

G H RAISONI COLLEGE OF ENGINEERING & MANAGEMENT, NAGPUR

(An Autonomous Institute Affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur)

Accredited by NAAC with A+ Grade

Department of Civil Engineering

GH raisoni COLLEGE
Engineering and Management
Nagpur

raisoni EDUCATION

Name of Faculty	Dr. Monika Jain
Name of Subject-	Disaster Management
Subject Course Code-	UCEL415
Year/Semester	4th / VIIth

GH raisoni COLLEGE
Engineering and Management Nagpur

raisoni EDUCATION

Course Title: Disaster Management										
Semester	VII	Teaching Scheme				Evaluation Scheme				
						Theory			Practical	
Term	ODD	Th	Tu	Pr	Credits	TAE	CAE	ESE	INT	EXT
Course Category	PCC5	3 Hrs.	.	-	3	10	15	50	25	-
Course Code	UCEL415									
Teaching Mode	Offline	3 Hrs.			Total	75			-	
Duration of ESE	3.00					75				

Course Objectives	To understand various types of disaster situations and the basic concept of disaster management.
	To understand the various processes of risk management.
	To apply basic concepts and scientific strategies to Control Disaster hazards and preparedness.
Course Outcomes	CO1: Understand Types, Trends, Causes, Consequences, and Control of Disasters.
	CO2: Interpret the usefulness of integrating management principles in disaster Mitigation work.
	CO3: Apply the concept of Disaster Management.
	CO4: Evaluate the different approaches needed to manage pre-during and post-disaster periods.
	CO4:Develop modern tools to solve disaster-related issues in line with Sustainable technology.

Mapping

Course Outcomes	Program Outcomes and Program Specific Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2		1	2					1		1	2		
CO2	2	2	1		2	1				1		1	3	2	
CO3	2	2	1		2	1				1		1	3	2	
CO4	2	2	1		2	1				1		1	3	2	

Unit-1

Introduction to Disaster

Disaster :

A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses.

The action of reducing the severity, seriousness, or painfulness of something



strategy to minimize loss of life, property damage, and social disruption.

Disaster response is the actions taken directly before, during or immediately after a disaster

Disaster recovery is how you resume regular operations after a disaster.

Types of Disaster

These disasters can be :

- Geophysical (e.g. Earthquakes, Landslides, Tsunamis and Volcanic Activity)
- Hydrological (e.g. Avalanches and Floods)
- Climatological (e.g. Extreme Temperatures, Drought and Wildfires)
- Meteorological (e.g. Cyclones and Storms/Wave Surges)
- Biological (e.g. Disease Epidemics and Insect/Animal Plagues)

Natural disasters:

Natural Disasters are of the following type:

- Earthquakes
- Volcanic eruptions
- Cyclones
- Floods
- Droughts
- Tsunami
- Wild Fire

Earthquakes

An earthquake is a shaking of the ground caused by the sudden breaking and movement of tectonic plates of the earth's rocky outermost crust. The edges of the tectonic plates are marked by faults. Most earthquakes occur along the fault lines when the plates slide past each other or collide against each other. The shifting masses send out shock waves that may be powerful enough to alter the surface of the Earth, thrusting up cliffs and opening great cracks in the ground and cause great damage ... collapse of buildings and other man-made structures, broken power and gas lines, landslides, snow avalanches, tsunamis.

Volcanic Eruptions

- Volcanoes erupt when molten rock called magma rises to the surface. Magma is formed when the earth's mantle melts.
- Melting may happen where tectonic plates are pulling apart or where one plate is pushed down under another.
- Magma is lighter than rock so rises towards the Earth's surface. As the magma rises, bubbles of gas form inside it.
- Runny magma erupts through openings or vents in the earth's crust before flowing onto its surface as lava.
- If magma is thick, gas bubbles cannot easily escape and pressure builds up as the magma rises.
- When the pressure is too much an explosive eruption can happen, which can be dangerous and destructive.
- this can build up enough pressure to cause an explosion.

Cyclones

- To form a cyclone, warm, moist air over the ocean rises upward from near the surface. As this air moves up and away from the ocean surface, it leaves less air near the surface. So basically as the warm air rises, it causes an area of lower air pressure below.
- Air from surrounding areas with higher air pressure pushes in to the low pressure area. Then this new "cool" air becomes warm and moist and rises, too. And the cycle continues...
- As the warmed, moist air rises and cools the water in the air forms clouds. The whole system of clouds and wind spins and grows, fed by the ocean's heat and water evaporating from the ocean surface.
- As the storm system rotates faster and faster, an eye forms in the centre. It is very calm and clear in the eye, with very low air pressure. Higher pressure air from above flows down into the eye.

Man Made Disasters

Man made disasters can be the following:

- Nuclear disaster
- Chemical disasters
- Terrorism
- Accident
- Building collapse
- Civil Unrest
- Fire Accidents

Nuclear disaster

- An accident taking place in any nuclear facility of the nuclear fuel cycle including the nuclear reactor, or in a facility using radioactive sources, leading to a large-scale release of radioactivity in the environment.

- A 'criticality' accident in a nuclear fuel cycle facility where an uncontrolled nuclear chain reaction takes place inadvertently leading to bursts of neutrons and gamma radiation (as had happened at Tokaimura, Japan).

- An accident during the transportation of radioactive material.

- The malevolent use of radioactive material as Radiological Dispersal Device (RDD) by terrorists for dispersing radioactive material in the environment.

- A large-scale nuclear disaster resulting from a nuclear weapon attack (as had happened at Hiroshima and Nagasaki in Japan) which would lead to mass casualties and destruction of large areas and properties.

Chemical disasters

Chemical disasters are occurrence of emission, fire or explosion involving one or more hazardous **chemicals** in the course of **industrial** activity (handling), storage or transportation.

Disasters that are caused by the excessive use and misuse of **chemicals** in **industries** are called **chemical disasters**.

Exaples: **Bhopal**: Union Carbide gas tragedy, 1984 (Official death toll: 5,295).

The April 1986 disaster at the **Chernobyl** nuclear power plant in Ukraine.

Civil Unrest

Civil disorder, also known as civil disturbance or civil unrest, is an activity arising from a mass act of civil disobedience in which the participants become hostile toward authority, and authorities incur difficulties in maintaining public safety and order, over the disorderly crowd.

Understanding Risk and Vulnerability in Disaster Management

- Definition
- Introduction
- Disaster Management Cycle
- Disaster Risk Reduction (RR)
- Risk Analysis, assessment, management
- Disaster Management Cycle for some events
- Why DRR

Introduction

A disaster is as sudden, calamitous event that seriously disrupt the functioning of a community or society and causes human, material, and economic or environmental losses.



Definition:

A disaster can be defined as any occurrence that cause damage, ecological, loss of human life, deterioration of health and health services on a scale, sufficient to warrant an extraordinary response from outside the effected community or area.

Disaster management

Disaster management is how we deal with the human, material, economic or environmental impacts of said disaster, it is the process of how we “prepare for, respond to and learn from the effects of major failures”.



Introduction

The action of reducing the severity, seriousness, or painfulness of something

strategy to minimize loss of life, property damage, and social disruption.



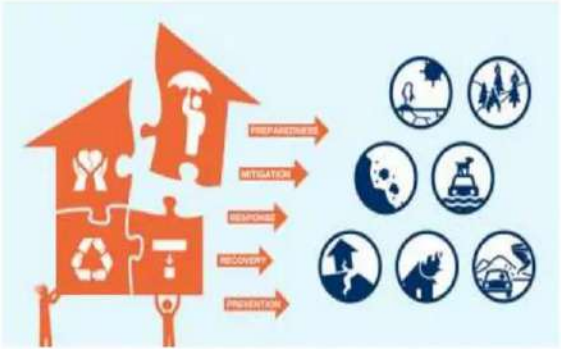
Disaster response is the actions taken directly before, during or immediately after a disaster

Disaster recovery is how you resume regular operations after a disaster.

Figure: Disaster Management Cycle

DISASTER RISK REDUCTION







Disaster Risk Reduction (DRR)

- Disaster risk reduction is aimed at **preventing new and reducing existing disaster risk and managing residual risk**, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development
- The concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events." (United Nations International Strategy for Disaster Reduction, 2009)





Some Important Definitions

- Risk
  - A measure of the potential for loss in terms of both the likelihood (events/year) of the incident and the consequences (effects/event) of the incident
  - Mathematically Risk = Σ probability of event $\times$ consequence of event

Risk Analysis

- The development of a quantitative estimate of risk based on engineering evaluation & mathematical techniques for combining estimates of incident likelihood and consequences

Some Important Definitions

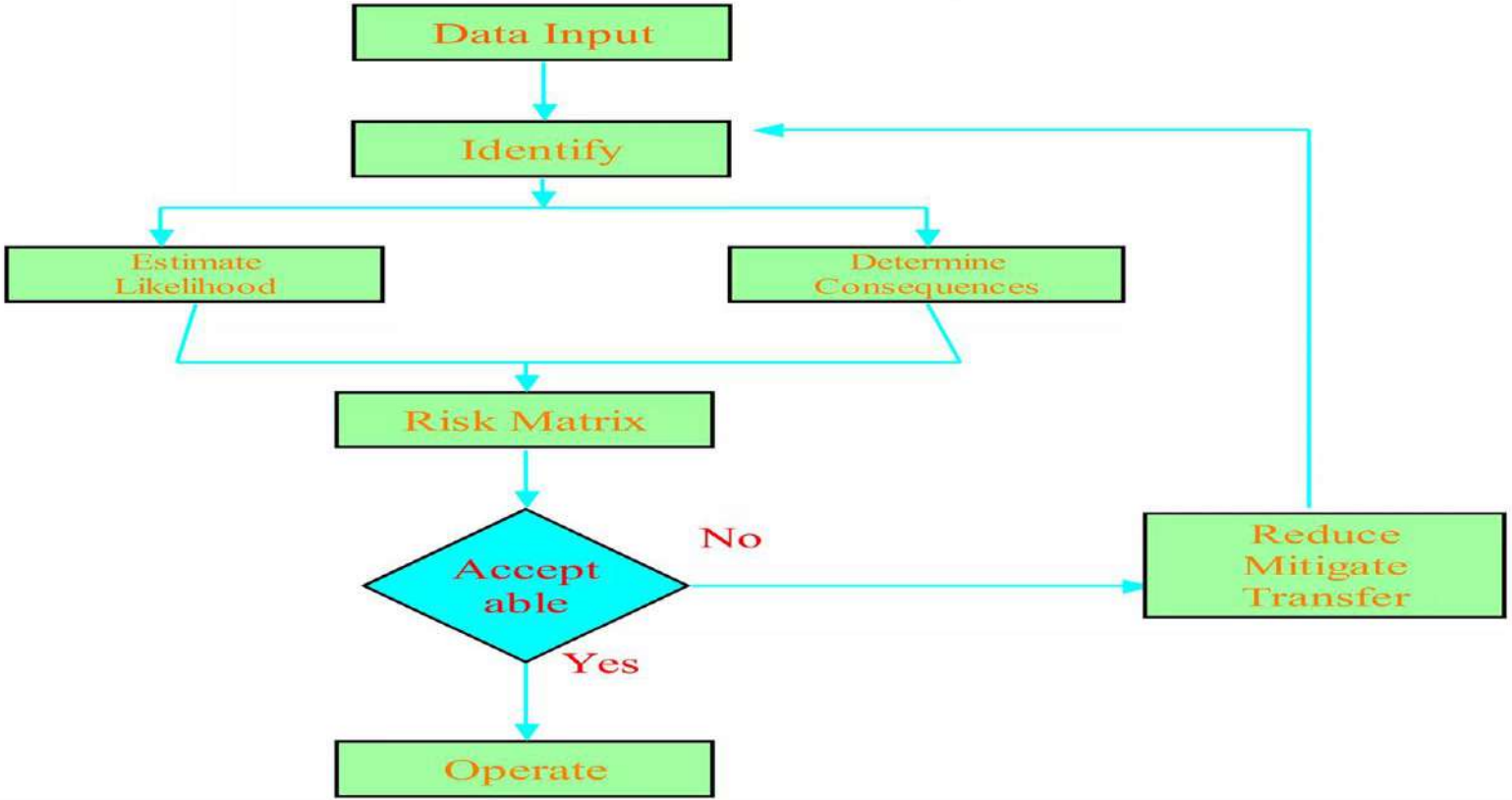
- Risk Assessment
  - The process by which the results of a risk analysis (i.e., risk estimates) are used to make decisions, either through relative ranking or through comparison with risk targets

- Risk Management
  - The planning, organizing, leading and controlling of an organization's assets and activities in ways, which minimize the adverse operational and financial effects of accidental losses upon the organization

Risk Analysis?

- It is an important part and precursor of risk assessment and management
- A full analysis involves the estimation *of* the frequency and consequences of a range of hazards scenarios and the damages expected.
- Damages include injury and loss of life, damage to the environment and equipment, loss of work, and finally also economic loss to the plant

Risk Management Procedure



Disaster Risk Assessment?

3 Factors:
1. Probability of Hazard
2. Vulnerability
3. Coping Capacity

$$DRA = \frac{\text{Probability of Hazard} \times \text{Vulnerability}}{\text{Capacity}}$$

1. Probability of Hazard

Amount of possible loss due to any disaster depends on the probability of occuring of hazards

Hazards >>> Disasters >>> Loss

Higher Probability of Hazards = High Disaster Risk

Lower Probability of Hazards = Low Disaster Risk

2. Vulnerability

The conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards.

Higher Vulnerability = High Disaster Risk

Lower Vulnerability = Low Disaster Risk

3. Capacity

How is the coping capacity of community or society is to fight any disaster

Higher Coping Capacity = Low Disaster Risk

Lower Coping Capacity = High Disaster Risk

Codes & Standards for Risk Analysis

- American Institute of Chemical Engineers have Guidelines for Chemical Process Quantitative Risk Analysis & Hazard Evaluation Procedures, OSHA has 29 CFR 1910.119, EPA Risk Management Plan (RMP)
- India has its own BIS guidelines in BIS 18001, guidelines by labour ministry
- Even in non chemical industries codes like Nuclear Regulatory Commission NUREG/CR-2815 , IEC 61508, SEMI S10 - Safety Guideline for Risk Assessment, S14 - Safety Guide for Fire Assessment & Mitigation for Semiconductor Manufacturing Equipment

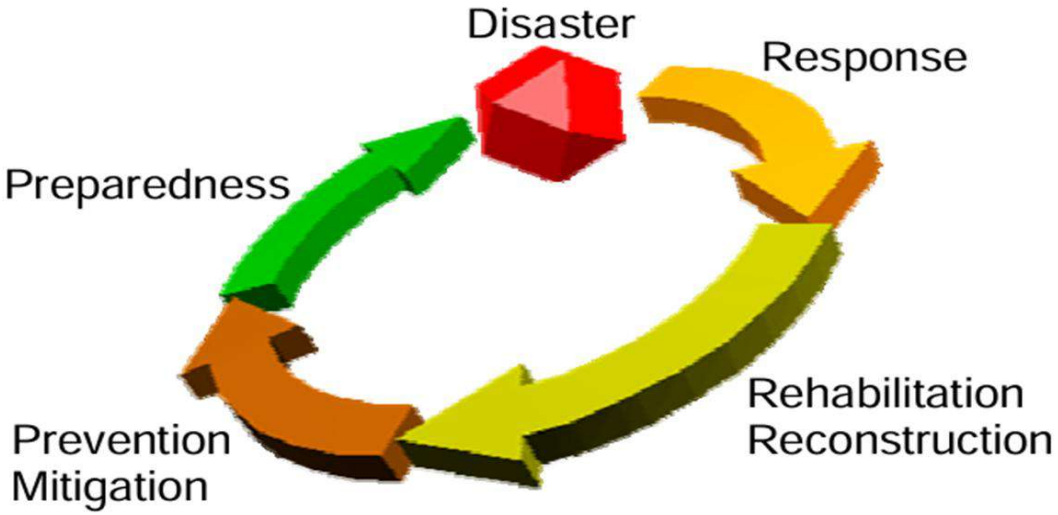


Fig. Disaster Risk Management Cycle

Disaster Management Cycle for some events

Phase \ Disaster	Earthquake	Flood	Storm (cyclone, typhoon, hurricane)	Landslide
Prevention/ Mitigation	- Seismic design - Retrofitting of vulnerable buildings - Installation of seismic isolation/ seismic response control systems	- Construction of dike - Building of dam - Forestation - Construction of flood control basins/ reservoirs	- Construction of tide wall - Establishment of forests to protect against storms	- Construction of erosion control dams - Construction of retaining walls
Preparedness	- Construction and operation of earthquake observation systems	- Construction and operation of meteorological observation systems	- Construction of shelter - Construction and operation of meteorological observation systems	- Construction and operation of meteorological observation systems
	- Preparation of hazard maps - Food & material stockpiling - Emergency drills - Construction of early warning systems - Preparation of emergency kits			

Response	- Rescue efforts - First aid treatment - Fire fighting - Monitoring of secondary disaster - Construction of temporary housing - Establishment of tent villages
Rehabilitation/ Reconstruction	- Disaster resistant reconstruction - Appropriate land use planning - Livelihood support - Industrial rehabilitation planning

Why DRR

Disaster causes the loss of lives and properties. Disaster also turns one's life upside down. Disaster could erase all the social and economic progress achieved till date.

Therefore, although disaster couldn't be totally prevented, its impact can be reduced.

DRR thus, helps in identifying the vulnerable groups early and protecting them.

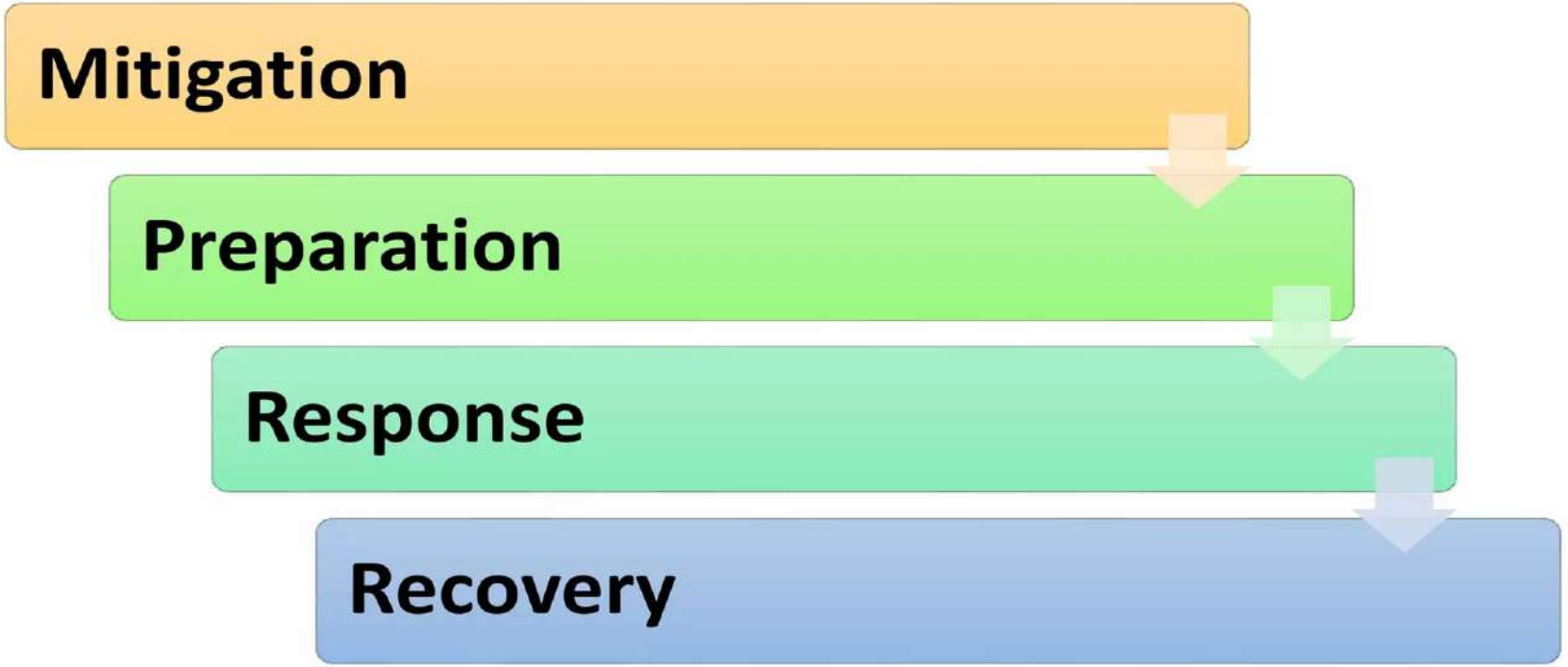
DRR is the way of being prepared against the sudden disasters

Natural hazards are naturally-occurring physical phenomena caused by either the rapid or slow onset of events having atmospheric, geologic and hydrologic origins on solar, global, regional, national or local scales.

Disasters often follow natural hazards, and they are a result of the combination of hazards, the conditions of vulnerability and of the insufficient capacity or measures to reduce the potentially negative consequences of the hazard.

Disaster risk reduction is the concept and practice of reducing disaster risks through systematic efforts to analyse and reduce the causal factors of disasters.

Components of DRR



Mitigation


Mitigation refers to the action that are to be taken before the occurrence of an event.
Mitigation phase is for reducing the overall risk and impacts.
Vulnerability assessment
Risk assessment
Hazard assessment

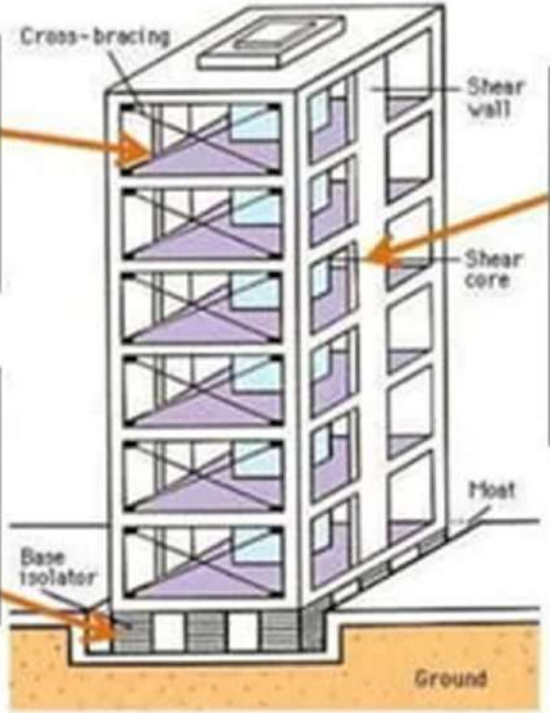
Disaster Mitigation includes

- Reviewing building codes.
- Vulnerability analysis updates.
- Zoning and land-use management and planning.
- Reviewing of building use regulations and safety codes
- Implementing preventative health measures
- Political intervention and commitment
- Public awareness

Earthquake Resistant Building

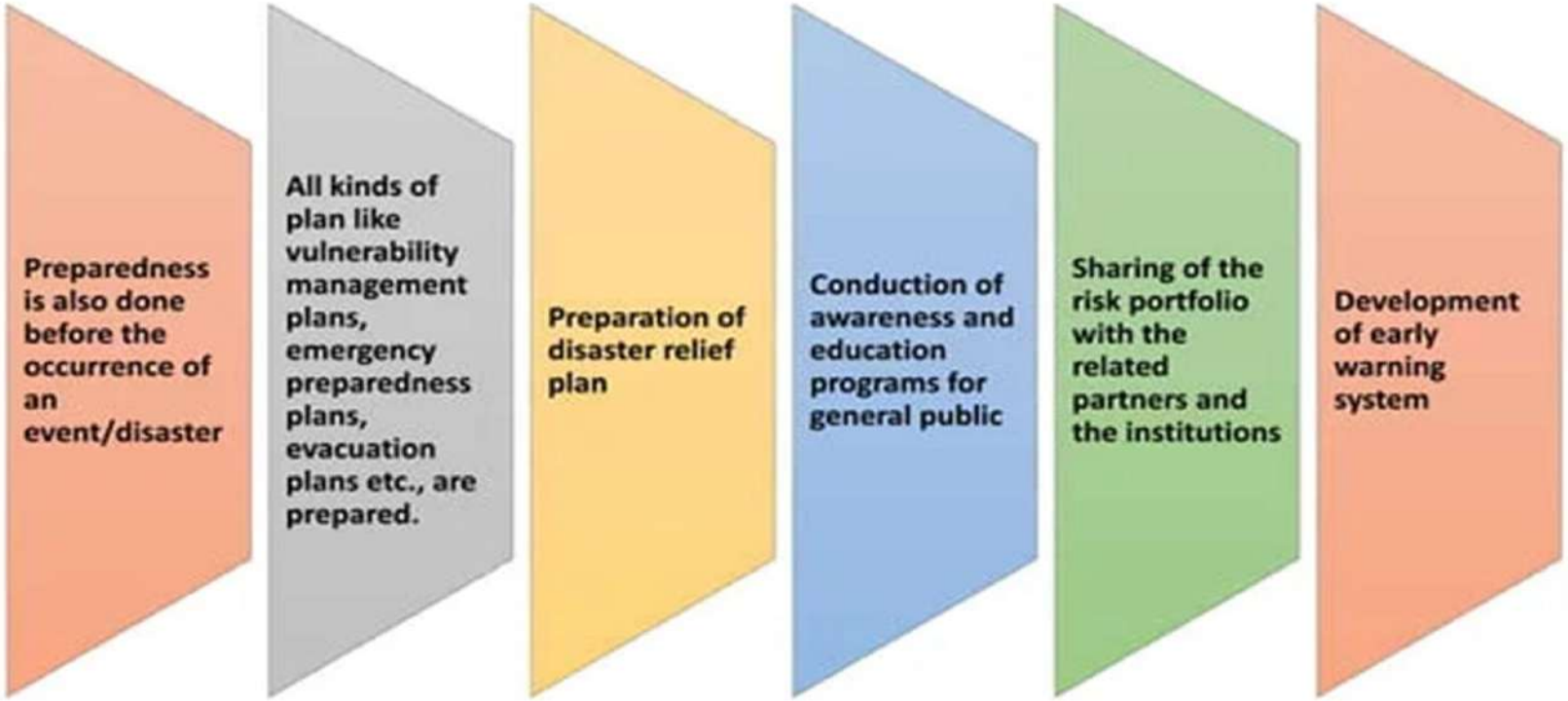
Cross-bracing
Reinforce walls using two steel beams

Shock absorbers (base isolators)
absorb tremors of earthquakes



Shear walls
(concrete walls with steel bars in them) to reduce rocking movements

Preparedness



Response

- Refers to the activities that are done after the event or disaster has occurred
- Saving human life is major concern at this stage
- Evacuation, Migration, administrating first-aid, transportation of affected people to hospital
- Emergency services (food, shelter, medical attention, etc.)
- Provision for medical help
- Coordination action between the local and international actions
- National and international support

Response

The mission of the response phase is to meet the basic needs of the people until more permanent and sustainable solutions are formulated.

There is growing awareness of costs associated with improper management of disasters and hence communities and government are trying hard to improve the first responder efforts.

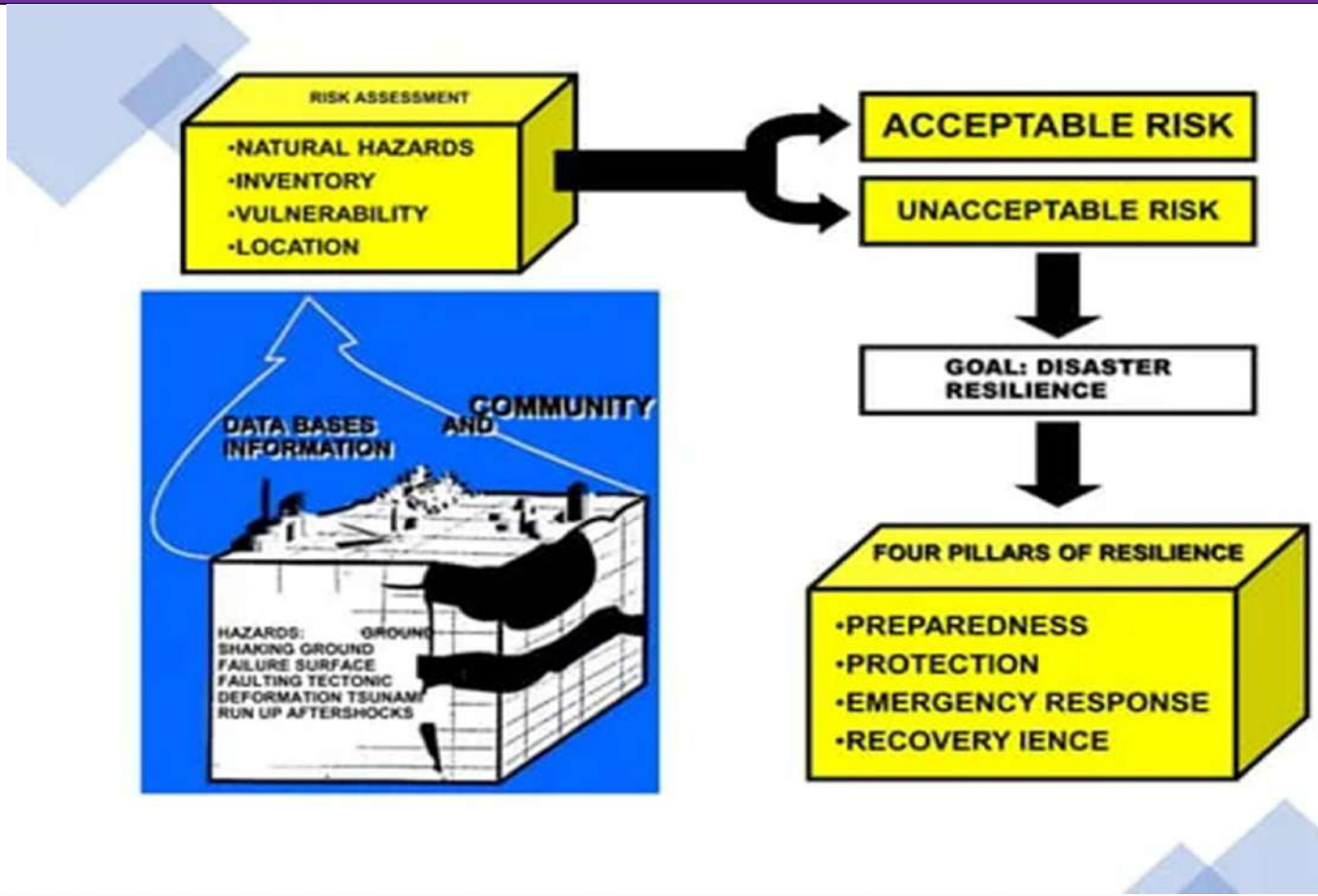
Disaster response is aimed at providing instant support to maintain life and health of the affected population.

There is a wide array of response activities carried out after disaster like first-aid, transportation, shelter and food, initial repairs to damaged infrastructure.

Recovery



- Recovery is a post disaster action
- Create emergency relief fund
- Rehabilitate the victims
- Reconstruction of the damages properties or make arrangement (through loans)
- Psychological counselling


RISK ASSESSMENT
•NATURAL HAZARDS
•INVENTORY
•VULNERABILITY
•LOCATION
ACCEPTABLE RISK
UNACCEPTABLE RISK
GOAL: DISASTER RESILIENCE
FOUR PILLARS OF RESILIENCE
•PREPAREDNESS
•PROTECTION
•EMERGENCY RESPONSE
•RECOVERY IENCE
DATA BASES AND COMMUNITY INFORMATION
HAZARDS:
SHAKING GROUND
FAILURE SURFACE
FAULTING TECTONIC
DEFORMATION TSUNAMI
RUN UP AFTERSHOCKS

Strategies to Strengthen DRR

International DRR efforts

- Many countries are putting an effort to develop and implement the strategy for DRR.
- Financial and technical support also enhances DRR effort.
- International support and assistance at such situation encourage for DRR plan.

Integration of DRR into national policy

- Political commitment is key to advancing DRR issues at all levels.
- This integration helps in bringing overall change.
- DRR needs to be integrated in all developmental projects
- Along with commitment requires transparency.
- Such integration is also necessary to gain international support and assistance.
- Many international conferences and organizations also emphasize on integration of DRR plans into national policy.

HAZARDS

'HASARD' in French and *'AZ-ZAHR'* in Arabic

meaning 'chance' or 'luck'

"A **dangerous condition** or **event**, that threat or **have the potential for causing injury to life or damage to property** or the **environment**"

VULNERABILITY

Latin ***vulnerabilis,*** from Latin ***vulnerare*** 'to wound', from ***vulnus*** 'wound'

THE DEGREE OF SUSCEPTIBILITY AND RESILIENCE OF THE COMMUNITY AND ENVIRONMENT ---------TO--------- **HAZARDS**

SUSCEPTIBILITY means being likely or liable to be influenced
RESILIENCE means the capacity to recover quickly from difficulties

IT DEPENDS ON THE CHARACTERISTICS OF A PERSON OR A GROUP

IN TERMS OF

CAPACITY TO ANTICIPATE, COPE WITH, RESIST AND RECOVER FROM THE IMPACT OF HAZARD

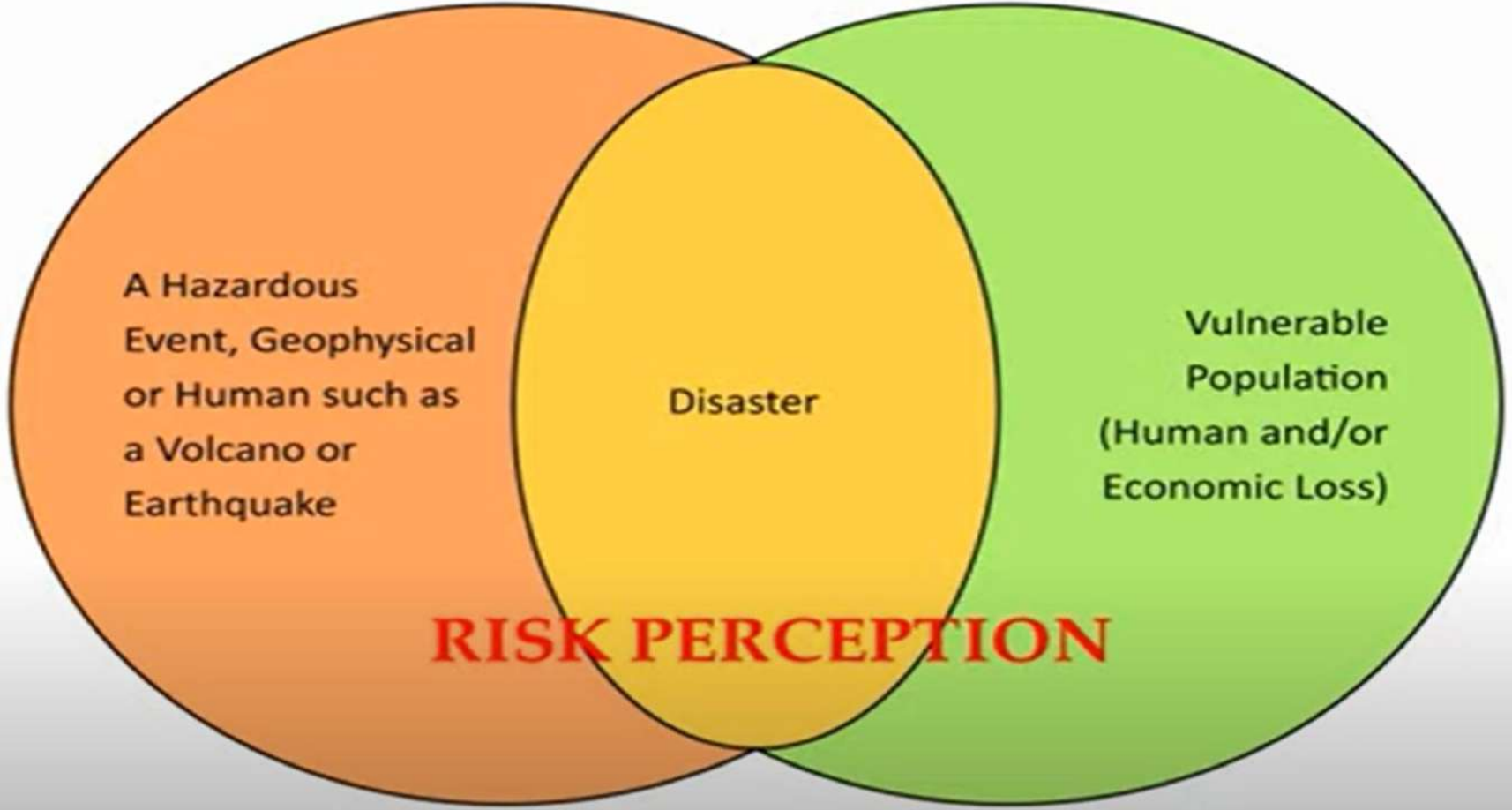
RISK

RISK INCLUDES TWO ELEMENTS

POSSIBILITY and PROBABILITY

the likelihood of something happening
the probable consequences if it happens

"Risk occurs where factors and processes are sufficiently measurable for believable probability distributions to be assigned to the range of possible outcomes"


A Hazardous Event, Geophysical or Human such as a Volcano or Earthquake
Disaster
Vulnerable Population (Human and/or Economic Loss)
RISK PERCEPTION

Disaster Preparedness

Disaster Preparedness

Disaster preparedness - is ongoing multisectoral activity. Integral part of the national system responsible for developing plans and programmes for disaster management, prevention, mitigation, response, rehabilitation and reconstruction.

Co-ordination of a variety of sectors to carry out-

- Evaluation of the risk.
- Adopt standards and regulations.
- Organize communication and response mechanism.
- Ensure all resources- ready and easily mobilized.
- Develop public education programmes.
- Coordinate information with news media.
- Disaster simulation exercises.

Medical Preparedness & Mass Casualty Management

- Developing and capacity building of medical team for Trauma & psycho social care,
- Mass casualtymanagement and Triage.
- Determine casualty handling capacity of all hospitals. Formulate appropriate treatment procedures.
- Involvement of private hospitals.
- Mark would be care centers that can function as a medical units.
- Identify structural integrity and approach routes.

Disaster Response

Immediate reaction to disaster as the disaster is anticipated, or soon after it begins in order to assess the needs, reduce the suffering, limit the spread and consequences of the disaster, open up the way to rehabilitation.

By-

- **M**ass evacuation
- Search and rescue
- Emergency medical services
- Securing food and water
- Maintenance of Law & Order



EARLY WARNING SYSTEM



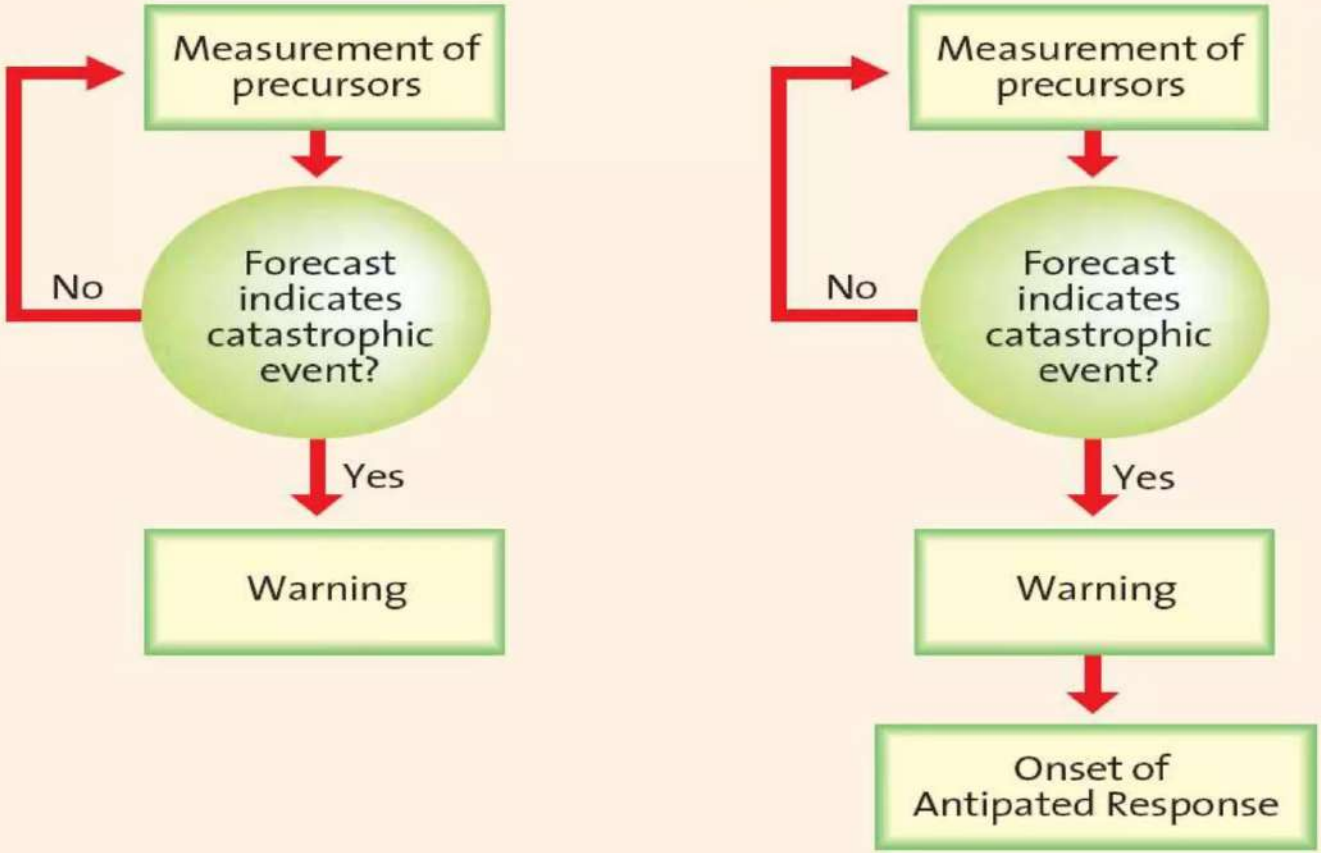
- An **Early Warning System** (EWS) can be defined as a set of capacities needed to generate and disseminate timely and meaningful warning information of the possible extreme events or disasters (e.g. floods, drought, fire, earthquake and tsunamis) that threatens people's lives.
- The purpose of this information is to enable individuals, communities and organizations threatened to prepare and act appropriately and in sufficient time to reduce the possibility of harm, loss or risk.

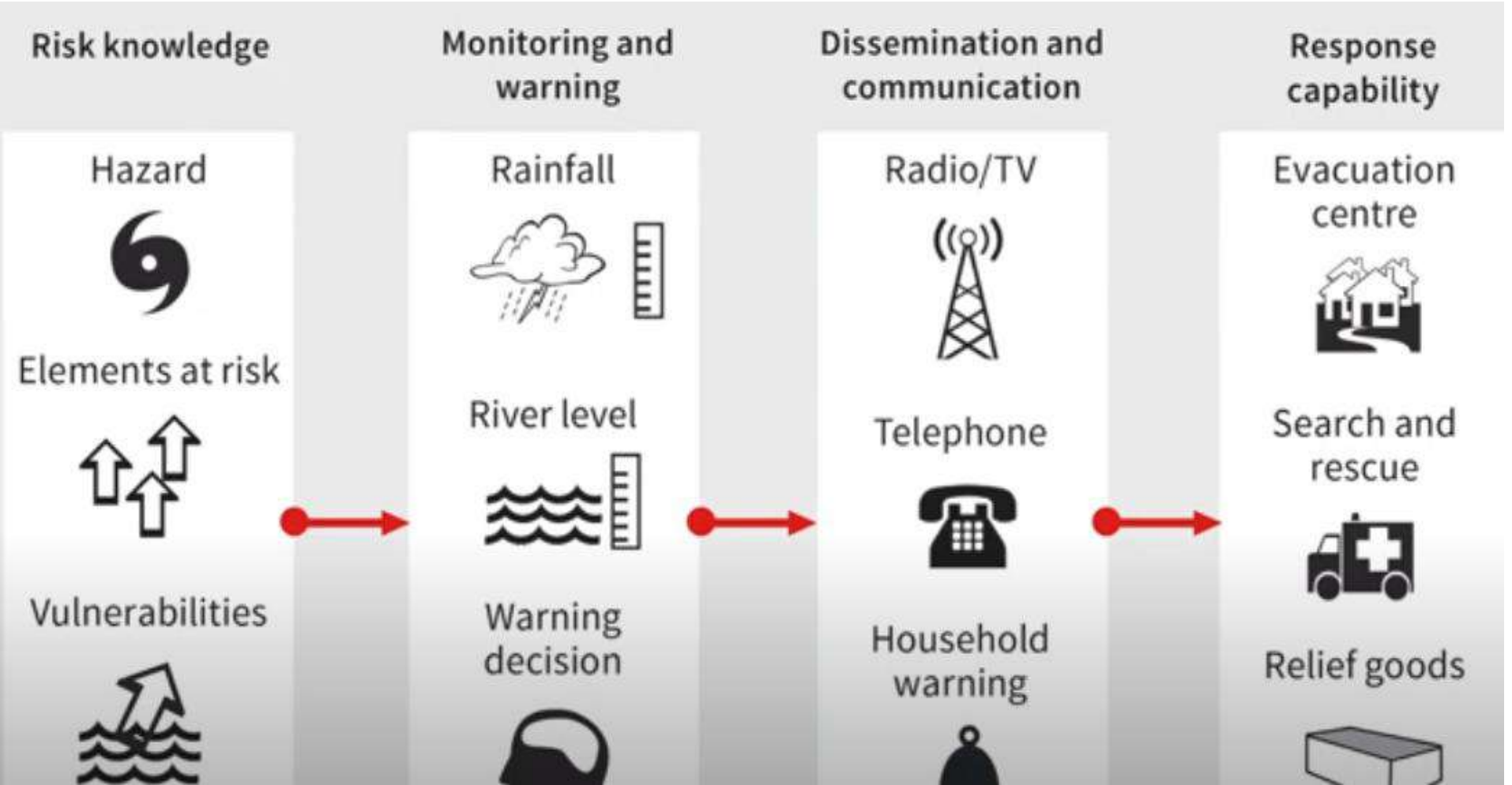


CHARACTERISTICS OF EWS

- Effective early warning systems require strong technical foundations and good knowledge of the risks.
- But they must be strongly people centered – with clear messages, dissemination systems.
- Public awareness and education are critical; in addition, many sectors must be involved.
- Effective early warning systems must be embedded in an understandable manner and relevant to the communities which they serve.

Three phases of early warning systems




Risk knowledge
Hazard
Elements at risk
Vulnerabilities
Monitoring and warning
Rainfall
River level
Warning decision
Dissemination and communication
Radio/TV
Telephone
Household warning
Response capability
Evacuation centre
Search and rescue
Relief goods

AGENCIES FOR FORECASTING

Disasters	Agencies
Cyclone	Indian Meteorological Department
Tsunami	Indian national centre for oceanic information services
Floods	Central water commission
Earthquakes	Indian Meteorological Department

Disaster Response

Response is the first stage of the disaster management cycle when a disaster has occurred or is imminent. Disaster response activities include setting up control rooms, putting the contingency plan in action, issue warning, action for evacuation, taking people to safer areas, rendering medical aid to the needy etc. Responders also need to cope with response-generated demands such as the need for coordination, communications, ongoing situation assessment and resource mobilization during the emergency period.

Response

- The task of limiting injuries, loss of life, and further damage to property and the environment is diverse.
- Response includes directly address the immediate needs of first aid, search and rescue, and shelter
- Rescue includes systems that to coordinate and support such efforts.
  - Response involves the rapid resumption of critical infrastructure (such as opening transportation routes, restoring communications and electricity, and ensuring food and clean water distribution) to allow recovery to take place, reduce further injury and loss of life, and speed the return to a normally functioning Society.

Response

- ***Last-minute mitigation and preparedness measures.***
  - Actions taken in last hours limit the hazard's consequences.
  - For instance, before a flood, sandbags may be used to increase the height of levees or to create barriers around buildings and other structures.
  - Windows and doors may be boarded up or shuttered before a windstorm.
  - Vaccines and other prophylaxis may be used to minimize infection rates with epidemics.
  - The public may be reminded of stockpiling and other preparedness actions they still have time for (such as purchasing extra water, food, batteries, and candles).

Response

- ***Disaster assessments***
  - **Situation assessment or damage assessment** determines impacts of the hazard.
    - Situation assessments can help determine the geographic scope of the disaster, and how it has affected people and structures
  - ***Needs assessment*** involves gathering data on the services, resources, and other assistance that will be required to address the disaster
- ***Provision of water, food, and shelter***
- ***Sanitation***
- **Safety and security**
- **Critical infrastructure resumption**
  - Transportation systems (land, sea, and air)
  - Communications
  - Electricity
  - Gas and oil storage and transportation
  - Water supply systems
  - Emergency services
  - Public health ● Continuity of government

Response

- Resumption of noncritical infrastructure
  - Education
  - Prisons
  - Industrial capacity
  - Information systems
  - Mail system
  - Public transportation
  - Banking and finance
- Emergency social services
  - *Providing service to deal with stress and trauma*
- Donations management
- *Coordination*

Response

- **The disaster declaration process**
  - The disaster declaration is a way for governments to acknowledge that response resources have become overwhelmed and to announce that additional assistance is required and, likewise, requested.
  - The legal mechanisms established to guide how disaster declaration takes place depend upon the nation's form of government and the rules outlined in any established emergency operations planning.

Disaster needs assessment reporting

Ongoing assessment approach for rapid-onset disasters						
Pre-disaster			**Post-disaster**			
	When possible	First 10 hours	**12-36 hours (& then, as needed)**	**7-15 days**	**30-60 Days**	**3 months**
Assessment type	Forecasting & early warning	Disaster (early) notification	More detailed disaster needs assessment	Ongoing monitoring of situation and needs		
Information needs	**Collect and disseminate early warning information** (especially for flash floods, tsunamis, storms, volcanoes, forest fires, etc.)	**Alert headquarters** • Disaster type, date • # casualties reported • # properties damaged and type of damage • Immediate emergency priority needs (e.g. search & rescue, first aid)	**Assessment team** • Disaster magnitude • Geographic area affected • Detailed assessment of needs and resources and other responders • Define intervention for ensuing weeks and months (if necessary)	**Continued monitoring and assessment** • Ongoing situation, responseand needs • Changes in status and needs • Need for longer-term assistance and rehabilitation (after 3 months) • Plan of action for assistance to continue past 3 months		

Immediate Medical Response

- **Triage**: Sorting patients by priority
- **First Aid**: CPR, stopping bleeding, managing fractures
- **Communication**: Coordinating with emergency responders, hospitals
- **Transport**: Quick evacuation of critically injured to medical facilities

Hospital Emergency Plans

- **Emergency units**: Establishing temporary medical centers
- **Coordination**: Working with local and international agencies
- **Surge capacity**: Handling mass casualties
- **Stockpiling**: Medicines, water, blankets, surgical tools

Public Health Response

- **Disease prevention**: Vaccination, sanitation, clean water distribution
- **Mental health**: Psychological first aid, counseling for victims and responders
- **Long-term effects**: Managing chronic illnesses, trauma-related health issues

Rehabilitation, Reconstruction and Recovery

Introduction

Disaster management includes four phases; mitigation, preparedness, response, and recovery. Rehabilitation relates to the work undertaken in the following weeks and months, for the restoration of basic services to enable the population to return to normalcy. The reconstruction is a rebuilding measure that involves building the confidence, self-respect, self-esteem, self-dependency, mutual support and trust and the rebuilding of communities. In order to have a successful completion of disaster reconstruction it is important to include the participation of social actors of the community.

Definitions of some terms:

Recovery:Recovery is used to describe the activities that encompass the three overlapping phases of emergency relief, rehabilitation and reconstruction.

Rehabilitation: Rehabilitation includes the provision of temporary public utilities and housing as interim measures to assist long-term recovery

Reconstruction:Reconstruction attempts to return communities to improved pre-disaster functioning. It includes such as the replacement of buildings; infrastructure and lifeline facilities so that long-term development prospects are enhanced rather than reproducing the same conditions, which made an area or population vulnerable in the first place.

Development:In an evolving economy, the development process is an ongoing activity. Long-term prevention/disaster reduction measures

Principles of reconstruction

1.In reconstruction the most vulnerable and marginalized sections like women, children, the poorest section of society, etc. are the primary stakeholders who need to be considered as partners in the empowering process.

2.The processes of recovery and reconstruction can go beyond the provision of basic needs.

3.The recovery activities, which include both short and long term, continue until all systems return to normal or improved status.

4.The rehabilitation phase includes medium term interventions such as

- construction of transitional housing,
- provision of basic food to the affected population,
- provision of social services,
- road clearing,
- income generation,
- water system rehabilitation

The scope of a disaster may be

- One room
- One floor
- One building
- One organization
- One community
- One region
- One nation

Sectors can be vulnerable to disaster impact, and which, therefore, will require rehabilitaton and reconstruction inputs:

- Buliding
- Infrastructure
- Economic assets(including formal and formal commercial sectors,industrial and agricultural activities etc)
- Diminstrative and political
- Psychological
- Cultural
- Social
- Environmental

14.2 ESSENTIAL FEATURES OF DAMAGE ASSESSMENT

Flow of Information

There is a clearly defined sequence to managing information:

- Converting raw data to useful information;
- Information input;
- Sorting (grading, collating, discarding what is unreliable);
- Evaluation;
- Decision making;
- Information output (dissemination); and
- Action

Rapid Damage Assessment

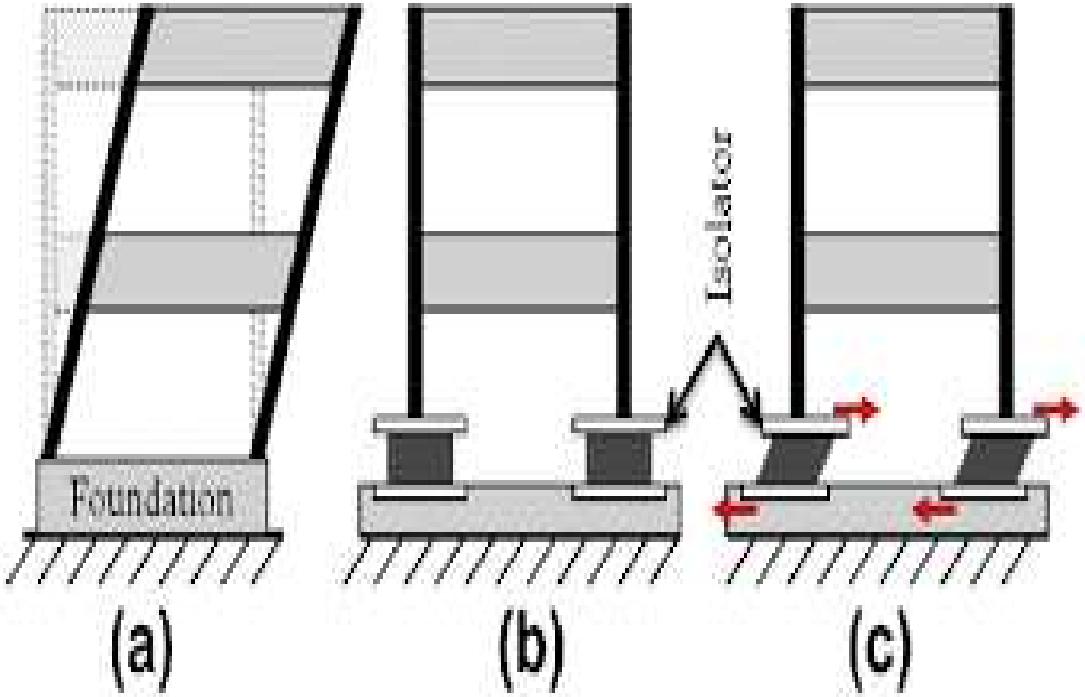
The official agency for reporting estimates of disaster damages is usually the Revenue and Relief Department of the state government, as they are also the authority for distributing relief to affected persons. As usual, there is a hierarchy of officials who report from the lowest level of Villages/Panchayats through Blocks/Revenue Circles, Tehsils/ Talukas, and Sub-divisions and finally to the districts and then to the state headquarters. However, relief agencies including NGOs also have their own damage assessment systems and teams to carry out the assessments. The basic items covered in rapid assessment are:

- Name of the place
- The causative disasters
- Date and time of disaster strike
- Area affected
- Total number of villages or neighbourhoods affected
- Total population
- Population affected in terms of number of people and households
- Details of local bodies (panchayats or wards/municipalities) affected
- In case of floods, area still under water
- In case of an earthquake or cyclone, buildings damaged
- Infrastructure affected (transportation, power, social infrastructure)

Detailed Damage Assessment

Detailed damage assessment goes further than the rapid assessment, and it includes the following additional information regarding disaster damage:

- Verified number of human lives lost and number of injuries
- Livestock lost
  - a) Number
  - b) Estimated Value
- Details of damage to crops in hectares and estimated loss of produce in quintals
  - a) Hectares completely damaged
  - b) Hectares partially damaged
  - c) Hectares likely to be replanted or re-sown
  - d) Extent affected in percentage
  - e) Crops lost in quintals
  - f) Estimated value of crops lost in rupees
- Houses damaged or destroyed
  - a) Number
  - b) Estimated value
- Loss to public works and utilities including local bodies property





Base Isolators



Dampers