**Unit I**

**Introduction Disaster**

**Understanding the concepts and definitions of Disaster**

A disaster is an event of nature or man-made that leads to sudden disruption of normal life of a society, causing damage to life and property to such an extent that normal social and economic values available are inadequate to restore normalcy after a disaster.

**General Concepts of Disaster**

**Hazard:-**

A hazard is a dangerous phenomenon, substance, human activity or condition. It may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

**Vulnerability:-**

Vulnerability is the quality of being easily hurt or attacked. Some seniors think it's funny to pick on the ninth graders because of their vulnerability. Vulnerability comes from the Latin word for "wound," vulnus.

**Risk:-**

Risk is the possibility of something bad happening, such as injury, loss, or damage. It can also refer to the uncertainty of the consequences of an activity, especially when those consequences are negative.

Here are some examples of risk:

* Health risk: The chance of harm or adverse health effects from exposure to a hazard
* Business risk: The probability that hazards may hurt employees or the business
* Financial risk: The chance of loss or uncertainty with regard to loss in an insurance contract
* Personal risk: The chance of loss or injury to a person

**Introduction**

A disaster is a serious disruption to a community or society that causes widespread human, material, economic, or environmental losses. Disasters can be caused by natural events, man-made events, or technological hazards. They can also be influenced by factors that make a community more vulnerable or expose it to more risk.

Here are some examples of disasters:

* **Natural disasters**: Earthquakes, hurricanes, floods, tornadoes, avalanches, and wildfires
* **Man-made disasters**: Oil spills, terrorist attacks, power outages, nuclear and radiological disasters, biological disasters, and chemical disasters

Disasters can be difficult to separate into natural and man-made categories because human actions can make natural disasters worse. Climate change can also increase the frequency of disasters caused by extreme weather.

The term "disaster" comes from the French word desastre, which is a combination of the words des meaning bad and aster meaning star.

The primary concept of a disaster is a serious disruption to a community or society that exceeds its ability to cope:

**Definition:-** A disaster is a serious disruption to a community or society that causes widespread human, material, economic, or environmental losses and impacts.

**Causes:-** Disasters can be caused by natural events, such as earthquakes, hurricanes, flooding, or tornadoes, or by man-made events, such as accidental toxic spills or nuclear power plant events.

**Effects**

Disasters can cause:

* + Human losses
  + Material losses
  + Economic losses
  + Environmental losses
  + Destruction of physical assets
  + Disruption of basic services
  + Damage to sources of livelihood

**Scale:-** Disasters can be immediate and localized, but can also be widespread and long-lasting.

**Approaches to disaster risk reduction for disaster management**Some approaches to disaster risk reduction (DRR) include:

**Early warning systems**

Improving monitoring and warning systems, and building trust between stakeholders

**People-centered approach**

Transferring risk management responsibility from the government to citizens

**Community-based disaster risk management**

Considering underlying risk factors, such as social factors, and focusing on community participation

**Preparedness**

An ongoing process of planning and training for what to do in the event of a disaster

**Digital solutions**

Collecting and analyzing context-driven data from multiple sources to better understand emerging risks

DRR is an essential part of social and economic development, and is crucial to achieving sustainable development. The goal of DRR is to reduce the risk of disasters and losses in lives, livelihoods, health, and economic, physical, social, cultural, and environmental assets.

**Various steps during Pre-Disaster Management:**

The steps in pre-disaster management include:

* Assessing risks: Identify potential risks and threats
* Developing information systems: Create systems to gather and share information
* Mobilizing resources: Prepare resources to be used in the event of a disaster
* Issuing warnings: Use various communication channels to warn people of potential disasters
* Ensuring safe transportation: Make arrangements to safely transport people to secure locations

The main goal of pre-disaster management is to reduce the number of human losses. Disaster preparedness activities can help prevent disasters and save lives and livelihoods.

Risk assessment and analysis are part of the pre-disaster management process, which involves taking action to reduce the risk of human loss before a disaster occurs:

**Hazard identification:-** Identify situations and processes that could cause harm, particularly to people.

**Risk analysis and evaluation:-** Determine the likelihood of each hazard occurring and the severity of its consequences.

**Risk prioritization:-** Prioritize risks for the purpose of managing them. This can be done by presenting the analyzed risks in different ways to help visualize and prioritize them.

**Risk mitigation:-** Prepare for all potential risks, but weigh the impact of each risk and prioritize planning around that impact.

**Preparedness:-** Develop plans of action to manage and counter risks, and take action to build the necessary capabilities to implement those plans.

**Capacity:-** Build the strengths, attributes, and resources available within a community, society, or organization to reduce risk.

**Vulnerability assessment:-** Identify vulnerabilities by understanding the hazards, threats, and risks facing a community or organization.

**Unit II**

**Management during Disaster and Post Disaster**

**Types of Disaster**

**Geological disaster**

* **Earthquakes:** Caused by the movement of tectonic plates, earthquakes happen when energy is released in the Earth's crust.
* **Landslides:** A landslide occurs when a mass of earth or rock falls down a slope.
* **Tsunamis:** Caused by earthquakes, volcanic eruptions, or landslides, tsunamis are infrequent compared to other hazards.

**Hydro Disaster**

* **Floods:** The most common natural disaster, floods occur when water submerges dry land.

**Biological disasters**

* **Forest Fire:**Forest fires are wildfires that spread uncontrollably, burning plants, animals, grasslands and brushlands that fall in their path.

**Technical Disaster**

* **Chemical:**A chemical disaster is the unintentional refuse of one or more hazardous substances which could harm human health or the environment.
* **Nuclear:**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

**Global Disasters Trends**

* **Climate Change and Urban Disaster:** Climate change is a global phenomenon that can have a significant impact on urban areas, leading to more frequent and severe disasters.

**Trends of Disaster**

* Some trends in disasters include:
* **Climate change**
* Climate change is increasing the frequency and severity of natural disasters. This is due to rising temperatures, which lead to higher sea levels, stronger storms, more intense droughts, and heavier precipitation.
* **Economic losses**
* Economic losses from natural disasters are increasing. This is due to population and economic growth in disaster-prone areas.
* **Droughts**
* The number of droughts is expected to increase by more than 30% between 2000 and 2030.
* **Population aging**
* Older people are more vulnerable to extreme heat and outdoor air pollution.
* **Demographic and socioeconomic characteristics**
* The demographic or socioeconomic characteristics of a population can place its members at greater risk of harm before, during, and after a disaster.
* **Technology**
* Technology can transform disaster management, especially if it is integrated with existing infrastructure.
* **Causes of Disaster**
* Disasters can be caused by natural events or man-made events:
* **Natural events**
  + **Earthquakes:** Caused by tectonic shifts
  + **Landslides:** Caused by gravity, heavy rainfall, earthquakes, or slope cuts
  + **Tsunamis:** Caused by submarine earthquakes, landslides, volcanic eruptions, or meteor or comet impacts
  + **Flooding:** Caused by poor urban planning, inadequate drainage, and poor solid waste management
  + **Wildfires:** Can damage plants and animals
* **Man-made events**
  + **Accidental toxic spills**
  + **Nuclear power plant events**
  + **Terrorist bombings**
  + **Poisonings**
* **Other factors that can contribute to disasters include:**
  + **Imbalances in the environment:** Such as air, noise, or water pollution
  + **Climate change:** Warmer air can hold more water, leading to heavier rainfall and extreme floods
  + **Human development:** Such as urban sprawl, mining, and deforestation
  + **Lack of infrastructure:** Such as unsafe housing and inadequate health services

**Consequences and control of geological disaster**

**Earthquakes:-**

Earthquakes are a natural hazard that can cause a variety of consequences, including:

* Damage to buildings and infrastructure: Earthquakes can cause buildings and bridges to collapse, and disrupt utility services like water, gas, oil, and electricity.
* Landslides, avalanches, and tsunamis: Earthquakes can trigger these events, which can cause further destruction.
* Loss of life and property: Earthquakes can cause large-scale loss of life and property.
* Economic and social disruption: The aftermath of an earthquake can destabilize a nation's economy and social structure.
* Health impacts: Earthquakes can damage health facilities and transportation, which can disrupt access to care.

The extent of damage and harm caused by an earthquake depends on several factors, including:

* The magnitude, intensity, and duration of the earthquake
* The local geology
* The time of day the earthquake occurs
* The design and materials of buildings and industrial plants
* The risk-management measures in place

To reduce the risk of injuries and loss of life, you can:

* Identify potential hazards ahead of time
* Plan in advance
* Follow these guidelines during and after an earthquake:
  + Administer first aid for minor injuries
  + Wait for professional medical help for more severe injuries
  + Be mindful of hazards like tumbling shelves, falling items, and damaged walls
  + Check gas and power connections
  + Stay clear of downed power lines

**Landslides**

Landslides are a common geological hazard that can cause significant damage and loss. The consequences of landslides include:

* **Loss of life:** Landslides can cause loss of life.
* **Infrastructure damage:** Landslides can destroy infrastructure.
* **Land damage:** Landslides can damage land and natural resources.
* **Ecological degradation:** Landslides can strip away vegetation, which can lead to long-term ecological degradation.
* **Habitat destruction:** Landslides can destroy natural habitats, which can endanger wildlife populations.
* **Flooding:** Landslide material can block rivers and increase the risk of flooding.

**Some ways to control landslides include:**

* **Early warning systems:** Geologists use sensors and remote sensing technologies to detect precursors to landslides.
* **Hazard mapping:** Identify areas that are more prone to landslides.
* **Restrict construction:** Restrict construction in risky areas.
* **Afforestation:** Afforestation programs can help prevent landslides.
* **Land-use planning:** Better land-use planning can help address the issues caused by climate change.
* **Insurance:** People can take insurance facilities to deal with the loss.
* **Response teams:** Response teams should be quick to deal with landslides if they occur.

Some human activities that can increase the risk of landslides include: Deforestation, Encroachment in vulnerable terrains, and Uncontrolled excavation.

**Tsunamis**

**Tsunamis can have many consequences, including:**

* **Loss of life:**Tsunamis can cause drowning, electrocution, gas explosions, and infrastructure collapse.
* **Damage to infrastructure:**Tsunamis can destroy buildings, vehicles, energy grids, bridges, and other objects.
* **Environmental damage:**Tsunamis can change the land, both above and below the water, and can harm agricultural land and natural resources.
* **Secondary effects:**Tsunamis can cause contaminated water sources, disease outbreaks, chemical pollution, homelessness, and economic loss.
* **Challenges to response and recovery:**Tsunamis can make evacuation, response, and recovery more difficult.

**To prepare for and mitigate the potential impacts of a tsunami, communities can:**

* Improve evacuation routes
* Build tsunami evacuation structures
* Limit new development in tsunami hazard zones
* Design, site, and build structures to minimize tsunami damage
* Adopt building codes that address tsunamis
* Protect and strengthen existing structures and infrastructure
* Move important community assets and vulnerable populations out of tsunami hazard zones
* Plan for post-tsunami recovery

**Hydro Disaster**

**Floods**

A flood is a type of hydrological disaster, which is a sudden and violent event that occurs when there is a change in the movement, distribution, or quality of water in the atmosphere or below the surface. Floods are one of the most frequent and costly natural disasters. Floods can be caused by a number of factors, including:

* **Heavy rainfall**: When there is more rain than the drainage system can handle, floods can occur.
* **River overflow**: Rivers can overflow their banks and cause flooding.
* **Strong winds**: In coastal areas, strong winds can cause flooding.
* **Dam breaking**: When a dam breaks, it can cause flooding.
* **Ice and snow melting**: When ice and snow melt quickly, it can cause flooding.
* **Storm surge**: A storm surge can occur when a storm rises above normal high tides due to strong winds and lower atmospheric pressure. Storm surges can cause significant damage to large areas near the coast.

**Flooding can have a number of negative environmental effects, including:**

* Soil and bank erosion
* Bed erosion
* Siltation
* Landslides
* Damage to vegetation
* Impacts on water quality, habitats, and flora and fauna

**Forest fires are a biological disaster that can have many negative effects on the environment, including:**

* **Global warming:**Forest fires release carbon into the atmosphere, which contributes to global warming and can lead to biodiversity changes.
* **Soil erosion:**Forest fires can burn away the organic layer of soil, which can lead to water repellency and increased soil erosion.
* **Plant and animal species:**Forest fires can damage the habitats of animals, causing them to wander into cities and die. They can also reduce the diversity of forest biological species.
* **Human health:**Smoke from forest fires can be detrimental to human health, causing significant health issues.
* **Economic impact:**Forest fires can impact the economy because many families and communities depend on the forest for food, fodder, and fuel.
* **Loss of livelihood:**Forest fires can lead to loss of livelihood for tribal people and the rural poor.

**Other effects of forest fires include:**

* Altering the hydrological cycle
* Disrupting climatic conditions
* Breaking down the carbon chain

**Technical Disaster**

**Chemical**

A chemical disaster is a technological disaster that occurs when hazardous substances are accidentally released, which can harm the environment or human health. Chemical disasters can include: Explosions, Fires, Leakages, Contamination of water or food supply, and Oil spills.

Chemical disasters can be caused by natural events, or by accidental or intentional events. They can range from small releases to major emergencies.

**Some examples of chemical disasters include:**

* **Bhopal Gas Tragedy:**In 1984, India experienced the world's worst chemical disaster, when the toxic gas Methyl Iso Cyanate (MIC) was accidentally released, killing thousands of people.
* **Water leaking into a methyl isocyanate (MIC) gas tank:**The physical cause of a gas leak, it is still debated whether this was an operator error or an act of sabotage.
* **Technological disasters can also include:** Biological hazards, Radiological hazards, Nuclear hazards, and Transport accidents.

**Some notable nuclear disasters include:**

* **Chernobyl, Ukraine (1986)**: Considered the world's worst nuclear disaster, this accident resulted in the release of large amounts of radioactive material across Europe and the Soviet Union. The disaster was caused by a power surge that led to explosions and the destruction of the reactor.
* **Fukushima, Japan (2011)**: The tsunami and earthquake that struck Japan on March 11, 2011 destroyed four reactors at the Fukushima nuclear power plant. The loss of cooling due to the tsunami led to the destruction of the reactors.
* **Three Mile Island (1979)**: A serious nuclear power plant accident.
* **SL-1 (1961)**: A serious nuclear power plant accident.

**Nuclear**

A nuclear disaster is a significant accident at a nuclear facility that releases radioactive substances into the environment, causing harm to people and the environment. Causes of nuclear disasters include:

* Technical failures
* Human error
* Natural disasters like earthquakes, cyclones, or floods
* Loss or misplacement of radiation sources
* Faulty handling of radiation sources

**Some examples of nuclear disasters include:**

* **Chernobyl disaster**:In 1986, technicians at the Chernobyl nuclear reactor in Ukraine performed a poorly designed experiment that led to a chain reaction of explosions.
* **Fukushima nuclear disaster:**In 2011, a nuclear disaster occurred in Fukushima, Japan. The spent fuel storage pools survived the earthquake and tsunami without significant damage.
* **SL-1 accident:**In 1961, a worker at the SL-1 boiling water reactor lifted a control rod 20 inches instead of the required four inches, causing a power surge and steam explosion. All three workers on duty were killed.
* To reduce the risk of nuclear disasters, countries have implemented technical measures, emergency preparedness plans, and safety culture. However, human error can still occur.

**To protect yourself from radiation, you can:**

* Limit the time you spend exposed to the radiation source
* Increase the distance between you and the radiation source
* Use dense material as shielding between you and the radiation source

**Global Disasters Trends**

**Climate Change and Urban Disaster**

Climate change is a global phenomenon that can have a significant impact on urban areas, leading to more frequent and severe disasters. Some of the ways climate change affects urban areas include:

* **Rising temperatures**: Climate change causes global temperatures to rise, which leads to rising sea levels and more extreme weather events.
* **More intense rainfall**: Climate change makes rainfall events more intense, which can lead to landslides and flooding.
* **Changing precipitation patterns**: Climate change alters the spatial distribution of precipitation.
* **Increased spread of tropical diseases**: Climate change can increase the spread of tropical diseases.
* **Heatwaves**: Climate change can lead to more frequent and severe heatwaves.
* **Stronger storms**: Climate change can lead to stronger storms.

Urban climate change resilience (UCCR) is an approach that aims to reduce the vulnerability of urban areas to climate change. UCCR considers cities as dynamic systems that can adapt and evolve to survive and thrive in the face of climate change. Urban resilience should be considered during the planning phase of urban projects, rather than when disruptions occur.