URP-302: Urban Hazard and Risk Management

Topic 5: Fire Hazard

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What is a Fire Hazard?

- Fire hazard is the condition that **favor fire development.**
- Three elements are required to start and sustain fire:

  1) oxygen, 2) fuel, & 3) heat

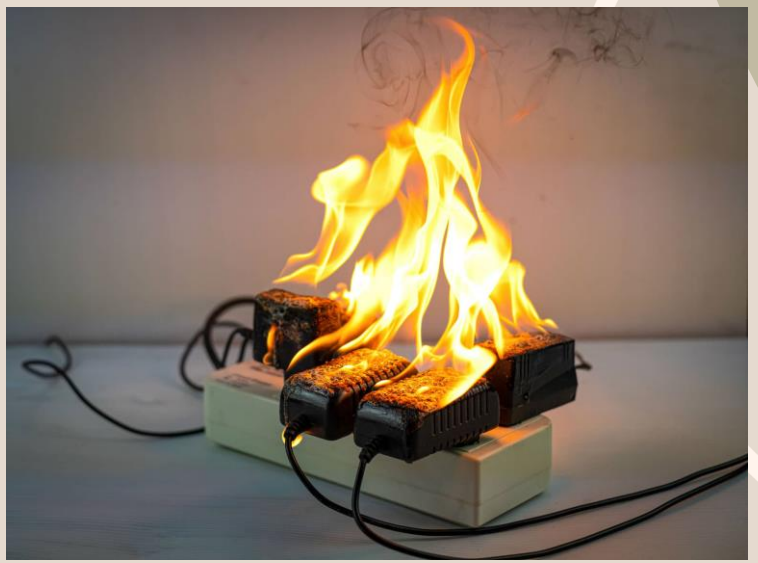
- As oxygen is naturally present in most earth environments, fire hazards usually involve mishandling of fuel or heat.
- Fire/ Combustion is a **chemical reaction** between oxygen and a combustible fuel.
- Sources of ignition are spark, flame, or high temperature.

Natural Causes of Fire

- **Lightening strikes** can set trees or houses on fire. It can also travel through metal reinforcing/ wires. Lightening can knock out power lines and send powerful electrical surges through electrical and phone lines.
- **Volcanic eruption**
- **Forest fire:** The leaves become flammable fuel during extreme dry weather. The warm temperature encourages combustion and strong wind spreads the fire quickly.

Man-made Causes of Fire

- Overheating of cooking and electrical appliances
- Short circuits, faulty wiring, overloading power points
- Fireworks
- Storing flammable liquids or gases near a heat source
- Cigarettes or candles if not properly put out



Types of Fire

- **Class A Fire:** Class A fire involves ordinary combustible materials like **paper, wood, fabrics, rubber, etc.** This type of fire can be effectively quenched by **water.**
- **Class B Fire:** Class B fire mostly involves **flammable liquids** (like gasoline, oils, greases, paints, etc.) and **flammable gases. Carbon dioxide and dry chemicals** are used to extinguish these fires.
- **Class C Fire:** It involves **electrical equipment** like motors, generators, and other appliances. **Carbon dioxide and dry chemicals** are used to put out these fires.

Types of Fire

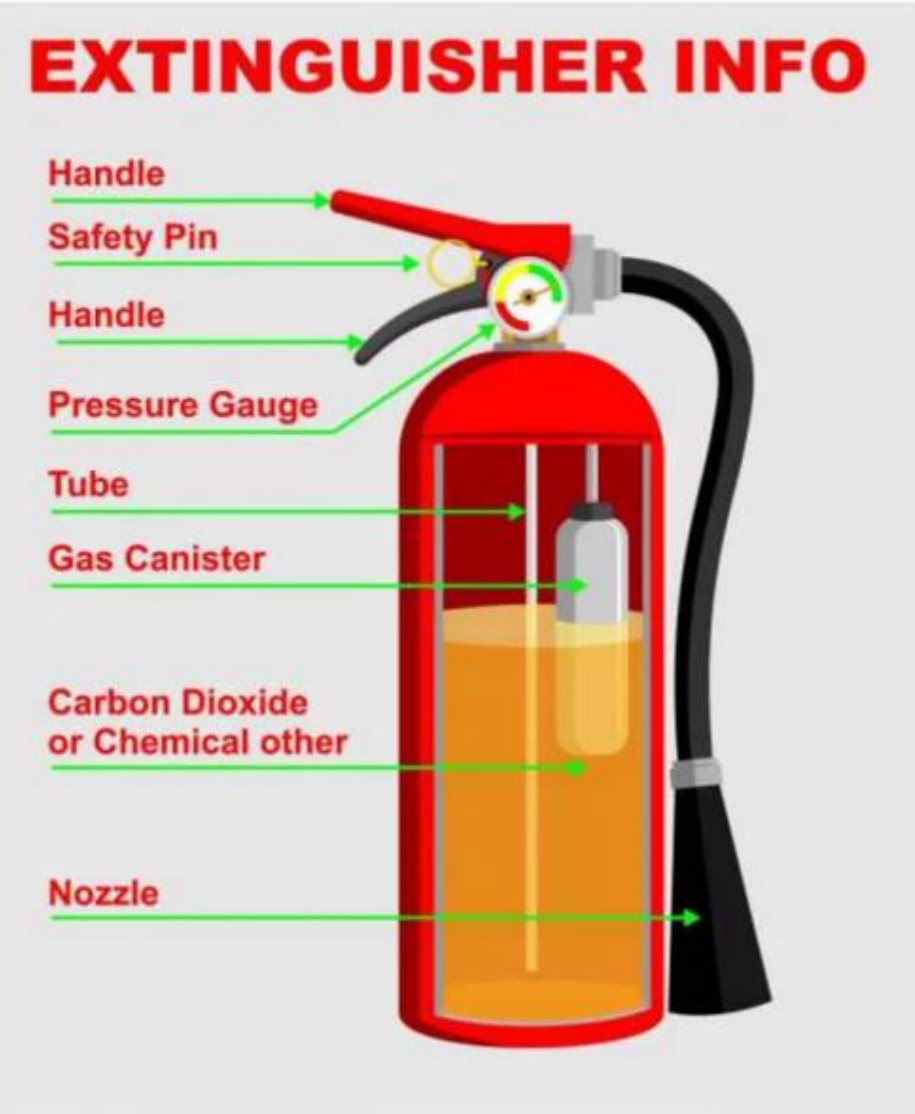
- **Class D Fire:** Class D fire involves **combustible metals** such as magnesium, sodium, lithium, potassium, etc. Sodium carbonate, Sodium chloride, and **salt-based dry chemicals** extinguish these fires.
- **Class K Fire:** Class K fire involves **cooking appliances** and combustible cooking media such as vegetable oil, animal oil, or fats. **Wet chemicals** are used to extinguish such fires.

Fire Extinguisher

- A fire extinguisher is an active **fire protection device** used to extinguish or control fires.
- Typically a fire extinguisher consists of a hand-held cylindrical pressure vessel containing **an agent.**

CLASS	A	B	B	C	D	K
PICTURE SYMBOL						
TYPE	Common Combustibles Solids (wood, paper, cloth, etc.)	Flammable liquids Gasoline and solvents	Flammable gases Propane	Live electrical equipment Computers, fax machines	Combustible Metals Magnesium, Lithium, Titanium	Cooking Media Cooking oils and fats
Water	✓ Yes	✗ No	✗ No	✗ No	✗ No	✗ No
Foam	✓ Yes	✓ Yes	✗ No	✗ No	✗ No	✓ Yes (ABF Foam Only)
Dry Powder	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ No	✗ No
M28/L2	✗ No	✗ No	✗ No	✗ No	✓ Yes	✗ No
Carbon Dioxide CO2	✗ No	✓ Yes	✗ No	✓ Yes	✗ No	✗ No
Wet Chemical	✓ Yes	✗ No	✗ No	✗ No	✗ No	✓ Yes

How to Use Fire Extinguisher



Fire Resistant Building Materials

- **Bricks** are made in fire kilns so they are highly resistant to fire. Depending on the construction and thickness, a brick wall can achieve one to four hours of fire resistance.
- **Gypsum board**, also known as drywall is used as a fire-resistant interior finish. Gypsum has chemically combined water with Calcium Sulphate. When affected by fire, the water comes out as steam. It resists the penetration of fire for a long time.
- **Stucco** is a plaster made of Portland cement, sand, and lime. It is an excellent and durable fire-resistant finish material. A 1-inch layer of stucco can lend a one-hour fire rating.
- **Concrete** is also a fire-resistant material but the resistance property depends on the type and amount of aggregate used. A new method of concrete development is **"Insulating Concrete Form (ICF)"** consisting of two insulation panels with a concrete layer in between them. It offers better insulation, noise blocking, and fire resistance.
- **Dual paned glass, tempered glass, wired glass,** etc. are used for fire-resistant windows.

Fire Resistant Building Materials

Brick

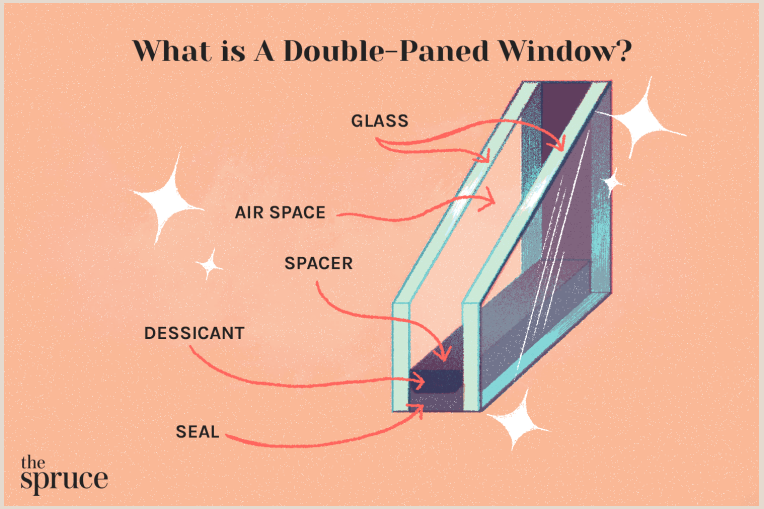
Concrete

Gypsum Board

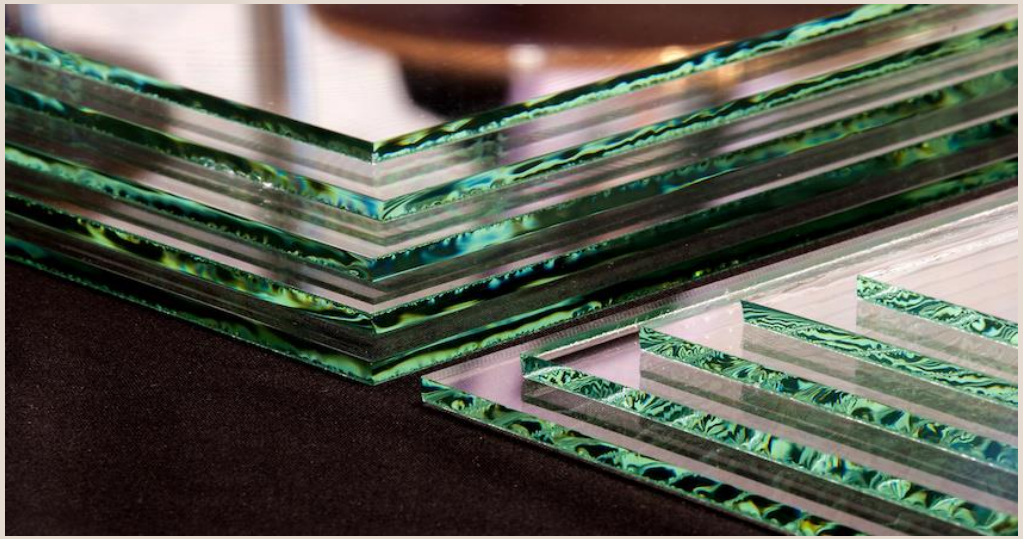
Stucco

Fire Resistant Building Materials

Double Pane Window



Tempered Glass



Wired Glass

Fire Protection System in Building

- **Fire Alarm:** They alert occupants to fire so that they can evacuate swiftly.
- **Smoke Detectors:** They detect smoke particles before they are visible and alert the occupants.
- **Fire extinguisher:** Used to put out small fires.
- **Fire Sprinkler:** It discharges water when any fire incident is detected. It can be operated automatically/ manually.
- **Fire Hydrant and Fire Hose System:** Each fire hydrant should be able to discharge water at a speed of 1000 liters/ minute. Hydrants are generally provided at street crossings or building courtyards. The fire hose is connected to the fire hydrants.
- **Hypoxic air fire prevention:** It is an oxygen reduction system that reduces the concentration of oxygen in a protected volume so that fire spreading cannot occur.

Fire Protection System

Fire alarm

Smoke detector

Fire extinguisher

Hypoxic fire prevention

Fire sprinkler

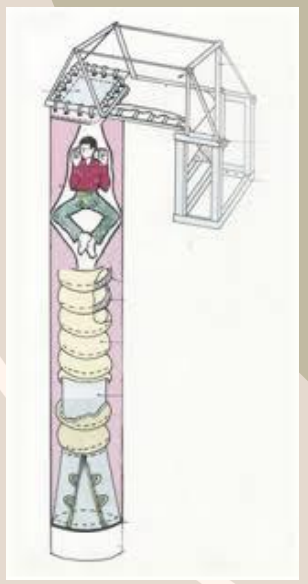
Fire hydrant and fire hose system

Fire Protection System in Building

The smoke kills more people than the fire itself. So safe evacuation of people is essential.

- **Fire Escape:** Fire escape is an emergency exit, usually mounted outside the building. When the inside stairs are inaccessible due to fire, this can be used.
- **Escape Chute:** It is a fabric or metal tube installed on the upper floor or roof of a building.

Fire escape



Fire escape chute

Fire Protection System in Building

Fire Exit:

- The **maximum travel distance** to reach an exit from any point of the building should not exceed **45 meters.**
- The standard fire **evacuation time** is **2.5-3 minutes.** Evacuation time is the total time required to detect fire, alert occupants, and the time taken to reach the exit or safe location.
- The **width** of a fire exit will be **at least 3.5 feet** (42 inches). However, the standard width differs based on the type of building (residential, commercial, institutional), number of occupants, and number of exits available.
- The fire exits should **never be blocked** and the fire exit sign should be **visible** in any condition.

Thank you