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Geography (Hons)-Paper-CT14-6th Semester

Fire: Factors, vulnerability, consequences and management

Questions

1. Define disasters due fire. (Marks-2)
2. Discuss the different causes of fire related disasters. (Marks-5)
3. What are the factors of vulnerability for disasters due to fire? (Marks-5)
4. What is the Fire Triangle? How does it work? (Marks-4+6)
5. What precautionary measures are to be taken for mitigation and management before, during and after the disasters due to fire? (Marks-10)

Fire is the rapid oxidation of a material in the exothermic chemical process of combustion, releasing heat, light, and various reaction products.

Many disastrous incidents take place due to the following accidental causes-

- Wildfire
- Industrial fire mainly due to inflammable chemical, oils, electrical disasters
- Accidental fire in the markets, building, slums in the urban area, electrical disasters
- Accidental fire is also become disastrous in the rural area

Causes of fire related disasters:

Wildfires occur when vegetated areas are set alight and are particularly common during hot and dry periods. They can occur in forests, grasslands, brush and deserts, and with sufficient wind can rapidly spread.

If unchecked, such fires can cause devastation to forests and other areas of vegetation. If fires approach or occur near towns or cities it often prompts a precautionary evacuation, as the direction fires may take are unpredictable.

- The most common causes of fires are-
- lightning strikes,
- sparks during arid conditions,
- the eruption of volcanoes, and
- man-made fires arising

A side-effect of wildfires that also threatens inhabited areas is smoke. Fires create large quantities of smoke, which can be spread far by wind and poses a respiratory hazard.

Satellites can be used to map the extent of a fire by observing the smoke plumes and identifying burn scars. Thermal infrared sensors can detect heat, thereby pinpointing the exact locations of fires and data acquired through the Charter may be passed on to firefighters on the ground within a matter of hours, providing helpful assistance for their efforts in locating and combating fires.

These are accident related disasters. Forest fires, urban fires, electrical disasters and fires, village fires

Fires are the accidents which occur most frequently, whose causes are the most diverse and which require intervention methods and techniques adapted to the conditions and needs of each incident.

Depending on the-

- type of fire (nature of the material ablaze),
- meteorological conditions (wind) and
- the effectiveness of the intervention,
- material damage can be limited (a single car, building or production or storage warehouse installation),
- or affect wide areas (forest or agricultural fires,
- hydrocarbons,
- gas or other highly flammable products,
- storage or piping installations,
- harbour installations and
- rail or marine transport equipment).

Explosion is in a different category.

Each type of fire is the object of specific technical prescriptions as regards prevention, intervention and the behaviour of the population affected. It is also relevant to note that many fires have a criminal origin and that in times of armed conflict or crisis as well as of indirect wars (sabotage) human intervention also provokes major accidents.

Vulnerability in disasters due to fire.

Vulnerability describes the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of due to fire-disasters. There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors.

Examples may include:

- poor design and construction of buildings,
- inadequate passage for fire brigade
- inadequate protection of assets,
- lack of public information and awareness,
- limited official recognition of risks and preparedness measures, and
- disregard for wise environmental management.

Vulnerability varies significantly within a community and over time. This definition identifies vulnerability as a characteristic of the element of interest (community, system or asset) which is independent of its exposure. However, in common use the word is often used more broadly to include the element's exposure.

The above explanation was taken from the [United Nations \(UN\) International Strategy for Disaster Reduction \(ISDR\) Terminology on Disaster Risk Reduction](#). Follow the [link](#) to look up other terminologies.

There are four (4) main types of vulnerability:

1. Physical Vulnerability may be determined by aspects such as population density levels, remoteness of a settlement, the site, design and materials used for critical infrastructure and for housing

Example: Wooden homes are less likely to collapse in an earthquake, but are more vulnerable to fire.

2. Social Vulnerability refers to the inability of people, organizations and societies to withstand adverse impacts to disasters due to characteristics inherent in social interactions, institutions and systems of cultural values. It is linked to the level of well being of individuals, communities and society. It includes aspects related to levels of literacy and education, the existence of peace and security, access to basic human rights, systems of good governance, social equity, positive traditional values, customs and ideological beliefs and overall collective organizational systems

Example: during the fire disasters some citizens, such as children, elderly and differently-able, may be unable to protect themselves or evacuate if necessary.

3. Economic Vulnerability. The level of vulnerability is highly dependent upon the economic status of individuals, communities and nations The poor are usually more vulnerable to disasters because they lack the resources to build sturdy structures and put other engineering measures in place to protect themselves from being negatively impacted by disasters.

Example: Poorer families may live in squatter settlements which are vulnerable to fire.

4. Environmental Vulnerability. Natural resource depletion and resource degradation are key aspects of environmental vulnerability.

Example: slums are vulnerable to fire

Fire disaster management and mitigation.

For practical reasons it is best to refer to technical documentation, which should be known or available to all security and fire-fighting services, and to national and regional disaster alarm and information centres. This is especially the case for rescue and fire extinction on motorways, buildings designed to be used by a great number of people (hospitals, hotels, cinemas, high-rise buildings, department stores, etc...); fires affecting chimneys, attires, cotton (bales, loose, explosive dust), fodder (fermentation), fires in

high warehouses, silos or underground garages as well as forest fires. All these types of intervention are subject to special measures.

2. Preventive and protective measures

Fires can spread more or less rapidly depending on their causes, the nature of the material and goods alight, the fire prevention installations (automatic sprinklers), meteorological conditions, the ways the population is informed and the initiative it shows, as well as the speed and efficiency of the intervening services and of their fire-fighting equipment. In the light of experience, prevention is seen to be most important and consists of two distinct components. On the one hand, the primary responsibility falling upon the political authorities empowered to implement the legal prescriptions concerning fire protection, to forecast accidents and to inform the population, as well as to set up measures and means for fighting fires and Explosions. On the other hand, the responsible behaviour of each individual based upon an education geared towards caution and the respect of instructions in case of fire. Defining, and controlling the implementation of, the particular rules of protection against fires, specific to each enterprise presenting a potential danger, including the training of security personnel, is also relevant in this context. The many types of fire and the preventive and protective measures which relate to them, make it advisable to limit the present study to the specific measures falling to the political authorities in one area only, namely that of "forest fires". This type of fire is of particular interest for developing countries and the preventive measures to be applied have a general representative value, that is-

- organising an observation service,

- prevention and alarm (security) at local and regional levels:

- implementing legislation regulating the use of fire by all the population present in or at the edge of forests, and

more particularly by owners and individuals exercising a professional activity in sensitive areas;

- planning and concrete preparation (periodic maintenance) for fire-fighting through adequate landscaping of the territory and appropriate forest cultivation limiting fire propagation (alternating vegetation, clearance, trimming),

creating and maintaining access paths (extinction) and fire-break areas as well as fire-fighting equipment such as water supplies (conduits, cisterns),

Watchtowers and meteorological posts, and the construction of helicopter landing pads;

- surveillance and detection of fires as soon as the danger of fires is forecast by the ad hoc meteorological service (which comprises automatic or mobile statistics posts observing the winds and the vegetation: dryness, force, direction, evolution);
- as soon as the danger of fire increases, activating an alarm plan (basic intervention plan) requiring the engagement of preventive intervention squads (firemen), and their wide positioning as near as possible to the threatened zones, and making available water bombers and specialised aerial machines ready for action;
- preparation and concretisation (organisation) of an intervention mechanism: this requires the setting up of specialised management programmes ensuring the coordination of powerful and efficient equipment and means for fighting forest fires (instruction);
- preparedness management and the coordination of the use of the means of intervention of the authorities and the information and alarm services for the population require a secure transmission network (radio network);
- planning the evacuation of the population possibly under threat in the various sensitive areas, particularly if there are risks of explosion (reservoirs and gas conduits explosives or ammunition dumps, hydrocarbon production, handling or transport installations, other dangerous material, etc.).

3. Intervention and assistance measures

The means of intervention brought into coordinated action at the local, regional or cross-boundary level vary according to the seriousness of the incident. The time factor and the quality of the intervention are of primary importance. Fire-fighting requires that substantial means be available at the right time and place and brought into action as quickly as possible. The chances of success are greater when the fire has just broken out. Generally, bringing into action the ways and means of fighting fires and explosions is the responsibility of the communal authorities that can call on firemen (professionals or volunteers) reinforced by the civil or military means of intervention available. But clearly, mastering major fires and specific fires and managing particularly powerful explosions require the technical support of professionals and experts, especially in the case of toxic or radioactive fall-out. When these reinforcements are necessary, they must be made available at the regional or national level. If national means of intervention prove insufficient to ensure the safeguard of the population and the environment, the government of the country affected by the disaster should appeal for international

emergency assistance. With regard to "forest fires", the means of extinction are logically adapted to the technical possibilities of the States and sectors concerned. The old technique of "fire beating" is still often called upon; this requires numerous working hands, courage and a sense of civic duty, with little chance of success. In developed countries, extinction techniques increasingly make use of water, generally with chemical additives (retardants or foams). Intervention techniques must be adapted accordingly and call upon very competent personnel using mobile and fast equipment such as off-track vehicles, motorised pumps, tankers, water cannons, and aviation (water bombers, airplanes or helicopters of varied capabilities). The manpower is therefore made up of a minority of professional firemen (leaders) and a majority of volunteers. Bringing this force into action therefore involves an operational and strategic operation with an effective management structure having reliable means of command. The key to success lies in the coordination of the different protection and assistance measures and the cooperation of all of the means and services involved. Because of the similarity in the damage caused by an explosion and an earthquake (direct and secondary effects) it seems relevant to apply the same principles of intervention and assistance to these two types of disasters, especially with regard to intervention tactics, the management structure and the disaster plan.

Instructions for the population

General precautions and safety measures relating to a potential danger

- Matches and lighters are to be kept out of the reach of children and they are to be taught caution around fires and inflammable objects;
- do not keep inflammable products (alcohol, petrol, gas containers, paper, and cloth, dried vegetable matter, etc.) near any source of heat;
- instructions relating to fires to be followed, find out about protection measures, know the whereabouts of gas and electricity conduits and learn to use domestic fire-fighting equipment (extinguishers, fire reels and hoses, nozzles, etc.);
- do not smoke, do not light fires, do not switch on electrical equipment or machinery likely to make sparks when handling, or pouring inflammable or toxic products (petrol, alcohol, gas, etc.), or if they are leaking;
- Telephone numbers of the fire-fighting and civil protection services and of the police are to listed and known

- respect instructions forbidding staying, lighting fires, or smoking in forests, plantations, agricultural installations, wooden houses, etc., during dry spells or violent winds;
- obey the rules, regulations and orders of the authorities, their control organs and the representatives of fire or police services;

4.2 During a fire

-Act in a calm and thoughtful manner,

Avoid panic

- call for assistance by first alerting the firemen (fire service) and precisely identifying the area (locality, road, number, type of accident, and also the name and address of the caller);
- immediately warn persons in danger and those responsible for security in the building or the enterprise especially in public places;
- try to rescue persons and animals in danger (wrap people whose clothing is alight in blankets or coats and roll them on the ground);
- prevent the rush of air by closing all doors and windows and switching off ventilation;
- do not use the lifts, leave the premises (stairs, exits and emergency exits);
- if stair wells and corridors are filled with smoke, stay in the flat, close the door and water it frequently, draught-proof it with wet rags. Show your presence at the windows (without opening them);
- if you are in a place that is getting filled with smoke, stay low on the ground where the air remains fresh;
- fight the fire with all available means (fire extinguishers, in-house hydrants, pouring water from utensils using the bath tub or sink as an improvised water reservoir;
- extinguish oil or fat fires (liquids or recipients on fire) by covering them with a damp cloth. If an electrical apparatus catches fire do not use water on it switch off the current immediately and pull out the plug;

-inform and guide fireman or other rescuers and follow their instructions;

in case of a “ forest fire” -----

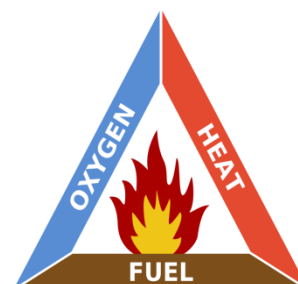
- weak structured house to be left
 - entry gate of the building to be opened to facilitate the entry of rescuers;
 - turn off gas bottles stored outside and place them away from the building but not in an access path;
 - vehicles to be sheltered, with their windows closed, against the side of the building protected from the wind;
- bring in watering hoses which may be used after the main fire is extinguished;
 - close shutters and entrance doors and take refuge in the house with all your family and domestic animals; if necessary, shelter the homeless and the passers-by fleeing the fire;
 - keep calm even if smoke enters the house despite the draught-proofing of the doors and windows;
 - watch the situation and how the fire progresses (fire moves at a speed of 20 to 30 meters per minute) from a door or window situated on the side of the house facing the wind.

4.3 After the main fire has passed

- Leave the house only if all parts of your body are protected (leather shoes, gloves, hat, clothes made of non-synthetic material);
- inspect your house and extinguish those parts which are burning (doors, shutters, etc.);
- inspect the roof, the timber frame, the attic and extinguish the cinders which may have infiltrated under the roof tiles and small openings by using the water hose or other recipients filled with water;
- water the vegetation surrounding your home and extinguish small flames if any;
- assist your neighbours and persons in danger (first aid);
- obey orders of the firemen and of the authorities' representatives.

What is the Fire Triangle?

The fire triangle is used to show the three elements that when present together can cause a fire to start. These three ingredients are fuel, heat and oxygen, under all circumstances they should be kept apart to avoid a fire starting. Understanding the basic principles of the fire triangle is essential in helping to protect your business and prevent fires from breaking out.



How does the fire triangle work?

When fuel or flammable materials are heated, the energy stored inside starts to react with oxygen in the air, giving off heat. This creates a vicious cycle, which causes the fire to spread. To stop the spread of a fire you have to remove one of these elements to break the triangle.

Tips for fighting and preventing fires based on the fire triangle:

Oxygen

This makes up about 20% of the air we breathe, so there is a ready supply to fuel a potential fire if flammable materials come into contact with enough heat to start a fire. Once a fire has started, depriving it of oxygen will weaken and extinguish it. This is a principle used by some fire extinguishers. Foam and dry powder extinguishers can be used to smother flames and deprive the fire of oxygen, whereas the CO₂ in carbon dioxide fire extinguishers will replace the oxygen to deprive the fuel source of it.

Without a sufficient supply of Oxygen a fire will stop burning, so it's always handy to keep appropriate fire extinguishers near areas with a high risk of fire. Always use fire extinguishers with care and check that you are using the correct type of fire extinguisher for the type of fire you are dealing with.

Heat

All flammable materials have a flash point, this is the lowest temperature at which they will ignite. If you are storing flammables on site then you will need to be aware of their flashpoints and make sure that all materials stored away from sources of heat and under their flash point temperature.

If a fire does break out then having a water fire extinguisher on standby is a good idea. Water has the effect of cooling the fire, thus removing heat from the equation. However remember not to use water on electrical appliances or cooking oil fires.

Fuel

A fire will continue as long as there is fuel to burn. Fuel comes under three categories, solid, liquid and gas. Each type should be treated specially to ensure that their presence does not result in a fire.

The most common types of fuel are solid materials. Just look around you, everyday materials that surround you such as paper, card, clothing, fabrics and furniture could all be potential fuel for a fire. To reduce the chance of a fire starting, keep these materials away from electric heaters, radiators and direct sunlight.

Liquid fuel and flammable gases require more special attention. Ideally you should keep liquids and gases in a sealed container away from other flammables and possible sources of ignition or heat. You should regularly check for signs of damage to the containers and keep as small an amount as necessary on site.

Of course following these tips can only help reduce the chance of a fire breaking out, so it is strongly advised to only keep flammable liquids and gases are absolutely needed and if no non-flammable alternative is available. Once a fire has started it is very difficult to remove the fuel, but wet chemical fire extinguishers which are specially designed for cooking oil and grease fires can achieve this. The chemicals released react with oil to form non-combustible soapy layer, which stops the spread of fire in its tracks.

Each year there are many non-domestic fires that could have easily been prevented. By understanding the basic principles of the fire triangle you can ensure that your business is best prepared to avoid potential disaster caused by fire.
