

Disaster Management Module 1 Important Topics

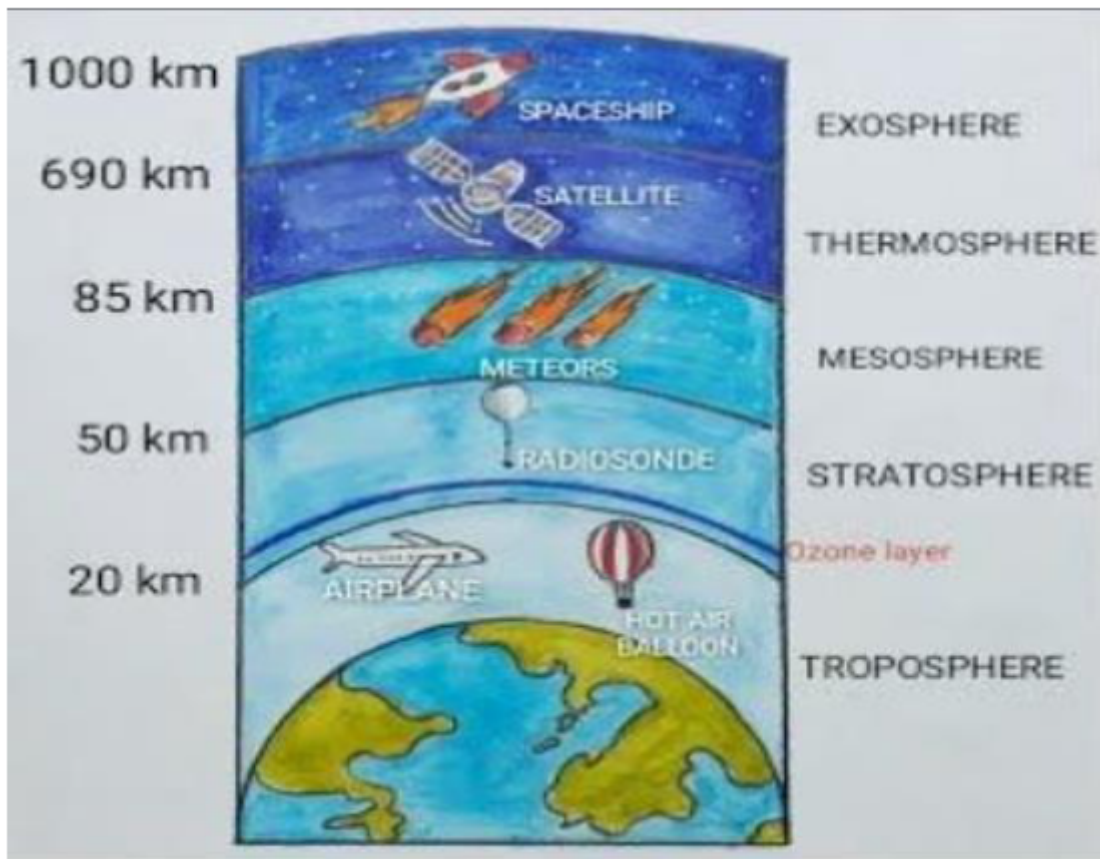
Table of contents

- [*Disaster Management Module 1 Important Topics*](#)
 - [*Various Layers of atmosphere with distance and sketch*](#)
 - [Troposphere](#)
 - [Stratosphere](#)
 - [Mesosphere](#)
 - [Thermosphere](#)
 - [*Key Terms in disaster management*](#)
 - [*Ozone Layer*](#)
 - [Ozone Layer](#)
 - [Ozone Formation](#)
 - [Ozone Layer Depletion](#)
 - [Reasons for Ozone Depletion](#)
 - [Prevention of ozone layer depletion](#)
 - [*Green House Effect*](#)
 - [Causes](#)
 - [Effects](#)
 - [*Cyclone*](#)
 - [Categories](#)
 - [Types](#)
 - [*Difference between disaster and hazard*](#)
 - [*Hydrosphere*](#)
 - [*Biosphere*](#)

Various Layers of atmosphere with distance and sketch

Based on the temperature, the atmosphere is divided into four parts:

- Troposphere
- Stratosphere
- Mesosphere
- Thermosphere



Troposphere

- The bottom dense part, containing 70 per cent of the mass, close to the ground is troposphere.
- Clouds, storms, fog and haze are found only in troposphere
- It reaches up to 11 km from the ground
- The temperature in this layer decreases at about $-6.4^{\circ}\text{C}/\text{km}$ with height. This decrease of temperature with altitude is called lapse rate.
- The boarder of troposphere is called Tropopause. Tropopause acts like a lid over troposphere. Temperature stops decreasing with height from tropopause.

Stratosphere

- This layer extends to a height of about 50 km from earth's surface
- Ozone (O_3) is found in this layer
- The temperature increases with height in stratosphere
- Above the stratosphere, there is a small layer called Stratopause where temperature neither decreases nor increases with height

Mesosphere

- The portion of the atmosphere above stratosphere, between 50 km and 80 km is known as mesosphere.
- Mesosphere plays a crucial role in radio communication as ionisation occurs here. The sunlight passing through this layer converts individual molecules to charged ions.
- These ionised particles are concentrated as a zone in this layer, which is named D-layer. The D-layer reflects radio waves transmitted from earth.
- Just above the mesosphere is a small layer called Mesopause, where temperature is stable.

Thermosphere

- Thermosphere extends from 80 km to about 60,000 km from earth. Here the temperature increases to about 2000°C
 - Thermosphere has no definable upper boundary and it gradually blends with the outer space
 - It is in thermosphere that most of the approaching meteoroids burn up before reaching earth.
 - Ionisation takes place in this layer also. Ionisation produces two ionised layers—E and F layers. These layers also have an influence over radio communication as it reflects radio waves
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Key Terms in disaster management

Disaster:

- A serious disruption of the functioning of a community or a society due to hazardous events interacting with conditions of vulnerability and exposure, leading to widespread human, material, economic and environmental losses and impacts.
- The International Federation of the Red Cross and Red Crescent Societies (IFRC) define disaster as a calamitous event resulting in loss of life, great human suffering and distress, and large-scale material damage.

Hazard:

- A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation is called hazard.
- A hazard turns into a disaster when there are elements of risk and vulnerability
- Hazards can be single or a combination of many, in origin and effects. It can vary with respect

to location, type, intensity, probability frequency

Exposure:

- Exposure is the nearness of people, properties or communities to a hazard zone in space and time to suffer potential impacts.
- Houses and people close to an earthquake zone or at the epicentre are more exposed than those far away.

Vulnerability:

- Vulnerability is the degree to which a system, such as a community, is susceptible and exposed to the adverse effects of a given hazard.
- It is a condition that predisposes individuals, groups, communities or systems to hazard event.
- Vulnerability depends on the physical, socio-economic and environmental characteristics and circumstances that make the target system or community susceptible.

Categories:

- Physical Vulnerability: It considers those aspects that may be damaged or destroyed by a hazard. This vulnerability is based on the physical conditions of a community and elements of risk.
- Physical conditions include different buildings, structures and infrastructures and their capability to withstand. The proximity and nature of hazard is also considered.

Socio- Economic Vulnerability:

- The socio economic conditions of a population also have a say on the intensity of impact to which a population is exposed to.
- For instance, poor people are most vulnerable in the event of cyclone or flood as the houses may not be strong and may be constructed with locally available materials. Further they find difficult to rebuild their houses.

Risk:

- The combination of the probability of a hazardous event and its consequences which result from interaction(s) between natural or man-made hazard(s), vulnerability, exposure and capacity is called risk.

Risk Assessment:

- An approach to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.

- Risk assessments (and associated risk mapping) include: a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes known as a risk analysis process.
- ISO 31000 defines risk assessment as a process made up of three processes
 - **Risk identification:** process that is used to find, recognize, and describe the risks that could affect the achievement of objectives.
 - **Risk analysis:** process that is used to understand the nature, sources, and causes of the risks that have been identified and to estimate the level of risk. It is also used to study impacts and consequences and to examine the controls that currently exist.
 - **Risk evaluation:** process that is used to compare risk analysis results with risk criteria in order to determine whether or not a specified level of risk is acceptable or tolerable.

Risk Mapping:

- Risk mapping is a process of analysing the hazard, vulnerability and capacity through a scientific methodology.
- The process of risk map preparation includes analysis of hazard, vulnerability and capacity.

Capacity:

- The combination of all the strengths, attributes and resources available within a community, society or organization to manage and reduce the risks and strengthen resilience.
- Capacity may include infrastructure and physical means, institutions, societal coping abilities, as well as human knowledge, skills and collective attributes such as social relationships, leadership and management.
- Capacity assessment is a term for the process by which the capacity of a group is reviewed against desired goals, and the capacity gaps are identified for further action.

Coping Capacity:

- The ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters is called coping capacity.
- The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during crises or adverse conditions.
- It can be two types:
 - Physical Coping capacity: Some members of a community affected by hazards could have the required skills to find employment elsewhere and helps their family to sustain.
 - Socio – economic coping capacity: In the event of any disaster maximum losses occurs

in physical and material realm. However rich members in a community could quickly and completely recover due to their strength of wealth. This may not be possible for poor people

Resilience:

- The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
- Resilience means the ability to “resile from” or “spring back from” a shock. The resilience of a community in respect to any hazard or event is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need.

Disaster Risk reduction:

- Disaster risk reduction is a systematic and continuous analysis and redressing of the causal factors of disasters.
- It is the first step and key component of disaster (risk) management.
- Disaster risk reduction involves structural and non-structural measures.
 - **Structural measures** include the use of physical or engineering solutions (such as ocean wave barriers or earthquake resistant buildings) to avoid disaster or reduce its impacts.
 - Non-structural measures involve the use of policies, laws, education and awareness creation, and practices to avoid or reduce the impacts of disaster.

Disaster risk management:

- Disaster risk management is the application of disaster risk reduction policies, processes and actions to prevent new risk reduce existing disaster risk and manage residual risk contributing to the strengthening of resilience.
- Disaster risk management includes actions designed to avoid the creation of new risks, actions designed to address pre-existing risks and actions taken to address residual risk and reducing impacts on communities and societies,

Early Warning Systems:

- An interrelated set of hazard warning, risk assessment, communication and preparedness activities that enable individuals, communities, businesses and others to take timely action to reduce their risks is called early warning systems.
- Effective “end-to-end” and “people-centered” early warning system comprises four interrelated key elements
 - risk knowledge and risk assessment
 - detection, monitoring, analysis and forecasting of the hazards and possible scenarios
 - dissemination and communication of timely, accurate and actionable warnings and

associated likelihood and impact information;

- preparedness and local capabilities to respond to the warnings received.

Disaster Preparedness:

- Disaster preparedness consists of the knowledge and capacities of institutions, communities and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent or active hazard events or conditions.
- Thus, preparedness is incomplete if potentially affected people are not aware of the threat of a hazard. Preparedness is embedded in disaster risk management.

Disaster Prevention:

- Activities and measures to avoid existing and new disaster risks is called prevention.

Disaster Mitigation:

- The lessening or limitation of the adverse impacts of a hazardous event is called mitigation.
- The adverse impacts of hazards often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions.

Disaster Response:

- Actions taken 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.
- Disaster response is predominantly focused on immediate and short-term needs and is sometimes called disaster relief.

Damage Assessment:

- Damage assessment is the procedure for determining the magnitude of damage caused by a disaster or emergency event.
- Damages are normally classified as:
 - Severe: the target facility or object cannot be used for its intended purpose. Complete reconstruction is required.
 - Moderate: the target facility or object cannot be used effectively for its intended purpose unless major repairs are made.
 - Light: the target facility or object can be used for intended purpose but minor repairs would be necessary.

Crisis Counseling:

- Crisis counselling is the process of alleviating the emotional and psychological disturbances of persons affected by disaster in order to restore a sense of control and mastery and to aid the process of recovery and reconstruction.

- Normally, disasters overwhelm the physical and psychological capacity of people to cope.
- This can lead to emotional and psychological disturbances which can affect a person's ability to make right decisions or adopt reasonable responsive actions.
- Crisis counselling addresses these problems and is a crucial part of recovery and reconstruction.

Needs Assessment:

- Needs assessment is a process of estimating (usually based on a damage assessment) the financial, technical, and human resources needed to implement the agreed-upon programmes of recovery, reconstruction, and risk management.
 - Post-damage needs assessment is normally a rapid, multi-sectoral assessment that measures the impact of disasters on the society, economy, and environment of the disaster-affected areas
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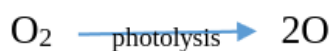
Ozone Layer

Ozone Layer

- Ozone is a protective layer found in ozonosphere, which is in the stratosphere layer of atmosphere.
- Ozone absorbs and prevents the harmful ultraviolet radiations from reaching earth.
- Maximum concentration of ozone occurs at 22 km from the ground level.
- If the ozone layer was absent, millions of people would develop skin disease and may have weakened the immune systems.

Ozone Formation

Oxygen molecule is photolysed by solar radiation, creating 2 oxygen radicals.



Oxygen radicals react with molecular oxygen to produce ozone.



Ozone Layer Depletion

- Ozone layer depletion is the gradual thinning of the earth's ozone layer in the upper atmosphere caused due to the release of chemical compounds containing gaseous

bromine or chlorine from industries or other human activities

- When CFC come in contact with ozone, chlorine splits ozone into individual molecules.
- Here chlorine acts as a catalyst.
- Chlorine breakdown the ozone and combine with free oxygen to create 2 oxygen molecule



Reasons for Ozone Depletion

- Depletion by CFC and BFC
 - Emitted by refrigerators and AC
 - UV radiation split these as, Chlorine (Cl) and Bromine (Br) radicals.
 - Due action, Ozone concentration is decreasing at a drastic rate
- Depletion by nitric oxide(NO)
 - Large quantities of nitrogen are emitted by aircrafts .
- Depletion by Natural Causes
 - The ozone layer has been found to be depleted by certain natural processes such as Sun-spots andstratospheric winds
 - The volcanic eruptions are also responsible for the depletion of the ozone layer.

Prevention of ozone layer depletion

- Avoid Using ODS (Ozone depleting substances)
 - Reduce the use of ozone depleting substances.
 - Avoid using malfunctioning A C and refrigerators, which emits more CFC and BFC
- Use Eco-friendly Cleaning Products
 - Most of the cleaning products have chlorine and bromine releasing chemicals that find a way into the atmosphere and affect the ozone layer.
 - These should be substituted with natural products to protect the environment
- Encourage Public transportation
 - Use of private vehicles will emits more pollutants to the atmosphere, so public transportation should be promoted.
- Use electric driven vehicles, in place of fuel driven vehicles
 - Promote the use of EVs in place of vehicles run by petrol /diesel.
 - Lead contained petrol will emits more pollutants.
- Use of Nitrous Oxide should be prohibited

- The government should take actions and prohibit the use of harmful nitrous oxide that is adversely affecting the ozone layer.
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Green House Effect

- The greenhouse effect is the process that occurs when gases in Earth's atmosphere trap the Sun's heat.
- The gases which traps sun's heat is known as greenhouse gases.
- Eg: CO₂, methane

Causes

- Burning of Fossil Fuels
 - Burning of fossil fuels releases carbon dioxide
- Deforestation
 - Plants and trees take in carbon dioxide and release oxygen. Due to the cutting of trees, there is a considerable increase in the greenhouse gases which increases the earth's temperature.
- Farming
 - Nitrous oxide used in fertilizers is one of the contributors to the greenhouse effect in the atmosphere.
- Industrial Waste and Landfills
 - The industries and factories produce harmful gases which are released in the atmosphere.
 - Landfills also release carbon dioxide and methane that adds to the greenhouse gases

Effects

- Global warming
 - It is the phenomenon of a gradual increase in the average temperature of the Earth's atmosphere
- Smog and air pollution
 - Smog is formed by the combination of smoke and fog. It can be caused both by natural means and man-made activities.
- Acidification of water bodies
 - The greenhouse gases mix with the rainwater and fall as acid rain.
 - This leads to the acidification of water bodies.

- Also, the rainwater carries the contaminants along with it and falls into the river, streams and lakes thereby causing their acidification.
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Cyclone

- System of winds rotating inwards to an area of low pressure, in a coiled manner.
- Reason: due to coriolis force, surface wind get spiralled towards the low pressure area
- Cyclones are not present in equatorial regions because coriolis force is absent.

Categories

- Category 1
 - Wind Speed 74-95 mph
 - Damage: Minimal
 - Surge surface: 4-5 feet
- Category 2
 - Speed 96-110 mph
 - Damage: Moderate
 - Surge Surface: 6-8 feet
- Category 3
 - 111-130 mph
 - Damage: Extensive
 - Surge surface: 9-12 feet
- Category 4
 - Speed 131-155 mph
 - Damage: Extreme
 - Surge surface: 13-18 feet
- Category 5
 - Speed >155 mph
 - Damage: Catastrophic
 - Surge surface: 19+ feet

Types

- Tropical Cyclone
 - Occurs in tropical oceans
 - Hurricanes and typhoons are two types.

- Polar Cyclone
 - Formed over arctic and Antarctic oceans.
 - It takes place quickly, so forecasting is difficult.
- Meso Cyclone
 - Formed along with strong thunderstorms.
- Extra Tropical Cyclone
 - Also known as mid latitude cyclones.
 - Winds are weaker

Difference between disaster and hazard

Hazard	Disaster
Hazard is an event that has potential for causing injury/ loss of life or damage to property/environment.	Disaster is an event that occurs suddenly/unexpectedly in most cases and disrupts the normal course of life in affected area.
Hazards can lead to disasters.	A disaster is the result of a hazard but at the same time is also a hazardous event.
Hazards come with warnings.	Ignoring warnings can lead to disaster.
Hazards may be inevitable.	Disasters can be prevented.
Hazard occurs at less populated area.	Disaster occurs at overpopulated area.

Hydrosphere

- The layer which contains all the water sources present on the earth.
 - It includes all the surface and subsurface water sources.
 - It forms over 70% of earth's surface
 - Hydrosphere has direct influence on weather and climatic condition on the earth
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Biosphere

- Biosphere is a thin envelop that encircles most of the earth, and supports life.
 - Biosphere is the spherical terrestrial layer that comprises of the lower part of the atmosphere, the seas and the upper layers of the soil wherein living organisms exist naturally.
 - All forms of life including human beings dwell in biosphere. The health of the biosphere is determined by the availability of oxygen, moisture, temperature, air pressure and soil.
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