

SEGMENT TEN - Fire Prevention

After studying this segment you should have a greater understanding of the way in which simple fire prevention precautions can reduce the risk of fire, and what actions to take in the event of fire in the workplace.

AIMS OF THE SEGMENT

The main aim of this segment is to help you to understand the hazards and risks associated with fire and be able to:

- State the elements of the fire triangle and explain how these relate to the causes and control of fire;
- Describe general precautions for fire prevention and safe evacuation;
- Give examples of how fires can be controlled including reference to fire extinguishers and blankets;
- State the action to be taken in case of fire.

INTRODUCTION

Fire at work costs industry a great deal of money and is responsible for many injuries and longer term ill health, such as:

- fatalities;
- burns;
- injuries caused by smoke inhalation or breathing toxic fumes;
- other injuries caused while attempting to escape from the fire or the collapse of buildings, falling objects etc;
- stress.

The more than 500,000 (in 2002/03 this was one million) alarms that the fire brigade respond to each year has been on a general downward trend for the last 10 years.. The statistics for the 12 months up to April 2016 for England are:

- 320,000 fires in total attended, down from 564,900 for 2002/03;
- There has been an increase in deliberate house and vehicle fires over the last few years;
- Around 300 people lost their lives in a fire during this period, almost half what was in the early 2000s;
- Not having a working smoke alarm increases the risk of a fatality by 300% (estimated)
- More than half (50%) of accidental fires in homes arose from cooking. Other common sources of ignition were: electrical appliances (12%), electrical distribution (10%), smokers' materials (7%), and space heating appliances (4%).

FIRE BASICS – What is fire, how does it start, how do we prevent it?

Scientifically speaking, fire is the result of a chemical reaction. Chemical reactions require substances to react and either use energy or produce it. In the case of fire the substances required are oxygen and something for the oxygen to react with – the fuel.

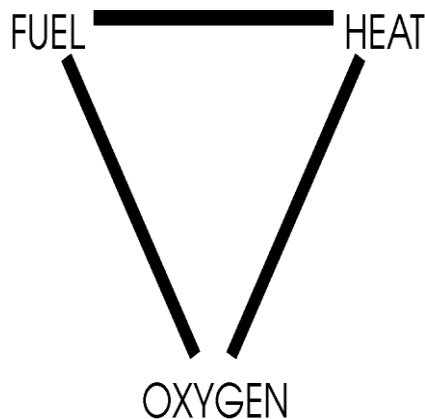
Oxygen is present in the air around us and about 1/5th of the air we breath is oxygen. The fuel that we need to keep the fire going can be simple things like fabrics, wood, plastic, paper etc. So, given that oxygen and fuel are fairly common in our everyday lives, why aren't fires much more common?

The simple answer is that there is a missing ingredient, energy. Although a fire usually produces lots of energy, it generally needs some energy to get started. Once started though, most fires will carry on until they run out of one of these ingredients.

The three ingredients required to support combustion are often shown in the form of a triangle:

- Fuel** - Which may be a solid, liquid, or gas.
- Oxygen** - 21% of air is oxygen.
- Energy** - usually in the form of heat which warms the fuel above a minimum temperature known as the ignition temperature. This varies with the type of material making up the fuel.

The Fire Triangle



By removing one of these ingredients the fire cannot be maintained. For example, by removing one corner, the triangle will collapse and a fire will not start.

Fire prevention is all about keeping the three ingredients apart.

Fire fighting is all about removing one of the ingredients once a fire has started.

SOURCES OF FUEL, HEAT AND OXYGEN

Fuel

Anything that burns is fuel for a fire. Particular attention should be given to those things that burn most easily. The pages of this training pack, cardboard, oil, petrol, solvents and paint, plastics and wood are all good examples of a potential fuel.

Heat

This includes anything that could produce enough heat to ignite the potential fuel present in the workplace. It could easily include:

- naked flames;
- heating equipment (gas, oil or solid fuel fired, or electrical heating);
- electrical equipment – particularly if faulty or abused;
- hot equipment and work processes – high energy lights, welding;;
- sparks, particularly from grinding operations;
- spontaneous combustion – batter scraps for example.
- matches and smoking materials.

Oxygen

The air is one obvious source of oxygen, but others include:

- oxygen supplies in cylinders and piped systems – hospitals for instance;
- chemical oxygen – some chemicals are ‘oxidisers’ and can provide sufficient chemical oxygen to start or maintain a fire.

CAUSES OF FIRE

Fires are caused by bringing together the three ingredients of the fire triangle. The four common ways in which this can happen are:

- **Mistakes** – human error
 - Smoking in prohibited areas.
 - Carelessness with matches or other ignition sources.
 - Losing control of a fire – when burning rubbish for instance.
 - Bad practice – carrying out ‘hot work’ without following proper safety practices such as removing flammable material before welding.
 - Simple stupidity – anything from using petrol to get a barbeque going to storing gas cylinders too close to a bonfire.
- **Misuse** of equipment – accidental or deliberate misuse.
- **Defective** equipment - poorly maintained, defective or damaged.
- **Deliberate** action – arson.

CONTROL OF FIRE

Fires are easy to prevent and control – all you need to do is avoid the fire triangle. Easier said than done sometimes!



But it can be done, if not by avoiding the three ingredients for a fire, then at least by reducing their occurrence.

Reducing sources of heat

Heat is essential in many, if not all workplaces. Danger from heat can be minimised by replacing dangerous heat sources with safer ones, by reducing the temperature of heat sources and by being aware of the risks. Other control measures can include:

- properly maintaining equipment so that it doesn't overheat;
- using a permit to work system for maintenance engineers involved in carrying out hot work;
- keeping flammable materials away from hotspots;
- keeping ventilation paths free from obstructions;
- removing all unnecessary naked flames and high temperature sources;
- Replace three bar electric heaters in offices with oil filled radiators;
- Ban smoking materials from high fire-risk workplaces:
- having a safe smoking policy - restricting smoking to a designated area or banning it altogether;
- keeping ducts and flues clean (e.g. fish and chip shops);
- making sure that electrical equipment is well maintained, not overloaded and the correct fuses are used;
- dealing appropriately with high risk materials – dispose of smouldering sawdust used in fish smoking properly;
- reducing the risk of arson by taking appropriate precautions.



Reducing risks from fuels

- Remove flammable materials from the workplace if possible.
- Replace flammable materials with safer ones.
- If neither of the above is possible, clearly indicate the danger from these materials by use of signs and staff training.
- Keep flammable substances in fire resistant containers or stores when not used.
- Minimise the quantity of flammable substance on site or in use at any one time.
- Good housekeeping to keep the accumulation of (flammable) waste to a minimum.
- Keep flammable substances away from sources of ignition.
- Be aware of the ignition points and safe limits of potential fuels.
- Be aware that some fuels can mix with air with explosive results – fine dusts can be potentially explosive as well as fumes.



What is the flash point?

This is the lowest temperature at which a flame will last if the fuel or flammable material is ignited. Below this temperature the flame will usually go out. The flashpoint of petrol is -43°C . That is 43°C below zero! This means that petrol will burn at any temperature we are likely to experience if an ignition source and oxygen are brought together.

Reducing Sources of Oxygen

- Controlling the use of oxygen in cylinders and supply lines.
- Reducing levels of ventilation when not needed.

This last bullet point can include closing all windows, doors and vents after working

hours and shutting down unnecessary ventilation systems when not needed. This will not have a major impact on the likelihood of a fire starting, but it will have a major impact on it spreading.

Open doors and ventilation shafts provide avenues for a fire to spread along.

FIRE PRECAUTIONS

SAQ

List the three factors that form the triangle of combustion.

- 1.
- 2.
- 3.

There are two main reasons for having fire precautions in the workplace. The first reason is to prevent fires. The second reason is to be able to react appropriately if a fire breaks out – to evacuate the premises safely.

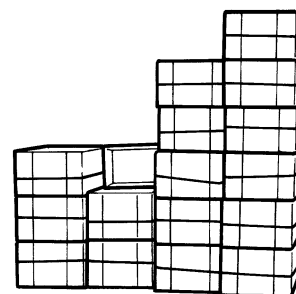
Fire Prevention is based around the early detection of fires, warning of fires and preventing the spread of fires.

Detection will include the installation and use of fire detection equipment and fire alarms. These provide an early warning system in case of the outbreak of a fire.

The type of detection and warning systems required will vary from workplace to workplace. If you work in a fish and chip shop or small fishmonger then fire detection may be as simple as keeping your eyes peeled and warnings may just be verbal ones. If you work in a supermarket or in a large fish processing company then detection systems will be much more sophisticated and the alarms will have to be capable of being heard and seen by everyone onsite. The fire certificate for your workplace may require an automatic fire detection system or the simpler manual call points or both.

Your workplace would need an automatic system if:

- there is the chance of fires starting outside of working hours, or in areas where they may not easily be detected – such as unoccupied areas like store rooms;
- a fire could spread rapidly through the workplace because of the presence of large quantities of combustible material or the layout or construction of the workplace;
- a fire could rapidly escalate into something more dangerous because of the



presence of dangerous or explosive substances.

Automatic systems may be designed to detect smoke (the most common) or heat or flames. The automatic system may be linked to a display panel showing the location or the alarm and may also pass information onto the local fire service station. Automatic systems may also incorporate some form of fire fighting system such as sprinklers.

Manual alarm systems can include a combination of verbal warnings, bells and whistles as appropriate.

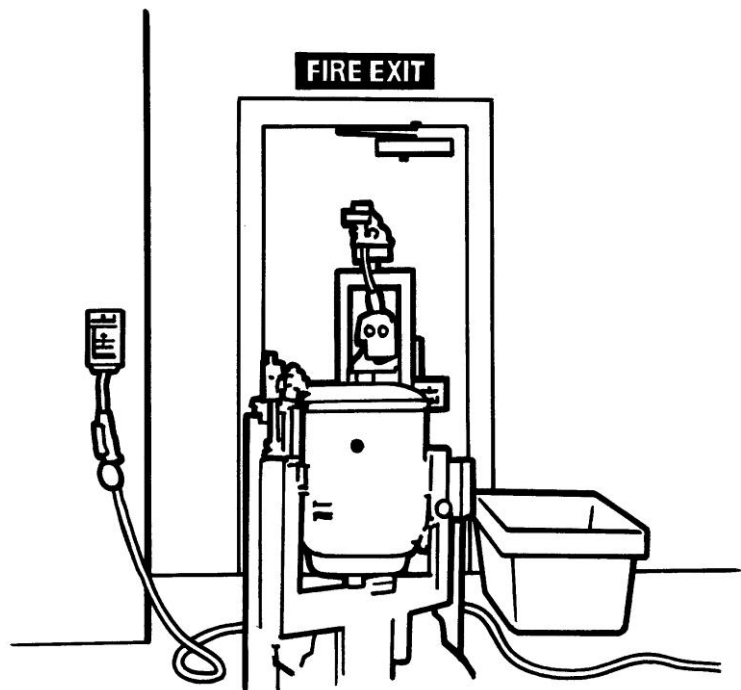
Manually operated alarm points – the ‘smash glass’ type are common and are usually positioned along the routes to fire exits (as are fire extinguishers). The reasons for this are simple. If you discover a fire in your workplace you should be able to immediately head for the nearest fire exit. On your way to the fire exit you should quickly come to a point at which you can trigger an alarm and if necessary find an appropriate fire extinguisher.

Just as an exercise, the next time you are at work and able to, imagine there is a fire. Now walk to the nearest fire exit. How far did you have to go before coming to an alarm point and to an extinguisher? If you think it was too far then speak to your employer about it.

Employers have a number of responsibilities under H&S legislation for fire safety for ensuring effective fire precautions are taken which includes providing:

- enough exits for everyone to get out easily and safely;
- fire doors and escape routes that are clearly marked and unobstructed;
- and maintaining fire escape doors which can be opened easily from the inside.

Although every possible precaution is taken to prevent a fire, in the event of a fire, it is essential that all staff are able to evacuate safely.



To do this they should all be aware of the following:

- where the fire alarms are;
- how to activate the fire alarm;
- where the nearest, safest fire exits are;
- where the assembly points are;
- how to call the fire brigade for any suspected outbreak of fire.

Remember, when things go wrong, people may be exposed to serious and immediate danger, such as fire and smoke. Always think about the worst that can happen and try to develop a plan of action to meet all situations. Employers have a responsibility to plan for a fire. In developing this plan, the following questions will have to be addressed.

- How will people involved deal with the problem? (How will they be trained?)
- Could the emergency services get to your workplace safely?
- Who will assist the services i.e. direct them to the incident from the road?
- How will the alarm be raised?
- Who will call the emergency services?
- Where should people go to reach a place of safety?
- What provision is there for emergency lights if necessary?
- Who are the nominated first aiders?
- Who has your employer nominated to take control?
- How will everyone be trained in emergency procedures?
- What are the needs of the disabled?

These are the kinds of questions employees (and their employer) should be able to answer. Do you know the answers for your workplace?

Means of Escape from Fire

During your initial induction training your employer should have made clear the importance of maintaining clear escape routes and ensuring that fire doors are clear of obstruction, both on the inside and on the outside.

You should also have been shown that a safe route is provided for you (and your

colleagues) to travel from any point in a building to a place of safety without outside assistance. Ideally, people should be able to turn their back on a fire and walk away from it rather than towards it, to reach safety.

These escape routes should be protected from fire and smoke. An escape route, such as a corridor or staircase, is protected if it is enclosed and is able to withstand the effects of fire for enough time.

By having a 'fire resisting construction' a protected route is regarded as a place of relative safety. Fire resistance is self explanatory, it applies to construction (walls, floors, ceilings or doors) that can resist attack by fire for a specific time.

There are other considerations your employer must take note of when assessing the suitability of escape routes including the amount of time needed to evacuate the premises.

Fire Resisting Doors

Fire resisting doors may perform several functions. These include preventing:

- the spread of fire into protected escape routes;
- the spread of smoke into protected escape routes;
- smoke spreading through a long corridor;
- the spread of fire from one floor to another.

It is essential that staff understand the importance of keeping fire doors closed at all times. **Under no circumstances should any fire door be wedged open and unattended.**

This latter point is very important. If a fire door is wedged open then it is no longer a fire door. Instead it is a convenient route for fire to spread.

Some fire doors are held open by magnetic or electrically operated latches. These are designed so that if the alarm sounds or power fails in the building they will automatically close and so protect the escape route.

There is only one time that it is permitted to keep open a fire door and that is during manual handling operations when the risk of physical injury would be greatly reduced by the door being kept open.

Only then is it permitted to keep open a fire door and only for as long as the handling operation is underway. This is a temporary solution. In these circumstance you should inform the appropriate person (fire marshal or manager) and seek their permission before you keep open the door.

The opened door must be observed at all times and closed as soon as possible. At no time must the door be left open and unattended.

Note:- fire resisting doors only serve their function if they are closed at the time of a fire.

SAQ

Complete the following statement regarding the different functions fire resisting doors may perform. Fire resisting doors prevent the spread of:

- a)
- b)
- c)
- d)

REMEMBER

1. Never wedge open fire doors. When closed properly they will stop smoke and fire from spreading.
2. Fire alarms should be able to be heard over normal background workplace noise.
3. Enough fire extinguishers, of the right type, should be provided to deal promptly with small fires.
4. Everyone should know what to do in case of a fire. Clear instructions should be displayed and you should have a fire drill periodically.



All employees should be instructed on how to raise the fire alarm. It is also important that (if appropriate) employees be trained on which fire extinguisher to use on certain fires and how to use them.

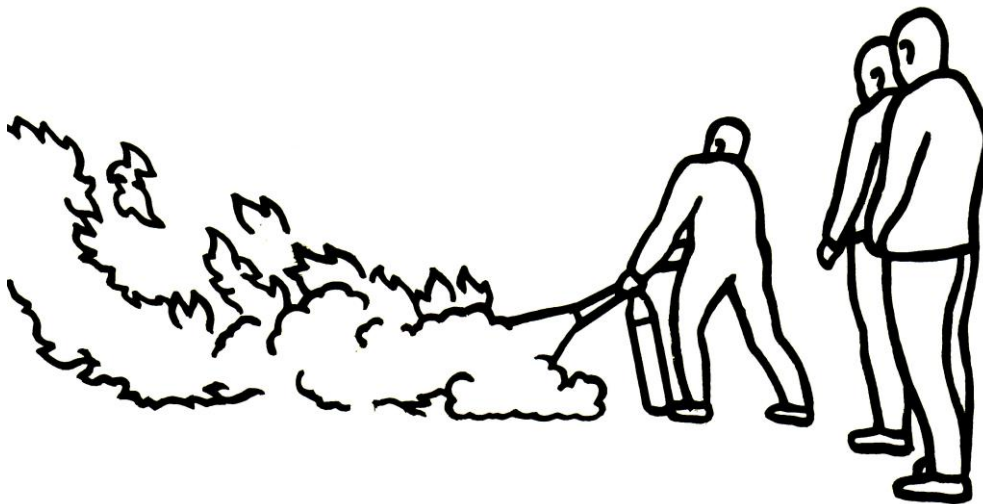
Depending on the nature of your business, the level of risks involved and your employer's approach to health & safety, it may not be company policy for employees to use extinguishers.

Using an extinguisher will place you in greater danger as you will have to approach the fire to fight it. Some employers decide that this is an unacceptable risk and they instruct employees simply to raise the alarm and evacuate to a safe place. Fighting the fire is then left to either specially-trained staff or to the fire service.

SAQ What is your employer's policy on this ?

Fighting Fires

- Think of fire fighting as you would first aid. Don't do it if you don't know what you are doing.
- Think of your own safety first and only contain the fire until the professionals arrive.
- Never attempt to fight a fire that is beyond your capabilities or the capabilities of the extinguisher. Think of a fire extinguisher as having the fire fighting capacity of a single bucket of water.



Fire Drills and Staff Training

Staff training and fire drills are clearly related, but are not the same. Yet, it is a common belief that a company's training obligations are satisfied by carrying out periodic fire drills.

Fire drills are both necessary and useful, but they do not educate employees in all matters with which they should be familiar. All new employees should receive complete instructions in fire safety as part of their induction training.

They should be instructed to leave by the nearest fire exit on hearing the alarm and not by their normal route out of the building. All fire drills should be documented as they are a test of the workforce's competence in responding to an evacuation alarm. Records should show who attended each fire drill and feedback should be sought from staff on their experiences in evacuating the building.

Every fire exit should be used during a drill, not just the one out the front door!

Periodic refresher training should then be given, perhaps annually.

A guide which is relevant to those places of work that require a fire certificate, recommends that instructions should be given by a competent person, to ensure that everyone at work is instructed at least once, but preferably twice, every year. It is this requirement that is normally incorporated in a fire certificate, thereby making training mandatory.

Why are fire drills necessary? List two reasons.

1 _____

2 _____

Fire Fighting and Protection Methods

Although fire is dangerous, it should be stressed it is even more dangerous when untrained employees attempt to extinguish a fire beyond their capabilities.

- Fire fighting should be done by the professionals.
- Do not attempt to tackle a fire that is beyond your capabilities.
- Fire fighting in the work place should be approached in the same way as first aid in the work place, i.e. contain the incident to prevent it getting worse until the properly trained people arrive.

However, people in the work place should be trained to respond to the fire by use of fire doors, escape routes and exits. Training in the proper use of fire extinguishers for staff should only be considered if it is your company's policy for you to fight a fire.

How could it be dangerous for untrained staff to tackle small fires?

Write below a few of your thoughts.

Fire Extinguishers

Portable fire extinguishers may contain any of the following agents.

- Water.
- Foam.
- Powder.
- Carbon dioxide.

Before we think about the types of extinguisher and what they are used for, I need to explain about the different classes of fires. Fires are classified according to the kinds of fuel involved and the risks presented by the fire. Some classes are rather unusual and you are unlikely to ever see one.

Class A fires – mostly solid materials such as wood, paper, fabric, some plastics etc. The burning material does not melt and act as a liquid – the fire stays put!

Class B fires – burning liquids. It includes solids that melt easily when burning and act as liquids. Examples include petrol, oil, grease, lard and some plastics.

Class C fires – burning gases.

Class D fires – these fires involve burning metals such as sodium, magnesium and aluminium. They are very hard to fight and you are unlikely to ever see one unless you work in certain industries.

Class E fires – fires involving live electrical equipment and the danger of electrocution. If the equipment is turned off or isolated than they change to one of the other classes.

Class F fires – this more recent classification recognises the specific risks inherent in burning cooking oil and fats. These increased risks are due to the volume and temperature of cooking oil fires. The large volumes of oil, near to the flashpoint temperature provide a challenge that ordinary foam or powder extinguishers cannot easily deal with.

What extinguisher for what type of fire?

Water is the most common agent and is suitable for class A risks, which involve "normal" combustibles such as wood, paper, and textiles. It is not suitable for class B risks. (ie those involving flammable liquids) nor for use with live electrical equipment.

Water extinguishers are common in offices and similar places. The water has an immediate cooling effect on the fire robbing it of the heat needed to keep burning.

Foam extinguishers are becoming much more common than they used to be. :

Foam extinguishers have a slight cooling effect but mostly smother the fire cutting off the supply of oxygen.

Powder

According to the type of powder used, these extinguishers may be suitable for both

class A and class B fires, or only class B fires. Powder provides very rapid knock down of the flame and its performance on both class A and class B fires is good.

A disadvantage of powder is that it has no cooling effect, so the fire may well re-ignite.

Powder can be used on live electrical equipment, but is liable to cause damage to electronic and electromechanical equipment. Powder extinguishers are not recommended for fire escape routes for the very practical reason that if they are used in a corridor or other confined space it can be very hard to see where to go. Escape routes need to be kept clear and that includes clear of blinding clouds of powder.

Carbon Dioxide

The extinguishing performance of carbon dioxide is significantly less than other extinguishers of similar weight. They are provided mainly for use on fires involving electrical equipment. They also generate a significant amount of noise when they are operated.

A further problem is that the discharge horn becomes very cold during use and if gripped tightly for long enough can result in mild frostbite. Hold them by the cylinder and not the pipe or the horn.

Class F extinguishers are for fighting class F fires. They contain a special wet chemical that reacts with the burning oil forming a crust or layer on top. They can be designed to tackle fires in deep fat friers holding large volumes (60 litres and more) of hot oil and are distinctly marked with a yellow band on the red body of the extinguisher. If you work in a Fish and Chip shop, it may be worth thinking about having this type as your main extinguisher.

The following points should be considered when positioning an extinguisher.

1. Extinguishers should be sited in conspicuous locations on escape routes, such as exits and in corridors and should be wall mounted on brackets.
2. No person should need to travel further than 30 metres to reach the nearest extinguisher.
3. It may be advisable to provide additional extinguishers of a suitable type in proximity to particular hazards. For example a carbon dioxide extinguisher could be provided in the vicinity of any electric equipment or a Class F extinguisher for a Fish & Chip shop.

Apart from fire extinguishers, there are two other types of fire fighting equipment that may be available in the workplace. These are:

- fire blankets.
- hose reels.

Fire Blankets

Fire blankets are normally made from fibreglass or leather, and are contained in wall

mounted housings. They are used for extinguishing fires in peoples clothing, and can be used to smother a fire involving burning food.

Their main application is in kitchens, but they may also be found in some laboratories or areas which people handle highly flammable liquids.

If your clothing is on fire don't follow your instincts and run for a fire blanket as running will only fan the flames. The accepted approach can be summed up as:

STOP – DROP and ROLL

Cover your face to protect your face and lungs. If a colleague is on fire and panics then tackle them to the ground and smother the flames by rolling if necessary.

Hose Reels

Hose reels comprise of a reel of hose that is normally 30 metres in length and is permanently connected to a water supply.

Usually, it is necessary for the user to open a valve before running out the hose. However, some hose reels have automatic valves which provide a supply of water after a short, predetermined length of hose has been run out. If you have hose reels on the premises then go and find out which type they are.

SAQ

Carbon dioxide extinguishers are mainly for use on fires involving electrical equipment. List some of the problems of using carbon dioxide extinguishers.

Staff Training

It is the responsibility of the management to ensure that all members of staff should be properly instructed and trained in the use of all extinguishing equipment installed in a building, if necessary.

While there should be no pressure on employees to fight fires, it is not realistic to assume that, pending the arrival of the fire brigade, an employee will watch a small fire, perhaps in a rubbish bin, grow without some action.

For the employee's own safety and the protection of the business it is clearly desirable that the employee some understanding of the use of extinguishers.

Statistics indicate that fire extinguishing appliances make a valuable contribution to defences against fire loss.

If staff are expected not to fight fires then they should be clearly told so during their

training.

Contents of Training Sessions

It is important that the following points should be covered in all training sessions.

Training has to take into consideration the changes to the work pattern and/or modification to the work area or equipment and processes and should include the following topics:

- means of escape;
- action in the event of a fire;
- means of raising the alarm and of summoning the fire brigade;
- action on hearing the fire alarm;
- location and use of fire appliances;
- general fire precautions.

To these should be added other matters that are more specific to the workplace, such as:

- smoking policy;
- specific fire prevention practices;
- specific fire precautions relevant to particular equipment or process etc.

It is important that all employees are informed at the start of each training session, never to assume that the sound of the fire alarm may be just another fire drill.

Fire drills are a useful means of reinforcing evacuation procedures and monitoring their effectiveness.

Fire drills are not always taken seriously by employees or managers and are seen as an unnecessary interruption to business. This is unfortunate as a properly conducted drill can highlight problems, such as failure of occupants to use all fire exits, so resulting in an inordinately long evacuation time.

The evacuation time, defined as the time between the operation of the fire alarm and the evacuation of the last person from the building, should always be measured and recorded. In premises with more than one staircase or fire exit, one staircase or exit may be blocked off by a fire marshal or manager during the drill, to test that an acceptable evacuation time is still physically possible and that staff are able to use an alternative exit.

The drill should begin by permitting an employee to operate a manual call point. A "post mortem" should always be held soon after each drill. This provides an opportunity to report any problems, such as unwillingness of individuals to evacuate or difficulties in hearing the alarm system.

What should you do in case of a fire?

This should have been made clear to you by your employer as part of your training. It should also be written into your employers emergency plan. However, here is a useful checklist:

If you discover the fire then:

- do not panic, simply take the appropriate actions;
- raise the alarm;
- only if necessary and safe to do so, fight the fire with the appropriate appliance;
- evacuate to a place of safety or your designated assembly point;
- inform the fire marshal or fire brigade where the fire is.

If you hear the fire alarm then:

- do not panic, simply take the appropriate actions;
- evacuate to a place of safety or your designated assembly point;
- keep fire doors closed as much as possible;
- assist your colleagues to evacuate.

In the words of the fire service **Get out! Get the Brigade out! Stay out!**

SAQ

Which of the following are common causes of fires? Tick those you believe are common causes.

- a) Incorrect use of electrical services and appliances.
- b) Smoking in prohibited areas.
- c) Carelessness with lighted matches and cigarettes.
- d) Faulty electricity, wiring and fittings.
- e) Loss of control over burning of rubbish.

SUMMARY

In this section you have covered fire protection methods which included looking at the causes of fire and the provision of fire precautions, such as exits and fire doors.

You have also covered fire drill training, identified the contents of training sessions and looked at what's involved in carrying out fire drills.

Finally, you looked at fire fighting and protection methods which included the different types and use of fire extinguishers, as well as the use of fire blankets and hose reels.