

FIRE HAZARDS

LESSON 1: Fire Triangles

The **fire triangle** outlines the three essential components necessary for fire: oxygen, heat, and fuel. Without any one of these elements, a fire cannot ignite. Understanding this concept aids in fire prevention and risk reduction.

Oxygen

The Earth's atmosphere consists mainly of Nitrogen (79%) and Oxygen (21%), providing enough oxygen for combustion. However, fire can be sustained even with lower oxygen levels until it is depleted entirely. In an experiment with a candle covered by a jar, the oxygen is gradually consumed by the fire, causing it to extinguish. Oxygen plays a crucial role in fire hazards, as seen in rescue missions where fire-resistant blankets are used to deplete oxygen and extinguish fires.

Heat

Heat is essential for starting fires as it raises materials' temperatures to their ignition points, where combustion begins. Different materials have varying **ignition temperatures**, illustrated by the ease with which a matchstick ignites compared to a candle's wick. In an experiment, adding water cooled the wick, preventing ignition. Similarly, firefighters use water to cool areas and reduce heat during fires to control and extinguish them.

Fuel

The third element essential for a fire is fuel, which can be various **combustible materials** like wood, paper, gasoline, and alcohol. However, not all materials can serve as fuel. In an experiment, attempting to ignite only the wax at the bottom of a candle failed to produce a fire, demonstrating that **noncombustible materials** like wax cannot sustain combustion. Structures constructed from noncombustible materials like concrete are less susceptible to fires compared to those made primarily of wood.

LESSON 2: Causes of Fire

Fire poses a significant threat in the Philippines, affecting various areas such as urban, rural, agricultural, and even marine environments. With over 10,000 cases reported annually, the country faces numerous fire incidents. The Bureau of Fire Protection, responsible for fire-related matters, identifies several causes of these incidents.

Causes of Fire

- **Faulty electrical wiring or connection** - The primary cause of fire incidents in the Philippines is faulty electrical wiring. When wires are exposed or overloaded, the electrical current running through them heats up, potentially leading to fires.
- **LPG-related** - Liquefied Petroleum Gases (LPGs) are highly flammable and can fuel fires. Defective LPG tanks with gas leaks can explode, leading to fires.
- **Neglected cooking stove** - Leaving stoves or ovens unattended at home can cause fire disasters, especially if combustible materials are nearby and come into contact with the stove's flames. Oil splattering outside the pan can also ignite and start a fire.
- **Cigarette butt** - Cigarette butts contribute to fire incidents in the Philippines, particularly when discarded in areas with abundant flammable materials like farms and forests.
- **Torch** - Fire torches, commonly used for activities like setting fire to forests and agricultural areas for kaingin, contribute to fire incidents in the Philippines. Arsonists also employ torches to ignite objects and structures intentionally.
- **Candle/gas lamps** - Unattended candles pose a fire risk, especially in places like homes, cemeteries, campsites, restaurants, and offices where they may be placed near combustible materials.
- **Matchstick/lighter** - Matchsticks and lighters are potential fire hazards because they are made up of combustible materials. Improper use, primarily by children, of lighters and matchsticks can accidentally cause fire disasters.
- **Static electricity or direct flame contact** - Static electricity, while less common, can ignite combustible materials, particularly in places like gasoline stations where it can spark and ignite fuel being pumped into vehicles. Though rare, static electricity has been implicated in some fire incidents, along with direct flame contact.
- **Neglected electrical appliances or devices** - Electrical appliances like refrigerators, microwaves, ovens, flat irons, and washing machines pose fire risks if mishandled or used improperly. Even malfunctioning appliances can spark fires if used.
- **Electrical machineries** - Electrical machinery, like appliances, can catch fire if mishandled, misused, or malfunctioning.
- **Chemicals** - Improper storage and handling of highly flammable chemicals in laboratories, factories, and industries can lead to fire incidents as these substances may react with their environment and ignite.
- **Incendiary device or ignited flammable liquid** - Incendiary devices like Molotov cocktails, flamethrowers, and Greek fire are specifically crafted to start fires deliberately.
- **Spontaneous combustion** - Spontaneous combustion occurs when organic materials, particularly dry plants, ignite due to their increased internal heat, often in hot and dry weather conditions, leading to forest fires.
- **Pyrotechnics** - Pyrotechnic-related fires stem from mishandling or improper storage of fireworks, which can malfunction and ignite unintentional fires. These incidents are particularly common during holiday festivities.
- **Bomb explosion** - Bomb explosions during warfare and terrorist attacks can lead to fires, especially in areas with combustible materials. This increases the risk of fire-related incidents alongside the initial explosion.



Lightning - Lightning strikes on flammable objects like trees can ignite fires, making lightning a potential source of fire ignition.

- Others - The Bureau of Fire Protection categorizes unspecified causes of fire as "others." This encompasses various factors such as vehicular fires, children playing with fire, incidents related to holiday decorations, and accidents involving household products, among others.

Fire Classification

The Bureau of Fire Protection (BFP) has identified 17 causes of fire, which are categorized into five groups based on the type of fuel source. This classification helps firefighters determine the appropriate handling and extinguishing methods for each fire incident. Additionally, fire extinguishing substances are developed according to this classification system.

Classification	Description
Class A	Fires related to common combustible materials that produce residue like paper, wood, plastic, rubber, fabric, and garbage.
Class B	Fires concerning flammable liquids and gases like petroleum oil, gasoline, paint, propane, and butane.
Class C	Fires related to energized electrical components like electrical appliances, machinery, and motor equipment.
Class D	Fires caused by combustible metals like potassium, sodium, aluminum, magnesium, and titanium.
Class K	Fires resulting from combustible household liquids like cooking oil, animal fat, and grease.

LESSON 3: Precautionary Measures and Response Procedures in a Fire Incident

Fire is a persistent hazard in the Philippines, affecting thousands yearly. In 2013, the Bureau of Fire Protection recorded 12,301 fire incidents, with faulty electrical wiring being the primary cause. This type of fire is particularly perilous as it often goes unnoticed until it's too late. A notable incident occurred on November 16, 2017, when a fire sparked by a faulty wire engulfed the Caloocan City Police Headquarters, spreading rapidly due to the building's flammable materials.

The national government took steps to prevent fire incidents by declaring **Fire Prevention Month** through Proclamation 115-A in 1966, signed by President Ferdinand Marcos. This initiative aims to instill safety awareness year-round, emphasizing caution, vigilance, sobriety, common sense, and respect for the law as preventive measures against fire hazards.

Precautionary Measures Against Fire Incidents

1. **Fire risk assessment** is crucial for preventing fire incidents by understanding an area's situation and identifying preventive measures. It involves evaluating the structure, occupants, and materials present. By identifying ignition and fuel sources, action plans can be developed to prevent fires. Training for at-risk individuals is also essential in these plans.
2. **Installing a fire alarm system** provides early detection of fires, allowing for prompt response. Coupled with a sprinkler system, it can effectively suppress fires even in unattended areas.
3. **Acquiring fire extinguishers and fire blankets** is crucial for preventing small fires from escalating. Conducting a risk assessment beforehand helps determine the appropriate type of fire extinguisher required for specific areas.
4. To prevent fire incidents, it's essential to **practice safe cooking habits**. Never leave cooking stoves unattended, as the heat can reach nearby combustible materials. Splattering cooking oils can also ignite fires, so it's crucial to stay vigilant while cooking.
5. To prevent fires, it's important to **dispose of cigarette butts properly**. Simply tossing them aside can ignite nearby combustible materials, as the residual heat can serve as an ignition source.
6. To prevent fires, **handle appliances and equipment carefully**. Regularly inspect electrical wires and components for faults and avoid overloading electrical sources to prevent unwanted surges that could start fires.

Mastering the use of a fire extinguisher is crucial. Follow the **PASS system**:

1. Pull the pin
2. Aim at the fire's base
3. Squeeze the handle
4. Sweep side to side at the fire's base.

LESSON 4: Basic Response Procedure During a Fire Incident

Phases of Fire

Fires typically start small and can quickly grow if not addressed promptly. The progression of a fire from its initial spark to its extinction can be divided into four phases. The first phase, ignition or the incipient phase, occurs when the elements of the fire triangle combine, causing fuel to heat up and ignite when exposed to oxygen.

Ignition, the first phase of fire, can occur either through external heat sources interacting with fuel and oxygen (piloted ignition) or from internal heat within materials (auto ignition). In this phase, oxygen is plentiful, heat is relatively low, and fuel is abundant. Growth, or the free burning phase, follows ignition as the fire consumes more fuel, spreading and increasing in size. As the fire grows, it creates a convection flow, drawing in more air and depleting oxygen while producing more heat and carbon dioxide. A flashover point may occur when multiple fuel sources ignite rapidly. The fully developed phase is reached when all available fuels are ignited, sustaining maximum fire size as long as there is oxygen. Decay, the final phase, begins as oxygen and fuel diminish, causing the fire to decrease in size. Backdraft, a sudden inflow of air, can lead to fire explosions during this phase.

Basic Response Procedures

In a fire situation, individuals should follow an action plan tailored to the specific scenario. If inside a burning area, they should locate exits, evacuate upon hearing the alarm, pull alarms if possible, inform others, attempt to extinguish small fires, check doors for heat before opening, close openings, use stairs, stay low to avoid smoke inhalation, and seek help if needed. If outside, they should stay away, avoid entering, contact emergency services, relay information, assist firefighters, and follow orders. If caught on fire, individuals should stop, drop, and roll, and attend to burns promptly to reduce infection risk.