

Industrial & Management Engineering Department

Industrial Relations

IM 111

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Fire Hazards and Prevention

Causes of fire

On average, fires kill approximately 5500 Americans and injure over 300,000 each year. The major causes of fires are:

- Smoking 26%
- Incendiary or Suspicious 16%
- Heating 14%
- Children Playing 10%
- Electrical Distribution 10%
- Cooking 8%
- Other Causes 16%

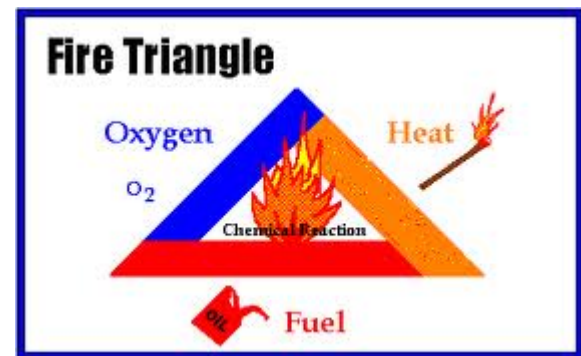
(Source: National Fire Protection Association)

Fire Hazards and Prevention

- The Leading Cause of death in a fire is asphyxiation.
- Fire consumes the oxygen in the air and increases the amount of deadly carbon monoxide, which causes loss of consciousness or death within a few minutes.
- Fire victims rarely SEE the flame.

Nature of a fire

Fire is a chemical reaction that takes place when a material oxidizes (i.e. reacts with oxygen) rapidly. In order for this process to occur, the three elements of the fire triangle must be present: **Fuel + Oxygen + Heat**








Fire Hazards and Prevention

- Fuel** can be any combustible or flammable material, and may be a solid, a liquid or a gas
- Oxygen** makes up approximately 21% of the air (by volume) that we breathe. To sustain a fire, a ratio of 16% oxygen (or greater) is required.
- Heat** sustain it (many types of fires will generate their own heat once burning, feeding the process.

Classification of Fuels

- Not all fuels are the same, and if you use the wrong type of fire extinguisher on the wrong type of fuel, you can , in fact make things worse.
- It is therefore very important to understand the four different classifications of fuels.

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CLASSES OF FIRES	TYPES OF FIRES	PICTURE SYMBOL
A	Wood, paper, cloth, trash & other ordinary materials.	
B	Gasoline, oil, paint and other flammable liquids.	
C	May be used on fires involving live electrical equipment without danger to the operator.	
D	Combustible metals and combustible metal alloys.	
K	Cooking media (Vegetable or Animal Oils and Fats)	

Class A: Wood, paper, cloth, trash, plastics, solid combustible materials that are not metals





Class B: Flammable liquids such as gasoline, oil, grease, acetone. Any non-metallic material in the liquid state.

Class C: Electrical; energized electrical equipment, as long as it is plugged in it is considered a class C fire.

Class D: Metals such as potassium, sodium, aluminium, magnesium.





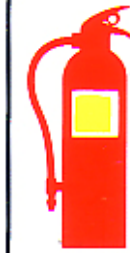





Fire Hazards and Prevention

Fire Extinguisher Chart

Extinguisher		Type of Fire				
Colour	Type	Solids (wood, paper, cloth, etc)	Flammable Liquids	Flammable Gasses	Electrical Equipment	Cooking Oils & Fats
	Water	✓ Yes	✗ No	✗ No	✗ No	✗ No
	Foam	✓ Yes	✓ Yes	✗ No	✗ No	✓ Yes
	Dry Powder	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ No
	Carbon Dioxide (CO2)	✗ No	✓ Yes	✗ No	✓ Yes	✓ Yes

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Symbols found on fire extinguishers & what they mean

					
	Water	Foam spray	ABC powder	Carbon dioxide	Wet chemical
Wood, paper & textiles 	✓	✓	✓	✗	✓
Flammable liquids 	✗	✓	✓	✓	✗
Flammable gases 	✗	✗	✓	✗	✗
Electrical contact 	✗	✗	✓	✓	✗
Cooking oils & fats 	✗	✗	✗	✗	✓

Types of Fire Extinguishers

	<p>Dry Chemical extinguishers are usually rated for multiple purpose use. They contain an extinguishing agent and use a compressed, non-flammable gas as a propellant.</p>
	<p>Halon extinguishers contain a gas that interrupts the chemical reaction that takes place when fuels burn. These types of extinguishers are often used to protect valuable electrical equipment since they leave no residue to clean up. Halon extinguishers have limited range, usually 4 to 6 ft. The initial application of Halon should be made at the base of the fire, even after the flames have been extinguished.</p>
	<p>Water extinguishers contain water and compressed gas and should only be used on Class A (ordinary combustibles) fires.</p>
	<p>Carbon Dioxide (CO₂) extinguishers are most effective on Class B and C (liquids and electrical) fires. Since the gas disperses quickly, these extinguishers are only effective from 3 to 8 ft. The carbon dioxide is stored as a compressed liquid in the extinguisher; as it expands, it cools the surrounding air. The cooling will often cause ice to form around the “horn” where the gas is expelled from the extinguisher. Since the fire could reignite, you should continue to apply the agent even after the fire seems to be out.</p>

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When to use an extinguisher

- The fire is small.
- You know what materials are burning.
- You have the proper extinguisher.
- You have considered the possible dangers in the area.
- You know how to operate the extinguisher.
- You are sure you have an unobstructed escape route.

When to evacuate

- You are not sure which extinguisher to use.
- You do not know how to use an extinguisher.
- The fire is starting to spread.
- The fire is becoming smoky.
- The only exit could become blocked.

Basic Fire fighting Concepts

1. P.A.S.S

Fighting the Fire

P

Pull the pin

A

Aim low at the base of flames

S

Squeeze the handle

S

Sweep side to side



Basic Fire fighting Concepts

2. R.A.C.E

- Rescue- rescue people in immediate danger
- Alert – yell out “code Red/Fire” (or whatever your facility implementing procedure dictates), pull fire alarm, dial emergency phone number.
- Contain – Close all doors and windows
- Extinguish/Evacuate – Extinguish small fires, evacuate people, if appropriate