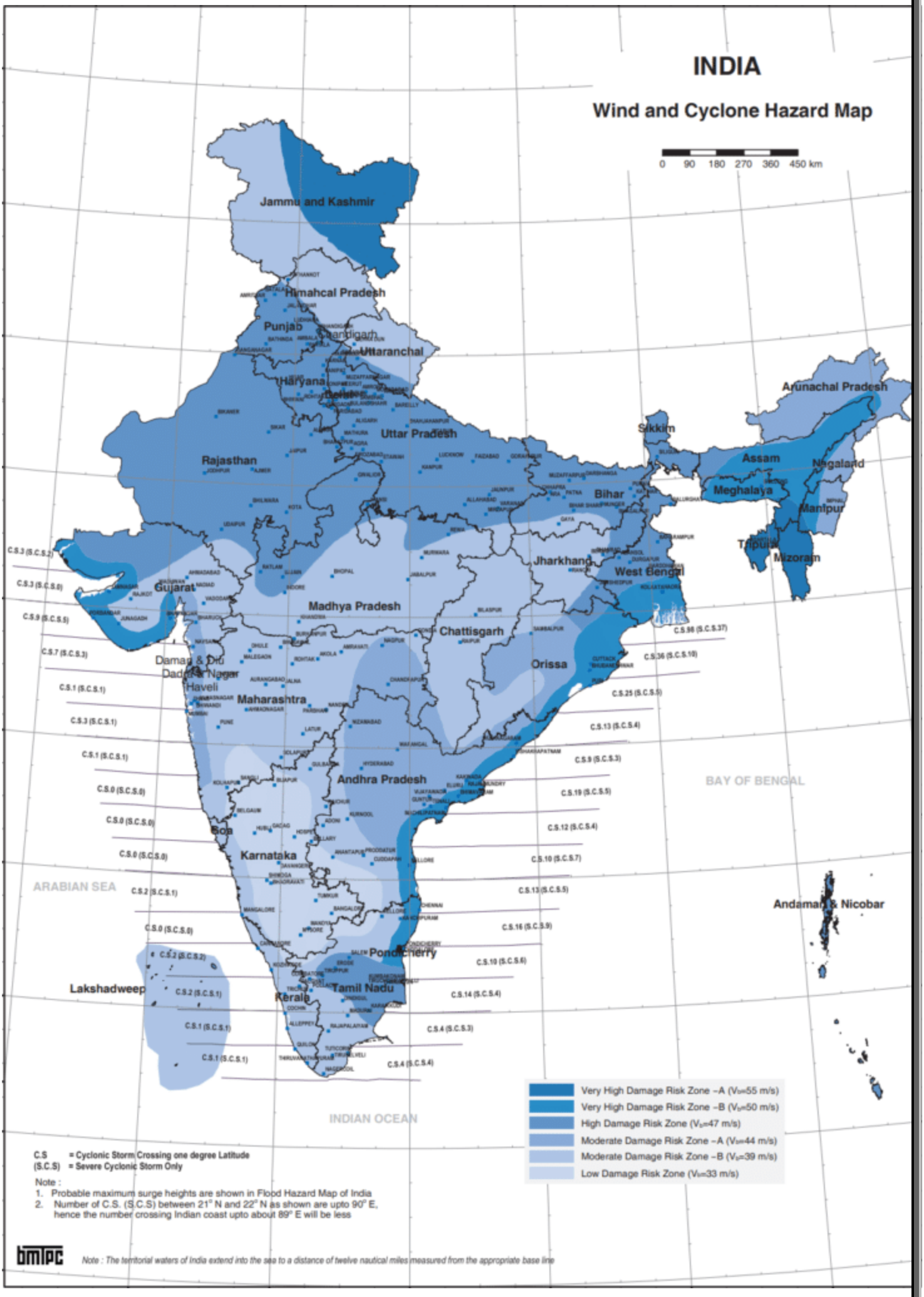
- The Indian Tsunami Early Warming Centre (ITEWC), which is based at and operated by Indian National Centre for Ocean Information Services (INCOIS), Hyderabad has all necessary advisories to India as well as to Indian Ocean Countries (24 countries).
- Land use zoning can be made a function of hazard maps which report expected heights of tsunami likely to occur.
- Houses and other buildings can be moved to higher ground and new construction banned in the principal risk areas.
- Breakwaters can be constructed to weaken the approaching waves.
- There is not a single method to control and mitigate the Tsunamis.
- Tsunamis can be predicted and even after that they can damage the habitation.
- Environmental methods and means are the best and the most sustainable. But the best strategy for protecting a coast against Tsunamis is to use an appropriate mixture of the various measures and methods of Tsunami control.

Tropical Cyclones

- Tropical cyclones are intense low pressure areas confined to the area lying between 30 degree north and 30 degrees South latitude.
- Tropical cyclone and Hurricane is like a heat engine that is energized by the release of latent heat on account of the condensation of moisture that the wind gathers after moving over the oceans and seas.

Initial Conditions for Emergence of Tropical Cyclone

- Large and continuous supply of warm and moist air that can release enormous latent heat.
- Strong coriolis force that can prevent filling of low pressure at the centre.
- Unstable condition through the troposphere that creates local disturbances around which cyclone develops.
- Finally absence of strong vertical wind wedge which disturbs the vertical transport of latent heat.


INDIA
Wind and Cyclone Hazard Map
0 90 180 270 360 450 km
Jammu and Kashmir
Himahcal Pradesh
Punjab
Chandigarh
Uttaranchal
Haryana
Delhi
Uttar Pradesh
Rajasthan
Sikkim
Arunachal Pradesh
Assam
Nagaland
Meghalaya
Manipur
Tripura
Mizoram
Bihar
Jharkhand
West Bengal
Orissa
Chattisgarh
Madhya Pradesh
Gujarat
Damaan & Diu
Dadra & Nagar Haveli
Maharashtra
Andhra Pradesh
Goa
Karnataka
Pondicherry
Tamil Nadu
Kerala
Lakshadweep
Andaman & Nicobar
BAY OF BENGAL
ARABIAN SEA
INDIAN OCEAN
C.S.3 (S.C.S.2)
C.S.3 (S.C.S.0)
C.S.9 (S.C.S.5)
C.S.7 (S.C.S.3)
C.S.1 (S.C.S.1)
C.S.3 (S.C.S.1)
C.S.1 (S.C.S.1)
C.S.0 (S.C.S.0)
C.S.0 (S.C.S.0)
C.S.0 (S.C.S.0)
C.S.2 (S.C.S.1)
C.S.0 (S.C.S.0)
C.S.2 (S.C.S.2)
C.S.2 (S.C.S.1)
C.S.1 (S.C.S.1)
C.S.1 (S.C.S.1)
C.S.4 (S.C.S.4)
C.S.4 (S.C.S.3)
C.S.14 (S.C.S.4)
C.S.10 (S.C.S.6)
C.S.16 (S.C.S.9)
C.S.13 (S.C.S.5)
C.S.10 (S.C.S.7)
C.S.12 (S.C.S.4)
C.S.19 (S.C.S.5)
C.S.9 (S.C.S.3)
C.S.13 (S.C.S.4)
C.S.25 (S.C.S.5)
C.S.36 (S.C.S.10)
C.S.98 (S.C.S.37)
Very High Damage Risk Zone –A (Vb=55 m/s)
Very High Damage Risk Zone –B (Vb=50 m/s)
High Damage Risk Zone (Vb=47 m/s)
Moderate Damage Risk Zone –A (Vb=44 m/s)
Moderate Damage Risk Zone –B (Vb=39 m/s)
Low Damage Risk Zone (Vb=33 m/s)
C.S = Cyclonic Storm Crossing one degree Latitude
(S.C.S) = Severe Cyclonic Storm Only
Note :
1. Probable maximum surge heights are shown in Flood Hazard Map of India
2. Number of C.S. (S.C.S) between 21° N and 22° N as shown are upto 90° E, hence the number crossing Indian coast upto about 89° E will be less
bmtpc
Note : The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line

Consequence of Tropical Cyclone

- The coastal areas are often struck by severe cyclonic Storms with an average velocity of 180 km per hour.
- Often this results in the abnormal rise in the sea level known as storm surge.
- This results in inundation of human settlements, agricultural fields, damaging crops and destruction of structures created by human beings.

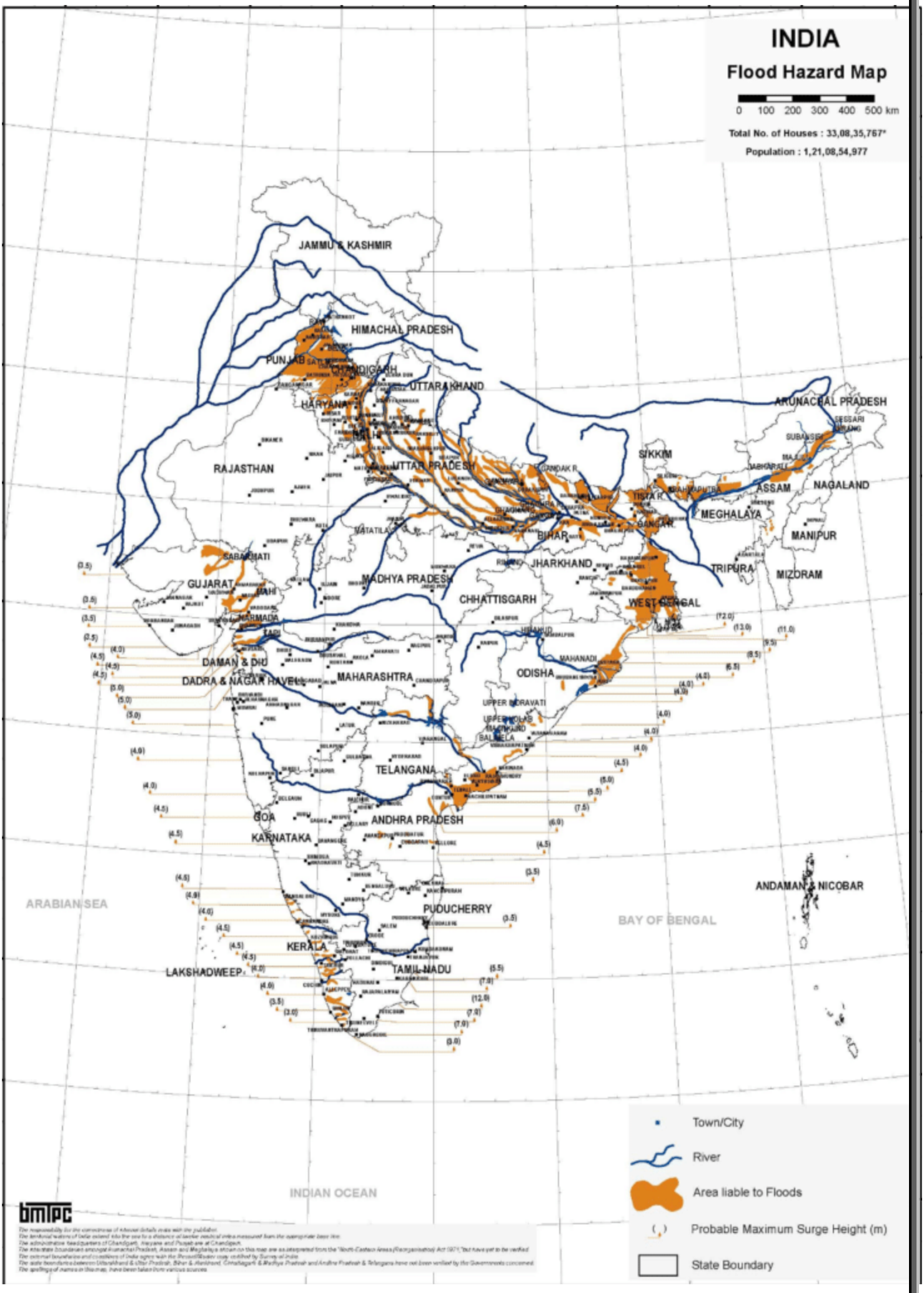
Tropical Cyclone Hazard Mitigation

- Green belt plantation along the coastal line in a scientific interweaving pattern can reduce the effect of the hazard.
- Land use control should be designed so that least critical activities are placed in vulnerable areas.
- Structures need to be built to withstand wind forces.
- Torrential rains, strong wind and storm range leads to flooding in the cyclone affected areas.
- There are possibilities of landslides too. Flood mitigation measures could be incorporated.
- **Cyclone shelter:** are buildings or safe shelter in the coastal villages, which could withstand, the intensity of the cyclone and storm surges.
- Efficient cyclone forecast and warning services.
- Over the years because of efficient forecasting and administration there is reduction in the loss of property and lives caused by cyclones in India.

Year	Cyclone	Deaths	Damage (in$)
1999	BOB 06	10000	400 crore
2013	Phalin	45	70 crore

Floods

- Flooding is a condition of inundation of land and human settlements by the rise of water in the channels and its spillover is present.
- Floods are relatively slow in occurrence and often occur in well identified regions and within expected time in a year.


INDIA
Flood Hazard Map
0 100 200 300 400 500 km
Total No. of Houses : 33,08,35,767*
Population : 1,21,08,54,977
JAMMU & KASHMIR
HIMACHAL PRADESH
PUNJAB
CHANDIGARH
UTTARAKHAND
HARYANA
DELHI
RAJASTHAN
UTTAR PRADESH
SIKKIM
ARUNACHAL PRADESH
ASSAM
NAGALAND
MEGHALAYA
MANIPUR
TRIPURA
MIZORAM
BIHAR
JHARKHAND
WEST BENGAL
SABARMATI
GUJARAT
MADHYA PRADESH
CHHATTISGARH
NARMADA
TAPI
DAMAN & DIU
DADRA & NAGAR HAVELI
MAHARASHTRA
ODISHA
MAHANADI
TELANGANA
GOA
ANDHRA PRADESH
KARNATAKA
PUDUCHERRY
KERALA
TAMIL NADU
LAKSHADWEEP
ANDAMAN & NICOBAR
ARABIAN SEA
BAY OF BENGAL
INDIAN OCEAN
Town/City
River
Area liable to Floods
Probable Maximum Surge Height (m)
State Boundary
bmtpc

Causes of Floods

Floods occur when

- Water in the form of a surface runoff exceeds the carrying capacity of the river channels and streams and flows into neighbouring low-lying floodplains.
- Storm surges.
- There is High intensity rainfall for a considerably longer time period.
- Melting of ice and snow.
- Reduction in the infiltration rate and presence of eroded material in the water due to higher rate of soil erosion.

Role of Human being in Causing Floods

Unlike other natural disasters, human beings play an important role in causing floods. This may be attributed to:

- Indiscriminate deforestation;
- Unscientific agricultural practice
- Disturbances along the natural drainage channel
- Colonization of floodplains and river beds etc.

Flood Prone Areas in India

- The states that are usually affected by the floods include Assam, West Bengal, Bihar, Andhra Pradesh, Punjab , Haryana, and Gujarat along with north eastern states.
- Sometimes Tamil Nadu experiences flooding during November to January due to the retreating monsoon.

Consequences of Floods

- Serious damage to physical infrastructure such as roads, rails, bridges and human settlements along with the agricultural land have serious consequences on the national economy and Society
- Millions of people are rendered homeless and spread of disease like cholera, gastroenteritis Hepatitis and other water borne diseases spread in the flood affected areas.

Control Measures of Floods

Following are the few measures which shall be taken to control floods:

- Construction of flood protection embankments in the flood prone areas.
- Construction of dams

- Afforestation
- Flood Plain zoning to regulate land use in the flood plain in order to respect the damage due to floods.
- Discouraging major construction activities in the upper reaches of most of the flood creating rivers
- Removal of human encroachment from the river channels and depopulating the flood plains.

Over 40 million hectares (12 per cent of land) is prone to floods and river erosion.

Urban Floods

- Urban floods occur when weather phenomena delivers more precipitation than the capacity of (Urban) drainage basin to readily absorb or transfer it.
- Example Chennai Floods caused by heavy rainfall due to retreating monsoon.
- Unplanned development and encroachment of sprawling habitations alongside rivers and watercourses have impeded the natural flow of streams.
- As a result of this, the runoff has increased causing urban floods. Example floods in Gurugram.

Causes of Urban Floods:

- According to Intergovernmental Panel on Climate Change (IPCC) with the occurrence of Global Warming the intensity of precipitation and cyclones has increased leading to heavy rainfall.
- As per NASA study due to urban Heat Island there occurs low pressure zone over Chennai and Pune.
- Thus pushes clouds upwards and lead to high intensity rainfall.
- Natural Channel of streams encroached by buildings, bridges, roads etc For example encroachment in Jhelum basin caused floods in Srinagar.
- Artificial Channels have inadequate capacity to drain the water during heavy rainfall.
- Also urban local bodies lack sufficient staff and tools to keep these drains desilted and clean.
- Desiltation of river is not done regularly. Heavy siltation in Adyar river has caused floods in Chennai.

Mitigation Strategies for Urban Floods :

- Urban flooding has localized impacts on commercial industrial, business, residential and institutional locations.

- Disruption of water supply, sewerage, power supply, transport and communication system is common. The following three phases of disaster management can be applied to mitigate the impact of urban floods:

(a) Pre-Monsoon Phase (Preparedness): Familiarization of the stakeholders (training of municipality staff), identification of teams for maintaining the drains and roads.

(b) During Monsoon Phase (Early Warning and Effective Response): If involves giving qualitative and quantitative warnings based on the intensity of rainfall to various agencies to take preventive measures.

The response phase focuses primarily on emergency relief. Saving lives, providing first aid, minimizing and restoring damaged systems (communication and transportation), meeting the basic life requirements of those impacted by disaster (food,water and shelter).

(c) Post-Monsoon Phase: Restoration and rehabilitation phase includes establishment of a programme to restore both the disaster site and the damaged materials to a stable and usable condition.

Drought

- There is no globally adopted operational definition for drought applicable to all contexts.
- However for a better understanding the term drought is applied to an extended period when there is a shortage of water availability due to inadequate precipitation, excessive rate of evaporation and over utilisation of water from the Reservoir and other storages including the groundwater.
- Drought is a phenomenon that is widely considered as a ‘creeping disaster’ whose onset, end, and severity are difficult to determine.
- Unlike the suddenly occurring disasters, a drought may develop very slowly over several months affecting very large geographical area without causing little or no structural damage.
- The impacts depend on natural conditions, socio-economic situation, and the kind of land and water resources as well as the use patterns in the affected region.


INDIA
DROUGHT PRONE AREA
TAJIKISTAN
AFGHANISTAN
PAKISTAN
CHINA (TIBET)
NEPAL
BHUTAN
BANGLADESH
MYANMAR (BURMA)
SRI LANKA
LADAKH
JAMMU & KASHMIR
HIMACHAL PRADESH
PUNJAB
UTTARAKHAND
HARYANA
DELHI
RAJASTHAN
UTTAR PRADESH
BIHAR
SIKKIM
ARUNACHAL PRADESH
ASSAM
NAGALAND
MEGHALAYA
MANIPUR
TRIPURA
MIZORAM
JHARKHAND
WEST BENGAL
GUJARAT
MADHYA PRADESH
CHHATTISGARH
ODISHA
DAMAN & DIU
DADRA & NAGAR HAVELI
MAHARASHTRA
TELANGANA
GOA
KARNATAKA
ANDHRA PRADESH
TAMIL NADU
KERALA
LAKSHADWEEP (INDIA)
ANDAMAN & NICOBAR ISLANDS (INDIA)
BAY OF BENGAL
ARABIAN SEA
INDIAN OCEAN
Legend
Drought Prone Area
International Boundary
State Boundary
Map not to Scale
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Types of Drought

- **Meteorological Drought:** It is a situation when there is a prolonged period of inadequate rainfall marked with mal- distribution of the same over time and space.
- **Agricultural Drought:** It is also known as soil moisture drought.
- It is characterized by Low soil moisture that is necessary to support the crops thereby resulting in crop failure.
- Moreover if an area has more than 30% of its gross cropped area under irrigation the area is excluded from the drought prone category
- **Hydrological Drought:** It results when the availability of water in different storage and reservoir like aquifers, lakes, reservoir etc falls below what the precipitation can replenish.
- **Ecological Drought:** When the productivity of a natural ecosystem fails due to shortage of water and as a consequence of ecological distress damages are induced in the ecosystem.

Drought Situations

The IMD recognizes five drought situations:

- **Drought Week:** When the weekly rainfall is less than half of the normal.
- **Agricultural Drought:** When four drought weeks occur consecutively during mid-June to September.
- **Seasonal Drought:** When seasonal rainfall is deficient by more than the standard deviation from the normal.
- **Drought Year:** When annual rainfall is deficient by 20 percent of normal or more, and
- **Severe Drought Year:** When annual rainfall is deficient by 25 to 40 percent of normal or more.

Drought Prone Areas in India

On the basis of severity of droughts, India can be divided into the following regions:

- **Extreme Drought Affected Areas:** It includes parts of Rajasthan particularly areas to the west of Aravalli hills, that is marusthali and Kutch region of Rajasthan falls in this category.
- Other areas include districts like Jaisalmer and Barmer from the Indian desert that receive less than 90 mm average annual rainfall.
- **Severe Drought Prone Areas:** Parts of eastern Rajasthan, most parts of Madhya Pradesh, Eastern parts of Maharashtra, interior parts of Andhra Pradesh and Karnataka plateau, Northern parts of interior Tamil Nadu and Southern parts of Jharkhand and interior Orissa are included in this category.
- **Moderate Drought Affected Areas:** Northern parts of Rajasthan Haryana, Southern districts of Uttar Pradesh, the remaining parts of Gujarat, Maharashtra except konkan, Jharkhand and Coimbatore plateau of Tamilnadu and interior Karnataka included in this category.

Consequences of Drought

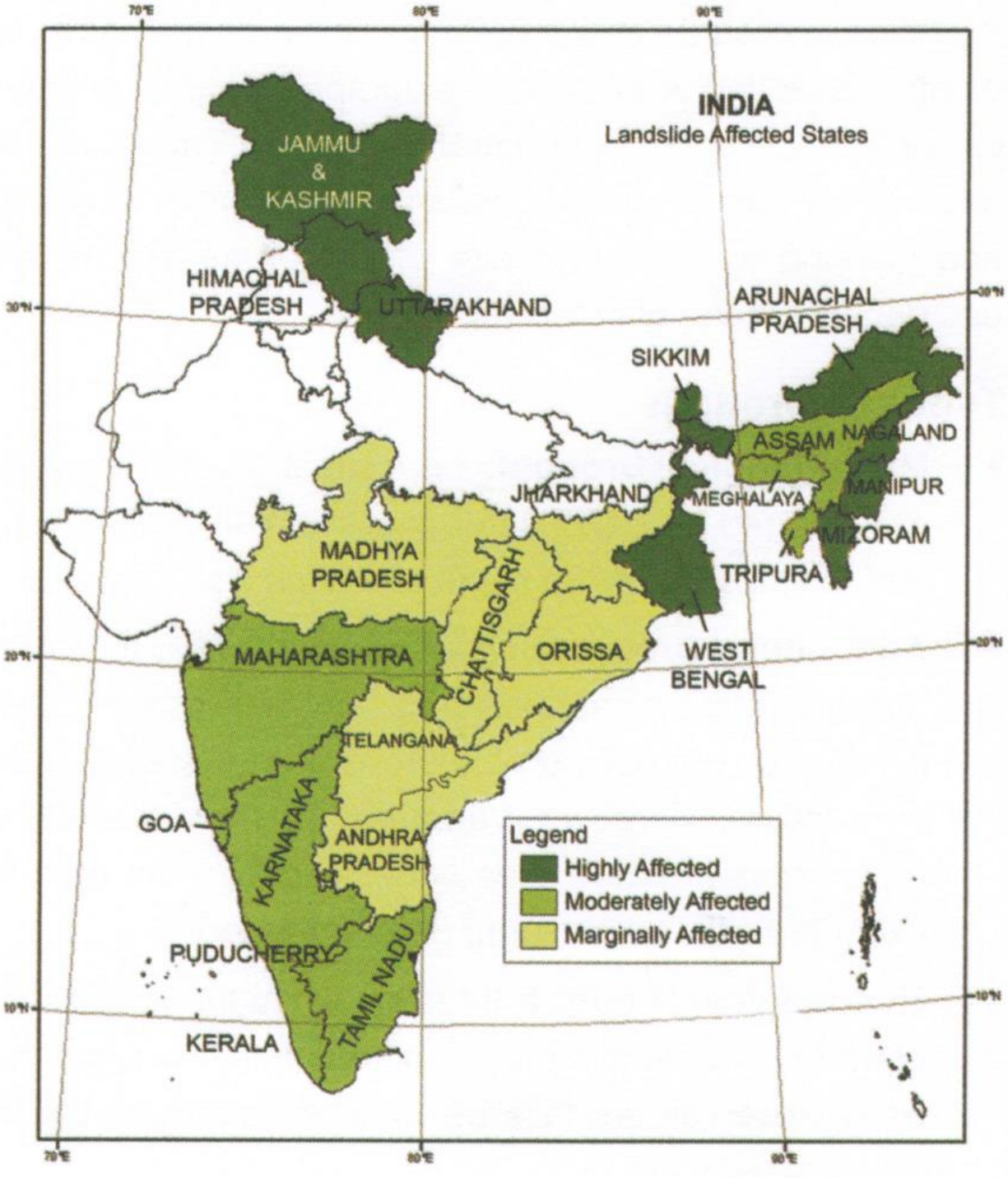
Droughts have cascading effects on various aspects such as:

- Crop failure,
- Shortage of water which leads to large scale death of cattle and other animals.
- Migration of human and livestock
- Scarcity of water compels people to consume contaminated water resulting in the speed of many water borne diseases.

Mitigation of Droughts

Some of the following steps can be taken to mitigate droughts::

- Provision for the distribution of safe drinking water.
- Medicines for the victims
- Availability of fodder and water for the cattle
- Shifting of the people and their livestock to safer places



Long Term Measures to Control Drought

- Identification of groundwater potential in the form of aquifers.
- Transfer of river water from surplus to the deficient areas.
- Rainwater harvesting.
- Interlinking of rivers and construction of reservation and dams.
- Remote sensing and satellite imageries can be useful in identifying the possible river basin and in identifying the groundwater potential.
- Dissemination of knowledge about drought resistant crops at proper training to practice the same can be some of the long-term measures that will be helpful in drought mitigation.

Drought Crisis Management Plan

- The NDMA manual sets out four important measures that a state government should take at the time of drought, with the help of Union government. **These are:**

- Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) to provide immediate employment.
- Strengthening of public destribution system to provide food and fodder.
- The government should either waive off or defer farmer loans and arrange for crop loss compensation.
- Recharge ground water through check dams and providing pipeline water and other irrigation facilites.

Landslides

- The term 'landslide' includes all varieties of mass movements of hill slopes and can be defined as the downward and outward movement of slope forming materials composed of rocks, soils, artificial fills or combination of all these materials along surfaces of separation by falling, sliding and flowing, either slowly or quickly from one place to another.
- Landslides are largely controlled by highly localised factors.
- Hence, gathering information and monitoring the possibilities of landslides is not only difficult but also immensely cost intensive.

Landslide Vulnerability Zones

1. Very High Vulnerability Zone: This include:

- Highly unstable and relatively young mountainous areas in the Himalayas and Andaman and Nicobar.
- High rainfall regions with steep slopes in the Western Ghats and Nilgiris.
- The North Eastern regions along with areas that experience frequent ground shaking due to earthquakes and areas of human activities.

2. High Vulnerability Zone:

- Areas that have almost similar condition to those included in the very high vulnerability zones are also included in this category.
- The only difference between these two is the combination, intensity and frequency of the controlling factors.
- All the Himalayan states and the states from North Eastern region except the plains of Assam are included in the high vulnerabilities zone

3. Moderate to low Vulnerability Zone:

- Areas receive less precipitation such as TransHimalayas areas of Ladakh and Spiti,.
- Low population areas of Aravali.
- Rain Shadow areas in the Western and Eastern Ghats and Deccan Plateau.

Consequences of Landslides

Landslides have relatively small and localised area of direct influence but the consequences may be far reaching such as:

- Diversion of river courses due to landslides can also lead to flood and loss of life and property.
- It also makes spatial interaction difficult risky as well as costly which in turn adversely affect the developmental activities of the areas.

Landslides Hazard Mitigation

- Adopt area specific measures
- Restriction on construction and other developmental activities such as roads and dams
- Limiting agriculture to valleys and areas with moderate slopes
- Control on the development of large settlements in the high vulnerability zones
- Promoting large scale afforestation programs
- Construction of bunds to reduce the flow of water

Human Induced Disasters

Chemical (Industrial) Disaste

- Due to the regional concentration of chemical companies in certain pockets, the chemical hazard has increased many folds.
- The growth of chemical industries has led to an increase in the risk of occurrence of incidents associated with hazardous chemicals.
- The common causes for chemical accidents are:
- Deficiencies in safety management systems or human errors,
- Natural calamities or
- Mishaps or failures in industry
- Chemical/industrial accidents are significant and have long term impact on the community and environment.

- It leads to injuries, pain, suffering, loss of lives, damage to property and environment. **Hence, a robust plan and mitigation measure needs to be adapted to overcome the hazard.**

Nuclear and Radiological Disaster

A nuclear disaster is caused due to:

- An extraordinary release of radioactive material or radiation in the operation of nuclear reactors
- Explosion of a Radiological Dispersal Device (RDD) or Improvised Nuclear Device (IND).
- Explosion of a nuclear weapon.
- It is accompanied with a sudden release of harmful radiations or radioactive materials or both together into the environment.

However, nuclear emergencies can still arise due to factors beyond the control of the operating agencies from human error like system failure, sabotage,extreme natural events like earthquake, cyclone, flood, tsunami or a combination of these.

To counter this, proper emergency preparedness plans must be in place so that there is minimum loss of life, livelihood, property, and impact on the environment.

Fire Risks

Fires in Buildings

- India often sees death due to fires in buildings.
- On an average, India, suffers from death of more than 20,000 people annually.
- Most of these deaths could be prevented, provided we take proper steps in preventing the fire.
- Inadequate data on these losses does not make it easy for policy makers to come up with fire mitigation policies.
- Oxygen leaks, especially in hospitals are also one of the causes of fires in building.
- Numerous incident of fires have been observed, especially during the time of Diwali due to illegal manufacturing and storage of firecrackers at several places.
- Recently a horrific fire at a Hotel in Karol Bagh, Delhi has killed 17 people. It was mainly due to violation of fire safety norms.

Measures to Prevent Fire Accidents

- Regular inspection and timely maintenance of defective equipment
- Comprehensive Fire Safety Audit
- Enhancement of existing infrastructure with advanced technology & well trained fire-fighters
- Dedicated helpline to reduce response time- mapping of cities using color coded zones based on their level of vulnerability.

- Strict adherence to Standard Operating Procedures through proper training of concerned staff.
- Training and participation of staffs and officials in fire safety drills at all public and private work places, schools, educational institutions.
- Encouraging people to participate in mock fire drills to ensure there is no panic during adverse situations of fire-incidents.
- Better facilities in hospitals through quick medical aid at the nearest hospital.
- Construction of explosion and fire resistant buildings in future.

Forest Fires

- Forests are vulnerable to fire. Their vulnerability varies from place to place depending upon the type of vegetation and the climate.
- According to Global Forest Watch, India witnessed a 125% increase in forest fires in just two years (2015-17). Also about half of India's forests are prone to fire.

Cause of Forest Fires

Forest fires are caused by Natural as well as manmade causes.

- **Natural Causes:** Lightning sets trees on fire, high atmospheric temperature and dryness makes forest prone to fire. Wind speed is the biggest reasons of fires in Bamboo forests.

Manmade Causes:

- 90% of forest fires are man made
- Large scale expansion of Chir-pine forests in Flim alayan mountains. The dry leaves of Chir trees are highly inflammable and catch fire easily.
- Fire is caused when a source of fire like naked flame, cigarette or bidi, electric spark or any source of ignition comes into contact with inflammable material.
- Shifting cultivation in the North Eastern regions of India and in parts of the states of Odisha and Andhra Pradesh.
- To conceal illegal timber cutting, the forest are deliberately set on fire by timber mafias.

Measures to Prevent Forest Fires

- Capacity development of forest departments' officials at different levels (national, regional and local) to reduce the vulnerability of Indian forests to fires.
- Creating Forest fire manuals for field staff suggesting them ways to detect and report forest fires.
- Incorporation of guidelines and responsibilities of different role players and other stakeholders for a
- systematic management of forest fire.
- Mechanism to assess and monitor forest fire risks and increase sustainable application of warning systems.
- Using indigenous knowledge and techniques to detect and suppress forest fire.

- Making use of technology through research to reduce instances of forest fires.
- Promotion of natural broad leaf trees in place of Chir Pine trees.
- Joint forest management: Local participation of tribal people and farmers need to be encouraged example Van Panchayats.

Railway Accidents

- Rail accidents in India have become a regular feature taking place every year causing a large number of casualities and damage to the railway property.

Causes of Rail Accidents

Some of the major causes of Rail accidents include:

- **Derailment:** Between 2003-04 and 2015-16, derailments were the second highest reason for casualties.
- **Unmanned Level Crossings:** Unmanned level crossings (UMLCs) continue to be the biggest cause of maximum casualties in rail accidents.
- **Consequential Train Accidents:** Consequential train accidents include collisions, derailments, accidents at level crossings, train fires and similar accidents that have serious repercussions in terms of casualties and damage to property.
- These exclude cases of trespassing at unmanned railway crossings.
- **Accidents Due to Failure of Rail Staff:** More than half of the accidents are due to lapses on the part of railway staff.
- Such lapses include carelessness in working, poor maintenance work, adoption of shortcuts and non-observance of laid down safety rules and procedures.
- **Accidents Due to Loco Pilots:** Accidents also occur due to signalling errors for which loco-pilots (train operators) are responsible.
- Further, currently no technological support is available to the loco-pilots and they have to keep a vigilant watch on the signal and control the train accordingly.
- Loco-pilots are also overworked as they have to work beyond their stipulated hours of duty.
- This work stress and fatigue puts the life of thousands of commuters at risk and affects the safety of train operations.
- Under-Investment in the Railways Leading to Accidents: under-investment in the railways has resulted in congested routes, inability to add new trains, reduction of train speeds and more rail accidents
- Slow Expansion of Rail Networks has put undue burden on the existing infrastructure, leading to severe congestion and safety compromises

Measures to Control Rail Accidents

- Indian Railways should switch completely to the Linke Hoffman Busch (LHB) coaches as they do not pile upon each other during derailments and hence cause lesser casualties.
- Audio-visual warnings should be implemented at level crossings to warn road users about approaching trains.

- These may include the Approaching Train Warning Systems and the Train Actuated Warning Systems.
- In the Union Budget 2017-18, elimination of all unmanned level crossings on broad gauge lines by 2020 has been proposed.
- A regular refresher course for each category of railway staff should be conducted.
- Require some significant investments towards capital and maintenance of railways infrastructure.

Levels of Disaster

- The capacity of the authorities to deal with the disaster and the vulnerability of disaster affected area shall be taken into account for planning and tackling disaster management.
- Therefore, High Power Committee on Disaster Management in its report of 2001 categorized disaster situations into three 'levels': L1, L2, and L3. The period of normalcy, L0, should be utilized for disaster risk reduction.
    - **Level-L1:** The level of disaster that can be managed within the capabilities and resources at the District level. However, the state authorities will remain in readiness to provide assistance if needed.
    - **Level-L2**: This signifies the disaster situations that require assistance and active mobilization of resources at the state level and deployment of state level agencies for disaster management.
    - The central agencies must remain vigilant for immediate deployment if required by the state.
    - **Level-L3:** This corresponds to a nearly catastrophic situation or a very large-scale disaster that overwhelms the State and District authorities.
- The categorization of disaster situations into levels LO to L3 finds no mention in Disaster Management Act 2005. Further, the DM Act does not have any provision for notifying any disaster as a 'national calamity' or a 'national disaster'.

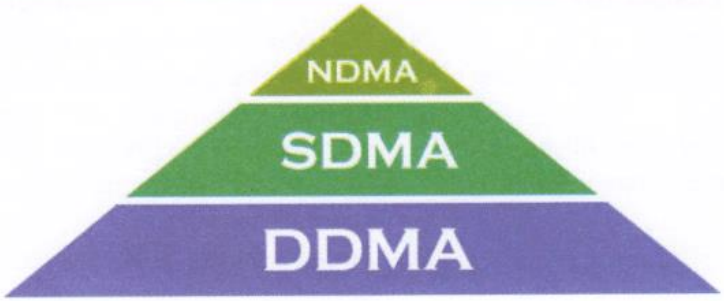
Disaster Management in India

Disaster Management

- The United Nations International Strategy for Disaster Reduction (UNISDR) defines disaster risk management as the systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters.

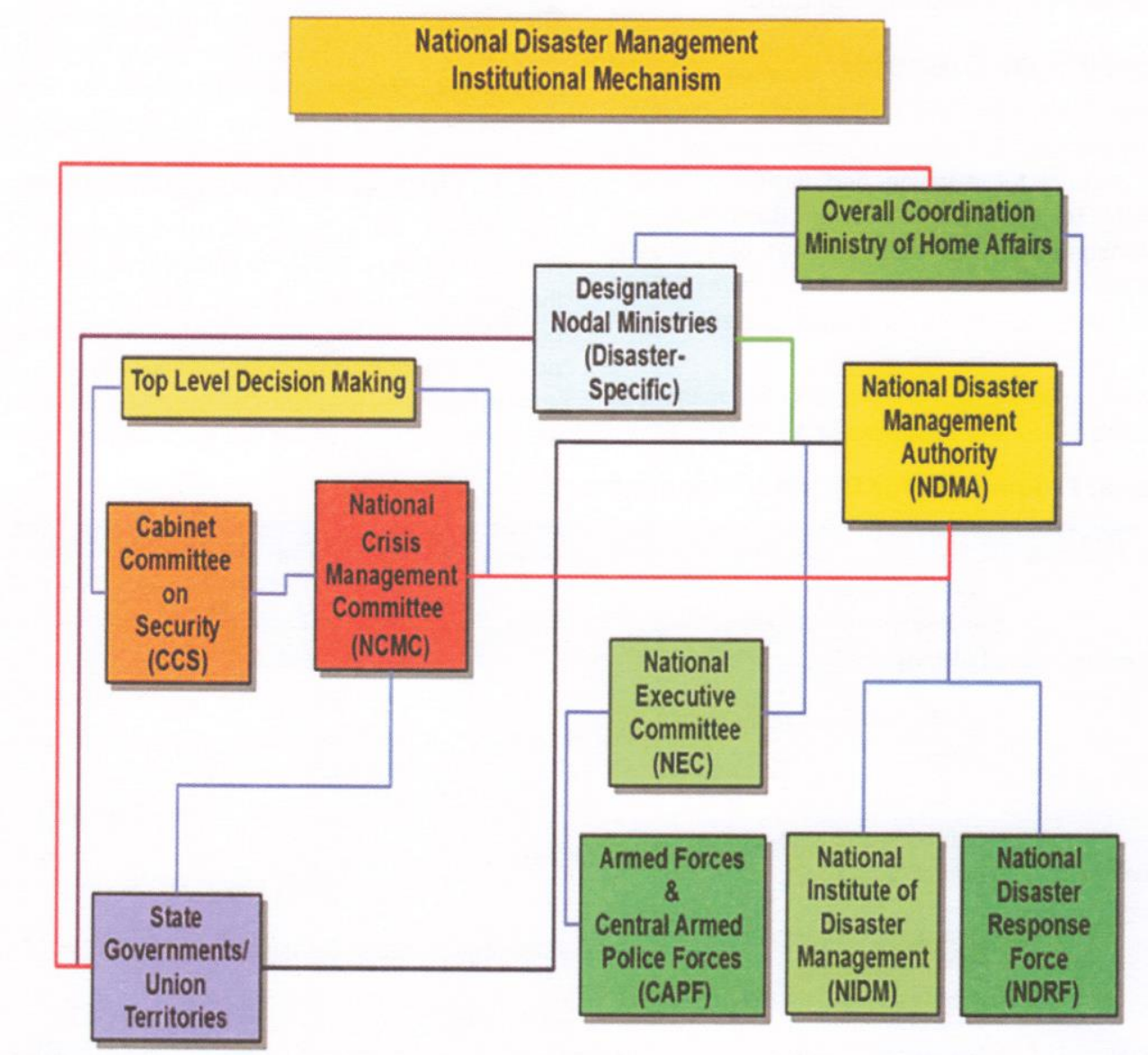
Institutional Framework for Disaster Management

Institutional Level	Authority	Chairman	Institutions
Central Government ↓	National Disaster Management Authority (NDMA)	Prime Minister	National Executive Committee (NEC)
			National Disaster Response Fund (Sec. 46 Dis Mgt Act 2005)
	Ministry of Home Affairs (MHA)	Home Minister	National Disaster Response Force (NDRF)
			National Institute of Disaster Management (NIDM)
State Government ↓	State Disaster Management Authority (SDMA)	Chief Minister	State Executive Committee (SEC)
			State Disaster Response Fund (Sec. 48 Dis Mgt Act 2005)
	Disaster Management Department (DMD)	Minister-in-Charge	State Disaster Response Force (SDRF)
District Government • Panchayats • Municipalities	District Disaster Management Authority (DDMA)	District Magistrate/ Chairman Zila Parishad	State Executive Committee (SEC)



1. National Level

- The overall coordination of disaster management vests with the Ministry of Home Affairs (MHA).
- The Cabinet Committee on Security (CCS) and the National Crisis Management Committee (NCMC) are the key committees involved in the top-level decision-making with regard to disaster management.
- The NDMA is the lead agency responsible for the preparation Disaster Management plans and the execution of Disaster Management functions at the national level.
- The extent of involvement of central agencies will depend upon the types, scale, administrative spread of the disaster.
- The Central government will provide all necessary support irrespective of the classification of the disaster, if the situation requires direct assistance from central government or the deployment of central agencies.



National Level Decision Making Bodies for Disaster Management

Cabinet committee on Security

- **Composition**
  - Prime Minister
  - Minister of Defence, Minister of
  - Finance
  - Minister of Home Affairs
  - Minister of External Affairs
- **Vital Role**
  - Evaluation from a national security perspective, if an incident has potentially security implications.
  - Oversee all aspects of preparedness, mitigation and management of Chemical, Biological, Radiological and Nuclear (CBRN) emergencies and of disasters with security implications.

- Review risks of CBRN emergencies from time to time, giving directions for measures considered necessary for disaster prevention, mitigation, preparedness and effective response.

National Crisis Management Committee (NCMC)

- **Composition**
  - Cabinet Secretary (Chairperson).
  - Secretaries of Ministries / Departments and agencies with specific Disaster Management responsibilities.
- **Vital Role**
  - Oversee the Command, Control and Coordination of the disaster response.
  - Give direction to the Crisis Management Group as deemed necessary.
  - Give direction for specific actions to face crisis situations.

National Disaster Management Authority (NDMA)

- **Composition**
  - Prime Minister (Chairperson).
  - Members (not exceeding nine, nominated by the Chairperson).
- **Vital Role**
  - Oversee the Command, Control and Coordination of the disaster response.
  - Give direction to the Crisis Management Group as deemed necessary.
  - Give direction for specific actions to face crisis situations.

National Executive Committee (NEC)

- **Composition**
  - Union Home Secretary (Chairperson).
  - Secretaries to the GOI in the Ministries / Departments of Agriculture, Atomic Energy, Defence, Drinking Water and sanitation, Environment, Forests and Climate Change Finance (Expenditure), Health and Family Welfare, Power, Rural Development, Science and Technology, Space, Telecommunications, Urban Development, Water Resources, River Development and Ganga Rejuvenation, The Chief of the Integrated Defence Staff of the Chiefs of Staff Committee, ex officio as members.
  - Secretaries in the Ministry of External Affairs, Earth Sciences, Human Resource Development, Mines, Shipping, Road Transport and Highways and Secretary, NDMA are special invitees to the meetings of the NEC.
- **Vital Role**
  - To assist the NDMA in the discharge of its functions.
  - Preparation of the National Plan.
  - Coordinate and monitor the implementation of the National Policy.
  - Monitor the implementation of the National Plan and the plans prepared by the Ministries or Departments of the Government of India.

- Direct any department or agency of the Govt, to make available to the NDMA or State Disaster Management Authorities such men, material or resources as are available with it for the purpose of emergency response, rescue and relief.
- Ensure compliance of the directions issued by the Central Government.
- Coordinate response in the event of any threatening disaster situation or disaster
- Direct the relevant Ministries / Departments of the GoI, the State Governments and the SDMAs regarding measures to be taken in response to any specific threatening disaster situation or disaster.
- Coordinate with relevant Central Ministries/ Departments/Agencies which are expected to provide assistance to the affected State as per Standard Operating Procedures (SOPs).
- Coordinate with the Armed Forces, Central Armed Police Forces (CAPF), the National Disaster Response Force (NDRF) and other uniformed services which comprise the GoI's response to aid the State authorities.
- Coordinate with India Meteorological Department (IMD) and a number of other specialised scientific institutions which constitute key early warning and monitoring agencies.
- Coordinate with Civil Defence volunteers, home guards and fire services, through the relevant administrative departments of the State Governments.

National Disaster Response Force (NDRF)

- **Composition**
  - Specially trained force headed by a Director General Structured like para military forces for rapid deployment.
- **Vital Role**
  - Provide assistance to the relevant State Government/District Administration in the event of an imminent hazard event or in its aftermath.

National Institute of Disaster Management (NIDM)

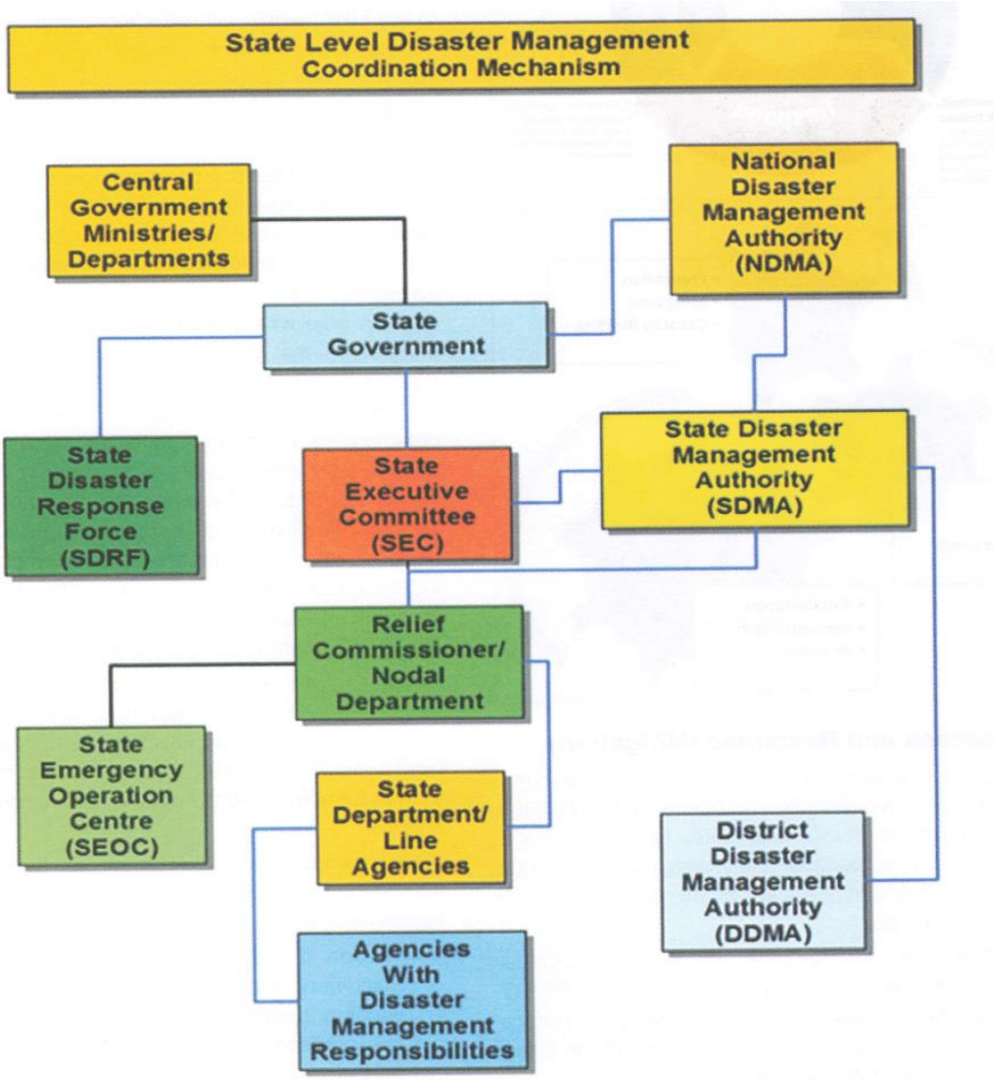
- **Composition**
  - Union Home Minister
  - Vice Chairman, NDMA
  - Members including Secretaries of various nodal Ministries and Departments of Government of India and State Governments and heads of national levels scientific, research and technical organizations, besides eminent scholars, scientists and practitioners.
- **Vital Role**
  - Human resource development and capacity building for disaster management within the broad policies and guidelines laid down by the NDMA.
  - 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.
- Promote awareness generation.

2. State Level

The Disaster Management Act 2005 mandates that:

- Each state in India shall have its own institutional framework for disaster management.
- Each State Government shall take necessary steps for the preparation of state Disaster Management plans, integration of measures for prevention of disasters or mitigation into state development plans, allocation of funds.
- The State Government shall also assist the Central Government and central agencies in various aspects of Disaster Management.
- Each state shall prepare its own State Disaster Management Plan.
- Setting up of a State Disaster Management Authority with the Chief Minister as the ex officio Chairperson. Similar system will function in each Union Territory with Lieutenant Governor as the Chairperson.



3. District Level

The Disaster Management Act mandates that

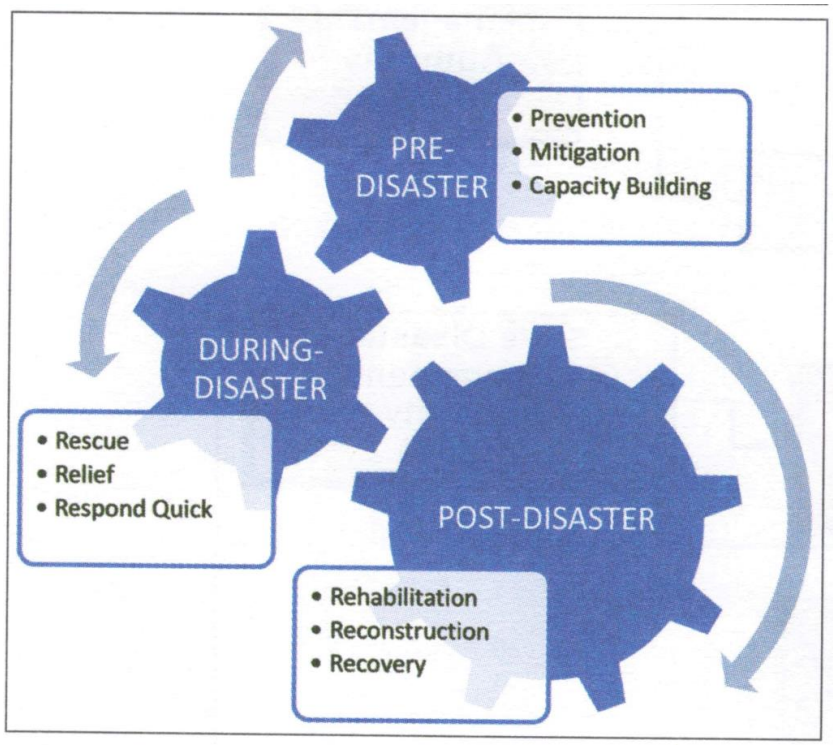
- At the district level, District Disaster Management Authority (DDMA), the District Collector or District Magistrate or the Deputy Commissioner, as applicable, will be responsible for overall coordination of the disaster management efforts and planning
- Detailed Disaster Management Plan will be developed, subject to periodic review and revision, at the levels of state, district, towns and blocks (taluka).
- Each State Government shall establish a District Disaster Management Authority for every district in the State.
- The District Disaster Management Authority will act as the planning, coordinating and implementing body for DM at the District level and take all necessary measures for the purposes of DM in accordance with the guidelines laid down by the NDMA and SDMA.

Nodal Ministry for Management / Mitigation of Different Disasters

Disaster	Nodal Ministry/ Department
Biological	Ministry of Health and Family Welfare (MoHFW)
Chemical and Industrial	Ministry of Environment, Forests and Climate Change (MoEFCC)
Civil Aviation Accidents	Ministry of Civil Aviation (MoCA)
Cyclone/Tornado	Ministry of Earth Sciences (MoES)
Tsunami	Ministry of Earth Sciences (MoES)
Drought/Hailstorm/Cold Wave and Frost/Pest Attack	Ministry of Agriculture and Farmers Welfare (MoAFW)
Earthquake	Ministry of Earth Sciences (MoES)
Flood	Ministry of Water Resources (MoWR)
Forest Fire	Ministry of Environment, Forests, and Climate Change (MoEFCC)
Landslides	Ministry of Mines (MoM)
Avalanche	Ministry of Defence (MoD)
Nuclear and Radiological Emergencies	Department of Atomic Energy (DAE)
Rail Accidents	Ministry of Railways (MoR)
Road Accidents	Ministry of Road Transport and Highways (MoRTH)
Urban Floods	Ministry of Urban Development (MoUD)

Disaster Risk Reduction

- According to UNISDR, Disaster Risk Reduction consists of a framework of elements that will help to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.



Preparedness and Response (Mitigation)

- According to UNISDR , the knowledge and capacities developed by governments, response and recovery organizations to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions is known as preparedness for disaster management.
- The UNISDR defines response as "the provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the

people affected." The immediate response in the event of a disaster lies with the local authorities with the support of the State Government.

- The Union Government supplements their efforts through providing logistic and financial support, deploying NDRF, Armed Forces, CAPF, and other specialized agencies like in case of CBRN disaster. Different measures that shall be taken for preparedness and response are as following :

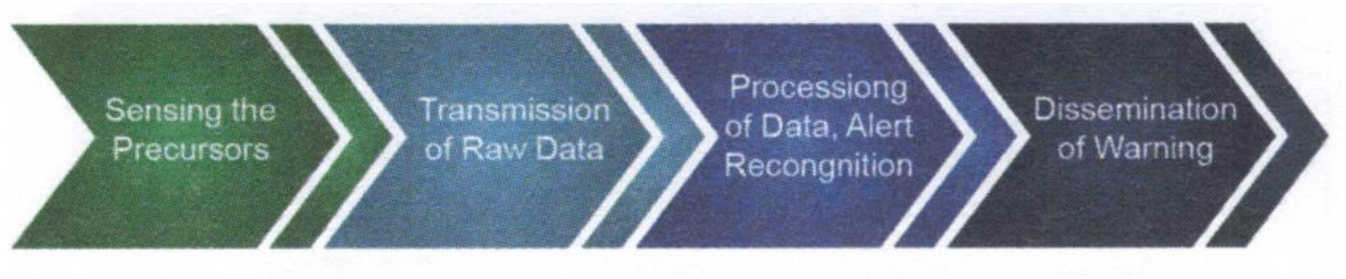
National Early Warning System

- The Government of India has designated specific agencies to monitor the onset of different natural disasters, set up adequate Early Warning Systems (EWS), and disseminate necessary warnings/ alerts regarding any impending hazard, for all those hazards where early warning and monitoring is possible with the currently available technologies and methods.
- These agencies provide inputs to the MHA, which will issue alerts and warnings through various communication channels

The agencies responsible for Early Warning System will maintain equipment in proper functioning order and conduct simulation drills to test their efficacy.

- **Importance of EWS:** Early warning systems are the key to effective risk reduction.
- They do save lives and livelihoods (and) in the world we live in, with so much division between rich and poor, they also save an enormous amount of investment for the donor countries that will be called upon to help when people die from such disasters.
- It is understood that the most effective early warning takes more than scientifically advanced monitoring systems.
- All the sophisticated technology won't matter if we don't reach communities and people.
- Satellites, buoys, data networks will make us safer, but we must invest in the training, the institution building, the awareness rising on the ground.
- If we want effective global early warning systems, we must work together, government to government, federal and local officials, scientists with policy makers, legislators with teachers and community leaders.
- **Experience:** After the Odisha Super Cyclone, advanced Doppler radars have been installed at three locations on the eastern coast which has made the tracking of cyclones more accurate, but such systems are not available in the west coast which makes weather prediction fairly primitive as was demonstrated during the unprecedented rainfall in Mumbai.
- **Way Ahead:** Second ARC in its 3rd Report Crisis management – from Despair to Hope made following recommendation:
- Though it is the responsibility of the government machinery and the local bodies to disseminate the warning, peoples' participation has to be enlisted.
- For this purpose, the role of community leaders, NGOs and others should be clearly defined in the emergency response plan and they should be fully trained and prepared for their respective roles.

- Communications networks with sufficient redundancies should be established between the data collection point to the points where hazard is likely to occur.
- The communication channels from the point of alert generation to the point of disaster should have enough redundancies so as to maintain line of communication in the event of a disaster striking.
- Care has to be taken to put in place systems to disseminate warnings to all sections of the people.
- The early warning system should be evaluated after each disaster to carry out further improvements. Following are four components of Early Warning System.



Strengthening Disaster Risk Governance

- Disaster Risk governance refers to the way in which public authorities, civil servants, media, private sector, and civil society cooperate in order to manage and reduce disaster and climate related risks.

- In other words, ensuring that sufficient levels of capacity and resources are made available to prevent, prepare for, manage and recover from disasters.

- Strengthening disaster risk governance is necessary to foster collaboration and partnerships for the implementation of disaster risk reduction and sustainable development.

The Sendai Framework lays emphasis on the following to strengthen disaster risk governance :

- Mainstream and integrate disaster risk reduction within and across all sectors.
- Adopt and implement disaster risk reduction strategies and plans across different levels.
- Carry out assessment of the technical, financial and administrative disaster risk management capacity to deal with the identified risks at different levels.
- Promote necessary mechanisms and incentives to ensure high levels of compliance with the safety enhancing provisions.
- Empower local authorities, as appropriate, through regulatory and financial mechanism to work and coordinate with civil society.
- Work with parliamentarians for disaster risk reduction by developing or amending relevant legislation and setting budget allocations.

- Formulate relevant public policies and laws aimed at addressing issues of prevention or relocation, where possible, of human settlements in disaster risk-prone zones.

Disaster Recovery

- Recovery is "the restoration, and improvement where appropriate facilities for livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.

- Disaster Management Act 2005 mandates the government to carry out rehabilitation and reconstruction activities, it does not explicitly refer to 'recovery' as a component to be used as a part of disaster management strategy.

Stages of Disaster Recovery		
Recovery Stage	**Duration**	**Brief Description**
Early	3-18 Months	Cash for work, resumption of markets, commerce and trade, restoration of social services, transitional and temporary shelters.
Mid-term	Up to 5 Years (concurrent with early recovery)	Recovery plans for assets and livelihoods, reconstruction plans for housing, infrastructure, public buildings and cultural heritage buildings.
Long	Within 10 Years	Implemented along with developmental plans: infrastructure strengthening, environmental, urban and regional planning.

Rehabilitation

- Rehabilitation package includes total reconstruction of damaged physical and psychological infrastructure, as well as economic and social rehabilitation of the people in the affected region.

- The rehabilitation is classified into the following:

- **Physical Rehabilitation:** It refers to Reconstruction of physical infrastructure with short term and long term strategies towards watershed management, canal irrigation along with rehabilitating artisan, agriculture and animal husbandry by providing adequate subsidies, farm implements, flood plain zoning, adherence to land use planning.
- **Social Rehabilitation:** providing special social support to the vulnerable groups by reviving the education activities, rehabilitating olders, women and children etc among others
- **Economic Rehabilitation:** It include livelihood restoration and ensuring the continuity of businesses, trade, and commerce by restoring employment and income generating opportunities and access to functioning market to disaster affected communities.
- **Psychological Rehabilitation:** It refers to the psychological trauma of losing relatives and friends, and the scars of the shock of disaster event which take much longer to heal than the stakeholders in disaster management often realize.

- Thus, counselling for stress management should form a continuous part of a disaster rehabilitation plan. It can include:
  (a) Psycho-therapeutic health programmes.
  (b) Occupational therapy.
  (c) Debriefing and trauma care.
  (d) Tradition, values, norms, beliefs, and practices of disaster-affected people.

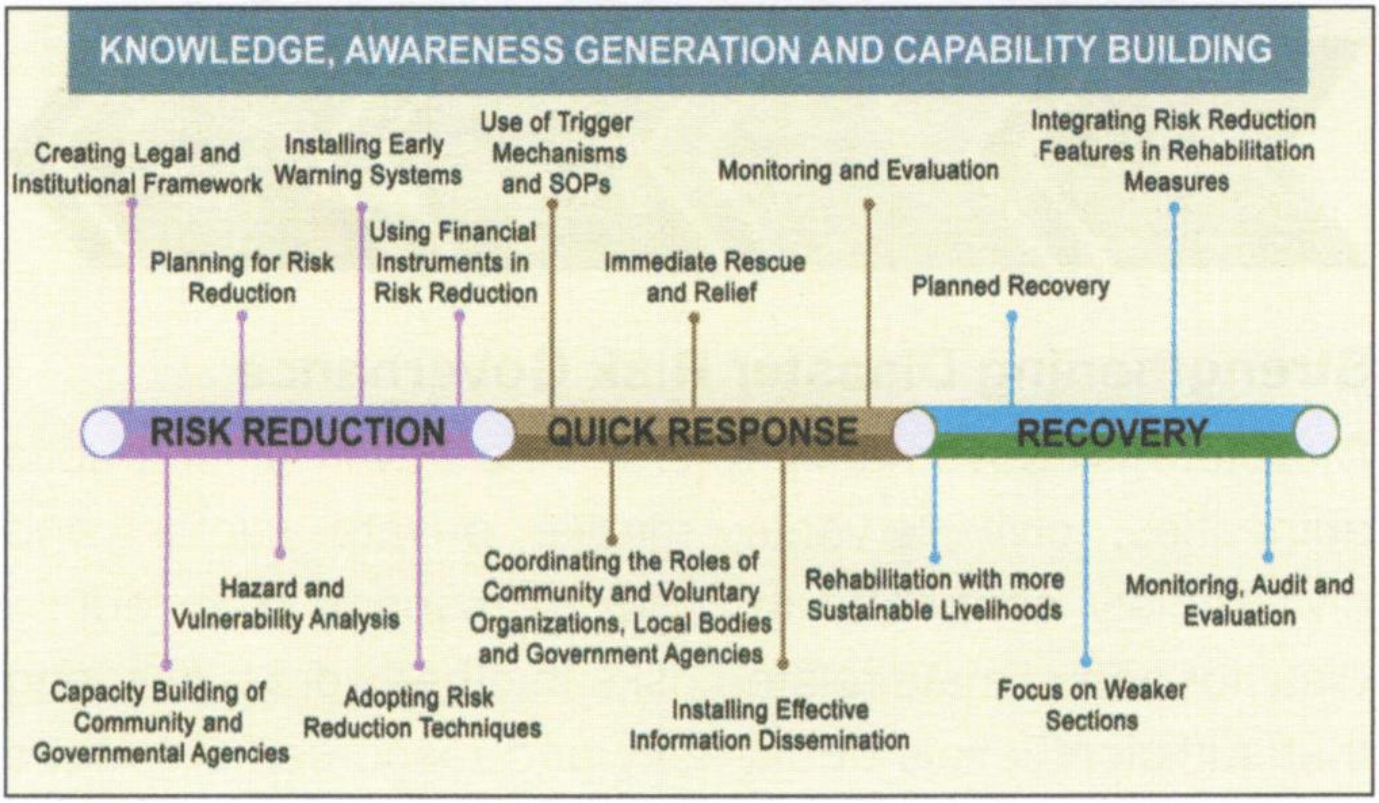
Fund Mobilisation

- The work of rehabilitation and reconstruction can move forward only if sufficient fund is allocated.
- These projects are typically financed through the State exchequer.
- However in recent times, large funds have been raised from multilateral/ bilateral funding agencies/ international agencies in close coordination with the national Governments.
- The funds can also be raised by imposing special tax or surcharge and issuing tax free bonds.
- The State Government, through the relevant ministry of the Central Government, shall finalize the fund mobilization strategy, incorporating appropriate conditions governing flow of funds, its disbursement, and usage as per norms decided by the Central Government.
- But the funds so allocated shall be disbursed in time and proper monitoring should be done.
- As per Section 47 of the DM Act 2005, Central Government may constitute a National Disaster Mitigation Fund for projects exclusively for the purpose of mitigation.

Capacity Development

- Capacity development covers strengthening of institutions, mechanisms, and capacities at all levels of all stakeholders.
- It is an important component of investing in disaster risk reduction.
- Capacity development commonly refers to a process that is driven from the inside and starts from existing capacity assets.
- The framework underlines the need for capacity development of women in disaster management and building their ability to participate effectively in managing disaster risk As capacity development entails activities on various levels, i .e. legal and institutional frameworks, systems of organisations, organisation and human and material resources, it is necessary to address challenges on all of them by implementing a mix of activities, on short and long term.
- These three stages – preparedness and risk management, emergency response and recovery and rehabilitation may be subdivided into various detailed activities as presented in Figure.

Elements of Crisis Management



National Disaster Management Plan

- The National Disaster Management Plan (NDMP) provides a framework and direction to the government agencies for all phases of disaster management cycle.
- The NDMP is a “dynamic document” in the sense that it will be periodically improved keeping up with the global best practices and knowledge base in disaster management.
- The NDMP provides a framework covering all aspects of the disaster management cycle.
- It covers disaster risk reduction, mitigation, preparedness, response, recovery, and betterment and reconstruction.
- While it focuses primarily on the needs of the government agencies, it envisages all those involved in disaster management including communities and non-government agencies as potential users. Section 11 of the DM Act 2005 mandates that there shall be a National Disaster Management Plan (NDMP) for the whole of India.
- The NDMP complies with the National Policy on Disaster Management (NPDM) of 2009 and conforms to the provisions of the DM Act making it mandatory for the Government of India and various central ministries to have adequate DM plans.

Acts and Policies Related to Disaster Management

Developments in Disaster Management

National Disaster Management Act, 2005

Evolution of the Act

- The Government of India (GOI) set up a High-Powered Committee (HPC) in August 1999 and a National Committee after the Gujarat earthquake, for making recommendations on the preparation of Disaster Management plans and suggesting effective mitigation mechanisms.
- Also the tenth five year plan document for the first time contained a detailed chapter on disaster management.
- Thus all the efforts finally culminated in 2005 by enactment of the National Disaster Management Act.

Functions and Responsibilities

- NDMA, as the apex body, is mandated to lay down the policies, plans and guidelines for Disaster Management to ensure timely and effective response to disasters.

It is entrusted with the following responsibilities:

- Lay down policies on disaster management ;
- Approve the National Plan and plans prepared by the Ministries or Departments of the Government of India in accordance with the National Plan;
- Lay down guidelines to be followed by the State Authorities in drawing up the State Plan and Coordinate the enforcement and implementation of the policy and plans for disaster management.
- Recommend provision of funds for the purpose of mitigation.
- Provide such support to other countries affected by major disasters as may be determined by the Central Government.

National Policy on Disaster Management

- **NPDM was approved in 2009 with the vision "To build a safe and disaster resilient India by developing a holistic, proactive, multi-disaster oriented and technology driven strategy through a culture of prevention, mitigation, preparedness and response"**.

- NPDM provides for an integration approach for management with emphasis on building strategic partnerships at various levels.

- The National Policy on disaster management puts in place an enabling environment for all.

Prime Minister's Ten Point Agenda on DRR

1	All development sectors must imbibe the principles of disaster risk management
2	Risk coverage must include all, starting from poor households to SMEs to multi-national corporations to nation states
3	Women's leadership and greater involvement should be central to disaster risk management
4	Invest in risk mapping globally to improve global understanding of Nature and disaster risks
5	Leverage technology to enhance the efficiency of disaster risk management efforts
6	Develop a network of universities to work on disaster-related issues
7	Utilise the opportunities provided by social media and mobile technologies for disaster risk reduction
8	Build on local capacity and initiative to enhance disaster risk reduction
9	Make use of every opportunity to learn from disasters and, to achieve that, there must be studies on the lessons after every disaster
10	Bring about greater cohesion in international response to disasters

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International Cooperation on Disaster Management

International Organisation and Frameworks

Yokohama Strategy (1994)

- The need to mitigate the impact of natural disaster in terms of human and economic losses was felt by the United Nations and other countries.

- So they held World conference on natural Disaster reduction in the city of yokohama in 1994.

- It was accepted that these disaster affected the poor and disadvantageous group the worst, particularly in the developing countries, which are ill equipped to cope with them.

The resolution of the world conference on natural disaster reduction was as follows:

- Each country has the sovereign responsibility to protect its citizen from natural disasters.
- It would give priority attention to the developing countries, particularly the least developed landlocked countries and Small Island developing Nations.
- It will develop and strengthen National capacities and capabilities.
- It will promote and strengthen sub regional, regional and international cooperation in activities to prevent reduce and mitigate natural and other disasters.
- It also declared the decade 1990-2000 as the international decade for natural disaster reduction.

United Nations office for disaster Risk Reduction (1999)

- The UN General Assembly adopted the International Strategy for Disaster Reduction as asuccessor arrangement of the International Decade for Natural Disaster Reduction in December 1999 and established United Nations International Strategy for Disaster Reduction (UNISDR).

- Its mandate was expanded in 2001 to serve as the focal point in the United Nations system to ensure coordination and synergies among disaster risk reduction activities of the United Nations system and regional organizations.

Hyogo Framework (2005)

- The world conference on Disaster Reduction which was held Kobe, Hyogo Japan in 2005 adopted the framework for action 2005-2015.

The hyogo framework for action had the following goals:

- The integration of disaster risk reduction into sustainable development policies and planning.
- Development and strengthening of institutions, mechanism and capacities to build resilience to hazards.
- The systematic incorporation of risk reduction approaches into the implementation of emergency preparedness, response and recovery programme. Its priority of action included:
- Ensure that disaster risk reduction (DRR) is a national and a local priority with a strong institutional basis for implementation.
- Identify, assess and monitor disaster risks and enhance early warning.
- Use knowledge, innovation and education to build a culture of safety and resilience at all level.

- Reduce the underlying risk factors.
- Strengthen disaster preparedness for effective response at all levels.

Sendai Framework (2015)

- The Sendai Framework is a 15-year (2015-2030), voluntary, non-binding agreement which recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders.

- The Sendai Framework was adopted by UN Member States on 18 March 2015 at the Third UN World Conference on Disaster Risk Reduction in Sendai City, Miyagi Prefecture, Japan as a follow up of the hyogo framework.

The global targets set by Sendai Framework includes:

- Substantially reduce global disaster mortality by 2030.
- Substantially reduce the number of affected people globally by 2030
- Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.
- Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.
- Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.
- Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this Framework by 2030.
- Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.

The four priority areas for action in sendai framework are as:

- Understanding Disaster Risk: Disaster risk management should be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment.
- Such knowledge can be used for risk assessment, prevention, mitigation, preparedness and response.
- Strengthening Disaster Risk Governance: Disaster risk governance at the national, regional and global levels is very important for prevention, mitigation, preparedness, response, recovery, and rehabilitation. It fosters collaboration and partnership.
- Investing in Disaster Risk Reduction: Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment.
- **Enhancing Disaster Preparedness:** The growth of disaster risk means there is a need to strengthen disaster preparedness for response, take action in anticipation

of events, and ensure capacities are in place for effective response and recovery at all levels.
- The recovery, rehabilitation and reconstruction phase is a critical opportunity to build back better, including through integrating disaster risk reduction into development measures.

The NDMP incorporated the four priority areas and substantively the approach enunciated in the Sendai Framework which will help the country to meet the goals set in the framework.

The NDMP has been aligned broadly with the goals and priorities set out in the Sendai Framework for Disaster risk reduction.

- **The Sendai Framework Readiness Review, UNISDR 2017**: Critical data gaps exist in specific areas of disaster loss, in all areas of international cooperation, and for many aspects of early warning, risk information and disaster risk reduction strategies.

- The Review confirms that unless gaps in data availability, quality and accessibility are addressed, countries' ability to assure accurate, timely and high quality monitoring and reporting of implementation across all Targets and Priorities of the Sendai Framework will be severely impaired.

- **A Global Partnership for Disaster-related Data for Sustainable Development** would facilitate a collaborative, multi-stakeholder effort (bringing together governments, international organizations, the private sector, civil society groups, and the statistics and data communities), to optimize and operationalize existing and future disaster-related data in support of national and sub-national disaster risk reduction efforts.

- **2030 Agenda for Sustainable Development**: In the 2030 Agenda for Sustainable Development, ten of the seventeen Sustainable Development Goals (SDGs) have targets related to disaster risk, firmly establishing the role of disaster risk reduction in realizing the 2030 Agenda for Sustainable Development.

- **Paris Agreement at CoP 21**: In the Paris Agreement, adopted at the 21st Conference of Parties to United Nations Framework Convention on Climate Change in 2015, Member States committed to holding the global average temperature increase to well below 2°C above pre-industrial levels and to pursue efforts to limit the increase to 1.5°C, with the aim to "significantly reduce the risks and impacts of climate change".

Facts About Disasters and its Management

- About 10 per cent of the World's tropical cyclones affect the Indian coast.

- In India, tropical cyclones occur in the months of May-June and October-November.
- The North Indian Ocean Basin (NIO-Basin, including the Indian coast) generates about seven percent of the World's cyclones.
- It has been observed that between 1891 and 2006, 308 cyclones crossed the east coast, out of which 103 were severe
- Out of 40 million hectare of the flood prone area in the country, on an average, floods affect an area of around 7.5 million hectare per year.
- It is estimated that 30 percent of the World's landslides occur in the Himalayan ranges.
- Around 68% of India's land is prone to drought.
- Nearly 60% land marks is prone to earthquake.
- Approximately 76% of the 7516 km of India's coast line is affected by cyclones and tsunamis.

Problems in Disaster Management

Infrastructural-Physical & Human	Lack of knowledge and awareness among the citizens of India regarding the kind of disaster and ways to mitigate and respond to the problem. Lack of expertise in the effective management of disasters at all the levels in general and at local levels in particular. Insufficient and inefficient preparedness by the residents for any natural calamity particularly in vulnerable zones
Institutional Governance	Infrastructure and technological systems have politics. For example, often there are contention seen in the construction of dams between the government agencies and the residents of the areas in the vulnerable areas. There is little coordination and sharing of data among different ministries and between the government and agencies involved in disaster risk management.

Disaster Mitigation

Some of the ways to mitigate the Disaster problems include:

Infrastructural-Physical & Human	Improvement to be brought in effective processes, such as continuous training, multiple redundancies, accountability, better data, hierarchical differentiation and autonomy, and crucially, nurturing cultures of reliability. Perform drill practices to train people about the response, measures and care to be taken of in case of any disaster. Preparation of location specific and disaster specific centres should be open to provide services in the time of disaster.
Institutional Governance	Understanding the patterns in human social dynamics in any given region. Involve NGOs and SHGs to spread awareness among the residents by campaigning and other such methods. Democratic processes and shareholder participation are critical for effective Disaster risk governance. Time to move on from being focussed only on managing disaster emergencies to improve resilience.

National Policy on Disaster Management, 2009

- The **National Policy on Disaster Management (NPDM)** has been prepared in tune with and in pursuance of the **Disaster Management Act, 2005**.
- National Policy on Disaster Management (NPDM) will provide the framework/roadmap for handling disasters in a holistic manner.
- The Policy covers **all aspects of disaster management** covering institutional, legal and financial arrangements; disaster prevention, mitigation and preparedness, techno-legal regime; response, relief and rehabilitation; reconstruction and recovery; capacity development; knowledge management and research and development.
- It focuses on the areas where action is needed and the institutional mechanism through which such action can be channelized.
- The NPDM addresses the concerns of all the sections of the society **including differently abled persons, women, children and other disadvantaged groups.**
- In terms of grant of relief and formulating measures for rehabilitation of the affected persons due to disasters, the issue of equity/inclusiveness has been accorded due consideration.
- The NPDM aims to bring in **transparency and accountability** in all aspects of disaster management through **involvement of community**, community based organizations, Panchayati Raj Institutions (PRIs), local bodies and civil society.

Vision

- **To build a safe and disaster resilient India by developing a holistic, proactive, multi-disaster oriented and technology driven strategy** through a culture of prevention, mitigation, preparedness and response.

Approach

- A holistic and integrated approach will be evolved toward disaster management with emphasis on building strategic partnerships at various levels.

The themes underpinning the policy are:

- Community based DM, including last mile integration of the policy, plans and execution.
- Capacity development in all spheres.
- Consolidation of past initiatives and best practices.
- Cooperation with agencies at national and international levels.
- Multi-sectoral synergy.

Objectives

The objectives of the national policy on disaster management are:

- Promoting a culture of prevention, preparedness and resilience at all levels through knowledge, innovation and education.
- Encouraging mitigation measures based on technology, traditional wisdom and environmental sustainability.
- Mainstreaming disaster management into the developmental planning process.
- Establishing institutional and techno-legal frame works to create an enabling regulatory environment and a compliance regime.
- Ensuring efficient mechanism for identification, assessment and monitoring of disaster risks.
- Developing contemporary forecasting and early warning systems backed by responsive and failsafe communication with information technology support.
- Promoting a productive partnership with the media to create awareness and contributing towards capacity development.
- Ensuring efficient response and relief with a caring approach towards the needs of the vulnerable sections of the society.
- Undertaking reconstruction as an opportunity to build disaster resilient structures and habitat for ensuring safer living.
- Promoting productive and proactive partnership with media in disaster management.

Background of National Policy on Disaster Management (NPDM) 2009:

- The Disaster Management Act, 2005 enacted by the Parliament was notified in the Gazette of India on 26th December, 2005.
- The Act provides for the legal and institutional framework for the effective management of disasters.
- The Act mandates creation of new institutions and assignment of specific roles for Central, State and Local Governments.
- Under the provisions of the Act, the **National Disaster Management Authority (NDMA)** has been established under the Chairmanship of the Prime Minister and **National Executive Committee (NEC)** of Secretaries has been created to assist the NDMA in the performance of its functions.
- At the State level, a **State Disaster Management Authority** has been created under the Chairmanship of Chief Minster of the State, which has been assisted by a **State Executive Committee**.
- At the District level, **District Disaster Management Authorities** have been created.

Who is responsible for Disaster Management?

- The primary responsibility for management of disaster rests with the **State Government concerned**.

- The '**Nodal Ministry' in the central government** for management of natural disasters is the **Ministry of Home Affairs (MHA).**

- **Disaster Management is a multidisciplinary activity which is to be performed in cohesive synergy among all stakeholders**.

- The **institutional mechanism put in place at the Centre, State and District levels helps states to manage disasters** in an effective manner.

- **National Disaster Management Authority** (**NDMA) is responsible for framing policies, laying down guidelines and best-practices for coordinating with the State Disaster Management Authorities (SDMAs)** to ensure a holistic and distributed approach to disaster management.

- The National Policy on disaster management puts in place an enabling environment for all.
- It is expected by all the stakeholders to put up their best efforts in managing any disaster as per the framework of NPDM.
- Every disaster teaches us new lessons and the Govt/Society learns to adapt with them accordingly.
- NPDM has been fruitful in developing a holistic, proactive multi disaster oriented and technology driven approach in the Country.

National Disaster Response Force (NDRF)

- The National Disaster Response Force is an Indian **specialized force constituted "for the purpose of special response to a threatening disaster situation or disaster"** under the Disaster Management Act, 2005.

- Since its raising, NDRF has been responding in various rescue operations in disasters within the country and abroad and saved many precious lives and retrieved dead bodies of victims.

- NDRF personnel responded outstandingly and the details of victims rescued and retrieved by NDRF till date is as under:

    - Rescued more than 4.5 lakh human lives.
    - Retrieved more than 2000 dead bodies.
    - Trained Community Volunteers – around 40,00,000.
    - Besides, NDRF is also imparting training to SDRF Personnel and other stakeholders.

National Disaster Management Plan, 2016

- **The National Disaster Management Plan (NDMP)** was **released in 2016,** it is the first ever national plan prepared in the country for disaster management. With **National Disaster Management Plan (2016), India has aligned its National plan with the Sendai Framework for Disaster Risk Reduction 2015-2030**, to which India is a signatory.
- **The National Disaster Management Plan (NDMP) aims to make India disaster resilient and significantly reduce the loss of lives and assets.** The plan is based on the **four priority themes of the "Sendai Framework,"** namely:
    - understanding disaster risk
    - improving disaster risk governance
    - investing in disaster reduction (through structural and non-structural measures)
    - disaster preparedness, early warning and building back better in the aftermath of a disaster.

Vision

- **Make India disaster resilient, achieve substantial disaster risk reduction, and significantly decrease the losses of life, livelihoods, and assets – economic, physical, social, cultural, and environmental** – by maximizing the ability to cope with disasters at all levels of administration as well as among communities.

Objectives

- Along with the mandate given in the Disaster Management Act 2005 and the NPDM 2009, the **national plan has incorporated the national commitment towards the Sendai Framework**. Accordingly, the broad objectives of the NDMP are:
- Improve the understanding of disaster risk, hazards, and vulnerabilities
- Strengthen disaster risk governance at all levels from local to centre
- Invest in disaster risk reduction for resilience through structural, non-structural and financial measures, as well as comprehensive capacity development
- **Enhance disaster preparedness** for effective response
- Promote **"Build Back Better" in recovery, rehabilitation and reconstruction**
- Prevent disasters and achieve substantial reduction of disaster risk and losses in lives, livelihoods, health, and assets (economic, physical, social, cultural and environmental)
- Increase resilience and prevent the emergence of new disaster risks and reduce the existing risks
- Promote the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures to prevent and reduce hazard exposure and vulnerabilities to disaster

- Empower both local authorities and communities as partners to reduce and manage disaster risks
- Strengthen scientific and technical capabilities in all aspects of disaster management
- Capacity development at all levels to effectively respond to multiple hazards and for community-based disaster management
- Provide clarity on roles and responsibilities of various Ministries and Departments involved in different aspects of disaster management
- Promote the culture of disaster risk prevention and mitigation at all levels
- Facilitate the mainstreaming of disaster management concerns into the developmental planning and processes

Salient Features of the Plan

- The plan covers all phases of disaster management: prevention, mitigation, response and recovery.
- For each hazard, the approach used in this national plan incorporates the four priorities enunciated in the Sendai Framework into the planning framework for Disaster Risk Reduction under the five Thematic Areas for Actions:
  - **Understanding Risk**
  - **Inter-Agency Coordination**
  - **Investing in DRR – Structural Measures**
  - **Investing in DRR – Non-Structural Measures**
  - **Capacity Development**
- The Response **part** of the Plan has identified eighteen broad activities which have been arranged into a matrix to be served as a ready reckoner:
  - Early Warning, Maps, Satellite inputs, Information Dissemination
  - Evacuation of People and Animals
  - Search and Rescue of People and Animals
  - Medical Care
  - Drinking Water/ Dewatering Pumps/ Sanitation Facilities/ Public Health
  - Food & Essential Supplies
  - Communication
  - Housing and Temporary Shelters
  - Power
  - Fuel
  - Transportation
  - Relief Logistics and Supply Chain Management
  - Disposal of Animal Carcasses
  - Fodder for livestock in scarcity-hit areas
  - Rehabilitation and Ensuring Safety of Livestock and other Animals, Veterinary Care
  - Data Collection and Management
  - Relief Employment
  - Media Relations

- The Plan has also incorporated a Chapter on Strengthening Disaster Risk Governance.
- The generalized responsibility matrix given in this section summarizes the themes for strengthening Disaster Risk Governance and specifies agencies at the Centre and State with their respective roles.
- The matrix has six thematic areas in which Central and State Governments have to take actions to strengthen disaster risk governance:
    - Mainstream and integrate DRR and Institutional Strengthening
    - Capacity Development
    - Promote Participatory Approaches
    - Work with Elected Representatives
    - Grievance Redress Mechanism
  - Promote Quality Standards, Certifications, and Awards for Disaster Risk Management
- **It provides for horizontal and vertical integration among all the agencies and departments of the Government.** The plan also spells out the roles and responsibilities of all levels of Government right up to Panchayat and Urban Local Body level in a matrix format.
  - The plan has a regional approach, which will be beneficial not only for disaster management but also for development planning.
- **It is designed in such a way that it can be implemented in a scalable manner in all phases of disaster management**. It also identifies major activities such as early warning, information dissemination, medical care, fuel, transportation, search and rescue, evacuation, etc. to serve as a checklist for agencies responding to a disaster.
  - It also provides a generalized framework for recovery and offers flexibility to assess a situation and build back better.
- **To prepare communities to cope with disasters, it emphasizes on a greater need for Information, Education and Communication activities**.

National Disaster Management Authority (NDMA)

- The National Disaster Management Authority (NDMA) is the **apex body for Disaster Management in India**.
- **Prime Minister heads NDMA**.
- It is a **statutory body created under the Disaster Management Act 2005.**
- Its primary purpose is to coordinate the response to natural or man-made disasters and for capacity-building in disaster resiliency and crisis response.

NDMA Guidelines (Summary)

- Disasters have an uncanny ability to bring to the forefront vulnerabilities of systems, structures, processes and people which in turn cause large scale damages.
- After the Gujarat earthquake, the government of India, in recognition of the importance of Disaster Management, enacted the Disaster Management Act, which envisaged the creation of National Disaster Management Authority (NDMA), headed by the Prime Minister in 2005.
- National Disaster Management Authority (NDMA) has been mandated, under the provisions of Disaster Management Act 2005 to, inter alia, issue guidelines for the management of disasters that periodically affects normal life and well being of the people.
- It envisions to build a safer and disaster resilient India by a holistic, pro-active, technology driven and sustainable development strategy that involves all stakeholders and fosters a culture of prevention, preparedness and mitigation.
- With changing times, the disaster risk management in India has undergone a paradigm shift in recent decades moving from a purely reactive, relief-based approach to a proactive approach that aims to prevent the creation of new risks and reduce existing risks by implementing mitigation measures and incorporating Build Back Better (BBB) approach.
- NDMA, through its guidelines, aims to mainstream disaster prevention, mitigation, preparedness and response activities in our country. Some of these guidelines are discussed below.

An Integrated Approach Towards Crowd Management

Guidelines on Crowd Management

- Over the last few years, India has witnessed several instances of crowd mismanagement leading to fatalities.
- Recently in 2017 stampede occurred at sub-urban Elphinstine road railway station in which 23 people were killed.
- Though crowd disaster is not new, they did not get due attention in the past considering their localized nature. However, with rapid population increase and increasing instances of mass gathering at different places, especially at socio-religious gatherings, railway stations and shopping malls, these mishaps are increasing.
- These disasters have forced the government to come up with a national policy on Crowd management. They can be prevented by proper policy making, planning and execution along with welltrained personnel.

As crowd disasters are local events, disaster management is primarily the responsibility of the organizers and local/ district administration with support, guidelines from the state and the national authorities.

Causes of Crowd Disaster

- Crowd Disasters happen due to various causes which have been classified as under:

Structural

- Structural collapse of bamboo railings, bridges, bamboo railings, etc;
- Absence of emergency exits and lack of entry points;
- Difficult terrains like presence of famous temples on top of hills which are difficult to access etc.

Fire/Electricity

- Fire in makeshift facility due to short circuit or cooking;
- Non-availability of fire extinguisher;
- Electricity supply failure leading to mass exodus;
- Panic due to fire on elevators;
- Illegal manufacturing and selling of fire crackers etc.

Crowd Control

- More than anticipated crowd at places of mass gatherings in various occasions;
- Underestimation of audience, staffing, services;
- Lack of access control;
- Lack of proper public address system to control crowd;
- Uncontrolled parkings and vehicular movement; etc.

Crowd Behaviour

- Wild rush to force the way towards the entrance/exit gates;
- Crowds attempting to enter a venue after the entry/ closing time'
- Free distribution of foods, clothing and other gifts triggering a surge and crush;
- Tussle to catch a glimpse of a celebrity;
- Unruly and irresponsible crowd behavior; etc.

Security

- Under deployment of security personnel to regulate to control crowd;
- Lack of adequate scientific planning to deal with the crowd;
- Lack of adequate dress rehearsals before an event;
- Absence of walkie-talkies for the police officials on duty;
- Inadequate CCTV surveillance of the crowd; etc.

Lack of Coordination between Stakeholders

- Coordination gap between different agencies (Police dept., fire department, PWD, Forest department, etc.);
- Communication delays;
- Vacant postings of key personnel etc.

Guidelines

- **Route maps** should be put up at strategic points. Barricading should be done to ensure the movement of people in a queue is key to control a burgeoning crowd.
- Unauthorized parking and makeshift stalls eating into pedestrian space also need to be regulated. CCTVs cameras should be employed to monitor movement of people.
- **Security of VIPs:** Specific plans for security of VIPs should be made by the authorities,
- **Medical Facilities:** Organizers must ensure presence of Ambulance and health care officials at event venues. Also, medical first-aid room should be created in every event to handle any emergency situation in order to handle post-disaster emergencies.
- **Disaster Preparedness**: A proper disaster management plan must be prepared and reviewed by event organizers in coordination with local administration.
- This will ensure that all the necessary facilities such as transport, medical and emergency facilities are as per standard safety standards.
- **Civil Society:** In addition to local administration including police authorities, the event organizers must involve NGOs and civil society to ensure immediate help in cases of disaster.
- **Capacity Building:** To ensure masses don't panicin cases of disaster, the focus should be on better training methods with regular updations through incorporation of best crowd management techniques across the world.
- **Standard Norms:** It is important that the organizers of any event take simple precautions by following standard norms and practices to ensure safety. Organizers should ensure authorised use of electricity, fire safety extinguishers and other arrangements meeting safety guidelines.
- **For participants:** In case of stampede, protect chest by placing your hands like a boxer and keep moving indirection of crowd. Mock drills can be conducted for the awareness of the people.

Way Forward

- A little mismanagement and these events can take the form of stampedes and fires resulting in casualties.
- A crowd can give in to baseless rumours or may just follow a herd like mentality. Once triggered, it is very difficult to contain this fluid mass of people.
- In most of the cases, the crowd disasters are man-made disasters and such tragedies can be prevented with proactive planning and execution by the authorities involved.
- Apart from that, lessons should be learnt from past mistakes and experiences. Every member of society is a stakeholder in such disaster prevention.
- NDMA should also focus on a central repository of incidences so that lessons can be learnt from past for a better and safer world.

Guidelines on Heat Waves

- Heat wave is a condition of atmospheric temperature that leads to physiological stress, which sometimes can cause deaths as well.

- The World Meteorological Organization defines a heat wave as five or more consecutive days during which the daily maximum temperature exceeds the average maximum temperature by five degrees Celsius.

- In India, heat wave is considered if maximum temperature of a station reaches at least 40°C or more for plains, 37°C or more for coastal stations and at least 30°C or more for hilly regions.

Criteria for Declaring a Heat Wave

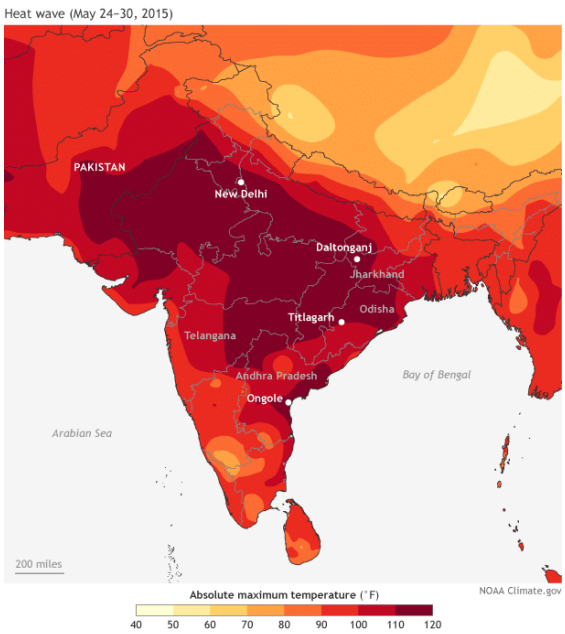
- **Based on Departure from Normal Heat Wave:** Departure from normal is 4.5°C to 6.4°C **Severe Heat Wave:** Departure from normal is > 6.4°C (b) **Based on Actual Maximum Temperature (for plains only) Heat Wave:** When actual maximum temperature >/= 45°C **Severe Heat Wave:** When actual maximum temperature >/= 47°C

- To declare a heat wave, the above criteria should be met at least at two stations in a Meteorological sub-division for at least two consecutive days. A heat wave will be declared on the second day.

- The latest World Meteorological Organization statements on global climate during 2016 (published 21 March, 2017) indicate that the global temperatures continue to increase; and the year 2016 made history with a record global temperature, exceptionally low sea ice, unabated sea level rise and ocean heat.
- The extreme weather and climate conditions have continued into 2017.

Preparing a Heat Wave Plan

- Ahmadabad is the first city in India to have its own heat wave action plan it was first launched in 2013 there after it has been reviewed for six times.
- It is now being adopted by 30 cities in 11 states.
- **Heat Wave and Disaster Management:** Heat wave has not been notified as a disaster by the Government of India yet and hence not eligible for relief under National/ State Disaster Response Fund norms.
- However, a State Government may use up to 10 per cent of the funds available under the SDRF for providing immediate relief to the victims of natural disasters that they consider to be disasters.



- **Rationale for Heat Wave Action Plan (HAP):** The combination of exceptional heat stress and a predominantly rural population makes India vulnerable to heat waves.
- Vegetable vendors, auto repair mechanics, cab drivers, construction workers, police personnel, road side kiosk operators and mostly weaker sections of society are extremely vulnerable to the adverse impacts of heat waves such as dehydration, heat and sun strokes.
- Hence, it is time to devise a national level strategy and plan to comba this disaster.
- **Vulnerability Assessment:** Identifying the vulnerable population helps in designing appropriate strategies and intervention at community level.

- **Key Strategies:** Severe and extended heat waves can also cause disruption to general, social and economic services.

- Government agencies will have a critical role to play in preparing and responding to heat waves at the local level, working closely with health and other related departments on a long-term strategic plan.

  - Establish Early Warning System and inter-agency coordination.
  - Developing inter-agency response plan.
  - Preparedness at the local level for health system.
  - Health system capacity building.
  - Public awareness and community outreach.
  - Collaboration with non-government and civil society.
  - Assessing the impact – feedback for reviewing and updating the plan.
  - Availability of shelters and water at regular distance.

Early Warning and Communications

- **Forecast and Issuance of Heat Alert or Heat Warning:** A new system of exclusively heat-related warnings has been introduced by the India Meteorological Department (IMD) with effect from 3rd April, 2017.
- These warnings, valid for the next four days, are issued around 1600 hours 1ST daily and are provided to all concerned authorities (Departments of health, disaster management, Indian Red Cross and Indian Medical Association, NDMA etc.) for taking suitable action at their end.

- **Identification of Colour Signals for Heat Alert:** IMD currently follows a single system of issuing warnings for the entire country through a colour code system which advises on the severity of an expected heat hazard.
- However, threshold assessments carried out in different parts of the country tells us that there are different cut-off points that determine the warning signals appropriate for a specific The States should carry out their respective threshold assessments for mortality and provide the information to IMD so that it can provide specific warning alerts to those States.

Guidelines on Earthquake

- The National Disaster Management Authority of India issued guidelines in April 2007 for Management of Earthquakes in India.
- The vision statement for guidelines is "Zero tolerance to avoidable deaths due to earthquakes."
- Long-term and sustained efforts are required to address the problem of earthquake risk in India.
- These Guidelines have been prepared to reduce the impact of earthquakes in the short term and the earthquake risk in the medium and long term.

Pillars of Earthquake Management

- The guidelines have introduced the six pillars of earthquake management, with prescribed time lines for the effective implementation of the various activities.

Pillar 1: Earthquake-Resistant Design and Construction of New Structures

Institutionalization of Earthquake-Resistant Design and Construction

- All central ministries and departments and state governments will facilitate the implementation and enforcement of relevant standards for seismically safe design and construction of buildings, bridges, flyovers, ports and harbours, and other lifeline and commercially important structures falling within their administrative control.
- State governments/SDMAs and ULBs will also consider using incentives and disincentives to encourage the construction of earthquake-safe buildings.
- The state governments/SDMAs will organize capacity building programmes among professionals and masons for the design and construction of new buildings as per earthquake-resistant building codes.

Compliance Review and Time Frame for Compliance

- The designs of all new buildings and structures specified in the model bye-laws will be scrutinised by the competent authorities through a general compliance review and mandatory technical audit process by qualified professionals.
- They schedule of activities need to be completed in the prescribed timeframe.

Pillar 2: Selective Seismic Strengthening & Retrofitting of existing Priority Structures and Lifeline Structures

Prioritisation of Structures

- All central ministries and departments and state governments will draw up phased programmes for seismic strengthening and retrofitting of selected existing structures duly prioritised and implement them through ULBs and PRIs.

Public Awareness Campaigns

- Public awareness campaigns will be initiated at the national, state and district levels in high-risk areas for widely disseminating information on earthquake risk reduction through seismic retrofitting among all stakeholders and to develop professional human resources for seismic retrofitting.

Seismic Strengthening and Retrofitting

- While undertaking seismic retrofitting of the critical and lifeline structures, other structures will be insured against losses during future earthquakes.
- State governments/SDMAs will initiate efforts to compile GIS databases and develop a GIS bank consisting of GIS maps for all urban areas, indicating all critical structures and infrastructure.

Pillar 3: Regulation and Enforcement

Building Codes and Other Safety Codes

- State governments/SDMAs will, in consultation with their State Earthquake Management Committees (SEMCs) and Hazard Safety Cells (HSCs), establish the necessary techno-legal and techno-financial mechanisms.

Licensing and Certification of Professionals

- All professionals dealing with safety aspects of buildings and structures will be certified through a licensing process.

Compliance Review

- Designs of all strutures will go through a mandatory compliance review by the professionals of the Urban Local Bodies (ULBs) and Panchayati Raj Institutions (PRIs) to which the designs are submitted for approval.
- Self-certification for all structures will be an integral part of the approval process.
- The model techno-legal regime recommended by the expert group set up by the Ministry of Home Affairs (MHA) , Government of India (GoI), will be incorporated in the Development Control Regulations (DCRs) to enforce the scrutiny of building designs for their compliance to safety in accordance with the graded requirements under the DCRs.
- The designs of some structures randomly selected by the Urban Local Bodies (ULBs) will be subjected to detailed technical audit for reviewing the entire design process and detailed design calculations.

Techno-Financial Regime

- After an earthquake, the central and state governments provide funds for immediate relief and rehabilitation. This process does not adequately cover the requirements for reconstruction of damaged structures.
- Financial institutions will consider the compliance of seismic safety before offering housing loans including those for construction of multi-storeyed complexes.
- The approval and disbursement of funds from banks and other financial institutions to industrial units will also be linked to the compliance with earthquake safety norms by these units.

Pillar 4: Awareness and Preparedness

Public Awareness

- State governments/SDMAs will, in collaboration with nodal agencies and other key stakeholders, make special efforts to mobilize communities to carry out earthquake mitigation efforts.
- At the national level, public awareness materials like brochures, manuals, booklets, action plans, videos, and demonstration kits will be developed for creating public

awareness on this subject. Such materials will be fine-tuned by the state governments/State Disaster Management Authority (SDMAs) to suit local needs, especially in rural areas.

- Electronic and print media will also be used to help create greater public awareness of seismic risk and vulnerability and on structural and non-structural risk reduction measures.
- A comprehensive awareness campaign will be developed and implemented on the safe practices to be followed before, during and after an earthquake.

Earthquake Preparedness

- Disaster Management (DM) plans will be systematically developed to prepare stakeholders to address earthquake risk.
- In metropolitan cities, the managements of cinema theatres, malls, auditoria, community facilities, etc., will develop plans for ensuring public safety in the event of an earthquake. Emergency managers will be designated, trained and given charge of implementing emergency response activities.
- NGOs and volunteer groups from within the community will prepare and implement community based DM plans.

Medical Preparedness

- All public health facilities will develop their own DM plans, with the scope for enhancing their surge capacity in the event of disaster. Training exercises and mock drills will be carried out regularly by doctors as well as paramedical staff.

Pillar 5: Capacity Development (Including Education, Training, R&D and Documentation)

Earthquake Education

- State governments must endeavour to strengthen earthquake education by incorporating the best available technical and non-technical inputs on seismic safety in educational curricula. Earthquake education will address the multifaceted aspects of earthquake management, especially preparedness, mitigation and response efforts.

Capacity Development

- Thecurriculaof NTs, NITs, engineering and architecture colleges, ITIs, polytechnics and universities will be suitably modified to incorporate earthquake-resistant design and construction techniques.

Training

- Ministry of Earth Sciences (MoES) will identify a number of leading institutes and universities and encourage the creation of dedicated chaired positions for faculty members working in the area of earthquake related education and research.

- The National Institute of Disaster Management (NIDM) at the national level and the Administrative Training Institutes (ATIs) at the state level have been tasked to train administrative personnel from all central ministries and departments and state governments in DM.
- Training artisans in specialised skills is a critical step in ensuring proper quality control in earthquake-resistant construction of all structures.

Research and Development

- State governments will proactively support application oriented research and development activities to address current challenges, offer solutions, and develop new techniques, for instance by undertaking base isolation of new hospital buildings with a view to improving their earthquake resistance.
- Scenario analysis and simulation modeling are extremely useful for undertaking long-term DM programmes and for strengthening earthquake preparedness, mitigation and response efforts.
- The MoES will, in collaboration with nodal scientific agencies and institutions, ensure the preparation of large-scale landslide hazard maps of areas of high vulnerability.

Documentation

- The MoES will undertake documentation of the history of formal earthquake engineering and seismology related activities in India.

Pillar 6: Response

Earthquake Response

- For earthquakes, depending on their magnitude, the scale of response and the corresponding role players will be identified and mobilised at the district, state or national levels.

- The response component of DM plans will consider the rapid deployment of people, supplies and logistics, along with the duration of their deployment. These plans will prescribe appropriate coordination mechanisms with other agencies working in the affected areas.

Emergency Search and Rescue

- Experience has shown that over 80 per cent of search and rescue from collapsed buildings is carried out by the local community before the intervention of the state machinery.
- Thus, Community level teams will be developed in each district with basic training in search and rescue.
- Training modules will be developed for trainers of community level search and rescue teams by National Disaster Response Force (NDRF) training institutes.

Emergency Relief

- Trained community level teams will assist in planning and setting up emergency shelters, distributing relief among the affected people, identifying missing people, and addressing the needs of education, health care, water supply and sanitation, food etc., of the affected community.

Incident Command System (ICS)

- All response activities will be undertaken at the local level through a suitably devised ICS coordinated by the local administration through the Emergency Operations Centre (EOC).

Community Based Disaster Response

- A number of organisations, like NGOs, self help groups, CBOs, youth organisations, women's groups, volunteer agencies, Civil Defence, Home Guards, etc. normally volunteer their services in the aftermath of any disaster.
- State government/SDMAs and District Disaster Management Authority (DDMAs) will coordinate the allocation of these human resources for performing various response activities.

Involvement of the Corporate Sector

- The corporate sector, as a part of the Corporate Social Responsibility (CSR) effort, can provide, inter alia, the services of hospitals, power and telecommunication, relief supplies, search and rescue equipment, earthmoving equipment, and transport and logistics of movement of relief supplies to the extent possible.

Improving Earthquake Response

- All state governments will rise, from within their armed police force, adequate strength of personnel for the State Disaster Response Force(SDRF) with appropriate disaster response capabilities.
- In addition, the police, fire services, Home Guards and Civil Defence are being strengthened and upgraded to have adequate capacity to respond effectively to disasters.

- National Disaster Mitigation Reserves, at the National Disaster Mitigation Resource Centres in NDRF locations will be available to the states in case of necessity.

Emergency Medical Response

- Prompt and efficient emergency medical response will be provided by Quick Reaction Medical Team (QRMTs), mobile field hospitals, Accident Relief Medical Vans (ARMVs) and heli-ambulances.
- A large number of victims may suffer from psycho-social trauma, for which appropriate counselling will be provided.
- The emergency medical plan will be operationalised immediately on receiving information from the earthquake affected areas.
- The plan will identify the requirement of enhanced manpower, medical stores and the requirement of blood and its components for various levels of earthquakes.

Guidelines on Tsunami

- Even though most people were not aware of the tsunami risk in India's coastal states, the Indian Ocean Tsunami of 26th December 2004 exposed the inherent vulnerabilities of the coastal communities in our 7516 km long coastline.

- The coastal population has been increasing steadily, mostly due to the expanding scope for exploitation of sea resources and economic activities propelled by increasing urbanization and industrialization in the coastal districts as well as increasing employment opportunities due to the unprecedented expansion in tourism-related activities.

- However, the efforts to strengthen the preparedness of the coastal communities to face the increasing threats of storm surges, sea level rise, coastal erosion, etc. have been often restricted to localized campaigns with very limited impact, in spite of the increasing disaster risk and vulnerability of the coastal communities.

Tsunami Risk and Vulnerability Analysis

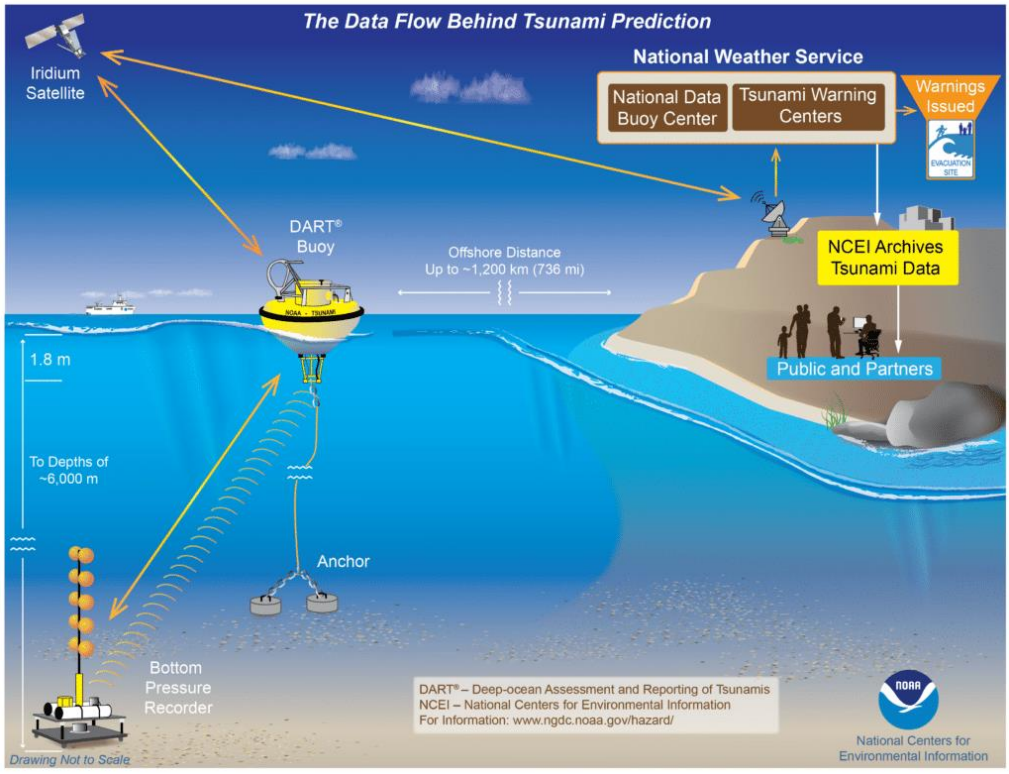
- One of the major gaps in the Tsunami risk management was the lack of awareness on the tsunami risk and vulnerability in India, and hence the lack of preparedness as reflected in the absence of a Tsunami Early Warning System (TEWS) in India.

- After the 2004 Indian Ocean Tsunami, India has now developed a state-of-the art Tsunami Early Warning System in the country.

- The critical gaps that now remain are the lack of public awareness on tsunami risk and vulnerability in the coastal areas, the weak enforcement and compliance of town planning byelaws, development control regulations and

building codes in the coastal areas, and the challenges in implementation of appropriate technologies to disseminate and communicate the early warning to the coastal inhabitants located in the near vicinity of a near source tsunami.

- Tsunamis are generated by large and rapid displacements of water, mainly from sudden and large scale changes in the configuration of the sea floor associated with fault displacement or gigantic underwater landslides, which could be mainly due to earthquakes.



- **Tsunami Hazard Assessment:** The assessment of vulnerability and risk and mapping thereof in the tsunami hazard area must be carried out taking the various other hazards as applicable.

- Many of the areas prone to tsunamis are also prone to storm surges caused by tropical cyclones.

- Hence, a multi hazard approach will have to be followed for addressing the preparedness, mitigation and emergency response requirements in the coastal areas.

- **Tsunami Vulnerability Assessment:** The vulnerability assessment of both built and natural environment due to tsunami impact will be developed for shores and harbours by MoES.

- **Geographic Information Systems (GIS)** will be prepared and subjected to continuous updating process for a better and more user friendly usage of the risk assessment and evaluation exercise.

- Vulnerability maps are loaded into a GIS system containing information on hazard and risk.

- The process that gets the risk map can be conceived as an overlapping of the hazard maps and the vulnerability maps.

- **Role of the Indian Naval Hydrographic Department (INHD):** INHD shall regularly provide bathymetry information to authorized agencies for drawing the inundation maps.

- The Survey of India (Sol), Nation a Remote Sensing Centre (NRSC), INHD and State Remote Sensing Application Centres must provide inputs to the MoES for preparing the DM Plans.

- **Use of Satellite Imageries in Monitoring:** With ground level benchmarking of field data, sever a satellite imageries could be processed for extracting and generating the necessary thematic maps for the Tsunami hazard assessment.

Guidelines

Preparedness

Warning System Components and Instruments

- The critical gaps in the availability of monitoring instruments like Bottom Pressure Sensors (BPRs), tide gauges, surface buoys, etc . to cover the Bay of Bengal, Arabian Sea and the Indian Ocean for close monitoring of tsunamigenic behaviour will be carried out by MoES urgently on priority.
- The MoES will carry out an assessment of the feasibility of the existing installations to cover the potential tsunami-prone areas and augment the installation of all instruments as per this assessment to ensure that all possible tsunamigenic behaviour patterns are captured as early warning and alert messages through this augmented network.
- The efforts for surveillance of the safety of the critical early warning instrumentation in the Bay of Bengal and the Arabian Sea will be augmented preferably with the specialised aircraft available with National Remote Sensing Centre (NRSC) and where available with Unmanned Aerial Vehicles (UAVs) with the help of Indian Air Force, Indian Navy and Coast Guard patrols to ensure the fail-safe functioning of these critical instruments and their protection from vandalism by fishermen and mariners.

Decision Support System and Standard Operating Procedures

- Those coastal areas falling outside the 60 minutes travel time from a tsunamigenic earthquake source could be put under Alert/Watch status based on expected run-up and upgraded to a Warning only upon confirmation of water-level data.

Tsunami Bulletins and Warning Categorisation

- Tsunami Alert, Watch and Advisory Bulletins received at the National Emergency Operations Centre (NEOC), State Emergency Operations Centre (SEOCs) and District Emergency Operations Centre (DEOCs) need to be disseminated through the fastest means to the people in the coastal areas likely to be affected.

Tsunami Early Warning Dissemination

- The National Emergency Communication Plan (NECP) connectivity network will form the backbone architecture for the dissemination of Tsunami Advisory , Watch, Alert and Cancellation Bulletins.

Role of Media in Warning Dissemination

- Establish and indicate nodal points for receiving Tsunami Warning Bulletins to the respective SDMAs/DDMAs.
- Integrate all regional and local offices of the media elements with the NECP network up to the DEOC level.
- Institutionalise Standard Operating Procedures (SOPs) for transmitting Tsunami Warning Bulletins as received by the nodal points.
- Incorporate measures in the various media channels and processes to ensure priority override for transmitting Tsunami Warning Bulletins as required.
- To build capacity for the Media professionals to ensure that the correct level of warning is made available at the right time.

Coordination Mechanisms

- India will participate in the international effort at improving the quality of preparedness and response by liaising with international organisations, United Nations agencies and other humanitarian actors and share the best practices in tsunami preparedness and mitigation.

Research and Development Efforts

- There is need to develop high-resolution models for tsunami wave propagation in the Indian Ocean.
- The Tsunami wave propagation characteristics have to be understood fully and peculiar features specific to the Indian Ocean have to be incorporated in the models in order to achieve high accuracy and reliability in the predictions.

Public Awareness

- Comprehensive public awareness campaigns will be developed and launched at the national, state and district levels, especially in high risk areas for familiarisation with the tsunami warning dissemination mechanism and responsibilities of various stakeholder groups.

Tsunami Preparedness for Far-field and Local Tsunamis

- The island states must have their own coping capacities and adequate capabilities to respond to any emergency, without waiting for assistance from the Central Government.
- They must set up the State Disaster Response Force (SDRF) from their existing police force and train these SDRF personnel with the help of master trainers from NDRF.
- The medical facilities in the island territories will also be adequately strengthened and the possibilities of deploying medical ships or medical boats to remote islands will be explored by the health administration.

Medical Preparedness

- Medical preparedness from tsunami risk will focus on likely injuries, outbreak of diseases and other post tsunami public health problems including psychosocial trauma.
- Preparation of Disaster Management Plans: Comprehensive DM plans will be prepared at the national, state and district levels.
- These plans will clearly identify the roles of key stakeholders for each level of disaster and also include assessments of their own response capacity.

Structural Mitigation Measures

Mainstreaming DM in Developmental Planning

- The Ministry or Department of the GoI or the State Government have to ensure that the physical and regulatory measures that must necessarily be taken based on design and engineering or technology to prevent or mitigate the effect of such disasters have been incorporated within the proposed financial allocation being sought.

Need for New Standards for Protection of Structures against Tsunami

- Bureau of Indian Standards (BIS) will develop other necessary standards for the safety of natural habitats against tsunami and storm surge.
- BIS will also periodically review the standards and codes prepared by them and wherever necessary, ensure that these standards and codes are revised and updated regularly and placed in the public domain.

Shelters for Storm Surges and Tsunamis

- On receiving a Tsunami Warning, evacuation of the population would be required by the local authority.
- Safe evacuation will be carried out to cyclone- cum tsunami shelters along the coast.
- Cyclone-cum-tsunami shelters should be designed in such a way that they address multi-purpose uses.

Institutionalisation of Design and Construction for Tsunami Safety

- In the design of public infrastructure like roads, schools, hospitals, multi-purpose shelters etc., prevailing risk and vulnerability has to be kept in mind.

Tsunami Mitigation Measures

- Coastal villages can be safeguarded from the impact of tsunami by adopting soft solutions and by educating the villagers to follow simple precautionary measures.

The details are as follows.

1. Construction of large scale submerged sand barriers in water depths of about 6 to 8 meters.
2. Developing sand dunes along the coast with sea weeds or shrubs or casuarinas trees for stabilization of the sand dunes.
3. Raising the ground level (above the design water level) with natural beach sand Development of coastal forest (green belt) by planting casuarinas or coconut trees along the coastline.
4. Periodical dredging of the inlets and associated water.
5. Construction of submerged dykes (one or two rows along the stretch of the coast).
6. Adopting natural beach nourishment to create steep beach face.
7. Positioning stationary platforms in the backwaters for evacuating the public during tsunami.
8. Creation of sandy ramps at close intervals all along the coast.
9. Vertical evacuation structures in all harbours.

Specific Design Principles for Tsunami

In addition to the above, following specific design principles may be adopted for tsunami.

- Know the tsunami risk at the site
- Avoid new construction developments in tsunami Runup areas or take adequate precautions to protect such structures
- Site Planning Strategies to reduce Tsunami Risk
- Protection of existing buildings and infrastructure – Assessment, Retrofit, Protection measures. Special Precautions in locating and designing infrastructure and critical facilities
- Planning for Evacuation

Development of Design Criteria

Considering the multi-hazard proneness of the coastal districts, the design criteria will have to cover the following aspects:

- Design wind velocity under cyclone condition.
- Effective wind pressure near sea coast.
- Height of storm surge with concurrent tide level.
- Protecting Seafronts and Lifeline Structures

- Mitigation measures can reduce the effect of tsunami wave impact on structures but do not reduce the effects of inundation.
- Strengthening of seafront (through plantations and coastal constructions) should be carried out along the most vulnerable stretches of the coast.
- DDMAs will explore the inclusion of coastal protection measures to be eligible for schemes like National Rural Employment Guarantee Scheme, as they will meet the employment generation objective and provide the much needed protection to the fragile coastal areas.

Prioritisation of Structures

- All Central Ministries and Departments and State Governments will draw up phased programmes for strengthening and/or possible relocation of selected existing structures duly prioritised and implement them through ULBs and PRIs.
- The necessary capacity for carrying structural safety audit assessments for private buildings will also be developed through suitable capacity development efforts among the professionals in the private sector.

Structural Safety Audit of Seafront, Coastal Natural Resources and Critical Lifeline Structures

- Assessment techniques may be used to determine the vulnerability of all buildings, in the order of priority decided by the State Governments/ SDMAs, in consultation with NTs, NITs and HSCs.
- Two levels of vulnerability assessment can be carried out for buildings, namely Rapid Visual Screening (RVS) and Detailed Vulnerability Assessment (DVA).
- The vulnerability assessment of the seafront and coastal natural resources can be carried out only on the basis of reliable large scale maps.

Regulation and Enforcement of Techno-Legal Regime

Land Use

- Coastal land use should be so designed so as to incur minimal losses to life and property due to these events.
- Existing zoning and other regulations need to be reviewed and updated in the context of Tsunami.
- Coastal ecology should be protected and strengthened while coastal habitats should be planned in such a way so as to remain in low hazard zone.

Bio-Shields

- Mangrove forests constitute provided biological mechanisms for protecting coastal communities from the fury of cyclones, coastal storms, tidal waves and tsunamis., which also safeguards ecological and livelihood security of fishing and farming communities living in the coastal zone.
- In addition to mangroves, there are many other tree species having with socioeconomic and ecological importance can reduce the impact of tsunami and cyclonic wind & sea surge

Options for Efficient Land Use Practices

- Following options for best land use practices should be considered.
- The policies and incentives for afforestation should be such that ecological security and income security are both safeguarded.
- Encourage adoption of science-based and traditional, sustainable land use, promote reclamation of wasteland and degraded forestland covering both public and privately owned lands giving necessary incentives, viz. right over the produce, provision of alternate land or compensation, etc.
- Encourage agro-forestry organic farming environmentally sustainable cropping patterns, and adoption of efficient irrigation techniques.
- Funding of green belt creation and conservation of mangroves. Innovative funding mechanisms should also be evolved by levying either a charge or a cess for all development activities on the coastal area which would be pooled to reverse degradation and enhance conservation of green belts.

Monitoring Shelterbelt Plantations and Mangrove Regeneration Zones

- Management plans for coastal and shelter belt plantations should be prepared by mapping of habitat utilisation patterns including sea turtle and sea bird nesting beaches.
- Monitoring coastal shelter belt plantations should be taken up on a regular and continuous basis.

Techno-Legal Regime for Coastal Zones

- Considering the overriding interest of public safety , the BIS will place all Indian Standards related to protection of structures and safety from storm surge and high tides, in the public domain, including the internet for free download, as and when they are issued.

Techno-Financial Regime

- Effective risk-transfer strategy shall be taken up through introducing innovating risk insurance tools for people.
- The Ministry of Finance will develop a national strategy of risk sharing through micro finance and self-help groups reaching to the most vulnerable communities.

Emergency Tsunami Response

Tsunami Response Requirement

- A coordinated and effective response system would be required for management of tsunami at central, state, district and community levels.

Emergency Search and Rescue

- Trained and equipped teams consisting of local people will be set up along the coastal areas to respond effectively in the event of tsunami.

Incident Response System

- NDMA has prepared the Guidelines on Incident Response System (IRS) in collaboration with all concerned stakeholder groups for streamlining the coordination of response in the event of a sudden occurrence of any disaster .

Community-Based Disaster Response

- A number of organisations, like NGOs, Self Help groups, Community Based Organisations, youth organizations, women's groups, volunteer agencies, civil defence, home guards, etc. normally volunteer their services in the aftermath of any disaster.

Involvement of Corporate Sector

- State Governments will facilitate the involvement of the corporate sector in making available their services and resources to the Government during the immediate aftermath of Tsunami.

Specialised Response Teams

- The Central Government has set up eight NDRF battalions for providing rapid response to disasters.
- The Police play a very important role after a disaster in maintaining law and order, assisting in search & rescue, transportation of the casualties and certification of casualties

Evacuation Plans and Shelter

- State Governments will compile a list of Inflatable motorised boats, helicopters and search & rescue equipments and identify suppliers of such specialised equipments and enter into Long Term Agreements for their mobilisation and deployment in the event of tsunami.

Emergency Medical Response

- Prompt and efficient emergency medical response will be provided by Quick Reaction Medical Teams (QRMTs), Mobile Field Hospitals, Accident Relief Medical Vans (ARMVs) and Heli-ambulances.
- The emergency medical plan will be operationalised immediately on receiving information from the tsunami affected areas.

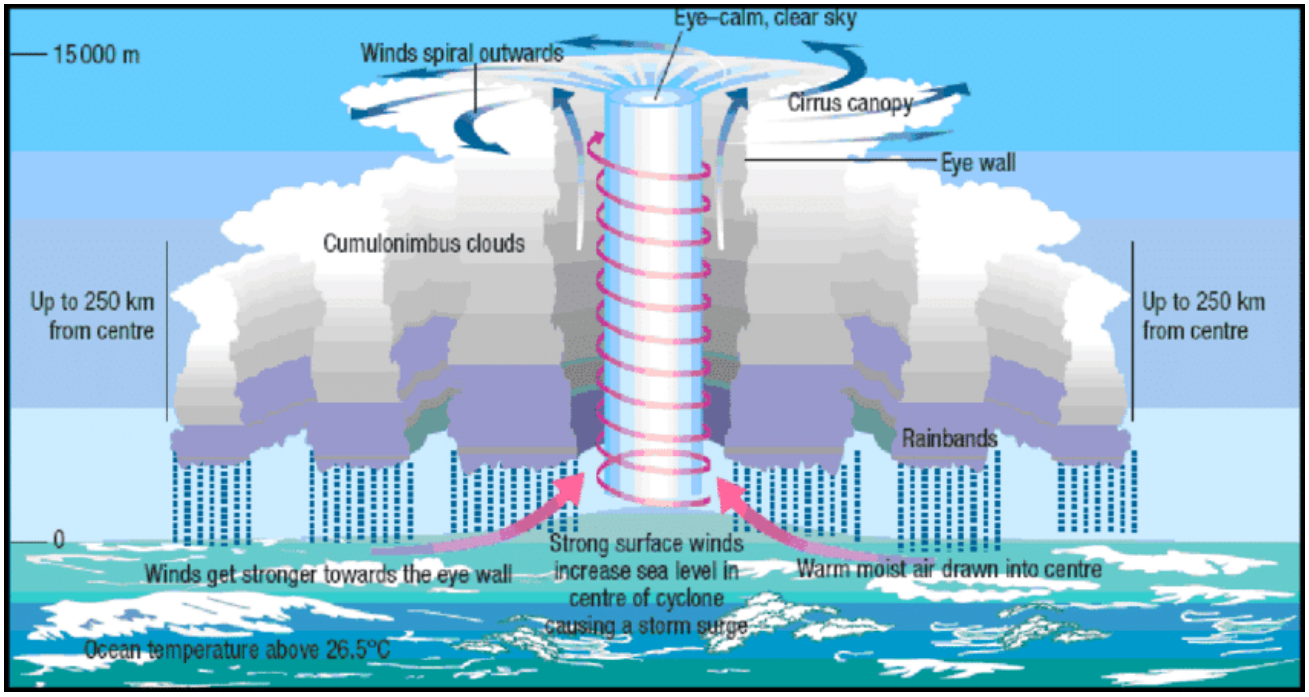
Guidelines on Cyclones

- A long coastline of about 7,516 km of flat coastal terrain, shallow continental shelf , high population density, geographical location and physiological features of its coastal areas makes India , in the North Indian Ocean (NIO) Basin, extremely vulnerable to cyclones and its associated hazards like storm tide (the combined effects. of storm surge and astronomical tide) , high velocity wind and heavy rains.

Impact of Cyclones

- Cyclones are characterized by their destructive potential to damage structures such as houses, lifeline infrastructure such as power and communication towers, hospitals, food storage facilities, roads, bridges, culverts, crops, etc., due to high velocity winds.

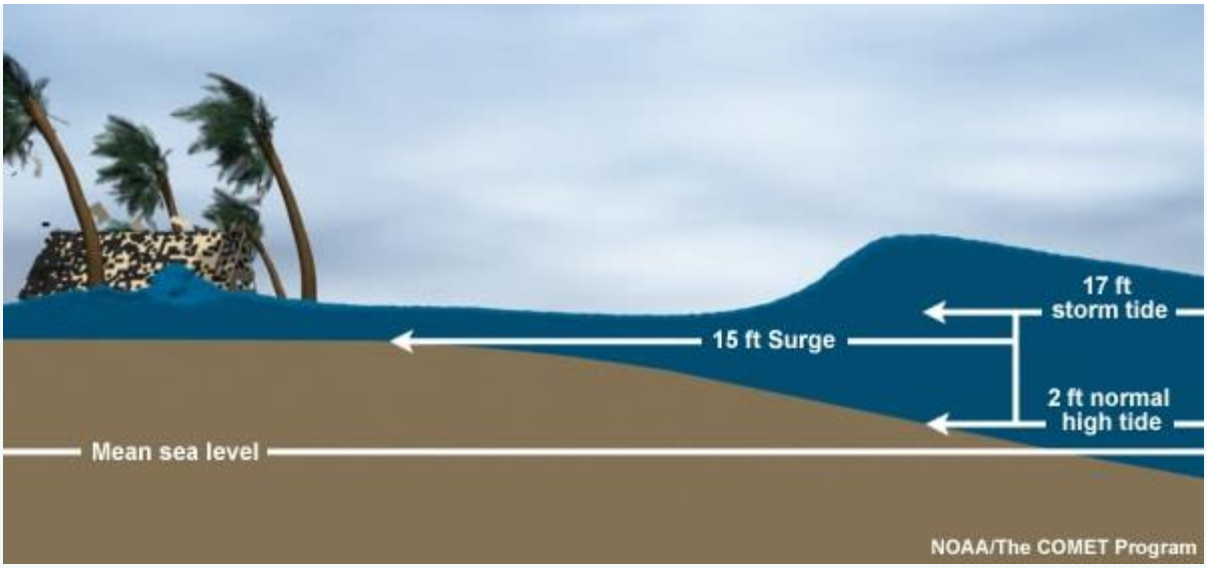
- Exceptionally heavy rainfall causes flooding. Storm surge inundates low-lying areas in the coastal areas resulting in loss of life and destruction of property, besides eroding beaches and embankments, destroying vegetation and reducing soil fertility.



Storm Surge

- It is a coastal phenomena, is the inherent catastrophic feature of cyclones the world over.

- The degree of disaster potential depends on the storm surge amplitude associated with the cyclone at the time of landfall, characteristics of the coast, phases of the tides and vulnerability of the area and community.



National Cyclone Risk Mitigation Project

- The National Cyclone Risk Mitigation Project (NCRMP), to be implemented with financial assistance from the World Bank, is envisaged to have four major components:
- **Component A:** Improvement of early warning dissemination system by strengthening the Last Mile Connectivity (LMC) of cyclone warnings and advisories.
- **Component B:** Cyclone risk mitigation investments.
- **Component C:** Technical assistance for hazard risk management and capacity building.
- **Component D:** Project management and institutional support.

Guidelines

The following are some of the salient initiatives recommended for implementation as part of the National Guidelines for Management of Cyclones:

1. Establishing a state-of-the-art cyclone EWS involving observations, predictions, warnings and customised local-scale advice for decision-makers (national/state/district level) for managing the impact of cyclones.
2. Commissioning of Aircraft Probing of Cyclone (APC) facility for India with a combination of manned aircraft and high altitude Unmanned Aerial Vehicles (UAV) which can effectively fill the critical observational data gaps in the case of cyclones over the Bay of Bengal and the Arabian Sea to a great extent.
3. An actual flight by an aircraft into and around the tropical cyclone during various stages of its development and movement can provide invaluable data for studying and understanding the structure and movement of a cyclone, thus reducing track and intensity prediction errors significantly.
4. Commissioning of the National Disaster Communication Infrastructure (NDCI) at the NDMA/MHA, State Disaster Management Authorities (SDMAs) of coastal states/ UTs and District Disaster Management Authorities (DDMAs) of the 84 coastal districts vulnerable to cyclones with the adoption of state-of-the-art operational infrastructure covering the following:

- High End Computing (scalable 30-50 Teraflops peak performance), Storage (800 Terabytes) and Communication Network (Gigabit Ethernet) Infrastructure;
- 3-D Virtual Reality Visual Studio;
- Centralised Comprehensive Databank for Cyclone Risk Management with nodes in various coastal states over a fail-safe communication backbone between the Operation Centres of NDMA , SDMAs and DDMAs (for Information and Data Fusion involving collating, analysing, interpreting, translating and monitoring of early warnings from line departments based on stateof-the-art scientific and technological know-how); and
- Comprehensive state-of-the-art Operation Centre for effective coordination of Disaster Response Actions at the state and local levels.

1. Expanding the warning dissemination outreach by using the services of Direct-To-Home (DTH) transmission in remote and rural areas (Panchayats) which cannot be otherwise covered, to introduce weather channel and broadcast cyclone warnings from high-power coastal radio stations including the use of satellite radio service like World Space, Ham radios, community radio and VHF network.
2. The following specific actions will be carried out for taking structural measures for cyclone risk mitigation:
   - Structural safety of lifeline infrastructure in coastal areas;
   - Establishing a robust system of locating multipurpose cyclone shelters and cattle mounds;
   - Ensuring cyclone resistant design standards are incorporated in the rural/ urban housing schemes in coastal areas;
   - Building all-weather road links to all coastal habitations, between habitations and cyclone shelters/cattle mounds;
   - Maintaining the full designed carrying capacity of main drains and canals along with feeder primary/ secondary/ tertiary channels, creating additional flood flow canals in frequently inundated areas;
   - Construction of saline embankments to prevent ingress of saline water associated with cyclonic storm surge; and
   - Encouraging public-private partnership with corporate/trusts.

Actions for effective cyclone risk reduction through management of coastal zones include:

- Mapping and delineation of coastal wetlands, patches of mangroves and shelter belts, identification of potential zones for expanding bio-shield spread based on remote sensing tools.
- Regulating infrastructure and development activities in coastal zones.
- Monitoring of water quality as well as the carrying and assimilative capacities of open waters with institutionalized remedial measures.
- Developing Integrated Coastal Zone Management (ICZM) frameworks for addressing the sustainability and optimal utilisation of coastal resources as also cyclone impact minimization plans.
- Evolving eco-system restoration plans for degraded ecological zones.
- Developing delta water management and freshwater recharge/management options.
- Coastal bio-shields spread, preservation and restoration/ regeneration plans.

- Implementing coastal flood zoning, flood plain development and flood inundation management and regulatory plans.
- Groundwater development and augmentation of freshwater requirement in coastal urban centres.
- Development of Aquaculture Parks in the identified potential zones.

1. Setting up of an exclusive eco-system monitoring network to study the impact of changing climate.
2. Developing integrated hazard mitigation framework taking into account cyclone and associated storm surge, wind hazard, rainfall-runoff, river flood and Geographical Information System (GIS) models for estimating possible areas of inundation along with the depth of inundation (levels), possible damage to infrastructure, crops, houses, etc., evaluating not only the vulnerability but also the changing profile of vulnerability from time to time.
3. Integrate ongoing efforts of the Survey of India, Department of Space under National Spatial Data Infrastructure, National Database for Emergency Management and MoEF initiatives for speedy completion of digital spatial data generation to cover 84 coastal districts that are vulnerable to cyclones, for evolving holistic cyclone risk reduction strategies on priority. High resolution (at least 0.5 m interval) coastal Digital Elevation Models (DEMs) are to be developed for micro-scale delineation of cyclone risk, hazard and vulnerability.
4. Augmentation of additional surveys by the Census Commissioner will be carried out for generating household, disaster specific attribute data.
5. Establishing a comprehensive Cyclone Disaster Management Information System (CDMIS) covering all phases of DM to provide on-line services to the departments of Disaster Management in the states.
6. Specifying the roles and responsibilities of the State Disaster Management Departments in institutionalising Cyclone Risk Mitigation with Developmental Planning.
7. Launching Community Based Disaster Management (CBDM) activities similar to the DRM Project initiatives of MHA in all villages of the 84 districts vulnerable to cyclones that have not yet been covered.
8. NCDMI will be established as an exclusive institutional set-up in one of the coastal states to address all issues related to cyclone risk. NDMA will conceptualise the entire project. NCDMI will involve stakeholders from the government and the community, focusing on preparedness, mitigation, response, rehabilitation and recovery.
    a. It will bridge the gap in the integration of disaster related technical support of all the concerned departments/ ministries of the Central Government with those of the states/UTs and local authorities.
    b. It will serve as a platform for all academics and S&T institutions to synergise their efforts to offer better disaster risk reduction options.
9. Institutionalising specific Emergency Response (ER) Actions for Cyclone Disaster Management.

Guidelines on Floods

- Floods have been a recurrent phenomenon in India and cause huge losses to lives, properties, livelihood systems, infrastructure and public utilities.

- India's high risk and vulnerability is highlighted by the fact that 40 million hectares out of a geographical area of 3290 lakh hectares is prone to floods.
- On an average every year, 75 lakh hectares of land is affected, 1600 lives are lost and the damage caused to crops, houses and public utilities is Rs. 1805 crores due to floods.
- From the past experience, it is observed that though the various Expert Committees/ Working Groups headed by eminent dignitaries have made several useful recommendations/ suggestions, these have mostly remained unimplemented, which is a cause of concern.
- These guidelines have highlighted those recommendations and actions required to be taken on them.
- The mission statement of NDMA Guidelines on Management of floods is "To minimise vulnerability to floods and consequent loss of lives, livelihood systems, property and damage to infrastructure and public utilities."

Guidelines

Status and Context

Flash Floods

- Flash floods forecasting and warning systems using Doppler radars will be installed by the India Meteorological Department (IMD).
- As a preventive measure, the inhabitation of low lying areas along the rivers, nallas and drains will be regulated by the state governments/State Disaster Management Authorities (SDMAs)/ District Disaster Management Authorities (DDMAs).

Areas Prone to Floods

- The Ministry of Water Resources (MOWR) and the state governments/SDMAs/DDMAs concerned will urgently undertake identification of areas prone to floods along with names of villages/talukas or tehsils/districts in a scientific manner in collaboration with the NRSA and Survey of India (SOI).

Damages Caused by Floods

- There is lack of documentation on floods and flood damage.
- The state governments will ensure that each and every flood event is properly documented and flood damage assessment is made on a scientific basis with the help of latest technological advancements in the field of remote sensing through satellites etc.

Drainage Congestion and Water-logging

- The MOWR along with the Ministry of Agriculture (MOA) and the state governments will, by the end of March 2008, make a scientific assessment of the area suffering from drainage congetion and water-logging.

River Erosion

- The MOWR along with the state governments will undertake river-wise studies of the problem of erosion and estimate the area liable to erosion by rivers, identity vulnerable spots and plan remedial measures to protect such areas.
- Latest technological developments for low cost measures, such as reinforced cement concrete (RCC) porcupines, will be considered while planning such measures.

Littoral Drift in River Estuaries

- Straight cuts into the sea with a view to make the slope steeper in outfall reaches are sometimes considered as one of the effective measures to overcome the problem.
- These measures must be taken only after an intensive study on the mathematical and hydraulic models is carried out so as to avoid the risk of increased flooding in case of high tides, cyclonic storms and tsunamis.

Snow-melt/Glacial Lake Outbursts Flood (GLOF), Formation and Subsequent Bursting of Landslide Dams

- While the guidelines for landslides will be issued by the NDMA separately the MOWR/CWC and the state governments will monitor the hilly areas liable to snow avalanches, blockages in rivers due to landslides etc. for such events and in the case of their occurrences, install warning systems for reducing the loss of life and property in the areas likely to be affected.
- They will also take remedial structural measures, if feasible, for averting the danger.

Cloudbursts

- TheIMDand CWC in association with state governments will develop forecasting and warning systems in areas prone to floods caused by cloudbursts.

International Dimensions of the Flood Hazard

- Negotiations upon issues such as establishment of hydro-meteorological stations and transmission of their data example, Brahmaputra etc. to India on a real time basis, afforestation, catchment area treatment (CAT) works and construction of reservoirs will be expedited by the MOWR and Ministry of External Affairs (MEA).

Implementation of the Recommendations

- The MOWR and the CWC will, in collaboration with the state governments, closely monitor the implementation of the recommendations of the Experts Committee to review the implementation of the recommendations of the Rashtriya Barh Ayog-2003 and the Task Force on Flood Management/Erosion Control-2004.

Institutional Framework and Financial Arrangements

National Institute of Disaster Management

- It will network with other knowledge-based institutions and assist in imparting training to trainers, DM officials, etc.
- It will also be responsible for synthesising research activities and will be geared towards emerging as a 'centre of excellence' at the national and international levels.

Central Water Commission

- The Ministry of Water Resources will strengthen and equip appropriately the River Management wing of Central Water Commission.

Ganga Flood Control Commission (GFCC)/ Ganga Flood Control Board

- The MOWR will take steps for strengthening the GFCC appropriately.

Brahmaputra Board/High Powered Review Board

- The MOWR will take immediate action for restructuring/ strengthening of the Brahmaputra Board.

National Flood Management Institute

- The MOWR in close collaboration with the NDMA , will establish a National Flood Management Institute (NFMI) as a centre of excellence with experts in its faculty and having state-of-the-art equipment at an appropriate location, in one of the flood prone states River Basin Organisations
- The MOWR has set up the Brahmaputra Board and GFCC to look after Flood Management in Brahmaputra and the Ganga river basins respectively.
- The MOWR in consultation with the state governments will take appropriate action in regard to the establishment of such organisations in other flood prone river basins and in strengthening of the CWC, Brahmaputra Board and GFCC.

State Disaster Management Authority

- At the state level, the State Disaster Management Authority (SDMA), headed by the chief minister will be established by the state governments to lay down policies and plans for DM in the state.

District Disaster Management Authority

- At the cutting edge level, the District Disaster Management Authority (DDMA) headed by the District Magistrate, with the elected representative of the local authority as the co-chairperson, will act as the planning, coordinating and implementing body for DM and take all necessary measures for the purposes of

DM in the district in accordance with the guidelines laid down by the NDMA and SDMA.

Local Authorities

- PRIs and ULBs will ensure capacity building of their officers and employees in DM , carry out relief, rehabilitation and reconstruction activities in the affected areas and will prepare DM plans in consonance with the guidelines of the NDMA, SDMAs and DDMAs.

State Disaster Response Force

- To augment their capacities, all state governments/ SDMAs will organise, from within their armed police force, adequate personnel for the constitution of State Disaster Response Force (SDRF) with appropriate disaster response capabilities. Under the aegis of the NDMA, the states will raise the SDRF.

Intra-state Multi-sectoral Coordination

- The state governments/SDMAs will establish appropriate multi-disciplinary mechanisms before the works are sanctioned by them and taken up for implementation by the departments concerned.
- The mechanisms will be empowered to make recommendations for making the works flood safe as well as ensuring that they do not lead to increase in vulnerability of the areas to floods and drainage congestion.

Calamity Relief Fund

- The issues of extending duration, in which the state governments are required to complete repair of damaged infrastructure and inclusion of drainage improvement works within the ambit of CRF, will be resolved after the deliberations of the Finance Commission.

National Flood Mitigation Project

- The NDMA will take action to expedite preparation of DPR and its approval for implementation by the central ministries and departments and state governments.

Flood Insurance

- The Ministries of Finance, Agriculture and Water Resources, the state governments and the insurance companies will jointly take up studies for a graded system of insurance premium according to flood risk in flood prone areas of the country.
- Consultations on the proposal will be held with all the players and stakeholders and the scheme implemented in a few selected areas on experimental basis. Once successful, the scheme will be implemented on a larger scale.

Flood Prevention, Preparedness and Mitigation

Embankments/Banks, Flood Walls, Flood Levees

- State governments/SDMAs will evolve date lines and priorities for carrying out studies in their States.
- It is only then that embankments with properly designed and located drainage sluices, spilling sections and anti-erosion measures in combination with other works such as reservoirs, channel improvement works; drainage improvement structures, etc., will be planned and implemented as a short-term and/or long-term solution to the flood problem.
- Ongoing embankment projects will also be reviewed with respect to their location and designs.

Channel Improvement

- Wherever required and subject to techno-economic considerations, the state governments will identify the locations and take up appropriate channel improvement works to increase the velocity and/or the area of flow and reduce the flood level in the river depending upon site-specific conditions.

Desilting/Dredging of Rivers

- The MOWR, CWC and the state governments/ SDMAs will study the problem of rise in river beds in a scientific manner with the help of science and technology, academic institutions and corporate sector firms of repute and explore the techno-economic viability of desilting/dredging as a remedial measure to mitigate the effects of rise in the river beds.

Drainage Improvement

- The state governments/SDMAs will review the adequacy of existing sluices and drainage channels in areas suffering from drainage congestion. Existing sluices in embankments and drainage channels will be improved by increasing the vents and improving outfall conditions.
- State governments/SDMAs will prohibit the blocking of the natural drainage channels and sluices by an appropriate law and improve their capacity and construct new channels and sluices to ensure flow of excess rainwater in the area.

Diversion of Flood Water

- Wherever the capacity of river channels passing through the towns and cities is inadequate and cannot be improved to the required extent, state governments/ SDMAs will study the feasibility of implementing the schemes for diverting excess water to existing or new channels by bye-passing them to prevent flooding.

Catchment Area Treatment /Afforestation

- The state governments/SDMAs will, take up appropriate watershed management measures including afforestation, check dams, detention basins etc in the catchment of rivers to prevent soil erosion, enhance water conservation and minimize water and sediment runoff.

Anti-erosion Works

- The state governments/SDMAs/DDMAs, will plan and implement appropriate anti-erosion measures such as revetments, slope pitching, permeable and impermeable spurs using conventional materials and/or geo-synthetics for protection of towns, cities, industrial areas, groups of thickly populated villages, railway lines, roads and embankments from erosion by rivers in a time-bound manner.

Sea Walls/Coastal Protection Works

- Sea walls/coastal protection works will be planned and executed by the respective coastal states/port authorities, keeping in view the complexity of sea behaviour and other environmental aspects.
- Alignment, Location, Design and Provision of Waterway i.e. Vents, Culverts, Bridges and Causeways in National Highways, State Highways, District and Other Roads and Railways Embankments Inspection, Rehabilitation and Maintenance
- The state governments/SDMAs will draw a programme of inspection of all structural measures twice a year, once before the commencement of the monsoon and again after the monsoon has withdrawn and ensure that restoration/strengthening measures of vulnerable spots are carried out before the commencement of monsoon every year.
- They will earmark adequate funds for the same in their annual budget and assign responsibility to individual officials for completing the same.

Flood Proofing

- The state governments/SDMAs will provide adequate number of raised platforms/flood shelters at suitable locations in the flood plains with basic amenities such as drinking water, sanitation, medical treatment, cooking, tents, lantern etc. for the people to take shelter during floods.
- The state governments/SDMAs will take steps to make all public utility installations flood safe. Integrated Water Resources Management
- State governments/SDMAs with the cooperation of the CWC and other states will implement the IWRM system for all the river basins and sub-basins.

Creating Awareness

- The state governments/SDMAs will take steps to create awareness to the type of illnesses and other health problems that can result in the aftermath of floods, to all the medical teams and the community at large.
- Hygienic practices e.g. hand washing with soap and use of the toilet for defecation, use of boiled water or adding chlorine to water and safe food cooking by disease-free persons will be promoted.

Creation of Trained Medical First Responders

- The state governments/SDMAs will ensure the creation of trained medical first responders for first aid and resuscitation measures for drowning cases.
- Medical staff must know how to take out water from the respiratory tract and how to carry out cardiopulmonary resuscitation.
- A list of trained medical and paramedical staff must also be made available.

Medical Stores

- Medical kits will be prepared for the management of flood casualties.

Patient Evacuation Plan

- State governments/SDMAs will make available emergency medical equipment and drugs for resuscitation.
- Disaster Management Plans Disaster Management Plans need to be prepared by all hospitals.

Flood Forecasting and Warning in India

Expansion and Modernisation of Flood Forecasting Services

- The CWC, IMD and the state governments will increase the density of the basin-wise network of rain gauge and river gauge stations and establish basin-wise system of Flood Forecasting (FF) and early warning.
- Various FF initiatives as listed below will be taken by the CWC , IMD and the states.

- **Data Collection:** A centralised mechanism for collection, archival and distribution of hydrological data from various river basins will be established on priority basis.
- **Data Transmission:** Data will be transmitted using modern automatic telemetry data transmission techniques e.g. satellite, VSAT, Internet/e-mail, mobile phones etc.
- **Flood Forecast and Impact Assessment Models:** Computer-based comprehensive catchment scale hydrological and hydrodynamic models interfaced with flood plain inundation mapping tools will be developed.
- **Forecast Dissemination:** Forecast will be disseminated using computer networks and satellite e.g. Internet, e-mail, VSAT, the terrestrial communication network, connectivity of the National Informatics Centre (NIC) etc.
- **Flood Hazard Mitigation Model:** Basin wise flood hazard mitigation models will be developed.
- **Damage Assessment and Quantification Models:** Damage assessment and quantification models will be developed on priority.
- **Advisories for Flood Relief Routes:** Advisories for facilitating flood relief routes will be formulated and issued.
- **Value Addition:** Flood forecasts and warnings will be formulated, preferably, in the local language, in a format which is simple and easily understandable by the administrators and common people as well. CWC will also improve the usefulness

of the forecasts and warnings by marking the area likely to be inundated, location of flood shelters etc. on the map of the area.

Coordination among the Central Water Commission, Indian Meteorological Department and the States

- The state governments will establish a mechanism wherein representatives of the CWC , IMD, National Remote Sensing Agency (NRSA) and the states interact with each other, exchange data on a real-time basis and formulate the flood forecasts and warnings, which are more reliable and understandable by the forecasters, administrators and the public to minimise loss of lives and property on account of floods.
- The CWC will also forecast the area likely to be inundated corresponding to the expected river water level.

Cooperation with Nepal

- The system of hydro-meteorological observations and transmission of data will be modernised by installing automatic sensors and satellite-based transmitters.
- Negotiations in this regard with the government of Nepal will be expeditiously concluded by the MOWR/MEA.

Cooperation with Bhutan

- The system will be modernized by the CWC with the installation of automatic sensors for observation of data and satellite-based transmitters for its transmission on a real-time basis.

Cooperation with China

- Negotiations with China will be expedited by the MOWR and MEA for extending cooperation with respect to exchange of hydro-meteorological data of rivers example, Brahmaputra etc . common to China and India on more rivers and by increasing the frequency of transmission to an hourly basis.

Dams, Reservoirs and Other Water Storages

Natural Detention Basins

- The state governments/SDMAs will study the availability of natural depressions, swamps and lakes in the vicinity of the rivers and wherever required and feasible, utilise them for temporary storage of flood waters.

Dams and Reservoirs

- The state governments/SDMAs/central agencies, wherever feasible, will therefore plan all the new dams and reservoirs with specific flood cushion provisions, prepare their Detailed Project Reports (DPRs) and complete the works in India by the year 2020 and in Nepal and Bhutan by the year 2025.

Dam Safety Aspects

- Pre-monsoon and post-monsoon inspections of dams will be carried out by experts and subsequen recommendations implemented by the state governments/SDMAs in a fixed time frame to ensure continued service and safety.

Regulation and Enforcement

Flood Plain Zoning Regulations

- The state governments/SDMAs will enact and enforce appropriate laws for implementing flood plain zoning regulations.

Incentives and Disincentives to States for Enactment and Enforcement of Flood Plain Zoning

- Regulations the MOWR will, in consultation with the state government and the CWC evolve a scheme of incentives and disincentives with respect to the central assistance to encourage the states for enactment and enforcement of flood plain zoning regulations.

Encroachments into the Waterways and Natural Drainage Lines

- The possibility of removing buildings/ structures obstructing existing natural drainage lines will be seriously considered by state governments/ SDMAs.
- In any case, and with immediate effect, unplanned growth will be restricted by state governments/SDMAs so that the construction of structures obstructing natural drainage or resulting in increased flood hazard is not allowed.

Bye-laws for Buildings in Flood Prone Areas

The following provisions will be incorporated by the state governments/SDMAs/Local bodies in the building bye laws for buildings in flood prone areas:

- Plinth levels of all buildings should be 0.6 m above the drainage/flood submersion lines.
- In the areas liable to floods, all the buildings should preferably be double and multiple storeys.

Survey of Flood Prone Areas

- The Indian Space Research Organisation (ISRO) has formulated a programme for Disaster Management Support (DMS) services wherein creation of digital, thematic and cartographic data base for hazard zonation and risk assessment and realisation of national database for emergency management have been identified as one of the programme elements.

Wetlands: Conservation and Restoration

- The reclamation of the existing wetlands/ natural depressions will be prohibited by state governments/ SDMAs and they will formulate an action plan for using them for flood moderation.

Watershed Management Including

- Catchment Area Treatment and Afforestation The Ministry of Agriculture (MOA) and Ministry Of Environment and Forests (MOEF) will, in collaboration with the NDMA, MOWR and state governments, implement watershed management including catchment area treatment and afforestation programmes to improve land and water management which will, in turn, result in flood moderation and sediment management in rivers.

Capacity Development

Flood Education

- The state governments will strengthen Flood Management education by facilitating the incorporation of the best available technical and non-technical inputs on FM in educational curricula.
- The MHA will facilitate the introduction of subjects related to the management of diseases caused by disasters including floods in the undergraduate medical curriculum.
- The state governments will be encouraged to introduce a five-year quality improvement programme for teachers and professionals engaged in teaching the subjects related to FM.

Target Groups for Capacity Development

- Specially designed public awareness programmes will be developed by the state governments/SDMAs/ DDMAs for addressing the needs of physically handicapped and mentally challenged people, women and the elderly.
- The people will be made aware of the need to keep special kits containing medicines, torch, identity cards, ration card and non-perishable eatables such as dry fruits, roasted chana etc. ready before commencement of monsoons so that, they can carry the same with them, in case, they have to be evacuated.
- The community will also be trained for preparation and utilisation of improvised flood rescue devices with household articles.

Research and Development

- The state governments will proactively support application-oriented research and developmental activities to address contemporary challenges, generate solutions, and develop new techniques to improve their sustainability in floods.

Flood Response

Search and Rescue Teams

- The state governments, through the ATIs, will develop procedures for formally recognizing and certifying such trained search and rescue team members; they will also provide suitable indemnity to community level team members for their actions in the course of emergency response following a flood.

Incident Command System

- All response activities will be undertaken at the local level through a suitably devised Incident Command System (ICS) coordinated by the local administration through the EOCs. State governments will commission and maintain EOCs at appropriate levels for the coordination of human resources, relief supplies and equipment.

Institutionalising the Role of Community Based Organisations, Non-governmental Organisations etc. in Incident Command System

- A number of organizations, like NGOs, self help groups, CBOs, youth organizations such as National Cadet Corps (NCC), National Service Scheme (NSS) , Nehru Yuvak Kendra Sangathan (NYKS) etc., women's groups, volunteer agencies, Civil Defence, Home Guards, etc. normally volunteer their services in the aftermath of any disaster .
- Village level task forces will also be constituted, on voluntary basis, for better preparedness of the community.

Dissemination of Information

- The state governments will utilise different types of media, especially print, radio, television and Internet, to disseminate timely and accurate information.

Involvement of the Corporate Sector

- State governments will facilitate the involvement of the corporate sector in making available their services and resources to the government during immediate aftermath of flood.

National Disaster Response Force (NDRF)

- The NDRF battalions will also be provided with communication equipment for establishing last mile connectivity .

Fire and Emergency Services in the Urban Local Bodies

- The fire and emergency services in the flood prone areas will develop adequate capacity to respond to serious flood situations, in addition to managing fires.

State Disaster Response Force

- To augment the capacities of the states, all state governments will constitute, from within their armed police force, adequate strength of personnel for the SDRF with appropriate disaster response capabilities.

National Reserves

- The National Reserves (NRs) will be created by procurement and stockpiling of items commonly required to provide immediate and emergency relief to victims of major natural and man-made disasters.

Identification of the Deceased

- In the event of mass casualties, states will develop systems for proper identification of the deceased, recording the details of victims, and making the use of DNA fingerprinting.

Emergency Treatment at Site of Floods

- Prompt and efficient emergency medical response will be provided by Quick Reaction Medical Teams (QRMTs), mobile field hospitals, including floating hospitals for riverine islands and areas inaccessible by roads, Accident Relief Medical Vans (ARMVs) and heli-ambulances.

Public Health Issues in Aftermath of Floods

- Safe and sufficient drinking water will be ensured. Vector control will be done by spraying of shelters with residual insecticides.

Psychosocial Aspects

- A team comprising a social worker, a psychologist and a psychiatrist will provide counselling to victims.

Guidelines on Urban Flooding

- Urban flooding has been experienced over decades in India but sufficient attention was not given to specific efforts to deal with it.

- In the past, any strategy on flood disaster management largely focused on riverine floods affecting large extents of rural areas.

- Urban flooding is significantly different from rural flooding as urbanisation leads to developed catchments and in the event of heavy/high intensity rainfall there is higher runoff which increases the flood peaks from 1.8 to 8 times and flood volumes up
  to 6 times.

- Consequently, flooding occurs very quickly due to faster flow times, sometimes in a matter of minutes.

- Taking this into account, NDMA has de-linked Urban Flooding from the subject of (riverine) Floods for the first time and commenced its efforts to come up with separate guidelines.

Urban Flood Risk in India

- There has been an increasing trend of urban flood disasters in India over the past several years whereby major cities in India have been severely affected.
- The most notable amongst them are Hyderabad in 2000, Ahmedabad in 2001, Delhi in 2002 and 2003, Chennai in 2004, Mumbai in 2005, Surat in 2006, Kolkata in 2007, Jamshedpur in 2008, Delhi in 2009 and Guwahati, Delhi in 2010, Chennai in 2015 and Mumbai in 2017.

Guidelines

- Ministry of Urban Development will be the Nodal Ministry for Urban Flooding.
- Establishment of the Urban Flooding Cell in Ministry of Urban Development (MoUD), State Nodal Departments and ULBs.
- Establishing a Technical Umbrella for Urban Flood Forecasting and Warning both at the National Level and State/UT levels.
- IMD will establish a 'Local Network Cell'.
- Establishment of Local Network of Automatic Rainfall Gauges (ARGs) for Real-time Monitoring with a density of 1 in every 4 sq km in all 2325 Class I, II and III cities and towns.
- Strategic Expansion of Doppler Weather Radar Network in the country to cover all Urban Areas for enhanced Local-Scale Forecasting Capabilities with maximum possible Lead-time.
- India Meteorological Department (IMD) will develop a Protocol for Sub-Division of Urban Areas on the basis of Watershed and issue Rainfall Forecast on theWatershed-basis.
- Establishing Urban Flood Early Warning System.
- Catchment will be the basis for Design of Stormwater Drainage System.
- Watershed will be the basis for all Urban Flooding Disaster Management Actions.
- Inventory of the existing stormwater drainage system will be prepared on a GIS platform.
- Pre-Monsoon De-silting of Drains will be completed before March 31 every year.
- Involve the Residents' Welfare Associations (RWAs) and Community Based Organisations CBOs) in monitoring this and in all Urban Flood Disaster Management (UFDM) actions.
- Every building shall have Rainwater Harvesting as an integral component of the building utility.
- Encroachments on Drains and in Floodplains will be removed by providing alternative accommodation to the poor people.
- Better Compliance of the Techno-legal Regime will be ensured.

- Establish the Incident Response System for Coordinated Response Actions.
- Capacity Development at the Community and Institutional level to enhance UFDM capabilities.
- Massive Public Awareness programmes covering Solid Waste Disposal, problems of Encroachments, relevance of Techno-legal Regime besides all other important aspects.
- Involve elected Public Representatives in Awareness Generation.

Guidelines on School Safety

- NDMA issued School Safety Policy Guidelines in January 2016. The Guidelines focus upon the urgent need to strengthen risk resilience of schools in rural as well as urban areas of the country.

The Guidelines highlight upon the following key elements:

- Addresses the vertical of school safety in a more inclusive and holistic manner in the national policy sphere
- Capacity building of children, teachers, school personnel, state and district education machinery on school safety and disaster preparedness
- Anchoring /implementing child centered community based disaster risk reduction in the local context
- Mainstreaming risk and safety education in the school curriculum.
- Linking school safety in the existing government schemes and policies.
- Strengthening coordination amongst institutional structures at the district, state, and national levels to promote effective child rights governance in disaster situations

Disasters: A Critical Threat to Children

- Experiences of fear, violence, separation from parents and caregivers, exploitation and abuse, are some of the key risks that children face. Moreover, the loss of livelihood of their families can lead to homelessness and extreme poverty.

- As with other infrastructure, schools are also exposed to disaster risk. Disasters have not only challenged the government and other stakeholders in providing access to education but also endangered the lives of children and those engaged in the pursuit of education.

- There is enough evidence to reflect that the quality of school premises and existing capacities of the stakeholders have a bearing on a child's vulnerability to disaster risks.

Guidelines

Institutional Strengthening at the State and District Level

- The RTE Act serves as a strong base for promoting school safety. The framework for implementation of RTE-SSA has a strong focus on Disaster Management
- There is a need to co-opt senior officials of the Department of Education at the State and the District level as part of the State and District Disaster Management Authorities for promotion of safe schools.
- In addition, a School Safety Advisory Committee may be formed to advise the education department on the subject.
- In addition, each district should designate the Block Education Officer or any other official as appropriate, for over-seeing and facilitating school safety at the block level.

Institutional Strengthening at the Local Level for Preparedness and Response

- The School Management Committee needs to be made responsible for taking on the safety agenda at the community and school level.
- The School Management Committee needs to be sensitized and oriented on their expected role.
- Each school should also identify and develop a cadre of peer educators/trainers for ensuring that safety messages, dos and don'ts of different disasters, procedures and protocols, reach each and every student in the school.
- These peer educators can be trained through National Cadet Corps, National scouts and guides camps, by the Red Cross or any other agency as deemed fit by the district.

Planning at the district level – links with district level DM efforts

- The District Disaster Management Plans (DDMPs) need to incorporate concerns and solutions for addressing safety related gaps in all the schools in the district and their surrounding environs.

Planning at the school level – inclusive and ongoing action

- The existing planning processes and protocols at the school level need to be adapted to adequately include safety concerns.
- For private and unaided schools, the National Accreditation Board for Education and Training needs to monitor safety aspects.
- In addition, as per the DM Act, DDMA needs to monitor all school buildings for their compliance with building codes.
- Based on the assessment of needs, the School Development Plan needs to be prepared by the School Management Committee.
- NDMA through SDMA and DDMA will provide standard tool kits and render other inputs to facilitate the process.
- In parallel, the plan also needs to be consulted/brought in picture with the village Panchayat for exploring opportunities for leveraging other schemes.

School Disaster Management Plan

- Schools should also develop a Disaster Management Plan defining procedures to confine, contain, consolidate and control the emergency and crisis, with inputs from DDMA.

Implementation of Safety Actions

- All existing as well as new schools need to conform to safety standards as per the National Building Code. In addition, any other norms prescribed by the state government need to be adhered to.
- Besides structural safety measures, non structural elements within the school campus need to be addressed to ensure safety.
- These are mostly low cost, regular maintenance items that the school should address on a regular basis from their own funds.
- Those activities that the school can undertake on its own such as non-structural mitigation measures for instance, clearing evacuation routes and addressing loose hanging objects, needs to be taken up by the Department of School Education.

Capacity Building for Safe Schools

- Awareness programmes for children on local hazards and risk reduction with relevant knowledge and life skills through discussions, street plays, drawing competitions, quiz competitions, essay/slogan writing and demonstration are proven ways of involving children in a meaningful manner.
- In addition, rallies, games/matches and other community level activities may be organised with inputs from DDMA/SDMA to make children as well as the larger community aware.
- Training would be imparted for performing specialized roles as part of the School Disaster Management Plan.

Guidelines on Droughts

- The South-west monsoon accounts for 70 to 80 per cent of the annual rainfall over major parts of India.
- Its timely occurrence in normal quantity and uniform distribution over all regions determine the prospects of agricultural production and allied activities every year.
- However failure of rains from south west monsoon results in occurrence of drought in the Indian region.
- Past monsoon analysis reveals that the Indian region experiences drought or flood in one part of the country or the other almost every year.
- In the past, drought management strategies were worked out generally during or after the onset of drought which lacked preventive interventions

Drought

- Drought is an insidious hazard of nature which sees a period of below-average precipitation in a given region, resulting in prolonged shortages in the water supply, whether atmospheric, surface water or ground water.

- It differs from other hazards since it has a slow onset, evolves over months or even years, affects a large spatial extent, and cause little structural damage. Its onset and end and severity are often difficult to determine.
- Like other hazards, the impacts of drought span economic, environmental and social sectors and can be reduced through mitigation and preparedness.

Classification

The National Commission on Agriculture in India classified three types of drought: meteorological, agricultural and hydrological.

- **Meteorological drought** is defined as a situation when there is significant decrease from normal precipitation over an area (i.e. more than 10%).
- **Hydrological drought** results from prolonged meteorological drought resulting in depletion of surface and sub-surface water resources.
- **Agricultural drought** is a situation when soil moisture and rainfall are inadequate to support healthy crop growth. Drought is also classified on the basis of time of onset as early season, mid season and late season.

Guidelines

Status and Context

- Separate Drought Monitoring Cells (DMCs) shall be created at the state level with adequate staff under the control of State Disaster Management Authorities (SDMA's).

- State DMCs shall undertake on a priority basis, the preparation of vulnerability maps for their respective States.

Drought Risk

Drought vulnerability is a product of a region's risk of water shortage and the exposure of the communities to the problems arising thereafter.
If nations and regions are to make progress in reducing the serious consequences of drought, they must improve their understanding of the hazard and the factors that influence vulnerability.
It is critical for countries to better understand this hazard and how it varies temporally and spatially to establish comprehensive and integrated drought early warning systems that incorporate climate, soil, and water supply functions such as precipitation, temperature, soil moisture, snow pack, reservoir and lake levels, ground water levels, and stream flow.

Watershed Development

- The watershed development approach is an important facet of drought management initiatives, taken up through the programmes of the Government of India.

Assessment and Early Warning

- Efforts shall be made to integrate the ground based information with the space-based information for comprehensive reporting.
- The role of all departments engaged in drought management shall be clearly spelt out.
- Alternative methods of quicker assessment of crop yield need to be evolved so as to mitigate the impact of drought in time. Also, Unit of deceleration of drought should be standardized.
- Automatic weather station and rain-gauges shall be put in place at appropriate spacing to enable micro level analysis and forecasting.
- The Drought Management Information System of DAC will be revamped, institutionalized and made operational with the support of State DMCs

Prevention, Preparedness and Mitigation

- The services of Village Resources Centres being established by Indian Space Research Organization (ISRO), ICAR, State Agricultural Universities and other Organizations, will be effectively used towards management of droughts.
- Large scale research will be conducted through the university system to evolve drought resistant crop varieties.
- The mitigation measures to be taken will include:

1. Conduct of pilot studies in all categories of drought prone areas for suggesting long term mitigation measures,
2. Convergence of lessons learnt from studies carried out by CRIDA, International Crop Research for Semiarid Tropics (ICRISAT), IMD, NRSC, ICAR, and other institutes ,
3. Cloud-seeding as a possible measure of mitigation will be considered ,
4. Measures for reducing the impact of climate change on drought.
   - The State Department of Agriculture and Agricultural Universities will therefore:
5. promote cultivation of crops under crop diversification through sprinklers/ Drip irrigation systems; and
6. promote protective irrigation through micro irrigation systems through incentives;
7. advise on the cropping systems to be covered under protective irrigation through appropriate micro irrigation systems.
   - Insurance products shall be developed for different agro-climatic zones providing coverage against drought.

Capacity Development

- Agricultural universities and National Research Centres of ICAR will be encouraged to undertake contractual research for industries/farmers as a means of revenue generation and providing solutions to immediate problems.
- The NIDM and Administrative Training Institutes (ATIs) and NDMA will take up the responsibility of training all the government personnel from all central ministries and departments and state governments on different aspects of Drought management.

- PRIs and ULBs will ensure capacity building of their officers and employees in DM to carry out relief, rehabilitation and reconstruction activities in the affected areas in consonance with the State Plan.
- ATIs, NGOs, PRIs and ULBs will be encouraged to take up awareness programmes on drought management consisting of sensitizing the farmers, communities and other stake holders at different levels.
- Drought mitigation aspects will also be disseminated through the PRIs and local bodies which are ideally suited for Community Based Disaster Management (CBDM) initiatives in the States at different levels.

Relief and Response

Strategy to Save Animals from Drought

- Assessment of need for fodder will be done well in advance. If a deficit is identified, ways and means to fill the gap will be explored including supplies from the nearest area, within the mandal, within the District, or in the nearby State.
- Raising of fodder in Government as well as farmers' lands with buy back arrangements for fodder.
- cultivated will be promoted.
- Use of tank bunds for fodder cultivation. Utilizing the period between crops for fodder
- cultivation.
- Distribution of fodder produced within a State in nearby areas.
- Establishment of fodder banks.
- Conserving fish and aqua culture during droughts.
- Utilizing the assistance of Ministry of Railways in transport of fodder and drinking water from unaffected areas to those affected.
- Organizing online availability of information relating to demand and supply of fodder.
- Undertaking market intervention to keep the prices reasonable.
- Intensification of water conservation measures in the villages.
- Agencies concerned in all the districts covered by this programme will be sensitized regarding their value in generating employment in the drought-affected areas and building assets such as tanks and wells which reduce the impact of drought
- Promotion of investment in drought mitigation measures will be encouraged for economic sustainability of small & marginal farmers.
- Provision of consumption loan will also be encouraged in drought prone areas and efforts will be made to bring agricultural labours into the net of social security.
- Vaccines for various diseases and essential medicines will be procured as required. Fodder, Cattle feed and mineral mixture will be supplied to all productive animals to prevent distress sales of cattle.

Guidelines on Landslide and Snow Avalanche

- Landslides are a significant natural hazard for India.

- They not only threaten the environment, human safety, infrastructure, and post-earthquake relief operations but also have a huge impact on the national economy.
- Vulnerability to landslides can be evaluated only if we know the exposure to landslide hazard and our preparedness to face that hazard.
- Vulnerability will be close to nil in the case of well managed and protected slopes.
- It will be the maximum for unprepared populations living on slopes with a proven history of landslides.
- Landslides is a process involving the downward and outward movement of a part of the slope forming material due to the action of gravity, other forms of mass movements like falls, flows, topples and creeps are generally included in the term landslides.
- Landslides form a significant component of the natural disasters that affect most of the hilly regions round the globe.

- Our country experiences landslides year after year especially during the monsoons and periods of intense rain. This hazard affects about 15 per cent of our country covering over 0.49 million square kilometers. Landslides of different types occur frequently in the geologically active domains of the Himalayan and Arakan-Yoma regions, as well as in the relatively stable domains in the Meghalaya Plateau, the Western Ghats and the Nilgiri Hills.

- Extensive anthropogenic interference is a significant factor that increases this hazard manifold.

- In all, 22 states and parts of the Union Territory of Pudducherry and Andaman & Nicobar Islands are affected by this hazard.

- Landslide hazard management in India had till now been confined to ad-hoc solutions of site specific problems and the implementation of immediate remedial measures including debris removal, and dumping of this debris either down slope or into a river.

- Vulnerability to landslides can be reduced by creating a culture of safety through careful land use planning, timely and appropriate engineering intervention, conscientious maintenance of slopes and connected utilities, early warning, public awareness, and preparedness.

- We need to develop a culture of quick response to managing disasters to reduce the impact of landslide disasters.

- The snow avalanche hazard, a common occurrence in snow covered mountainous regions, is a slide of snow mass down a mountainside.

- This is a rapid downslope movement of a large detached mass of snow, ice, and associated debris such as rocks and vegetation.

- Small avalanches, or sluffs, occur in large numbers, while large avalanches that may encompass slopes a kilometre or more in length with millions of tons of snow, occur infrequently but cause most of the damage.

Snow Avalanche is a slide of snow mass down a mountainside. It is a rapid, down slope movement of large detached mass of snow, ice and associated debris such as rock fragments, soil and vegetation.

Guidelines

Status and Context

- The preparation of a comprehensive and user-friendly national landslide inventory database will be taken up, paving the way for continuous updating of the landslide map of India.
- The SASE (Snow and Avalanche Study Establishment) and BRO (Border Roads Organisation) will be
- responsible for the identification and monitoring of snow avalanches. The SASE will be responsible for the zonation of avalanche prone areas and the forecasting of snow avalanches.
- The district administration will identify organizations/ institutions that can take up programmes to educate the communities living in avalanche prone areas, to prepare them with the latest techniques of self-survival, and to equip them with simple and essential tools.

Hazard Zonation Mapping

- Approaches to landslide hazard mapping being used by different agencies in India are at variance with each other.
- The ongoing mapping programmes should continue to make the best use of the prevailing stateof the-art technologies.

Geological and Geotechnical Investigations

- Geotechnical Investigation guidelines will be developed to usher in the culture of sound geotechnical investigation suited to different geological settings and anthropogenic situations.
- The private sector can play a major role in improving the national capacity for quality geotechnical investigations and will be encouraged to do so through professional bodies like the Indian Geotechnical Society (IGS).

Landslide Risk Treatment

- Identified hazardous landslides will be prioritized and treatment measures implemented after detailed investigations.
- Site selection for housing, human settlements and other infrastructure in hilly areas will be done by a highly competent multi-disciplinary team of experts aiming to preserve the texture of the place and its cultural fabric , maintaining balance between natural and anthropogenic factors.

Landslide Monitoring and Forecasting

- Projects will be encouraged to develop appropriate technologies as well as to effectively utilise the available state-of-the-art technologies to facilitate quality monitoring in a cost-effective manner, aiming at real-time early warning.

Regulation and Enforcement

- The state governments/SDMAs of landslide affected areas in consultation with the NDMA will establish the necessary techno-legal and techno-financial mechanisms to address the problem of landslide hazards in their respective states.

Awareness and Preparedness

- Creation of Public Awareness on Landslide Risk Reduction Handbooks, posters, and handbills containing the status of landslide hazards will be distributed.

Capacity Development

- Technical institutes, polytechnics, and universities located in vulnerable areas will develop adequate technical expertise on the various subjects related to landslide management.

Response

- Trained and equipped teams consisting of local people will be set up in landslide prone areas to respond effectively in the event of a disaster.
- Community level teams will be developed in each district with basic training in search and rescue
- Youth organisations such as the NCC, NSS, and NYKS shall provide support services to the response teams at the local level under the overall guidance and supervision of the local administration.
- The DDMAs will coordinate with organisations like NGOs, voluntary agencies, self-help groups, youth organisations, women's groups, civil defence, home guards, and the community at large that normally volunteer their services in post-disaster situations.
- The state governments will facilitate the involvement of the corporate and private sector and utilise their services and resources if offered to the government during the immediate post-disaster situation.
- All NDRF teams will be specially equipped and trained in landslide, avalanche and collapsed structure search and rescue operations.
- To augment the capacities of the states, all state governments will raise from within their armed police force, an adequate strength of personnel for the SDRF capable of responding to disaster situations.
- Whenever required, a prompt and efficient emergency medical response will be provided by QRMTs, mobile field hospitals, ARMVs and heli-ambulances that are in place for other disasters like earthquakes.

Research and Development

- Central ministries, state governments, and funding agencies shall encourage, promote, and support R&D activities to address current challenges, offer solutions, and develop new investigation techniques, with the application of the latest developments in remote sensing, communications, and instrumentation technologies.

Guidelines on Nuclear and Radiological Disasters

- India has traditionally been vulnerable to natural disasters. on account of its unique geoclimatic conditions and it has, of late, like all other countries in the world, become equally vulnerable to various man-made disasters.

- Since times immemorial, mankind has been continuously exposed to naturally occurring ionising radiation.

- However, it was only towards the end of the nineteenth century that human beings became aware of it, when X-rays were discovered in 1895 by Wilhelm Roentgen and radioactivity in uranium salts was discovered by Henri Becquerel in 1896.

- The dreadful memory of the use of nuclear weapons in 1945 by USA on Hiroshima and Nagasaki in Japan and the wide publicity given to the reactor accidents at Three Mile Island (TMI) in USA and Chernobyl in erstwhile USSR has strongly influenced the public perception of any nuclear emergency to be linked most often, though erroneously, to only these events.

Nuclear and Radiological Emergency

- Any radiation incident resulting in, or having a potential to result in, exposure to and/or contamination of the workers or the public, in excess of the respective permissible limits can be termed as a nuclear/ radiological emergency.
- Nuclear emergency scenarios at various nuclear fuel cycle facilities may arise due to the failure of multiple barriers, which include systems, equipment and human errors.

Guidelines

Preparation of Disaster Management Plans and Financial Arrangements

- The national guidelines are to be implemented by preparing appropriate DM plans at all levels of administration.
- Specialists in nuclear science and technology are to be inducted at all levels of administration in the formulation of the plans and their effective monitoring during implementation, covering all the activities of disaster continuum.

Capacity Development

- A reliable and dedicated communication system, with adequate redundancy and diversity, shall be established to provide the last-mile connectivity to the disaster affected site.
- Specialized response teams will be raised, specially trained for nuclear/radiological emergency/disaster and fully equipped at the state and central levels.
- The roads and transport network will be strengthened by SDMAs/DDMAs of the various state governments/ UTs for effective and quick response.
- The possible places of shelters in large metros and vulnerable areas are to be identified by the various state governments/UTs, with assistance from DAE/ DRDO, for the people to be evacuated in the event of any nuclear/ radiological emergency.
- Sufficient inventory of radiation monitoring instruments and protective gear will be built-up by all the SDMAs and DDMAs in order to ensure availability of these basic needs for response to nuclear/radiological emergency.
- Monitors at entry/exit points of the country will be installed by MHA to prevent illicit trafficking of radioactive materials and the security staff stationed at such points should be properly trained to prevent the smuggling/illegal trafficking of the radioactive materials.
- Education and awareness generation programmes for the community will be conducted throughout the country to allay their apprehensions about the nuclear energy programme and nuclear emergencies by the nuclear/radiological facility operators, NIDM and SDMAs/ DDMAs with assistance from MHRD , MHA, DAE, and DRDO
- There is a need to enhance the security of radioactive sources at radiation facilities and during their transportation by the concerned facility operator.
- Establishment/upgradation of primary, secondary, and tertiary care hospitals which can handle sufficient number of people affected during a nuclear emergency must be a priority.

Training of First Responders and Mock Drills

- Training of the various first responders and the administrative personnel involved in DM at various levels of administration will be imparted at regular intervals by the CBRN trained NDRF trainers and NIDM with assistance from DAE, DRDO and NDMA
- To cope with radiological emergencies, mock-drills and emergency preparedness exercises will be conducted by SDMAs/DDMAs on a regular basis in the public domain.

Guidelines on Chemical Disaster

- The growth of chemical industries has led to an increase in the risk of occurrence of incidents associated with hazardous chemicals (HAZCHEM).
- Common causes for chemical accidents are deficiencies in safety management systems and human errors, or they may occur as a consequence of natural calamities or sabotage activities. Chemical disasters, in general, may result from fire, Explosion, Toxic release, Poisoning.
- Chemical accidents result in fire, explosion and/or toxic release. The nature of chemical agents and their concentration during exposure ultimately decides the

toxicity and damaging effects on living organisms in the form of symptoms and signs like irreversible pain, suffering, and death.

- Chemical disasters, though low in frequency, have the potential to cause significant immediate or longterm damage.

Sources of Chemical Disasters

- Manufacturing and formulation installations including during commissioning and process operations; maintenance and disposal.
- Material handling and storage in manufacturing facilities, and isolated storages; warehouses and godowns including tank farms in ports and docks and fuel depots.
- Transportation (road, rail, air, water, and pipelines)

Impact of Chemical Disasters

- In addition to loss of life, the major consequences of chemical disasters include impact on livestock, flora/fauna, the environment (air, soil, water) and losses to industry as shown in Figure 1. Chemical accidents may be categorised as a major accident or a disaster depending upon the number of casualties, injuries, damage to the property or environment.

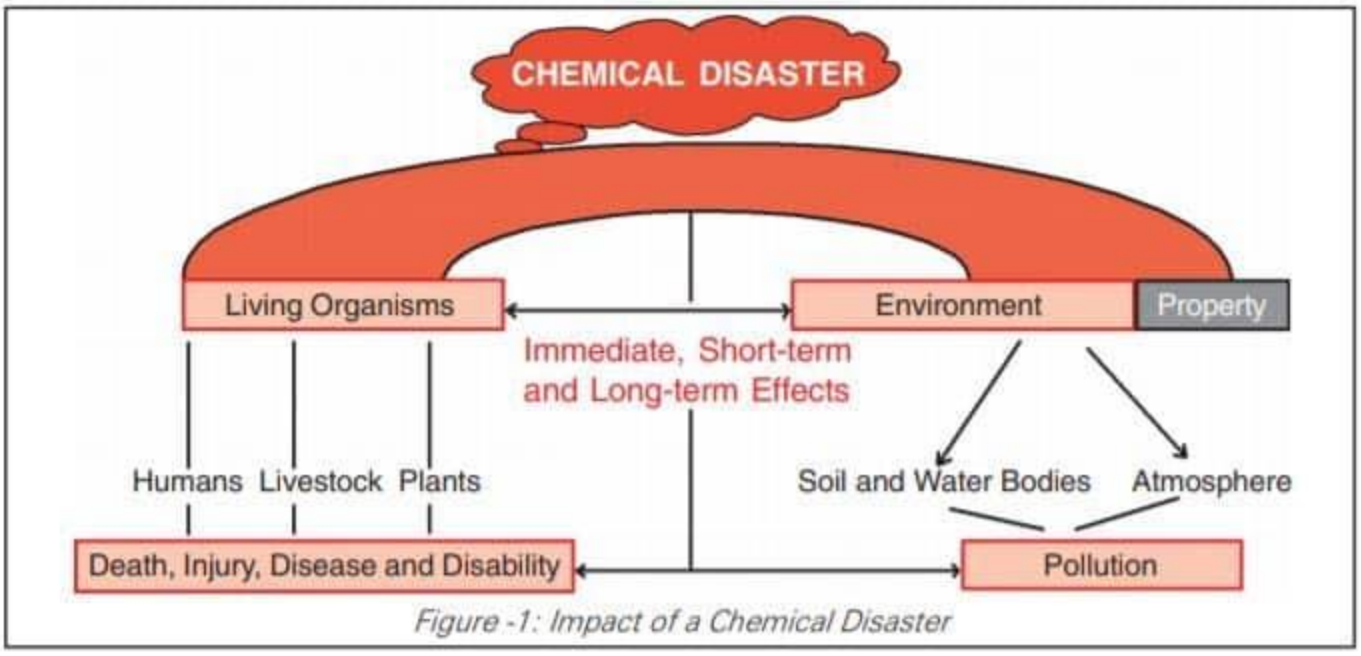


Figure -1: Impact of a Chemical Disaster

Guidelines

In recognition of the gravity of the risk posed by hazardous chemicals (HAZCHEM), the National Disaster Management Authority (NDMA) took up the task of strengthening Chemical Hazard Disaster Management. Some of the Guidelines are as under:

Regulatory Framework

- National regulation on medical emergency management, occupational safety and health shall be formulated and dovetailed with the existing regulation at central and state levels.
- Pipelines carry huge quantities of HAZCHEM both in liquid and gaseous form within and outside the manufacturing/ storage facilities. The regulatory framework has to thus, adequately address safety measures for pipelines and area en-route.

- Proper and safe disposal of hazardous waste shall be ensured as per existing regulations.

Standard Codes and Procedures

- Procedures for the conduct of safety audits need to be strengthened. Standardised national criteria for risk assessment/management of installations are not currently available. In their absence, a standard method is not available to study and monitor the consequences and draw conclusions.
- Mechanisms shall be developed on risk assessment/ management prescribing a standard criteria and methodology.
- Such mechanisms will be updated regularly.
- There is a need to develop scientific understanding of the functions and behaviour of HAZCHEM, which is central to achieving risk reduction.
- Risk reduction measures derived by scientific methods and consideration of social and economic factors, are needed to reduce or eliminate the harmful effects of chemicals and the consequences of a chemical disaster.

Capacity Development

- Specialised chemical facilities for the collection, identification, detection of HAZCHEMs need tobe established close to chemical disaster-prone areas. Efforts shall also be made to develop their fullcapabilities.

Networking and Information

- An exclusive CDM website needs to be developed and maintained by the nodal ministry, states and districts that will contain comprehensive databases on HAZCHEM used nationally and internationally.
- Data shall also be available on important subjects like regulations, side effects of HAZCHEM and their antidotes.
- The website shall also be accessible to the industry and public at large.

Medical Preparedness

- All medical and paramedical staff shall be made aware about the type of illness, injuries, burns and other health problems caused by various toxicants and their preventive prophylactic and therapeutic measures.

Industrial Installations

- Regular testing of critical equipment/ storage vessels through non-destructive testing (radiography, thickness survey, hydraulic testing etc.)
- Efficacy of safety systems shall be checked regularly with special emphasis on Provisions of two-to-three tier safety, Early-warning system and two-to-three tier power back-up system for safety of equipment/ provision.

Storages

- Factories/Storages having Off-Site consequences need to be treated at par with MAH factories in view of the probability of occurrence of accident due to the risks associated with bulk storage of HAZMAT.
- The storages of large inventories of HAZMAT should go with corresponding safety, containment measures, good engineering and environmental practises.
- Comprehensive guidelines for safe storage of Hazardous materials and Hazardous Chemicals should be followed. Defining and ensuring the limits of quantity of HAZMAT as per the capacity of storage facility is vital.

Transport

- Air transport of dangerous goods is required to conform to the International Air Transport Association (IATA) Dangerous Goods Regulations which govern the packaging and labeling of HAZCHEM.
- Maritime transportation of dangerous goods follow the required shipping regulations enforced by national and international institutions..
- Though railways have their own safety manual for the transportation of hazardous goods, the same needs to be strengthened keeping all requirements for management of transport accidents in view.
- Road transport carries the bulk of dangerous goods in India while sea transport handles the import and export of dangerous goods. Thus, guidelines must be strengthened by introducing fresh rules, guidelines and facilities for the prevention and management of transportation emergencies.
- Local Community Leaders shall be identified and developed for an effective emergency response. Community leaders should accept the responsibility to train the public and should play a special role in building support and enthusiasm for awareness programmes.
- Parking Lots of overnight parking of HAZCHEM vehicles should be away from residential areas.
- Trauma/Poison Centres should be spread out uniformly in India so that they are easily accessible during the transportation of casualties to prevent the loss of lives.
- Round-the-clock emergency crews should be established to reach transport accident spots for immediate and urgent help.
- The arrangement would not be limited to dangerous goods transported by an installation only.
- For urgent and immediate relief to victims in transportation accidents, all states should have dedicated helicopter services for medical relief and transfer of casualties to bigger hospitals.
- The pipeline shall be inspected and maintained regularly. Moreover, only reliable trained staff or qualified contractors may carry out maintenance works on a pipeline.

Guidelines on Chemical Terrorism

- There are a large number of toxic chemicals that have been used either in warfare or for terrorist activities.

- Although instances of what might be styled as chemical weapons date back to antiquity, much of the lore of chemical weapons as viewed today has its origin in World War I.

- India's unique geo-climatic conditions make it vulnerable to natural disasters. However, socio political conditions in the Indian Subcontinent have made this region particularly vulnerable to man-made disasters including chemical terrorism.

Chemical Terrorism

- Chemical terrorism relates to acts of terrorism using chemical agents.
- Terrorists sponsored by states, and non-state actors with substantial financial resources and technical expertise, may acquire explosives, incendiaries, and chemical agents similar to those used by military services.
- Toxic industrial chemicals or materials, together with their hazardous waste, as well as Chemical Warfare (CW) agents are included in the quadrate of Chemical, Biological, Radiological and Nuclear (CBRN) agents due to their widespread accessibility, availability of dual technology, lesser complexity of production, ease of use, and potential toxicity.
- The possibility of a chemical terrorism attack can be minimised by spreading general awareness and building the capacity of the community, institutions, and governmental and non-governmental organizations.

Types of Chemical Agents

Toxic chemicals which can be used in terrorism may be generally classified in the following broad categories based on their toxicity and usage.

- CW agents.
- Dual use chemicals.
- Toxic Industrial Chemicals/Materials (TIC/ TIM).
- HAZCHEM and their waste by-products.
- Agricultural chemicals.
- Other poisonous substances.
- Natural gas and petroleum products.

Guidelines

Legislative and Regulatory Framework

- Policies and guidelines issued by NDMA will be the basis for developing DM plans by various stakeholders and service providers, both in the government (nodal and

line ministries, state government and district administration) and private setup at each level.
- Prompt and effective response to various chemical terrorism activities will be coordinated by NDMA, NEC, NCMC, SDMAs, and DDMAs.

Preventive

- Important preventive measures like counter-terrorism strategies, risk and vulnerability assessment, chemo surveillance, and environmental monitoring can help in the prevention or mitigation of the effects of CTD.
- To ensure chemical security, the NDMA and other relevant agencies must ensure the development of essential indicators by understanding the terrorists' motivation and capabilities, and deny them likely access to toxins, tailoring deterrence strategies, and strengthening response measures.
- The effective networking of intelligence services, sharing of infallible and concise chemical security provisions and the continuous assessment and upgradation of existing indicators based on threat perception are important.
- Illegal trafficking of hazardous waste and their potential usage in CTD must be prevented through a systematic and fail-safe approach by employing public-private partnership to monitor and prevent the creation of illegal hazardous waste dumping sites in order to prevent terrorists from easy access to HAZCHEM and HAZMAT.
- Standard Operating Procedures must be developed for all the emergency responders working under the overall supervision of the incident commander.
- Mechanism will also be developed for preventing cyber based exchange of information which can be used to cause a CTD.

Preparedness

- Capabilities for individual physical protection (respiratory and body protection), and collective protection must be ensured at the district level, as are adequate numbers of protective gear.
- A mobile chemical laboratory containing chemical analyzers will be developed for highly vulnerable areas.

Capacity Development

- Basic relevant knowledge of toxic chemicals will also be imparted through induction courses, to the public and private sector employees of industries, isolated storages, hazardous waste sites, and to those engaged in the transportation of potentially toxic chemicals.

Community Preparedness

- Community preparedness will be strengthened .
- The community will be empowered with appropriate knowledge in such a manner that it does not panic and reacts appropriately if an incident occurs.
- The community will be a part of the district or local DM plan and will participate in mock-drills conducted for the management of CTD.

Hospital Preparedness

- Major/earmarked hospitals in the government and private sector will be fully equipped and geared for managing CTD.
- An 'all hazard' hospital DM plan will focus on the specialised requirements of hospitals handling chemical casualties.
- The precautions to be taken by hospitals for unidentified chemical attacks includes providing of protective gear and necessary antidote treatment for doctors, nursing teams, paramedical and other staff to prevent the possibility of secondary contamination.
- Poison information centres need to be contacted to establish linkages of the poison. Hospital care will also include monitoring and management of delayed health effects of chemicals.

Research and Development

- It is essential to develop new research methods and technologies, which will facilitate rapid identification and characterisation of novel threat agents.

Rehabilitation and Recovery

- SOPs will be prepared for medical rehabilitation, including psycho-social care, long-term medical care for vulnerable groups, and vocational rehabilitation.

Media Management

- Media management is a necessary component of CTD management. A strong mechanism for effective media management shall be developed.

Public-Private Partnership

- Public-private partnership is required for preparedness, mitigation, rehabilitation, response, and management of CTD. The private infrastructure needs to be integrated with Disaster Management Plan for preparation, mitigation, response, and post disaster phases of rehabilitation and recovery.

Guidelines on Medical Preparedness and Mass Casualty Management

- A Mass Casualty Event is an event resulting in a number of victims large enough to disrupt the normal course of emergency and health care services is called a mass casualty event.
- A mass casualty event includes all the incidences that are beyond the coping capacity of the local administration.
- In mass casualty events, a large number of people and livestock get affected resulting in a high degree of morbidity and mortality.
- A mass casualty event unprecedented challenges as they significantly impact the health care system and other resources.
- Thus, medical response in such a scenario decides the well being of the injured.

Guidelines

Preventive

- Special campaigns for immunisation shall be conducted in high risk, vulnerable areas prior to impending disasters to prevent post-disaster epidemics.
- The Integrated Disease Surveillance Program (IDSP) will be fully operationalised in all the districts shortly with the help of computer-aided information.
- It will enable detection of early warning signals for instituting appropriate public health measures.

Preparedness

- Medical teams will be fully trained and equipped to handle all kinds of emergencies resulting from natural or man-made disasters.
- Within one hour of injury, treatment should commence by providing basic life support to reduce morbidity and mortality.

Transportation and Evacuation of Casualties

- The transportation and evacuation of casualties will be organised using a multi sectoral approach including PPP.
- The district disaster management plan will have an evacuation plan with identified routes, types of ambulances that are to be used during different levels of disaster and a resource inventory of paramedics, doctors, QRMTs(Quick Reaction Medical Teams and drivers.
- Each ambulance should have basic medical equipment for resuscitation, essential drugs, stretchers and two-way communication. Also support staff of the ambulance should be well-versed in the use of the equipment it is carrying.
- The ambulance network developed will be integrated into the other emergency networks of the districts including police/ fire/State Disaster Response Force (SDRF).
- Designated air ambulances and adequate mechanism to prioritize the modalities for aerial evacuation will be developed.

Communication

- Communication is a vital component of DM.
- In addition,communication systems are also vulnerable to failure during disasters, thus it is important to develop strategies to protect these systems and to make them more disaster resilient.
- Public awareness campaigns will be undertaken in regard to ambulance services of the city, helpline numbers and their appropriate usage during emergencies.
- Mobile hospitals will be located at strategic locations earmarked by states/districts and will be attached to designated hospitals.
- Mobile tele-health/ tele-medicine services can be used for disasters by putting diagnostic equipment and Information Communication Technology (ICT) together on a vehicle to get connectivity between the disaster site and advanced medical institutes where such connectivity already exists.
- Such systems may be placed in known disaster prone areas or could be moved at the onset of disasters.

Capacity Development

- Arrangements between various private hospitals and the government will be developed for treating casualties during disasters and cost sharing factors will be worked out in the pre- disaster phase.
- Disaster related medical training will be provided to medical officers, nurses, emergency medical technicians, paramedics and MFRs to handle disasters including CBRN and other types of MCE.
- A hospital disaster management plan should plan for the increased requirements of beds, ambulances, medical officers, paramedics, and mobile medical teams.
- New hospital buildings will be made disaster resistant.
- Structural safety of the existing tertiary and secondary health care facilities will be evaluated to withstand high intensity earthquakes and at least one government hospital in each district will be retrofitted, if found necessary.
- Trauma centres shall be developed to strengthen the existing facilities within the hospitals.
- Trauma centres will cover all the accidents on highways, nearby rail tracks and natural and man-made disasters.
- States which are vulnerable to earthquakes of magnitude six and above on the Richter scale and other types of disasters will ensure the development of all these centres.
- Burn centres are a prerequisite for the management of all disasters.
- The burn centres will have trained doctors and supporting medical staff capable of treating chemical burn emergencies.
- •Establishment of blood bank facilities in districts where presently not existing. Mechanism for priority based transportation for blood and its components through various modes including road, railways, or air will be worked out.

Training and Education

- Education of CBRN (Chemical, biological, radiological and nuclear defense) management is necessary for all health care workers and other stakeholders.
- All medical and paramedical staff will be made aware about the types of illnesses, injuries, bums and other health problems caused by CBRN agents and their preventive and therapeutic measures.

Guidelines on Biological Disasters

- In recent years, biological disasters including bioterrorism have assumed serious dimensions as they pose a greater threat to health, environment and national security.

- The risks and vulnerabilities of our food chain and agricultural sector to agroterrorism, which involves the deliberate introduction of plant or animal pathogens with the intent of undermining socio-economic stability, are increasingly being viewed as a potential economic threat.

- **Biological Disasters:** Biological disasters are scenarios involving disease, disability or death on a large scale among humans, animals and plants due to toxins or disease caused by live organisms or their products.
- Such disasters may be natural in the form of epidemics or pandemics of existing, emerging or reemerging diseases and pestilences or man-made by the intentional use of disease causing agents in Biological Warfare (BW) operations or incidents of Bioterrorism (BT).
- **Bioterrorism (BT):** The intentional use of microorganisms, or toxins, derived from living organisms, to produce death or disease in humans, animals or plants.
- **Biorisk:** The probability or chance that a particular adverse event (in the context of this document: accidental infection or unauthorised access, loss, theft, misuse, diversion or intentional release), possibly leading to harm, will occur.

Biological Warfare (BW) and Bioterrorism (BT)

- The historical association between military action and outbreaks of infections suggest a strategic role for biological agents.
- The nondiscriminatory nature of biological agents limited their use till specific, protective measures could be devised for the 'home' troops.
- The advances in bacteriology, virology and immunology in the late 19th century and early 20th century enabled nations to develop biological weapons.
- While biological warfare does not appear to be a global threat , the use of some agents such as anthrax by terrorist groups poses a serious threat.
- The ease of production, packaging and delivery using existing non-military facilities are major factors in threat perception.
- These artificially induced infections would behave similar to natural infections (albeit exotic) and would be difficult to detect except by an effective disease surveillance mechanism.
- The threat posed by bioterrorism is nearly as great as that by natural epidemic causing agents.
- Post-WW II, the Cold War saw the serious development of bioweapon programmes.
- Major state-sponsored research was carried out, especially in United States and Soviet Union.
- The number of countries currently working on biological weapons is estimated to be between 11 and 17 and include sponsors of terrorist activities. Even smaller groups have now acquired bioterrorist capabilities.
- Bioweapons such as anthrax are more likely to be used by terrorists, possibly encouraged by state or non-state actors, against vulnerable populations or industrial centres.
- Apart from human targets, bioweapons could be used to attack agricultural crops and livestock. Recently in India, an infection of avian flu in a limited area required the mass culling of birds, causing massive losses to commercial poultry enterprises, thus highlighting their vulnerability to attack and the potential of natural epidemics to cause economic losses.
- The collective conscience of the world, however, resulted in the Biological and Toxin Weapons Convention which resolved to eliminate these weapons of mass destruction. Despite considerable enthusiasm, the convention has been a non-starter.

Guidelines

Legislative

- Policies and guidelines issued by NDMA will be the basis for developing DM plans by various stakeholders and service providers both in the government and private set-up at each level.
- The response to various biological disasters will be coordinated by NDMA/ NEC/NCMC, SDMAs and DDMAs.

Capacity Development

- The roles of various health and non-health professionals at various levels in the management of a biological crisis will be defined. Control rooms to support the field responders will be set up.
- These professionals will be trained through refresher courses to fill the prevailing gaps.
- Community awareness about the delivery of services in various civic amenities will be strengthened so that appropriate knowledge is developed and provided to the stakeholders in such a manner that it does not spread panic.

Pharmaceutical and Non-pharmaceutical Interventions

- Tools will be developed to monitor the status of available pharmaceutical interventions including antibiotics, chemotherapeutics and anti-virals, and listing of essential drugs that may be required to manage biological emergencies.
- On-site contingency planning will be done to contain biotoxins within the laboratory premises.
- Various immunisation and vaccination programmes will be undertaken and the existing arrangements will be strengthened.
- Mechanisms to employ various nonpharmaceutical interventions like social distancing measures, and isolation and quarantine techniques will be adopted at various levels.

Research and Development

- R&D will cater for biodefence and operational research with models to develop checks on various public health consequences, thereby evaluating various mitigation strategies after testing them at numerous stages.

Development of Critical Infrastructure

- Nodal and line ministries at the central level and departments of health, SDMAs/DDMAs at the state/ district level will be tasked to identify the various requirements of critical infrastructure to be developed with PPP models to mitigate the impact of biological disasters.

Medical Preparedness

- A disaster-resilient public health infrastructure must include an effective inbuilt mechanism to keep a check on the early warning signs of an outbreak, make available safe food, water, personal hygiene facilities and also have the capacity to provide psycho-social care.

Institutional Mechanism for Public Health Response

- A properly functioning epidemiological mechanism, will be used to prepare an action plan for the management of avian flu, and similar incidences to effectively combat the inherent risks.

International Cooperation

- The mechanism for international cooperation will include both resource sharing, stockpiling of medical logistics at the regional level, joint international mock exercises and knowledge management systems.

Biological Containment Preparedness

- SOPs for biosafety and bio-security will be developed by the respective laboratories in accordance with the National Code of Practice for bio-security and Biosafety

Preparedness for Livestock Management

- A comprehensive strategy for emergency management will be developed and steps for prevention, mitigation and preparedness for management of livestock during disasters will be laid down.

Guidelines on Deficient Building Structure

- India has witnessed several moderate earthquakes in the last two decades causing over 25,000 fatalities and innumerable house collapses.
- The prevalent high earthquake hazard, large exposure and high vulnerability indicate that urgent proactive action is necessary to save lives.
- A large number of existing buildings across the country do not seem to have adequate earthquake resistant features as specified in IS Codes. Moreover, a large number of new houses are getting added to existing stock of the country. Earthquake performances of buildings in the last 25 years indicate that more than 25,000 human fatalities were caused primarily by collapse of buildings.
- Except for the 1993 Killari (Latur) earthquake, all other events occurred in known moderate to high seismic zones.
- Seismic strengthening of these existing houses is a technological challenge as well, in addition to being a social, economic and governance challenge.

Earthquake Risk of Housing In India

- The projected aggregate effect of expected number of lives likely to be lost, persons injured, property damaged and economic activity disrupted due to an expected strong earthquake in an area, is the earthquake risk of that area.
- The effort and technical input required to retrofit a building are much higher than that to make a new earthquake resistant building.
- In the present scenario, sufficient technical manpower is not available even for designing and constructing new buildings.
- Further, infrequent occurrence of earthquakes has not helped the cause of making the country realize the extreme shortage of technical inputs to take corrective steps towards ensuring that the built environment is made capable to resist expected earthquake shaking in each region.
- Significant gains can be made towards reducing loss of life by undertaking seismic strengthening of these non engineered structures.

- A comprehensive approach is required for promoting systematic, formal and technically sound retrofitting of deficient houses. For this, systemic changes are required, with precise measures for quality control and quality assurance.
- These include comprehensive continuing education programmes, stringent techno-financial and techno-legal regimes and improved contracting practices. Thus, retrofitting is not just an option, but a national urgency.

Year	Name of the Event	Casualties	Buildings Collapsed
1988	Bihar-Nepal Border	1,004	2,50,000
1991	Uttarkashi	768	42,400
1993	Killari	8,000	30,000
1997	Jabalpur	38	8,546
1999	Chamoli	100	2,595
2001	Bhuj	13,805	2,31,000
2004	Sumatra Tsunamis	> 1,31,000	80,000
2005	Kashmir	1,500	4,50,000

Approaches to Reduce Earthquake Risks

Two-pronged approach is required to reduce earthquake risk in India, namely

- **Ensure all New Constructions are Earthquake resistant:** New constructions should be built with at least the level of knowledge currently available in prevalent Indian standards, and hence made code compliant. To ensure that no new vulnerable structures are added to the existing stock of structures in the country, it is essential to improve regulatory framework so that all new constructions are code-compliant.

- **Ensure Seismic Retrofitting of Identified Vulnerable Construction:** Vulnerable buildings should be upgraded to meet specifications of prevailing Indian standards or other specifications laid down by statutory bodies and Ministries of the Union and State Governments. Retrofitting of existing vulnerable structures will mitigate losses during strong earthquake shaking.

Objectives of Selective Retrofitting

- **Safety:** Prevent loss of lives and property owing to collapse of buildings.
- **Governance Continuity:** Avoid handicap due to loss of critical and lifeline structures required in the aftermath of earthquakes; and
- **Economic Loss Reduction:** Make chosen structures including industrial structures meet certain stringent earthquake performance requirements towards maintaining business continuity and national productivity.

- Seismic retrofitting is needed for ensuring safety of both structural elements and of non-structural elements.

National Retrofit Program

- Considering gigantic number of buildings and structures to be retrofitted countrywide against seismic effects, a National Program on Seismic Retrofitting of Buildings and Structures in India should be launched with central coordinating office to address the issues of seismic retrofitting, like disruption planning, availability of funding and technology, designing, implementing and monitoring. These guidelines seek mandatory seismic retrofitting in a phased manner of all existing government-owned constructions and select existing privately-owned constructions, and encourage seismic retrofitting of all existing privately-owned constructions. Appropriate incentive schemes are necessary to ensure that owners of private constructions take up seismic retrofitting of existing constructions, a key component of earthquake risk reduction in the country.

Guidelines

- The Government must offer support to all stakeholders on Seismic Retrofit Technologies for various construction typologies.
- Provide incentives in terms of smaller municipal taxes, lower interest rates for bank loans intended for seismic retrofitting of buildings and structures
- Create a mechanism for building a Seismic Retrofit Fund, for undertaking seismic retrofitting of public interest government and private structures.
- Governments should undertake the exercise to have the precise enumeration of all structures under its purview of the different sets of typologies. Similarly, private sector organisations and agencies should be encouraged to prepare lists of their inventories.
- Seismic risk assessment should be conducted for all sets of buildings and structures. This risk assessment should consider hazard prevalent in the geographical region, vulnerability of typologies of construction that are likely to face expected shaking intensity, and exposure of the construction to life and property.
- The assessment should identify constructions with high risk. Thus, a prioritised list can be prepared for buildings and structures based on the level of risks.
- Special efforts should be made to make available financial resources at individual and institutional level through long term soft loans with low interest rates for seismic retrofitting.
- This can ensure that no additional vulnerable buildings and structures supported under Government schemes are added.

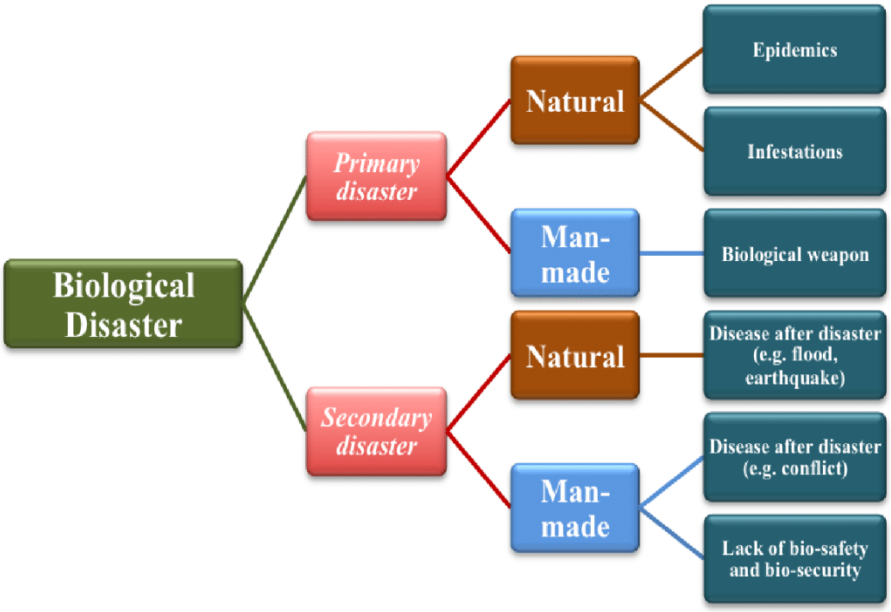
Biological Disaster Management

- The term "**Biological** **Disaster Management**" refers to the emergency plans in place in the event of a planned or unintentional biological release. The nature of the occurrence determines the response.

- A biological disaster is a disaster caused by the **rapid spread of disease among humans, animals, and plants, caused by microorganisms like bacteria, toxins, or viruses.** It is explained as the devastating effects produced by a **vast spread of a certain kind of living organism** – that may spread disease, virus, or infestations of plant, insect, or animal life on an epidemic or pandemic level.
- **Cholera, influenza H1N1(Swine-flu)**, and the most recent **COVID-19** outbreaks are examples of biological disasters.
- **Biological Hazards**
- It refers to the biological substances or organic matters produced by parasites, bacteria, fungi, viruses, and protein that threaten the health of living organisms, primarily that of humans—also known as Biohazards
- This comprises the medical waste and samples of a microorganism, virus, or toxin from numerous biological sources that can influence the health of the human body

Biological Warfare (BW)

- Also termed **Germ Warfare**, it is the use of biological toxins or infectious agents such as bacteria, viruses, and fungi to kill or incapacitate humans, animals, or plants as an act of war
- Biological weapons (often termed **"bioweapons," "biological threat agents," or "bioagents"**) are living organisms or replicating entities (viruses, which are not universally considered "alive") that replicate within their host victims
- The Ministry of Home Affairs (MHA) is the nodal ministry for Biological Warfare and associates with the Ministry of Health & Family Welfare in its management
- MHA is in charge of evaluating threat perceptions, setting up deterrent mechanisms, and providing intelligence inputs



Biological Disasters – Classifications

- Biological Disasters can take the following forms:
- **Epidemic**: Epidemics impact a disproportionately large number of persons within a group, community, or area at the same time. Examples include Cholera, Plague, Japanese Encephalitis (JE), and Acute Encephalitis Syndrome (AES).

- **Pandemic**: A pandemic is an outbreak of existing, new, or reemerging illnesses and pestilences that spreads across a broad territory, such as a continent or even the globe. Examples include Influenza H1N1 (Swine Flu) and COVID-19.

Biological Safety Levels

Charles Baldwin developed the symbol for biohazard in 1966.

- The US Center for Disease Control classifies biohazards into four biosafety levels as follows:

1. **BSL-1**: Bacteria and Viruses including Bacillus subtilis, some cell cultures, canine hepatitis, and non-infectious bacteria. Protection is only facial protection and gloves.
2. **BSL-2**: Bacteria and viruses that cause only mild disease to humans, or are difficult to contract via aerosol in a lab setting such as hepatitis A, B, C, mumps, measles, HIV, etc. Protection – use of autoclaves for sterilizing and biological safety cabinets.
3. **BSL-3**: Bacteria and viruses causing severe to fatal disease in humans. Example: West Nile virus, anthrax, MERS coronavirus. Protection – Stringent safety protocols such as the use of respirators to prevent airborne infection.
4. **BSL-4**: Potentially fatal (to human beings) viruses like Ebola virus, Marburg virus, Lassa fever virus, etc. Protection – use of a positive pressure personnel suit, with a segregated air supply.

Biological Disaster Management System

- The **nodal agency for handling epidemics – Ministry of Health and Family Welfare**
- Decision-making
- Advisory body
- Emergency medical relief providing
- The **primary responsibility of dealing with biological disasters is with the State Governments**. (Reason – Health is a State Subject).
- The nodal agency for investigating outbreaks – **National Institute of Communicable Diseases (NICD)**
- **Nodal ministry for Biological Warfare – Ministry of Home Affairs** (Biological warfare is the use of biological agents as an act of war)
- The NICD/Indian Council of Medical Research (ICMR) imparts teaching/ training, research, and laboratory support

Biological Disaster – Legislations

- The following legislations have been enacted in India for the prevention of biohazards and implementation of protective, eradicative, and containing measures when there is an outbreak:

1. The **Water (Prevention and Control of Pollution) Act, 1974**
2. The **Air (Prevention and Control of Pollution) Act, 1981**
3. The **Environmental (Protection) Act, 1986 and the Rules (1986)**
4. **Disaster Management Act 2005** – this provides for the institutional and operational framework for disaster prevention, mitigation, response, preparedness, and recovery at all levels.

Legal Framework

- The **Epidemic Diseases Act 1897**
- The **act was enacted to manage the bubonic Plague of Mumbai in 1897**.
- The law provides legal frameworks to manage disasters by providing special powers:
- **State Governments**: Regulation and Framework to manage Endemic affected regions, including Travel restriction
- **Central Government:** Power to form regulations and prescribe framework and restriction on travel.
- **Penalty Under Sec 188 of Indian Penal Code**.
- **People acting under the Act to be protected against any legal proceedings**.

Prevention of Biological Hazards

The basic measure to prevent and control biohazards is the elimination of the source of contamination.

Preventive Measures for workers in the field (medical):

- **Engineering controls** – to help prevent the spread of such disasters including proper ventilation, installing negative pressure, and usage of UV lamps.
- **Personal hygiene** – washing hands with liquid soap, proper care for clothes that have been exposed to a probably contaminated environment.
- **Personal protection equipment** – masks, protective clothing, gloves, face shield, eye shield, shoe covers.
- **Sterilization** – Using ultra heat or high pressure to eliminate bacteria or using biocide to kill microbes.
- **Respiratory protection** – surgical masks, respirators, powered air-purifying respirators (PAPR), air-supplying respirators.

Prevention of Biological Disasters

Prevention includes the following measures that should be taken before (preventive), during, and after any outbreaks.

Environmental Management:

1. Safe water supply, proper maintenance of sewage pipelines – to prevent waterborne diseases such as cholera, typhoid, hepatitis, dysentery, etc.
2. Awareness of personal hygiene and provision for washing, cleaning, bathing, avoiding overcrowding, etc.
3. Vector control:
   - Environmental engineering work and generic integrated vector control measures.
   - Water management, not permitting water to stagnate and collect and other methods to eliminate breeding places for vectors.
   - Regular spraying of insecticides, outdoor fogging, etc. for controlling vectors.
   - Controlling the population of rodents.

Post-disaster Epidemics Prevention:

1. The risk of epidemics is increased after any biological disaster.
2. Integrated Disease Surveillance Systems (IDSS) monitors the sources, modes of diseases spreading, and investigates the epidemics.

Detection and Containment of Outbreaks:

This consists of four steps as given under:

1. Recognizing and diagnosing by primary healthcare practitioners.
2. Communicating surveillance information to public health authorities.
3. Epidemiological analysis of surveillance data
4. Public health measures and delivering proper medical treatment.

Institutional Framework and operational framework

National Disaster Management Authority:

- The DM Act, 2005 was adopted on December 26, 2005, with the goal of providing for better disaster management.
- The Act aims to establish procedures at the national, state, and district levels to plan, prepare, and respond quickly to natural and man-made catastrophes and accidents.
- The Act mandates the following: **(a)** the establishment of a national apex body, the NDMA, with the Prime Minister of India as its Chairperson; **(b)** the establishment of SDMAs; and **(c)** the coordination and monitoring of DM activities at the district and local levels through the establishment of district and local level DM authorities.

National Crisis Management Committee (NCMC):

- The NCMC, which reports to the Cabinet Secretary, is responsible for coordinating and monitoring disaster response.
- The NCMC is made up of 14 union secretaries from several ministries, as well as the Chairman of the Railway Board.
- In the aftermath of disasters, NCMC ensures excellent coordination and implementation of emergency and relief actions.

National Disaster Response Force:

- The **NDRF was established by the DM Act of 2005** to provide specialised response to a threatening disaster situation or disaster.
- The NDMA is in charge of the force's overall supervision, direction, and control, while the Director General of the NDRF is in charge of its command and supervision.

Crowd Disaster Management

- **Crowd Disaster Management** refers to the substantiated and systematic planning and the guidance given to the orderly progress of occurrences where large crowds of people gather in a common area. As an element of crowd management, steps can be taken to control or restrict the conduct of groups of people.
- **Stampede**
  - The term stampede is applied to a **sudden rush of a crowd of people, usually resulting in many injuries and death from suffocation and trampling**. Stampedes are caused by surge of individuals in a crowd, in response to a perceived danger, loss of physical space or excitement.
  - Even when **crowd disasters** are not a recent phenomenon, they were supposed to be of localized nature and hence were not given their expected prominence. Nevertheless, with the ever-rising Indian population, large groups gathering at locations such as religious destinations, shopping malls, railway stations etc., might result in a mishap. Therefore, creating a national policy to manage this crowd disaster has become imperative.

Causes of Crowd Disaster

- **Structural failures**: The destruction of the interim facility, vertical stairs, narrow building because of unlawful structures, hawkers and parking, etc.
- **Electric/Fire Disasters**: Generally from the makeshift kitchens in public places, improper use of firecrackers or incorrect electrical wiring during the occasion.
- **Crowd Behavior**: Minimizing the size of the mass, lack of coordination with management, overselling of the tickets, mass panicking by sudden rush or rumours to get celebrity autographs or freebies.
- **Inadequate Security**: Insufficient deployment of safety team or security agencies taking drastic actions like firing teargas leading to in-crowd panic.
- **Lack of coordination among administrative agencies**: Lack of coordination between administrative agencies like fire service, police, shrine management, etc.

National Guide on Crowd Management-NDMA

- In view of the recurring stampedes at places of mass gathering, including religious places, and typically ad-hoc responses to those, the National Disaster Management Authority (NDMA) had prepared 'Suggestive Framework for Preparation of Crowd Management Plan for Events/Venues of Mass Gathering'.

The major recommendations include:

1. **Understanding venue, visitors and stakeholders:**
   - The basic element for event planning and crowd management is understanding the venue, visitors and different stakeholders.
   - It requires understanding of Type of event (such as religious, schools/ university, sports event, music event, political event, product promotion etc.); Expected Crowd (age, gender, economic strata), Crowd Motives (such as social, academic,

religious, entertainment, economic etc.); Venue (location, topography of area, temporal or permanent, open or closed), and role of other stake holders (such as NGOs, neighbours of event venue, local administrators etc.)

2. **Crowd Handling**
   - Traffic around the mass gathering venues should be properly regulated.
   - There should be a route map for venues along with emergency exits route maps.
   - There shouldBarricade facility to control the movement of crowd queues.
   - Snake line approach should be followed in case large crowd queues
   - The organizers of crowded events/venue managers should discourage general admissions and have plans to handle VIP visitors or, alternatively, refuse entry to VIPs where it adds to safety concerns.
3. **Safety and Security:**
   - The venue Organisers should ensure authorised use of electricity, fire safety extinguishers and other arrangements as per the safety guidelines.
   - It suggests use of CCTV cameras to monitor crowds and use of mini UAV incase crowd spread is too big
4. **Communication:** A public address system, with loudspeakers installed at all crowded points, to communicate with the crowds.
5. **Medical and Emergency care:** Medical first-aid rooms and emergency operations centres to handle post-disaster emergencies should be set up.
6. **Role of Event Managers:** The event organizers and venue managers should develop, implement, review and revise the disaster management plan in coordination with others including local administration and police.
7. **Role of Civil society**: Event/venue managers can involve NGOs and civil defence in traffic control, people flow control, medical assistance, sanitation and mobilization of local resources in case of disaster.
8. **Role of police:** The police should actively participate in venue assessment and preparedness checks and guide crowd and traffic movements.
9. **Capacity Building:** Capacity building, conducting drills, periodic assessment of training of security personnel, police is essential to prevent crowd disasters

National Disaster Response Force

- The National Disaster Response Force (NDRF) is an Indian **specialized force constituted "for the purpose of special response to a threatening disaster situation or disaster**" under the Disaster Management Act, 2005.
- The "Apex Body for Disaster Management" in India is the **National Disaster Management Authority (NDMA).**
    - The Chairman of the NDMA is the Prime Minister.
- Established in 2006, **NDRF is the world's single largest force** dedicated to disaster response.
- It is functioning under the **Ministry of Home Affairs,** within the overall command, control and leadership of the **Director-General.**
- **Organisation:**
    - At present, the NDRF consists of **15 battalions from the BSF, CISF, CRPF, ITBP, SSB and Assam Rifles.**
    - Each battalion has **18 self-contained specialist search** and rescue teams of **45 personnel each including engineers,** technicians, electricians, dog squads and medical/paramedics.
- **Functions:**
    - It is a **multi-skilled and high-tech** force that **effectively responds** to all types of **natural and man-made disasters**, including building collapses, landslides, devastating floods, and cyclones.
    - It is strategically deployed across the nation as per the vulnerability profile of the country.
        - The swift and effective response of NDRF during Japan Triple Disaster-2011 and Nepal Earthquake 2015 was acclaimed globally.

Background:

- The **Disaster Management Act, 2005 has made the statutory provisions for constitution of National Disaster Response Force (NDRF)** for the purpose of specialized response to natural and man-made disasters.
- Two national calamities in quick succession in the form of **Orissa Super Cyclone (1999) and Gujarat Earthquake (2001)** brought about the realization of the need of

having a specialist response mechanism at National Level to effectively respond to disasters. **This realization led to the enactment of the DM Act on 26 Dec 2005.**

Role and Mandate of NDRF:

- Specialized response during disasters.
- Proactive deployment during impending disaster situations.
- Acquire and continually upgrade its own training and skills.
- Liaison, Reconnaissance, Rehearsals and Mock Drills.
- Impart basic and operational level training to State Response Forces (Police, Civil Defence and Home Guards).
- Community Capacity Building Programme.
- Organize Public Awareness Campaigns.

Why it is said to be UNIQUE?

- It is the only **dedicated disaster response force** of the world.
- The **only agency with comprehensive response capabilities having multi-disciplinary and multi-skilled, high-tech, standalone nature.**
- **Experienced paramilitary personnel** specially trained and equipped for disaster response.
- Capabilities for undertaking disaster response, prevention, mitigation and capacity building

Saarthi

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