NEBOSH Certificate in Fire Safety and Risk Management

Unit FC1 - Fire Safety and Risk Management

SAMPLE MATERIAL

nebosh
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RMS PUBLISHING

Following a disaster:

- 25% of businesses never re-open.
- 80% of companies who don't recover in a month are likely to go out of business.
- 75% of businesses without business continuity plans in place fail within 3 years.

Primark warehouse fire, Leicestershire

Firefighters tackled the massive blaze at the 440,000 sq. ft. Primark warehouse at Magna Park, near Lutterworth (in 2005). The warehouse building itself cost £8 million to build, with up to an estimated £50 million worth of garments being destroyed. The building was owned and operated by TNT on behalf of Primark. This fully sprinklered building relied on the sprinkler systems to contain and prevent fire spread. The failure of the water supply for the sprinklers on the day of the fire meant the firefighters had no hope of saving the building or the contents once the fire took hold. The building was fully insured, both for stock loss and business interruption. The impact on the companies has been survivable, but the cost will, of course, go to the insurers.

Figure 1-2: Primark warehouse fire. *Source: BBC News.*

Figure 1-3: Buncefield Oil Terminal. *Source: Royal Chiltern Air.*

Buncefield oil terminal fire, Hertfordshire

The Buncefield fuel depot fire in December 2005 was the biggest in the UK's peacetime history. Explosions and heat from the fire caused severe damage to more than 80 buildings on the industrial estates surrounding the terminal, and some were demolished by the blasts. Initial estimates from Hertfordshire Chamber of Commerce put the cost of the damage at between £500 million and £1 billion. Information technology (IT) software and services firm Northgate Information Solutions was the closest business to the fire when a blast ripped through the oil depot in the early hours of Sunday, 11 December. The explosion rolled across Northgate's car park and into its 150,000 square-foot building, starting a fire which left the firm's UK headquarters an empty shell. This fire was an extreme example, with many buildings being destroyed or damaged by its effects. The oil company Total have now been held liable for all claims arising from the Buncefield incident, with approximately £750 million damages claims outstanding.

The site was operated by a joint venture between Total (60%) and Chevron (40%), but the High Court have ruled that Total were wholly liable. With the Regulatory Reform (Fire Safety) Order (RRFSO) 2005 requiring that we 'mitigate the effects of a fire on anyone in the premises and anyone in the vicinity of the premises, who may be effected by a fire on the premises', such future incidents will create test cases for how this new legislation is applied.

1.2 - The legal framework for the regulation of fire safety in new, altered and existing buildings

Regulatory Reform (Fire Safety) Order (RRFSO) 2005

The Regulatory Reform (Fire Safety) Order (RRFSO) 2005 applies to England and Wales (E&W). The legislation was introduced in Scotland (Sc) via two separate pieces of legislation, the Fire Safety (Scotland) Regulations (FSSR) 2006 and the Fire (Scotland) Act (FSA) 2005. The legislation was introduced in Northern Ireland (NI) via the Fire and Rescue Services (Northern Ireland) Order (FRSNIO) 2006 and the Fire Safety Regulations (Northern Ireland) (FSRNI) 2010. In principle, the laws in both England, Scotland and Northern Ireland cover the same matters.

Enforcement of the law is, however, separated out and put in place via the Fire (Scotland) Act (FSA) 2005 in Scottish law and the Fire Safety Regulations (Northern Ireland) (FSRNI) 2010 in Northern Ireland. One of the key differences is the person responsible in law.

In English law it is the ***responsible person***, in Scottish law it is the ***duty holder***, and in Northern Ireland, the ***appropriate person***. In essence, however, the aims of the different legislation and its responsibilities are virtually the same.

When released into the atmosphere the liquid instantly expands into a gas as the liquid boils and expands at a ratio of approximately 1:250. This gives the issue that any leak will quickly produce large volumes of flammable gas, which when mixed with air so that the mixture falls within the flammability range will produce large areas of explosive mixtures.

LPG must be stored away from heat sources and preferrably outside in fresh air. Any gas cylinders stored or used within buildings should be kept to a minimum and ventialtion to areas of use must be considered. Unauthorised access to storage areas must be prevented and storage places must be marked with notices prohibiting smoking, naked flames and other ignition sources. LPG should never be stored below ground level and its use in such areas should be given serious consideration. Premises handling and storing LPG should follow the requirements of the Dangerous Substances and Explosive Atmosphere Regulations (DSEAR) and UKLPG Code of Practice No. 7 'Storage of Full and Empty LPG Cylinders and Cartridges' should be followed.

See also 'Element 3.2 - Appropriate control measures to minimise fire risks'.

2.3 - The classification of fires

The classification of fire according to its fuel source

A basic understanding of the classes of fire is necessary because many fire extinguishers state the classes of fire that may be attacked using them.

Class A		Fires involving combustible solids (wood, paper, plastics, etc usually of an organic nature).
Class B		Fires involving flammable liquids or liquefiable solids (petrol, oil, paint, wax, etc.).
Class C		Fires involving flammable gases (propane, butane, natural gas, acetylene, etc.).
Class D		Fires involving metals (sodium, magnesium, zinc, aluminium and many metal powders, etc.). In general metals in the form of powders or swarf.
Electrical Hazards		Although ***not a class of fire***, fires in live electrical equipment cause an additional hazard requiring special consideration and the provision of suitable firefighting equipment. This is a pictogram/statement used on extinguishers to identify their suitability for use on electrical equipment.
Class F		Fire involving cooking fats and oils.

Figure 2-10: Classes of fire. *Source: Rivington Designs.*

2.4 - The principles of fire-growth and fire spread

Factors that influence fire-growth rates and smoke movement

FIRE-GROWTH RATES

The fire-growth rate is mainly affected by the rate of production of flammable fuel in the form of vapours and the availability of oxygen.

SMOKE MOVEMENT

Smoke is a mixture of gases and water vapour, carbon monoxide, carbon dioxide, nitrogen oxide, irritant volatile organic compounds, air toxics and small particles.

WASTE DISPOSAL CONSIDERATIONS

Taking into account the size of the site, waste material must not be allowed to accumulate. This means controlling build-up of waste at local points around the site, particularly where they impede access and egress, as well as any major accumulation points.

The disposal of building materials must be controlled by consignment certificates and the waste taken to a recognised licensed landfill site. Care must also be taken of special waste such as asbestos. Any waste materials that are left lying around a construction site (or any premises) are a ready source of fuel for an arsonist. Care should be taken regarding the siting of waste skips etc to ensure that there is a safe distance between the waste materials and the building. In this way, if the waste materials are ignited they should not spread fire to the building itself.

Figure 3-15: Combustible materials. *Source: RMS.*

Figure 3-16: Materials inappropriately stored. *Source: RMS.*

DEMOLITION HAZARDS

Structures may contain flammable materials as a result of previous use. Any residues of materials in storage tanks, storage areas or pipelines need to be identified and evaluated. Storage tanks and vessels may contain flammable vapours or toxic sludge, especially those forming part of an industrial process. Flammable liquids and vapours may also be encountered in confined spaces (such as tanks) and in pipes.

On demolition sites, after the removal of anything valuable or harmful, it is not uncommon for an amount of combustible materials to be left over and for this to be burnt on site to reduce the cost of removal and disposal of material. The safe working procedure for demolition needs to detail the controls to be used for handling, burning and disposing of flammable materials.

USE OF OXY-FUEL EQUIPMENT

Welding

- Only use competent trained staff.
- Regulators should be of a recognised standard.
- Colour code hoses - blue - oxygen.
  - red - acetylene.
  - orange - propane.
- Fit non-return valves at blowpipe/torch inlet on both gas lines.
- Fit flashback arrestors incorporating cut-off valves and flame arrestors to outlet of both gas regulators.
- Use crimped hose connections not jubilee clips.
- Do not let oil or grease contaminate oxygen supply due to explosion hazard.
- Check equipment visually before use, and check new connections with soapy water for leaks.
- Secure cylinders in upright position.
- Keep hose lengths to a minimum.
- Close supply valves at cylinder when not in use.
- Follow a permit-to-work system.

Figure 3-17: Welding equipment. *Source: RMS.*

Hot work

It is imperative that good safe working practices are utilised when carrying out hot work. Combustible materials must be removed from the area or covered up. Thought must be given to the effects of heat on the surrounding

In severe cases, fire evacuation lifts and/or evacuation platforms that transfer the individual in their wheelchair down the stairs would need to be considered. A PEEP may be required, for example, for anyone with a mobility issue, a sensory impairment such as hearing loss, mental impairment, or even for an able-bodied person who is working alone in a remote part of the building, for example, a roof space.

GENERIC EMERGENCY EVACUATION PLAN (GEEP)

In a building where it is probable that people will be present as visitors who will need assistance with evacuation a similar generic system should be devised and implemented. (This may be referred to as a SEEP (Standard Emergency Evacuation Plan).

4.3 - Methods and systems available to give early warning in cases of fire

Fire alarm and fire detection systems

When carrying out a fire risk assessment it is worth considering a generic hierarchal approach to fire alarms and detection, so that a suitable system can be installed.

The method of alarm and detection should be chosen from the following examples:

- Verbal warning - shout of fire.
- Manually operated individual fire alarm, for example, rotary gong.
- Self-contained fire alarm, call point/sounder.
- Manual-electrical fire alarm/call points and warning devices.
- Automatic fire alarm system/call points/detectors/warning devices.
- Voice alarm - system/taped message/detectors/call points/warning devices.
- Staff alarm system - method of warning staff prior to general alarm being given.

SHOUT OF 'FIRE'

It may be acceptable to rely on a person shouting ***'Fire!'*** as the only method of warning. In reality, this will only be suitable in very small buildings such as a portacabin or larger single-room buildings, where a shout can be heard by all occupants. It would not be acceptable for the person raising the alarm to have to run around the building shouting 'Fire'.

MANUAL ALARMS

The simplest type of fire alarm system is a manually operated system, for example, a hand bell or whistle. Their limitation is the size of the building in which it is possible to hear it and the need for it to be located conveniently. Some are portable and therefore could be prone to loss or theft.

Figure 4-36: Stand-alone call point and sounder. *Source: FSTC Ltd.*

Figure 4-37: Fire alarm call point. *Source: RMS.*

Stand-alone call points which operate a local alarm are now available. They offer an improvement on the traditional manual alarm as the individual does not have to remain in the area once the alarm has been operated. As with manual alarms, the audibility of any one alarm must be sufficient to give warning throughout the building or workplace. There are, however, versions of these stand-alone systems that can be linked together via radio signals. This may be a consideration instead of hard wiring a standard fire alarm system.

CALL POINTS

The fire alarm call point is the standard method of operation for a fire alarm system, allowing people in the building to manually operate it. However, it is necessary to ensure that workers know how to operate the system to avoid error in use or delay because of concern about how to use it. 'Will I cut my finger?' and 'Where's the break-glass hammer?' are typical questions that workers will ask. Call points should be sited so

Advantages of a fire marshal system include:

- It has been shown to be the quickest, most efficient way to evacuate a building.
- It allows the fire and rescue service into the building quickly to rescue people and reduce damage.
- Buildings are split into pre-defined areas for ease of control.
- It is a proactive approach - fire marshals identify dangers and problems arising during evacuation, not after it.
- The system uses people to evacuate people and by doing so it allows for adverse human behaviour.
- It allows for a controlled search of an area defined by information from the fire marshals.

Disadvantages of a fire marshal system include:

- It may only be in operation during the core working hours for the building.
- The role of fire marshal is normally voluntary - it relies on staff goodwill and their participation. In some situations it may be appropriate to employ someone formally in this role as part of their job.

It is important that all areas of the building are covered by fire marshals, and organisations that choose to adopt this system must ensure that there are sufficient numbers of fire marshals available at all times, bearing in mind that 'extra' fire marshals will be required to cover absences. Absences include sickness, holiday leave, attendance at training courses, or people temporarily absent from their normal place of work, for example, delivering a report to another part of the building.

There will often be areas of the building that fire marshals may not enter, for example, rooftops or plant room areas. The system in place still has to account for such areas, but they can be managed by a roll-call system with log in/out systems in place. There is nothing wrong with having two different types of evacuation system running in parallel in a building, provided that management structures are in place so that the whole evacuation system management is effective.

A fire marshal system can operate in a number of ways depending on the layout, use and occupation patterns of the building.

Fire marshal - fixed system (standard system)

A fixed system can be used when people occupy and use the building in such a way that they (or a proportion of them) do not normally move around the building during their normal work operations. This means that people who are generally at fixed positions within the workplace can be selected as fire marshals.

These fire marshals are allocated a fixed area of the building as a search area, and when the fire alarm operates they check their area before leaving the building.

Provided that there are sufficient fire marshals at work so that all areas can be covered, this system is the simplest type of 'floor-sweep' method.

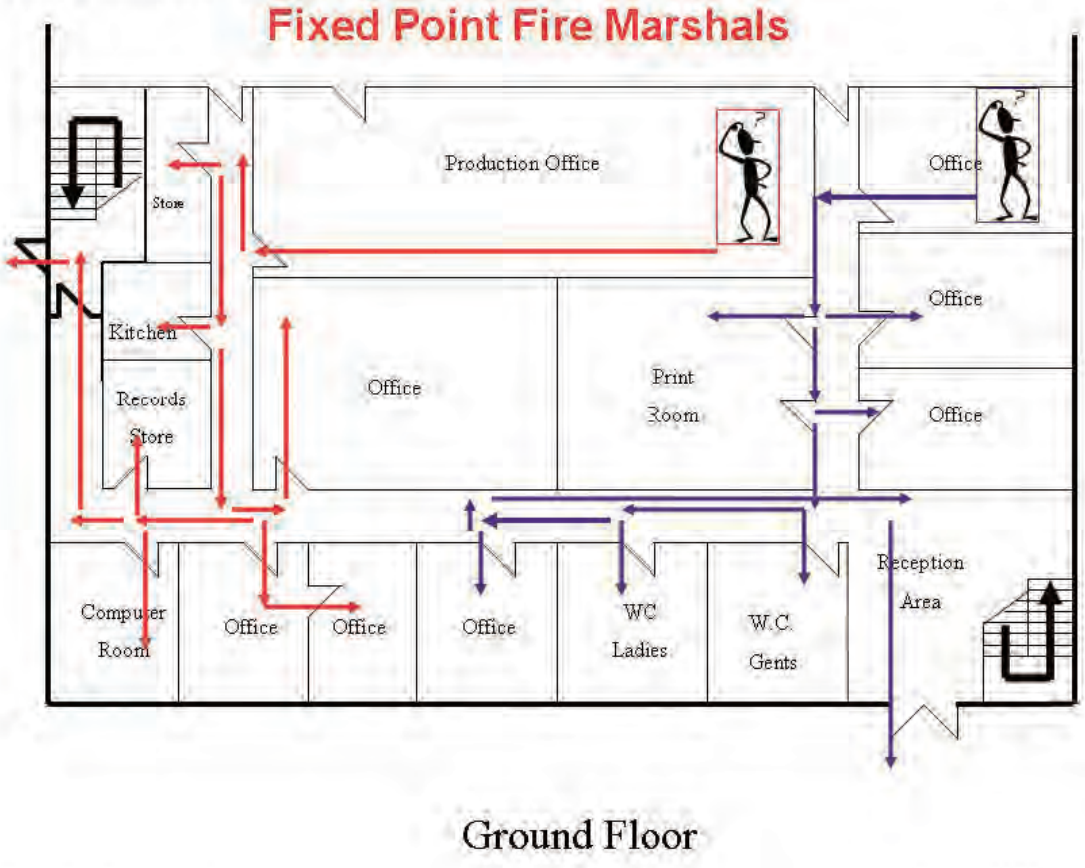

Figure 5-1: Fixed point fire marshals. *Source: FSTC Ltd.*

If premises are subdivided into assessment areas to make the task more manageable, it is important that an overview of the entire premises is also considered as part of the holistic process, because the assessment for one individual area may impact positively or negatively on another separate area.

It may also be necessary to conduct a number of fire risk assessments related to different circumstances, for example, one set of assessments for the normal operation of the organisation and another for maintenance and refurbishment periods.

Maintenance and refurbishment work can introduce new ignition and fuel sources into the workplace and may compromise fire safety measures. Risk assessments must be conducted by one or more competent persons.

The fire risk assessments created should supplement those already carried out for general health and safety reasons.

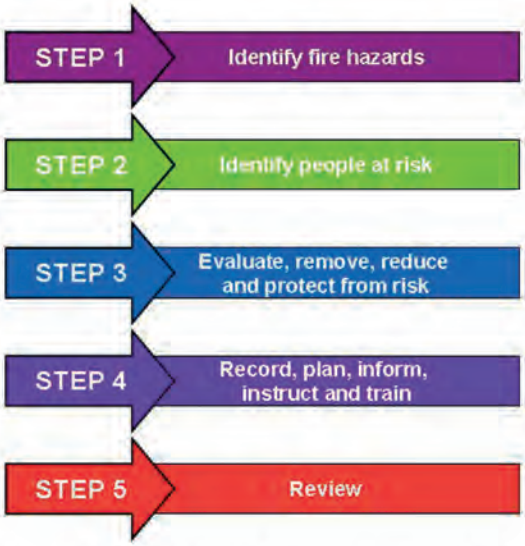

Figure 6-6: 5 steps to fire risk assessment. *Source: RMS.*

Step 1 - Identify fire hazards

FIRE HAZARDS

Sources of ignition

There are a wide range of sources of ignition that may be found in the workplace. Sources of ignition include smoker's materials, naked flames, grinding operations, arcing electrical equipment, heaters, hot processes, cooking, machinery, boilers, faulty or misused electrical equipment, lighting equipment, hot surfaces, friction, static electricity, metal impact and arson. Microwave and radio frequency non-ionising radiation may also act as a source of ignition in some situations where highly flammable gas or vapour is present.

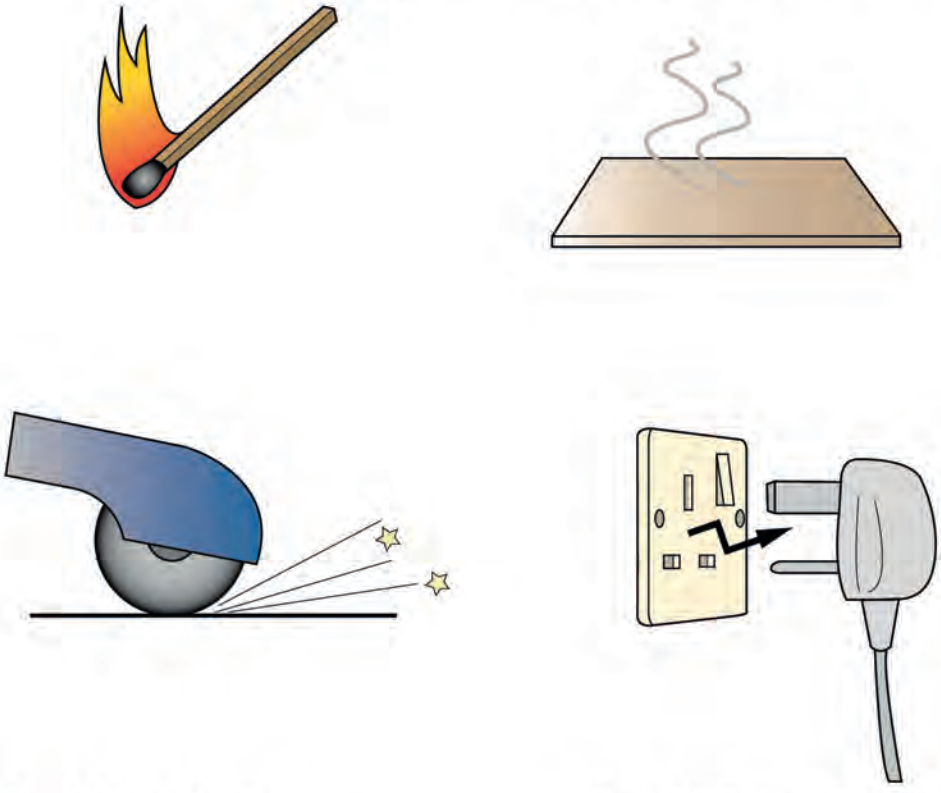

Figure 6-7: Sources of ignition. *Source: RMS/Government fire guides.*

Sources of fuel

Sources of fuel in the workplace may be in the form of raw materials, processed materials, waste products, parts of the building or furnishings. This is likely to include flammable liquids, flammable dusts, wood, paper, card, plastics, foam, flammable gases and liquefied petroleum gases (LPG), furniture, textiles, packaging materials and waste materials, including shavings, off-cuts and dust.

CONTROL OF PREMISES

Section 4

This section places duties on anyone who has control to any extent of non-domestic premises used by people who are not their employees.

The duty extends to the provision of safe premises, plant and substances, for example, maintenance of a boiler in rented out property.

MANUFACTURERS, DESIGNERS, SUPPLIERS, IMPORTERS, INSTALLERS

Section 6

This section places specific duties on those who can ensure that articles and substances are as safe and without risks as is reasonably practicable. The section covers:

- Safe design, installation and testing of equipment (including fairground equipment).
- Safe substances tested for risks.
- Provision of information on safe use and conditions essential to health and safety.
- Research to minimise risks.

Figure RSP-3: Risks from roadside work. *Source: RMS.*

Figure RSP-4: Risks from street light repairing or tree felling. *Source: RMS.*

EMPLOYEES' DUTIES

Section 7

a) To take reasonable care for themselves and others that may be affected by their acts/omissions, for example, wear eye protection, not obstruct a fire exit.

b) To co-operate with the employer or other to enable them to carry out their duty and/or statutory requirements, for example, report hazards or defects in controls, attend training, provide medical samples.

Additional duties created by the Management of Health and Safety at Work Regulations (MHSWR) 1999 employees' duties:

- Every employee shall use any equipment, material or substance provided to them in accordance with any training and instruction.
- Every employee shall inform (via supervisory staff) their employer of any (a) risk situation or (b) shortcoming in the employer's protection arrangements.

OTHER DUTIES

Section 8

No person to interfere with or misuse anything provided to secure health and safety, for example, wedge fire door open, remove first aid equipment without authority, breach lock off systems.

Section 9

Employees cannot be charged for anything done or provided to comply with a specific legal obligation, for example, personal protective equipment, health surveillance or welfare facilities.

OFFENCES COMMITTED BY OTHER PERSONS

Section 36

- Where the commission by any person of the breach of legislation is due to the act or default of some other person, that other person shall be guilty of the offence and may be charged with and convicted of the offence whether or not proceedings are taken against the first mentioned person.