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INTERNATIONAL GENERAL CERTIFICATE IN OCCUPATIONAL HEALTH AND SAFETY

Element 10: Fire

Overseas Industrial Technical Institute
version 1.3

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SCOPE OF LEARNING

10.1 Fire principles
10.2 Preventing fire and fire spread
10.3 Fire alarms and fire-fighting
10.4 Fire evacuation

10.1 FIRE PRINCIPLES
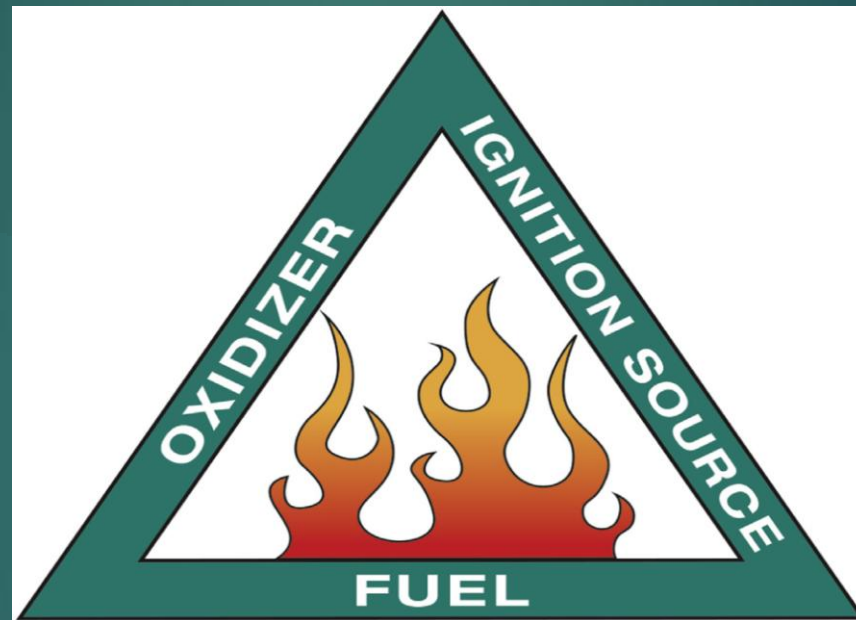
THE FIRE TRIANGLE

FIRE INITIATORS

• Electrical equipment – faulty wiring, overloaded conductors, misused equipment and the incorrect use of electrical equipment in inappropriate environments.

• Deliberate ignition – many workplace fires are started deliberately. In some cases, the workplace has been targeted, e.g. by a disgruntled employee or an unhappy customer. In other cases, it has not, e.g. youths playing with matches on an industrial estate.

• Hot work – any work involving the use of naked flames (e.g. a propane torch or oxy-acetylene cutting equipment), or which creates a significant ignition source (e.g. arc-welding and grinding).

FIRE INITIATORS

• Cooking appliances, e.g. fat pans left unattended.

• Heating appliances, e.g. electric fan heaters and space heaters, especially when left unattended.

• Unsafe use and storage of flammable liquids and gases, e.g. petrol, acetone and liquefied petroleum gas (LPG). Static sparks can be generated, which could ignite a flammable vapour.

• Mechanical heat – generated by friction between moving parts, such as a motor and its bearings, or cold work generating sparks.

• Chemical reactions - can also generate heat, e.g. oxidisers.

10.2 PREVENTING FIRE AND FIRE SPREAD

PREVENTING FIRE AND FIRE SPREAD

The best course of action to ensure fire safety is to prevent fires from starting.

Fire prevention can be based on some simple ideas taken from the fire triangle:
• Control fuel sources.
• Control ignition sources.
• Control oxygen sources.

Control of Combustible and Flammable Materials Combustible materials (such as paper, cardboard, wood and furnishings), flammable liquids (such as petrol and acetone) and flammable gases (such as butane, propane and methane) are all potential fuels and should be stored, handled, transported and used with appropriate care if the fire risk that they represent is to be controlled.

PREVENTING FIRE AND FIRE SPREAD

Control of Ignition Sources Poor control of potential ignition sources is a common cause of workplace fires.

• Electrical equipment should be routinely inspected and tested to ensure that it is safe. This will prevent faults developing that might cause sparks or overheating. Both portable appliances and fixed installations should be checked.

• Hot work should be controlled with a permit-to-work system unless it is being carried out in a purpose-built area, such as a welding bay in a workshop.

• Smoking should be controlled in the workplace.

• It is illegal to smoke in indoor workplaces in some countries. Even when it is not illegal, smoking can be controlled by company policies that ban or restrict it. In all cases, attention must be given to the safe disposal of smoking materials

PREVENTING FIRE AND FIRE SPREAD

Control of Ignition Sources Poor control of potential ignition sources is a common cause of workplace fires.

• Cooking and heating appliances should be used carefully and their use closely supervised. In particular, they should not be left unattended.

• Mechanical heat (such as friction from machinery and bearings) can be controlled by routine maintenance.

• Deliberate ignition can be controlled by making good security arrangements for the workplace. A perimeter fence, security staff at entrances, CCTV, security lighting, etc. can help

PREVENTING FIRE AND FIRE SPREAD

Storage of Flammables

Workplaces in which large amounts of flammable materials are displayed, stored or used can present a greater hazard than those where the amount kept is small. Wherever possible storage requirements should be:

- Minimum quantities (50 litres maximum in workrooms)
- Suitably fixed storage tanks
- Keep upright in well ventilated storage area
- Clear marking of containers
- Clearly marked storage area
- Spillage controls by using non-spill caps or bunding
- Adequate ventilation
- Suitable fire-fighting equipment
- Removing likely sources of ignition
- Trained competent staff
- Adequate Warning signs

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FUEL SOURCES

- ❑ Solids
- ❑ Liquids
- ❑ Gases
- ❑ Dusts

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CLASSIFICATION OF FIRE

Class A - fires involving solid materials, typically of an organic nature, such as wood, cardboard, paper, hardboard, and soft furnishings such as carpets and draperies, where combustion typically occurs with the creation of blazing embers.

Class B - fires involving flammable liquids, such as gasoline, paraffin, white spirit, thinners, varnish, and paints, or flammable solids, such as candles (wax) and fats.

Class C - fires involving gases like LPG (butane, propane) or natural gas.

Class D - fires involving metals such as sodium, lithium, manganese, and aluminium in swarf or powder form
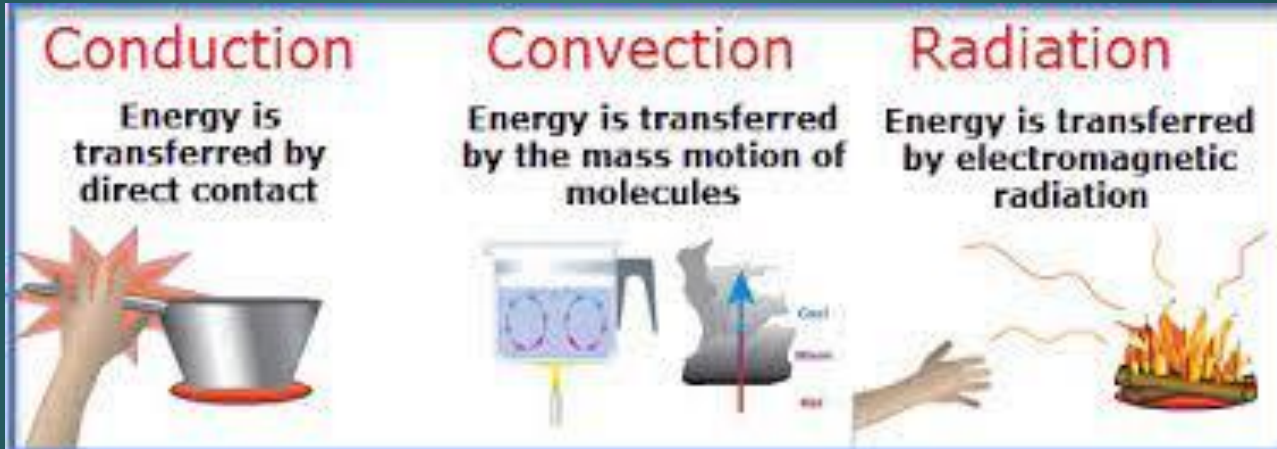
Class F - fires involving cooking substances such as vegetable or animal oils and fats in cooking gadgets. These fires are very difficult to extinguish because they retain a substantial amount of heat, allowing the chemical reaction to resume.

Electrical Fire

PRINCIPLES OF FIRE SPREAD

- ❑ Convection
- ❑ Conduction
- ❑ Radiation
- ❑ Direct burning

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10.3 FIRE ALARMS AND FIRE-FIGHTING

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FIRE DETECTION AND ALARM SYSTEMS

Employers and occupants of a building must make adequate and reasonable arrangements for detecting fire and sounding the alarm if they want to ensure the safe evacuation of their employees and guests. In certain instances, such as in small detached workplaces, it may be fair to rely only on the occupants to notice a fire and verbally alert others. It may be claimed that a reasonable level of safety for the occupants was thus established. For slightly bigger spaces, it may be deemed necessary to supplement this extremely basic system with a manually activated, electrically powered fire alarm.

Advantages:

➤ Detection of fires in unoccupied areas of the structure, such as storage and boiler rooms, at an early stage.

➤ Early notice of a fire to the occupants, allowing for effective evacuation

➤ The operation of additional safety devices, such as:

➤ Automated door closers and stairway pressure relief systems

➤ Shut down air conditioning and ventilation plant

➤ Making fire control systems operational

➤ Starting ventilation systems or fans for smoke control

➤ Opening doors or ventilators

➤ Functioning door release mechanisms, etc.

➤ Notification of the fire department in a timely manner, allowing for an early start to firefighting operations and a reduction in fire spread.

TYPES OF AUTOMATIC FIRE DETECTION AND ALARM SYSTEMS

Manual: use of Manual Call Points

Automatic:
- Heat Detectors
- Smoke Detectors
- Flame Detectors

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METHODS OF FIRE EXTINGUISHMENT

❖ Cooling . (: reducing temperature e.g. use water)

❖ Starvation. (: limiting fuel e.g. switching off gas valve)

❖ Smothering. (reducing Oxygen level e.g. use fire blanket)

❖ Inhibition/ Breaking the chain reaction . (blocking the progression of heat release that drives the fire.)

PORTABLE FIREFIGHTING EQUIPMENT

Typically, fire extinguishers are intended to combat multiple types of fire. Red is the colour of all extinguishers that comply with current rules. In order to identify the exact type of extinguisher, a colour-coded panel comprising at least 5 percent of the body is displayed. The size of the extinguisher offered for a certain area is determined by the fire hazard and the number of people who may need to use it. There are seven fundamental types of fire suppression equipment.

➤ Water
➤ Foam
➤ Dry powder
➤ Carbon dioxide
➤ Wet chemical
➤ Fire blanket.

PORTABLE FIREFIGHTING EQUIPMENT

Type (Fire / Extinguisher)	CLASS A — Combustible materials (e.g. paper & wood)	CLASS B — Flammable liquids (e.g. paint & petrol)	CLASS C — Flammable gases (e.g. butane and methane)	CLASS D — Flammable metals (e.g. lithium & potassium)	Electrical — Electrical equipment (e.g. computers & generators)	CLASS F — Deep fat fryers (e.g. chip pans)	Comments
Water	✔	✘	✘	✘	✘	✘	Do not use on liquid or electric fires
Foam	✔	✔	✘	✘	✘	✘	Not suited to domestic use
Dry Powder	✔	✔	✔	✔	✔	✘	Can be used safely up to 1000 volts
CO2	✘	✔	✘	✘	✔	✘	Safe on both high and low voltage
Wet Chemical	✔	✘	✘	✘	✘	✔	Use on extremely high temperatures

10.4 FIRE EVACUATION

MEANS OF ESCAPE

The Document defines means of escape as "structural measures through which a safe passage is provided for humans to escape in the event of a fire from any point within a structure to a place of safety outside the building without assistance from the outside."
While determining which level of means of escape may be appropriate in a specific circumstance, it is crucial to examine the following:
➤ Evacuation time
➤ Evacuation procedures
➤ Occupancy
➤ Travel distances
➤ Escape exits
➤ Travel routes
➤ External escape routes
➤ Emergency lighting signage
➤ Means of detection, giving warning and suppressing fire.

EMERGENCY EVACUATION PROCEDURES

During the design phase of a building, decisions on the mode of emergency evacuation are made depending on factors such as the intended use group and the size of the facility. Once a building is occupied, it will be necessary to create detailed emergency evacuation procedures that take into account the building's architectural features and fixed installations. Since the implementation of the RRSFO, the person designated as 'responsible' for fire safety management is in charge of planning and implementing emergency evacuation procedures.

While developing emergency procedures, the responsible party must consider the following:

➤ The features of the people, their behavior within the structure, and their physical and mental condition

➤ The dimensions, purpose, and construction of the building.

➤ The ways to get out of the building that are built in.

➤ When it will be necessary to leave

➤ How plans are made to put out the fire

➤ What kind of evacuation will be best, such as full or phased?

➤ How to get the evacuation started

➤ How do you get in touch with the fire department?

➤ What special roles, like fire wardens and fire incident controllers, are needed to help with the process?

➤ What facts, instructions, and training are needed to back up the procedure?.

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EMERGENCY EVACUATION PROCEDURES

The procedure

The procedure should cover:
➤ What to do on discovering a fire or smell smoke
➤ What to do on hearing the alarm
➤ Roles and responsibilities of staff, e.g. conducting in assisting disabled occupants
➤ Arrangements for calling the fire service
➤ How to save time, e.g. leaving personal belongings behind
➤ Where to evacuate to
➤ Any special precautions that may need to be taken.

EMERGENCY EVACUATION PROCEDURES

Competent staff

People can't just rely on the way a building is built, having enough ways to get out, fire alarms, emergency lights, etc. to make sure they can get out safely in case of a fire. Even in the smallest workplaces, you will need people who have been trained to help you get out in an emergency. Those in charge of fire safety in buildings and outside venues will need to think about hiring fire wardens/marshals, crowd safety stewards, fire alarm verifiers, and fire incident controllers.

EMERGENCY EVACUATION PROCEDURES

Fire wardens/marshals Role – The same job is called both "fire warden" and "fire marshal." It's important to know that fire wardens and fire marshals have different jobs that help keep people safe during fires.

First, they have a proactive role that requires them to help keep fire safety managed by doing things like:

➤ Assessing the fire risk at work on a regular basis
➤ Finding fire hazards and getting rid of them or telling management about them, for example:
➤ Taking steps to make arson less likely
➤ Making sure that flammable liquids are kept and used in the right way
➤ Making sure that sources of ignition are controlled or limited (for example, checking permits to work for any hot work)
➤ Keeping track of who smokes at work
➤ Keeping an eye on the build-up of flammable storage and trash
➤ For example, keeping an eye on fire safety measures:
➤ Making sure fire doors are in good shape and are locked or shut as needed
➤ Making sure fire-fighting gear is in place, tested, and in good shape
➤ Making sure that corridors and final exit doors are not blocked, especially with things that can catch fire.
➤ Making sure that all emergency exit doors are clearly marked and work as they should
➤ If there's a fire, you should know what to do.
➤ being trained to fight fires if they happen
➤ Being able to help people get out of a building safely and completely in case of a fire

EMERGENCY EVACUATION PROCEDURES

But a fire warden or marshal must be able to do the following in an emergency:

➤ Being able to sound the alarm

➤ Knowing how to contact the fire department

➤ Understanding the location of the means of escape for the portion of the workplace over which they have responsibility.

➤ Being trained and prepared to employ firefighting equipment when it is safe to do so.

➤ Helping with population evacuation by:

➤ Wearing a bright visibility jacket or waistcoat for easy identification

➤ Helping disabled employees in accordance with their respective PEEPS

➤ Performing a rapid but comprehensive sweep of all rooms, including walk-in closets, plant rooms, and restrooms.

➤ Ensuring that heat-generating equipment is off

➤ If feasible, doors and windows should be shut.

➤ Reporting the situation within their area of responsibility to the fire incident controller

➤ Take a roll call

➤ Assist the return to the workplace when the fire service confirms it is safe to do so.

EMERGENCY EVACUATION PROCEDURES

Assisting disabled people to escape

It is crucial that emergency plans for buildings accommodate for disabled individuals to ensure that there are not only adequate arrangements for access and use, but also for exit in the event of an emergency. Accommodations will need to be made for individuals whose ability to escape a fire may be hindered by the following:

➢ Aged
➢ Less able bodied
➢ Of impaired mobility
➢ Wheelchair users
➢ Impaired vision
➢ Impaired hearing
➢ Learning difficulties or mental illness

EMERGENCY EVACUATION PROCEDURES

Evacuating members of the public

The level of risk determines the extent to which measures must be taken to secure the safe evacuation of the public from a building. In rare instances, it may be deemed acceptable to just post a few fire notices in a building with restricted public access. On the opposite end of the spectrum, additional measures, such as public address systems and fire marshals, may be necessary for large premises or large crowds. When creating a system for the safe evacuation of the public, it is necessary to take into account the population size, location, and physical and emotional condition of the people.

EMERGENCY EVACUATION PROCEDURES

The purpose of drills, evacuation and roll-calls

Since the path is already familiar, there is no evidence that a fire exit sign will necessarily encourage people to head towards it in the case of a fire. It is possible for occupants to disregard designated fire exits in favor of more familiar pathways. It is quite probable that people would prefer to move to a familiar exit that is further away than to an unfamiliar exit that is closer. Thus, it is crucial that whenever possible.

Those who may need to use an exit in an emergency are acquainted with it. The purpose of practicing an evacuation procedure is to ensure that it functions properly, to ensure that everyone with a specific role in the procedure is aware of and competent in their role, and to demonstrate to all parties that measures have been taken to achieve a reasonable level of safety in the event of a fire.
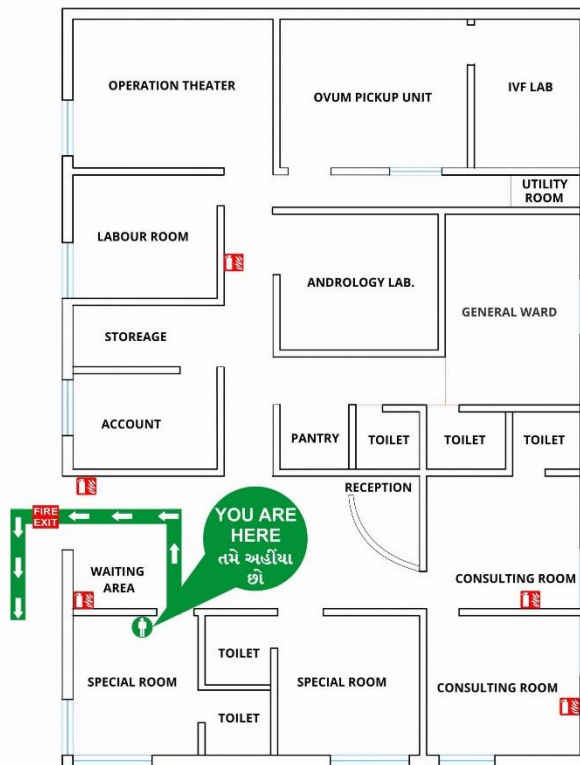
The purpose of a fire evacuation method is to encourage proper evacuation behavior so that people do not suffer or acquire major health problems connected with fire exposure.

To effectively test evacuation protocols, it is essential to be as realistic as feasible. If individuals believe the genuine emergency exits cannot be utilized, the technique will not be thoroughly examined.

EMERGENCY EVACUATION PROCEDURES

END OF SESSION QUIZ

1. Which of the following is a method of Fire Extinguishment?

(Choose the correct option)

1. Smothering
2. Substituting
3. Beating

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END OF SESSION QUIZ

Can Water in jet form be used to extinguish fires involving oils?

(Choose the correct answer)

1. True
2. False

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END OF SESSION QUIZ

Which of the following is a role of a Fire Marshall?

(Choose the correct option)

1. Switching off the power supply
2. Performing roll calls

END OF SESSION QUIZ

Which type of extinguisher to be used to Extinguish an Electric Fire?

(Choose the correct answer)

1. Water
2. Foam
3. Carbon dioxide

END OF SESSION QUIZ

Which of the following is used to trigger an Alarm manually at the workplace?

(Choose the correct answer)

1. Smoke Detectors
2. Manual Call Points