

1        REGULATORY DOCUMENT      1

1.7	FIRE AND FLAMMABLE SUBSTANCES.....	1
1.7.1	Fire Prevention and Control in the Office.....	4
1.7.2	Fire Prevention and Control in connection to construction .....	26
1.7.3	Dangerous Substances .....	36
1.7.4	Liquefied Petroleum Gases .....	51
1.7.5	Vehicle Fuels (including Petrol, Diesel and LPG) .....	70

**FORWARD**

- 1 The Qatar Construction Specifications (QCS) includes references and certain sections which address occupational health and safety. To ensure that the users of the RD/SAMAS are fully aware of where occupational health and safety issues are addressed in the QCS, the following table summarises where potential overlaps may occur. For consistency, it is recommended that in matters relating to occupational health and safety reference is made first to the RD/SAMAS. For the purpose of clarity, however, references are made in the relevant section of the RD/SAMAS to their comparable sections in the QCS and vice versa.
- 2 The purpose of QCS is to provide as a general technical guide for acceptable construction work practices in the State of Qatar, considering this; any addition for technology, material, specification, standard that are not mentioned in this section or their modification, shall be subject to approval as stated in the introduction of QCS (00-02).

Sr. No	QCS Section No.	Part No.	Part Name	Item No.	Item Name
1	1	7	Submittals	7.5.2	Health and Safety Organization Chart
2	1	7	Submittals	7.6.1	Health and Safety Plan
3	1	10	Health and Safety	All	All
4	1	11	Engineer's Site Facilities	11.4.6	Safety Equipment and Clothing
5	1	14	Temporary Works and Equipment	14.4	Test Certificates for Cranes and Lifting Tackle
6	1	15	Temporary Controls	All	All
7	1	16	Traffic Diversions	16.1.3	Safety
8	1	8	General	8.1.6	Safety
9	3	1	General	1.4.12	Safety and Management
10	4	1	General Requirements for Piling Work	1.6	Safety
11	4	4	Deep Foundations	4.9.1.7	Safety Precautions
12	4	4	Deep Foundations	4.9.1.13	Protection of Testing Equipment
13	6	1	General	1.6	Temporary Fencing
14	6	7	Asphalt Plants	7.8.13	Safety Requirements
15	6	14	Works in Relation to Services	14.2.2	Safety
16	8	1	General	1.3.2	Health and Safety
17	8	8	Painting and Protective Coatings	8.1.9	Safety
18	8	9	Trenchless Pipeline Construction	9.2.5	Safety Requirements
19	8	10	Pipeline Cleaning and Inspection Survey	10.1.7	Safety Requirements
20	8	11	Sewer Rehabilitation	11.2.2	Safety
21	9	1	General	1.2.8	Safety Guards
22	9	1	General	1.2.16	Noise Levels and Vibration
23	19	5	Hot Water Storage	5.1.6	Safety
24	21	1	General Provisions for electrical Installation	1.1.11	Fire and Safety Precautions
25	21	1	General Provisions for electrical Installation	1.1.23	Safety Interlocks
26	24	1	General	1.1.4	Scaffolding
27	29	1	Design Aspects	1.1.5	Fire Resistance Period
28	29	3	Geotechnical Specifications	2.3.1.5	Safety
29	29	4	Tunnel	4.5.8	Safety Regulations
30	29	4	Tunnel	4.5.9	Fire Prevention
31	29	4	Tunnel	4.6.4	Safety Measures and Systems
32	29	7	Concrete Structures	7.1.10	Safety Railing

## 1.7.1 Fire Prevention and Control in the Office

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### 1.7.1.1 Key points

- 1 Fires can and do kill, injure and cause serious human suffering and financial loss. The potential dangers are particularly severe on many construction sites, where construction activities such as hot work are frequently combined with circumstances where fires can spread quickly and escape may be difficult.
- 2 The rate of injury to people and damage to property and environment caused by fire in connection to construction is significant.
- 3 When construction activities are not adequately controlled, employees and members of the public can also be killed or injured, and property adjacent to construction sites be put at risk – for example, from a site fire large enough to spread off-site. Offices in particular site offices are vulnerable to fire risks and serious fire damage.
- 4 Particular attention is required regarding sites, premises, temporary accommodation brought onto site to provide offices, canteens and welfare facilities that are occupied by people at work on construction sites. They shall be subjected to a specific fire risk assessment.
- 5 Temporary accommodation on site must be used for their intended purpose. They shall not be used for storing dangerous substances.
- 6 a risk based approach must be taken for fire prevention and control and places legal obligations on the contractor to carry out a fire risk assessment and put in place appropriate control measures and maintaining them in accordance with any changes that occur.
- 7 Within each section a specific checklist in the form of a questionnaire has been included to help identify if the necessary controls are in place.

### Legislation

#### Reference

- 1 Refer to Section 11 – Part 1 – 1.8.1 – Sources of Health and Safety Information.
- 2 The following Standard are referred to in this part of specification:

BS 476 ..... Fire tests on building materials and structures. Method of test to determine the Classification of the surface spread of flame of products.

BS 3212..... Specification for flexible rubber tubing, rubber hose and rubber hose assemblies for use in LPG vapour phase and LPG air installations.

BS 5499..... Safety signs. Code of practice for escape route signing.

BS 5266..... Emergency lighting. Code of practice for the emergency lighting of premises.

BS 5306..... Fire extinguishing installations and equipment on premises. Recharging of Portable fire extinguishers.

EN 3.....Portable fire extinguishers. Provisions for evaluating the conformity of a portable fire extinguisher.

EN 60079-14..... Explosive atmospheres. Electrical installations design, selection and erection.

### **1.7.1.2 Legal Duties**

- 1 The contractors (hereafter referred to as ‘the contractor’) are responsible for fire prevention and control with regards to:
    - (a) site-based offices and temporary site accommodation;
    - (b) off-site company offices;
    - (c) any other place of work in connection to construction activities.
  - 2 The contractor must ensure that:
    - (a) construction sites, offices, premises and temporary accommodation or part of them are subjected to fire prevention and control measures;
    - (b) fire risk assessments are carried out, recorded, reviewed and acted upon;
    - (c) fire arrangements are in place for the offices, temporary accommodation and the construction site;
    - (d) elimination and reduction of risks from dangerous substances are followed;
    - (e) fire detection and fire systems are in place;
    - (f) Procedures for serious and imminent danger and for danger areas;
    - (g) emergency arrangements are in place including emergency routes and exits;
    - (h) liaison is undertaken with the relevant governing body for fire.

### **1.7.1.3 Enforcement of fire safety legislation**

- 1 The Fire safety legislation is enforced by the Civil Defence, Ministry of Interior, the State of Qatar.

#### **1.7.1.4 Duty for fire prevention**

- 1 The contractor shall undertake a formal risk assessment in relation to:
    - (a) site-based offices and temporary site accommodation;
    - (b) off-site company offices;
    - (c) any other place of work in connection to construction activities and his undertakings; so as to determine the appropriate fire safety measures to be implemented.
  - 2 These measures shall include a suitable means of escape, fire alarms, emergency lighting and fire-fighting equipment. Suitable records must be maintained.
  - 3 The Contractor must:
    - (a) take such general fire precautions as will ensure, so far as is reasonably practicable, the safety of any of their employees; and
    - (b) in relation to relevant persons who are not their employees, take such general fire precautions as may reasonably be required to ensure that the premises are safe.

- 4 The term 'General fire precautions' must include as a minimum:

  - (a) reducing the risk of fire and the spread of fire on the premises
  - (b) methods of escape
  - (c) measures for securing that the means of escape can be safely and effectively used at all times
  - (d) measures in relation to the means for detecting fire on the premises and giving warning in case of fire on the premises
  - (e) arrangements for action to be taken in the event of fire, including measures relating to the instruction and training of employees, and measures to mitigate the effects of the fire.
  - (f) measures in relation to the means for fighting fires on the premises

5 The Contractor must:

  - (a) assess the risks to which relevant persons are exposed
  - (b) consider the effects of dangerous substances
  - (c) review the risk assessment regularly, particularly if there have been significant changes to the environment
  - (d) not employ young persons without making a suitable and sufficient risk assessment of the risks to them.

6 The risk assessment must include the control measures which have been, or will be taken, to reduce the risk of fire and identify any group of persons identified by the assessment as being especially at risk.

7 No new work activity involving a dangerous substance may start unless the risk assessment has been made and the required measures have been implemented.

**Elimination or reduction of risks from dangerous substances**

8 Where a dangerous substance is present, the Contractor must ensure that risks are either eliminated or reduced so far as is reasonably practicable.

**Fire-fighting and fire detection requirements**

9 Where necessary, the contractor must ensure that the premises are equipped with appropriate fire-fighting equipment, fire detectors and alarms. Any non-automatic fire-fighting equipment must be easily accessible, simple to use and indicated by signs.

10 The Contractor must, where necessary:

  - (a) take measures for fire-fighting on and in the premises, adapting them to the nature of the activities carried out there and the size of the undertaking and of the premises concerned
  - (b) nominate competent persons to implement those measures and ensure that the number of such persons, their training and the equipment available to them are adequate, taking into account the size of the premises concerned and any related hazards. This requirement does not apply to a self-employed person or a partnership where, in either case, there is sufficient knowledge and experience to enable adequate preventative and protective measures to be taken
  - (c) arrange any necessary contacts with external emergency services, particularly regarding fire-fighting, rescue work, first aid and emergency medical care.

### **Emergency routes and exits**

- 11 In order to safeguard the safety of relevant persons where necessary, the Contractor must ensure that routes to emergency exits from premises and the exits themselves are kept clear at all times. The following requirements must be complied with.
- (a) Emergency routes and exits must lead as directly as possible to a place of safety.
  - (b) People must be able to evacuate the premises quickly and safely.
  - (c) The number, distribution and dimensions of emergency routes and exits must be adequate for the maximum number of persons who may be there at any one time.
  - (d) Emergency doors must open in the direction of escape. Sliding or revolving doors must not be used for exits specifically intended as emergency exits. Emergency doors must not be locked or fastened in a way that stops them from being easily and immediately opened in an emergency.
  - (e) Emergency routes and exits must be indicated by signs. Emergency routes and exits requiring illumination must be provided with emergency lighting of adequate intensity in the case of failure of their normal lighting.

### **Procedures for serious and imminent danger and for danger areas**

- 12 The Contractor must establish and put into effect appropriate procedures, including safety drills, and nominate a sufficient number of competent persons to implement those procedures. The Contractor must also ensure that nobody can access any area to which access has been restricted on grounds of safety, unless the person concerned has received adequate safety instruction.

### **Additional emergency measures in respect of dangerous substances**

- 13 The Contractor must ensure that:
- (a) information on emergency arrangements is available
  - (b) suitable warning and other communication systems are established to enable an appropriate response
  - (c) where necessary, before any explosive conditions are reached, visual or audible warnings are given and relevant persons withdrawn
  - (d) where the risk assessment indicates it is necessary, escape facilities are provided and maintained to ensure that, in the event of danger, relevant persons can leave endangered places promptly and safely.
- 14 The Contractor must ensure that the information required is made available to relevant accident and emergency services, and also displayed at the premises, unless the results of the risk assessment make this unnecessary.

### **Maintenance**

- 15 The Contractor must ensure that the premises and any facilities, equipment and devices provided are subject to a suitable system of maintenance and are maintained in an efficient state, in efficient working order and in good repair.
- 16 Where the premises form part of a building, the Contractor may make arrangements with other occupiers of the building to ensure that the above requirements are met.
- 17 Provision of information to employees, self-employed and Contractors from outside the undertaking

- 18 The Contractor must provide employees and relevant others with understandable and relevant information on the risks identified, the preventative and protective measures, the significant findings of the risk assessment and certain other matters. Such information will usually be communicated by way of safety signs, site induction, written procedures and similar means.

### **Training**

- 19 The Contractor must ensure that employees are provided with adequate safety training that includes suitable and sufficient instruction and training on the appropriate precautions and actions to be taken by employees in order to safeguard themselves and other relevant persons on the premises. It needs to take account of the fire risk assessment and the emergency procedures, and be easily understandable and repeated periodically. The training should cover:
- (a) discovering a fire
  - (b) how to raise the alarm
  - (c) what to do on hearing the alarm
  - (d) procedure for alerting visitors and all staff
  - (e) calling the fire service
  - (f) evacuation procedures, assembly points and fire drills
  - (g) location and use of fire-fighting equipment
  - (h) location of escape routes
  - (i) how to open escape doors
  - (j) importance of fire doors
  - (k) how to stop equipment and isolate power
  - (l) not using lifts
  - (m) use and risks of highly flammable and explosive substances
  - (n) good housekeeping
  - (o) smoking policy and smoking areas.

### **Co-operation and co-ordination**

- 20 Where two or more Contractors share, or have duties at, premises, whether on a temporary or a permanent basis, they must co-operate as necessary to enable them to comply with the requirements of these Regulations.

### **General duties of employees at work**

- 21 Every employee must, while at work:
- (p) take reasonable care for the safety of themselves and of other relevant persons who may be affected by their work
  - (q) co-operate with their employer (the contractor)
- 22 The employee must inform their employer, or any other employee with specific responsibility for the safety of employees, of any work situation which they would reasonably consider to be a serious and immediate danger to safety. Employees should also report any matter which they consider to be a shortcoming in the employer's protection arrangements for safety.

#### 1.7.1.5 The Management of Health and Safety

- 1 These Regulations require that risk assessments be carried out for all work activities. These include assessing and controlling the risk of fire on construction sites.
- 2 Furthermore, these Regulations require that all Contractors have access to competent health and safety advice, which again in the context of this module, includes having access to someone who is competent to:
  - (a) accurately assess the risks to the health and safety of any person from the outbreak of a fire, and
  - (b) indicate to the Contractor what additional actions, if any, must be taken to adequately control those risks

#### 1.7.1.6 Construction (Design and Management) CDM

- 1 In most cases, the requirements for fire and safety in on-site offices and other accommodation will be enforced under these Regulations and the requirements are:
  - (a) for measures to be taken to prevent the risk from fire, explosion or any substance likely to cause asphyxiation.
  - (b) for measures to be taken to detect and fight fires in relation to work carried out on construction sites.

#### 1.7.1.7 Fire risk assessments

- 1 The stages of a fire risk assessment are:

##### **Identify potential fire hazards on site**

- 2 What flammable materials are present?
- 3 What sources of ignition are present?
- 4 Can anything be done to reduce either?
- 5 What must be done to keep flammable materials and sources of ignition apart?

##### **Identify who might be harmed**

- 6 How many people are at risk?
- 7 Are any at an enhanced level of risk because of what they do or where they work?
- 8 Is the means of raising the alarm effective - can it be heard by all?
- 9 Are escape routes clearly signed and kept free of obstructions?
- 10 Does everyone know where their escape route is?

##### **Determine the level of risk**

- 11 Having considered the fire hazards and who might be harmed, is the level of risk acceptable - are the existing fire prevention measures adequate?
- 12 To determine the answer to the above point consider:
  - (a) are sources of ignition under adequate control?

- (b) is a hot-works permit system in place and if not, is one necessary?
  - (c) are the existing fire detection/warning systems effective?
  - (d) is the means of escape (for everyone on site) adequate?
  - (e) is the means of fighting fire (for example, portable fire extinguishers) adequate, appropriate for the likely type of fire and well maintained?
  - (f) have sufficient site staff been trained in the use of fire extinguishers?
  - (g) is it necessary to establish a network of Fire Wardens to oversee any evacuation of the site?

### **Record the significant findings**

13 Significant findings of the risk assessment, including details of any actions taken to reduce the fire risk, must be recorded in a manner that can be easily retrieved should it be necessary to do so.

#### **Review the fire risk assessment**

14 It could be argued that this stage is more important on construction sites, due to the ever-changing nature of the site, than it is in many other types of workplace.

15 For example, consider:

- (a) what was an escape route last week might be a 'dead-end' today
  - (b) the increasing complexity of escape routes as large structures are built
  - (c) the start of a "hot-works" process
  - (d) the start of a process that necessitates the storage of flammable substances, such as LPG and other gases, in bulk.

**1.7.1.8 The following is a list of some of the factors that should be considered when carrying out a fire risk assessment.**

## 1 Sources of possible ignition

- (a) Hot work
  - (b) Abrasive cutters
  - (c) Heaters
  - (d) Heat-producing processes
  - (e) Electrical apparatus
  - (f) Machinery overheating
  - (g) Discarded smoking materials
  - (h) Arson or malicious fire-raising

## 2 Storage of combustible materials

- (a) Flammable gases
  - (b) Flammable liquids
  - (c) Timber
  - (d) Plastics
  - (e) Paper, cardboard and similar materials

- (f) Cotton, wool and similar materials
- (g) Flammable waste material

3 Building features

- (a) Access, egress
- (b) Floor openings
- (c) Flues
- (d) Doors, windows
- (e) Atria
- (f) Wall linings
- (g) Floor construction

4 Maintenance

- (a) Cleaning (use of flammable materials)
- (b) Plant maintenance

5 Fire detection

- (a) Automatic detectors
- (b) Fire alarm call points
- (c) Alarm bells

6 Means of escape in case of fire

- (a) Doors
- (b) Staircases
- (c) Passageways
- (d) Assembly points

(Note that lifts are not recommended as a means of escape.)

7 Provision of fire-fighting equipment

- (a) Fixed fire-fighting equipment
- (b) Hose reels, sprinklers
- (c) Extinguishers
- (d) Position of extinguishers
- (e) Site fire plan

8 Maintenance of fire-fighting equipment

- (a) Test regularly
- (b) Service after use
- (c) Maintain in correct position

9 Staff training

- (a) Raising the alarm
- (b) Emergency procedures

- (c) Appointment of fire wardens
- (d) Fire drills
- (e) Fire-fighting equipment
- (f) End-of-day fire checks

10 An example fire risk assessment questionnaire is included at Appendix 2.

#### 1.7.1.9 On-site temporary buildings

- 1 Temporary buildings on site include site offices, canteens, rest rooms, drying rooms and toilets. They are often of timber construction, although of fire-resisting surface materials. They may be found as a single building, or as a range of single-storey structures, or they may form a multi-floor 'administrative complex'. Ideally all temporary buildings would be easily accessible by the fire and rescue service, should the need arise.
- 2 Temporary buildings should be separated from the building under construction, other temporary buildings and storage compounds by a fire-break of at least 10 metres where possible. If it is not possible to achieve a 10-metre separation, ideally, the fire break will not be less than 6 metres.
- 3 Temporary buildings which are located inside the building under construction, or within 6 metres of it, must be equipped with fire-detection systems.
- 4 Temporary buildings should be designed and constructed:
  - (a) of materials that would not contribute significantly to the growth of a fire or the propagation of smoke or corrosive fumes
  - (b) of fire-resisting material to BS 476 with regard to walls, roof, doors and windows, to achieve 30 minutes fire resistance
  - (c) where stacked on top of each other, the floor and roof assembly, and members supporting it, should have at least a 30-minute fire resistance.
- 5 Where temporary buildings do not sit flush on the floor, measures must be taken to prevent the accumulation of rubbish in the space beneath the floor, whilst still allowing under-floor ventilation.
- 6 Consideration should be given to fitting automatic fire detection systems and intruder alarms to temporary buildings in which flammable substances are stored.
- 7 Automatic fire detection systems must be fitted in temporary buildings in which cooking is carried out.

#### 1.7.1.10 The conditions for fire

- 1 In order to take the measures required to prevent fires starting, it is first necessary to understand the conditions that must be present to enable a fire to start.
- 2 Three factors are necessary for fires to burn:
- 3 **Fuel** or combustible material. Any material or substance, whether liquid, solid or gas, which will burn given sufficient amounts of heat and a supporter of combustion such as air or oxygen.
- 4 **Heat** or ignition source. Every fuel has an ignition temperature. All solids and liquids give off vapour when heated, and it is this vapour that ignites.
- 5 **Air** (or other supporter of combustion such as oxygen) which is always there to sustain fire,

providing the other factors are present.

- 6 Once a fire has started, if any one of these factors is isolated or removed, the fire will be extinguished. There are three basic ways of achieving this:
  - 7 Removal of the fuel or combustible material, leaving nothing to burn.
  - 8 Removal of the heat by the application of water to cool the burning material.
  - 9 Reduction or exclusion of the air/oxygen by smothering the burning material. Foam, dry powder, carbon dioxide (CO<sub>2</sub>) and fire blankets are all smothering agents.



#### 1.7.1.11 How fires can be spread

- 1 Fire can be spread in four ways:
  - (a) conduction
  - (b) convection
  - (c) radiation
  - (d) direct burning.
- 2 **Conduction** is where heat is transmitted from one place to another along or through solid material, such as along a metal pipe or through a door or wall. The conduction of heat therefore has the potential to start a fire in a location that is remote from the original source of heat.
- 3 **Convection** occurs where superheated gases or heat rising from a fire ignites other combustible material or when particles of burning material in the circulating air are deposited in another place, causing another fire.
- 4 **Radiation** is the transfer of radiated heat from the fire, through the air directly to other flammable materials nearby, which will cause those materials to be raised to their ignition temperature and then burn.
- 5 **Direct burning** is a combination of conduction, convection and radiation and is where the fire spreads and reaches other combustible materials and ignites them, adding further fuel to the fire.

#### 1.7.1.12 Classes of fire

- 1 All fires can be placed into one of the following six categories.
  - (a) **Class A** - Carbonaceous material, such as paper, cloth, wood, rubber, often referred to as 'solid fuel fires'.
  - (b) **Class B** - Flammable liquids or liquefiable solids, such as oil, fat, paint and fuel. These can be subdivided into:
    - i. **B1** - Fires involving liquids that are soluble in water, such as methanol. They can be extinguished by carbon dioxide, dry powder and water spray.
    - ii. **B2** - Fires involving liquids that are not soluble in water, such as petrol and oil. They can be extinguished using foam, carbon dioxide and dry powder.
  - (c) **Class C** - Flammable gases or liquefied gases, such as propane, butane, hydrogen or acetylene.
  - (d) **Class D** - Combustible metals, such as magnesium, sodium and phosphorus.

- (e) **Class E - Electrical fires** - Any fire involving electrical apparatus or equipment.
- (f) **Class F - High temperature cooking oils or fats**, such as those used in deep fat fryers in large catering establishments or restaurants.

#### **Class A - carbonaceous material**

- 2 On the majority of building or construction sites, the following carbonaceous items are freely available sources of fuel:
  - (a) cardboard, paper and cloth
  - (b) wood
  - (c) dirty rags, oily rags and clothes
  - (d) packaging materials.
- 3 If a fire occurs involving carbonaceous material, a hose-reel or a water extinguisher should be used. The jet of water should be aimed at the base of the fire first, and then moved progressively over the whole of the burning area. Always remove the material from the source of heat if possible, but without endangering the person involved or starting a fire in another location.

#### **Class B - flammable liquids or liquefiable solids**

- 4 Fires involving flammable liquids, such as:
  - (a) petrol or diesel
  - (b) oil
  - (c) paraffin
  - (d) paint
  - (e) resin and adhesive.
- 5 This type of fire should be dealt with using **foam** or **dry powder** extinguishers, depending on whether the fire is contained or flowing.
- 6 If the fire is contained, use a foam extinguisher with the jet of foam directed at the back of the container.
- 7 This allows a blanket of foam to build up and spread across the surface of the burning liquid.
- 8 If the fire is flowing, a dry powder extinguisher should be directed at the front edge of the fire, in an attempt to separate the flames from the fuel.
- 9 The aim of using extinguishers in such a way is for the fire to be covered with a blanket of either foam or dry powder. This will cut off the supply of air, and thus the oxygen, to the fire.
- 10 Once the blanket has been laid, do not disturb it until the liquid has cooled. Any reintroduction of air may cause the fire to re-ignite.
- 11 **NEVER** use a water extinguisher or a hose-reel on a fire involving any flammable liquid. The water will react violently with the burning liquid and cause an explosion.

#### **Class C - flammable gases or liquefied gases**

- 12 Extreme caution is necessary when dealing with fires involving liquefied gases as there will always be the danger of an explosion.

- 13 LPG expands to a ratio of 274:1 so a leak of just 1 litre of liquid would produce a cloud of gas, if diluted in air to the right concentration, large enough to fill a room 3m x 2m x 2m. This would cause an explosive atmosphere.
- 14 If a fire occurs in which a compressed gas cylinder is *directly* involved:
- call the Qatar Administrative Authority and tell them of the location of the cylinders and type of gas involved
  - attempt to turn the gas off at the cylinder, **if it is safe to do so**
  - attempt to turn off any gas appliances **if it is safe to do so**
  - activate the emergency evacuation procedure and clear the site.
- 15 Do not try to fight a fire in which a compressed gas cylinder is *directly* involved; leave it to the Qatar Administrative Authority as an overheated cylinder can explode.
- 16 If a fire involves other combustible materials, for example timber, that might cause the fire to spread to the location of the cylinders, a decision based upon personal safety will have to be taken upon whether to attempt to fight the fire to prevent an escalation of the situation.
- 17 Class C fires are best dealt with by the use of **dry powder extinguishers**.

#### Class D - combustible metals

- 18 Fires of this type involve magnesium, sodium, phosphorus, and similar metals, and should only be dealt with by trained fire fighters.
- 19 **NEVER APPLY WATER TO ANY BURNING METAL FIRE OR A FIRE INVOLVING POWDERED METAL.** It would cause an immediate explosive reaction.
- 20 Specially formulated powders are available for use in controlling fire in metals but, as a last resort, if no proprietary powder is available, **dry** sand or earth may be applied to smother the burning area.
- 21 The proprietary powder should be carefully placed and **not thrown** onto the burning metal. Throwing the powder will cause the burning material to be spread.
- 22 Be sure either to wear darkened safety glasses whilst attempting to cover the fire, or to look away from the extreme brightness. Failure to take these precautions could damage the eyes.

#### 1.7.1.13 Electrical fires

- 1 Fires involving electrical equipment can be dealt with using carbon dioxide (CO<sub>2</sub>) or dry powder.
- 2 In staff training, the following simple rules for safety should be emphasised:
- do not use water on any fire involving electrical equipment. You may be electrocuted
  - switch off the electricity supply, if possible, before fighting the fire. It is then just an ordinary fire
  - do not approach closer than 1 meter to any fire where the electrical supply has not been switched off
  - carbon dioxide (CO<sub>2</sub>) is the best extinguishing medium if the concentration of gas can be confined, for example within an electrical distribution cupboard
  - in extinguishing electrical fires, direct the discharge from the extinguisher to one edge of the fire and, with a sweeping movement, pass to the far edge until the fire has been

extinguished.

- 3 Electrical equipment used on building and construction or demolition sites sometimes incorporates devices to protect against overheating and fire.
- 4 Most fires in electrical equipment are due to misuse or neglect, where appliances have not been properly maintained, or are being used for a purpose, or in a manner, for which they were not designed.
- 5 A fuse larger than the appliance rating will negate the purpose of the fuse and render the appliance potentially unsafe.
- 6 All employees should be properly trained so that they do not misuse equipment, and ensure that damaged or defective equipment is reported, taken out of use and professionally repaired.

#### **1.7.1.14 Other types of fire**

##### **Flammable adhesives and flammable liquid stores**

- 1 Use dry powder or foam.
- 2 Extreme care must be taken if the adhesive is petroleum- or spirit-based as explosive vapours will be given off.

##### **Cooking ranges (site canteens)**

- 3 Use **foam, dry powder, carbon dioxide (CO<sub>2</sub>) or a fire blanket**. Never move a cooking container, the contents may splash and cause serious burns.

##### **Hot working with cutting or welding equipment, bitumen boilers**

- 4 Use foam, dry powder or carbon dioxide (CO<sub>2</sub>). Turn off the heater.
- 5 The correct types of fire extinguisher must be provided and kept close at hand, with a careful watch being maintained for fire breaking out whilst work is in progress.

#### **1.7.1.15 Dealing with fire**

- 1 In the event of a fire, the most important consideration is the safety of occupants such as site visitors and staff.
- 2 Effective control measures, such as periodically practising emergency evacuations and the routine maintenance and/or testing of fire detection and fire-fighting equipment, can save lives. Everyone must know what they have to do if there is a fire or during a rehearsal of emergency evacuation procedures (a fire drill).

#### **1.7.1.16 Emergency procedures**

- 1 In the event of a fire occurring, it is essential that the alarm is raised as quickly as possible so that workers can quickly and safely reach a place of safety.
- 2 This can only be achieved by considering the following steps.
- 3 A means of detecting and warning of fire must be provided in all offices. Hand bells, klaxons, manually or electrically operated sounders may be suitable so long as they are clearly audible above background noise in all areas and can be readily identified as being a fire alarm. Flashing lights or vibrating pagers may be required in certain circumstances.

- 4 Legible written emergency procedures must be displayed in prominent locations within offices and should include:
- (a) the location of the notice to enable the location of the fire to be pinpointed, e.g. first-floor photocopier room
  - (b) instructions for raising the alarm
  - (c) instructions for calling the fire and rescue service
  - (d) instructions to report to the nearest assembly point
  - (e) clear information as to the whereabouts of the assembly point
  - (f) a clear instruction not to leave the assembly point until a roll-call has been taken
  - (g) an indication of the locations of fire escape routes
  - (h) an instruction not to re-enter the building or site until it has been declared safe to do so by someone in authority.

#### **1.7.1.17 Calling the fire and rescue service**

- 1 If a fire is discovered, everyone on site must be made aware of it. The fire and rescue service must be called. Where there is a switchboard, it is usual for the switchboard operator to be nominated as the person who always calls the Civil Defence (Fire Department).
- 2 On hearing the alarm, anyone calling the fire and rescue service should give the full postal address of the site, any prominent nearby landmark, and any instruction for entering the site where there is more than one option.
- 3 If you have a fire alarm which is automatically connected to the Civil Defence (Fire Department) via an alarm company, the Civil Defence (Fire Department) must still be called to confirm that the automatic call has been received.

#### **Location of occupants**

- 4 It will be necessary to appoint fire wardens whose job it is to ensure that offices and other accommodation are completely evacuated in the event of the fire alarm sounding (including practice drills) and conduct a roll-call at the assembly point if appropriate.
- 5 The fire wardens must be trained in their duties and have a clear understanding of the area of the offices for which they are responsible. The number of fire wardens required will depend on several factors, including the area and layout of the office complex and the number of levels on which it is sited.
- 6 The location of permanent staff can be easily identified by the use of IN/OUT boards that can be removed from their normal location, taken to the assembly point and used for the roll-call.
- 7 Arrangements must be made for visitors to be logged into and out of offices so that, in the case of an emergency, they can be located quickly and taken to a safe place.

#### **Means of escape**

- 8 Adequate means of escape must be provided to enable all visitors and employees to reach a place of safety if a fire occurs. If a fire occurs in the open air, it will usually be obvious to all site staff where the danger lies and the direction they must go to remain safe.
- 9 Means of escape must have regard and consider individuals with disabilities.
- 10 They should also consider the following points:

- (a) As part of emergency planning, dedicated escape routes should be decided on, clearly signed and adequately lit.
  - (b) All directional signs should be clearly visible and kept unobstructed and should conform to BS 5499.
  - (c) Such signs should be positioned where the escape route changes direction or level. The signs must indicate the final exit to a place of safety.
  - (d) To ensure that all site employees are aware of these escape routes, periodic fire drills should be carried out at a maximum interval of 6 monthly and should include the full evacuation of all visitors and staff from the building. Records should be kept of all drills and evacuations.
- 11 Where construction site offices are located in a multiple-occupancy building, the safety of other occupiers, as well as their visitors and members of the public, must be a consideration. For example, emergency exit routes from the premises may have to be maintained or provided for other occupiers through the construction area or other provisions made for them.

#### 1.7.1.18 Emergency lighting

- 1 The provision of emergency lighting should always be considered when assessing the fire safety requirements for satisfactory means of escape.
- 2 This is particularly important where work is dependent on artificial lighting because natural light is not available or practical.
- 3 If the lighting circuits fail, any standby emergency lighting system must switch on automatically and clearly illuminate:
  - (a) exits and directional signs
  - (b) corridors and associated exits
  - (c) circulation areas
  - (d) changes in levels
  - (e) any projections and protrusions, such as temporary partitioning, office equipment and storage
  - (f) internal and external staircases.
- 4 Emergency lighting, whether by battery or standby generator or a combination of both, should be tested on a regular basis by a competent person in accordance with BS 5266.
- 5 Records of tests of the emergency lighting equipment should be kept and must be available for inspection when required.

#### 1.7.1.19 Fire alarms

- 1 Automatic or manual fire alarms should be tested weekly, with a different call point being used on each occasion where these are a feature of the system.

#### 1.7.1.20 Fire drills

- 1 Fire drills in site offices and on site should be held on a regular basis, at not more than six-monthly intervals. They should take the form of a rehearsal of the evacuation procedures to ensure that everyone knows how to leave the site quickly and safely if a fire occurs.
- 2 Records of fire alarms, equipment tests and fire drills should be kept.

### 1.7.1.21 Fire-fighting equipment

#### Portable fire extinguishers

- 1 Fire extinguishers do not prevent fires.
- 2 Fire extinguishers can be used by trained employees in an attempt to minimise loss and damage after a fire has started. However, preventing the fire in the first place is a far better option.
- 3 Where there is a realistic possibility that staff will have to use a fire extinguisher, they should be trained in their use.
- 4 In line with the risks identified in a fire risk assessment, adequate numbers of suitable types of portable fire extinguisher must be provided and kept available throughout the premises (see appendix 1).
- 5 Extinguishers must be located in conspicuous positions near exits on each floor. They should be fixed to the wall with their carrying handles approximately 1 metre above the floor level. Where this is not possible, they should be fixed in position (for example, using base plates or stands) at floor level.
- 6 In the open, they should be situated in red painted boxes which are either sitting on the floor or raised 500 mm above ground level, with a 'FIRE POINT' sign at a height readily seen above any obstructions. Care must be taken during winter months to ensure that extinguisher contents do not freeze.
- 7 To protect electrical distribution panels and items of electrical equipment, appropriate extinguishers (usually carbon dioxide) must be provided near but not dangerously close to the equipment concerned.
- 8 For large or costly items of equipment, such as computer suites, the installation of automatic fire detection and extinguishing systems should be considered.
- 9 Fire-fighting equipment should be inspected monthly and maintained and tested at least once a year by a competent person. The maintenance and tests should be carried out in accordance with the manufacturer's instructions.
- 10 All fire-fighting equipment must be maintained and inspected regularly, and all such inspections recorded in the appropriate register.
- 11 Extinguishers should be tested by discharge at intervals specified in BS 5306, and should always be recharged immediately after any use.

#### Colour of fire extinguishers

- 12 All fire extinguishers should conform to EN 3.
- 13 Colour-coding by agent or medium (see below) enables a trained person to rapidly identify the type of extinguisher needed in an emergency.

#### Extinguishing medium

Water

#### Colour of panel

Red

Foam	Cream
Powder (all types)	Blue
Carbon dioxide	Black
Wet chemical	Yellow

- 14 Other information concerning its use may also be displayed on the body of the extinguisher.

#### Toxic vapours from fire extinguishers

- 15 The discharge of a carbon dioxide (CO<sub>2</sub>) extinguisher in any small, enclosed or confined space will reduce the percentage of oxygen in the air. The dust cloud from a dry powder extinguisher may, in a confined space, produce local and temporary breathing difficulties and poor visibility.
- 16 Once an extinguisher has been discharged in such circumstances, the user should leave the area immediately. When it is safe to do so, the area should be thoroughly ventilated before allowing anyone to re-enter. If there is a need to re-enter before the air has cleared, suitable breathing apparatus will have to be worn.

#### Staff training in the use of fire extinguishers

- 17 The contractor is to ensure that all employees are familiar with fire procedures, and that an appropriate number of them are trained in the use of fire-fighting equipment.
- 18 Training in the selection and use of portable extinguishers is essential if they are to be used effectively in fighting small fires.
- 19 It is also very important that the right type of extinguisher is used on certain types of fire. Details of which one to use with which type of fire are contained in Appendix 2 of this section.
- 20 Attention should be given to the physical strength of persons who may have to use extinguishers. Some extinguishers weigh up to 20 kg.
- 21 During staff training on the use of extinguishers, the following points also need to be emphasised:
- (a) think of evacuation first
  - (b) only use an extinguisher if it is safe for you to do so
  - (c) do not let the fire come between you and your escape route. You may become trapped if the fire develops
  - (d) always stay between the fire and your escape route
  - (e) if the extinguisher does not appear to be working or is ineffective on the fire, get out immediately
  - (f) if the fire starts to increase or gets out of control, get out immediately.
- 22 During induction training or ongoing staff training, the following points should be made to all staff:
- (a) do not use a fire extinguisher unless you have been trained to do so

- (b) do not misuse fire extinguishers, for example, when messing around or as a joke
- (c) do not move fire extinguishers from their allocated positions
- (d) do not use fire extinguishers as door stops
- (e) immediately report any fire extinguishers that appear to have been used, misused or damaged.

#### 1.7.1.22 Hose-reels

- 1 Hose-reels linked to a constant water supply may sometimes be available, and can be an effective means of fire-fighting.
- 2 Hose-reels work:
  - (a) either, by the user opening a valve adjacent to the hose-reel drum before unreeling the hose and turning on the nozzle
  - (b) or, by automatically turning on the supply as the hose-reel is unwound.
- 3 Training employees in the correct use of hose-reels is essential if fire-fighting is to be effective. Staff need to be fully aware of how the hose-reels work before they use them in an emergency.
- 4 A HOSE-REEL SHOULD NOT BE USED:
  - (a) on live electrical apparatus
  - (b) on any fire involving fat, oil, paint or other flammable liquids
  - (c) on any fire involving burning metal or metal powder.
- 5 To do so could lead to electrocution, or a violent explosion of burning liquid or metal.

#### 1.7.1.23 Fire blankets

- 1 These are usually sufficient to deal with small, contained fires involving frying pans, tea-making facilities and so on.
- 2 Before attempting to extinguish such fires, always turn off the gas or electricity supply.
- 3 Pull the blanket from its container and wrap the corners of the blanket around your hands, making sure that your hands and forearms are completely covered. Hold the blanket at chest level and gently place it over the burning container to exclude the air from the fire. **DO NOT THROW** the blanket as you may miss the burning container or cause it to spill.
- 4 Leave the blanket in place until the container has cooled down. Do not lift one corner to check if the fire is out as this may allow enough air in to re-ignite the fire. Do not move the container before it is cold.

## Construction Site Safety

### 1.7.1 Appendix 1

#### Types of portable fire extinguisher and what to use them on

Make yourself aware of the instructions on the fire extinguisher before using it.

Class	Substances, materials, etc.	Water (red)	Foam (cream)	Carbon dioxide (CO <sub>2</sub> ) (black)	Dry powder (blue)	Wet chemical (yellow)
A	Carbonaceous and organic materials, wood, paper, rag, textile, cardboard, common plastics, laminates, foam	YES Excellent	YES	YES Difficult to use o For small fires	YES outdoors in windy conditions only if no water available	YES, but not ideal
B	Flammable liquids, petrol, oil, fats, adhesives, paint, varnish	NO	YES If liquid is not flowing	YES, but not ideal	YES	YES, but not ideal
C	Flammable gas: LPG, butane, propane, methane, acetylene	YES Will cool the area and put out secondary fires	YES If in liquid form	YES	YES	NO
D	Metal, molten metal, reactive metal powder	NO	NO	NO	YES Trained person - if no explosive risk Special powders are available, but DRY sand or earth may be used	NO
Electrical	Electrical installations, computers, electric typewriters, VDUs, photocopiers, televisions, etc.	NO	NO	YES	YES, but not ideal Or switch off electricity and deal with as an ordinary	NO

					fire. Be aware that equipment may retain an electrical charge.	
F	Commercial deep fat fryers or oil fryers	NO	NO See Note	NO	NO	YES

**Notes:** Dry powder may not penetrate spaces or behind equipment

Light water foam (AFFF) may be used instead of water or foam

Extinguishers used to control Class B fires will not work on Class F fires because of the high temperatures generated

## Construction Site Safety

### 1.7.1 Appendix 2

#### Fire safety questionnaire

- 1 This questionnaire has been worded so that the desirable answer is **YES**. If you answer **NO**, you may wish to give more thought to the problem.

##### General

- 2 Has a fire risk assessment been carried out?
- 3 Have any shortcomings highlighted by the risk assessment been rectified?
- 4 Have employees been made aware of the significant findings of the fire risk assessment?

##### Flammable materials

- 5 Are flammable materials, especially flammable waste materials, cleared away on a daily basis?
- 6 Is there proper storage for highly flammable liquids?
- 7 Are LPG bottles being stored properly?

##### Smoking materials

- 8 Is there a non-smoking policy?
- 9 Are ashtrays provided in places where smoking is permitted?
- 10 Are there adequate and clear 'No Smoking' signs in areas where smoking is not permitted?

##### Heating appliances

- 11 Are heating appliances correctly sited, installed and maintained?
- 12 Are fuel supplies, such as propane and butane, kept outside and piped into the building?
- 13 Are combustible materials being kept well away from heaters and stoves?

##### Electrical appliances

- 14 Is all electrical work or repairs carried out by competent electricians?
- 15 Are the correct fuses fitted to electrical appliances?
- 16 Is only one appliance being used from each socket?
- 17 Are all electrical appliances being inspected and tested regularly?

### **Staff training**

- 18 Is everyone on site trained in fire prevention?
- 19 Are all staff being properly trained in procedures to be followed in case of fire?
- 20 Are all staff being trained in the use of fire-fighting equipment?
- 21 Have fire marshals been appointed and trained?
- 22 Is the location of the fire assembly point known to everybody?

### **Fire extinguishers**

- 23 Are all fire extinguishers serviced regularly, checked and recharged as necessary?
- 24 Are all fire extinguishers of the appropriate type?
- 25 Are all fire extinguishers clearly identified and easily accessible?
- 26 Is there an up-to-date fire plan, showing the location of each fire extinguisher and its type, for the premises?

### **Fire alarm**

- 27 Is the fire alarm tested weekly?
- 28 Is a different call point used for each test?
- 29 Can the fire alarm be heard clearly in all parts of the premises?
- 30 Is someone nominated to call the fire and rescue service in case of fire?

### **Fire drills and records**

- 31 Are fire drills held on a regular basis?
- 32 Are records kept of all drills and tests of equipment?
- 33 Are the records readily available for inspection?

## Construction Site Safety

### 1.7.2 Fire Prevention and Control in connection to construction

#### Legislation

##### 1.7.2.1 Key points

- 1 The risk of fire is greater during the construction- including refurbishment and demolition works.
- 2 This set of regulations is about preventing fires from starting and ensuring people's safety if they do.
- 3 It applies to all construction works, small and large, and applies at all with a role in developing, managing and applying fire safety prevention and development of standards and arrangements on site.
- 4 Fire safety must be considered in the planning for construction and implemented effectively during the construction phase. Precautions must also be considered at the design stage and before work starts.
- 5 It needs to address the risks both to the site personnel and neighbouring environment. This may mean rejecting proposals for particular methods and materials in a specific location, based on the potential for serious consequences from any fire during the construction stage, or planning additional, sometimes expensive or difficult, mitigation methods if a specific design or method is not to be changed.
- 6 Materials, methods of construction and site processes must be selected to minimise fire risk and work planned in an order that is practical but also minimises risk. For example, alternative specifications for materials which are fixed together using mechanical rather than hot means can reduce risk.
- 7 Sites involving higher risk materials and processes will need higher standards of general fire precautions. Reducing the risks is particularly important when there are constraints which cannot be removed such as location of site and space available.
- 8 There are specific duties for the responsible person to carry out fire risk assessments for construction and construction related activities. A detailed fire risk assessment and required controls need to be developed from the outset identifying the stages and activities which give rise to critical risk points and which, therefore, will need highest levels of control.
- 9 Fire risk assessments must be carried out by a competent person. Projects that are more complex will probably need to be assessed by a person who has had comprehensive training or experience in fire risk assessments.
- 10 A high degree of communication and co-operation is required between all parties, including main and sub-contractors, to ensure adequate controls are in place at all times. Where construction work takes place in occupied or part-occupied buildings or premises, the responsible person needs to take account of the implications for occupiers including staff. Effective liaison between contractors and occupiers is essential.
- 11 Coordination with the Civil defence for works, including demolition shall be part of planning of works. The Civil Defence (Fire Department) may wish to be involved in advising on the management of on-site fire risks.

It should be noted that the Civil Defence (Fire Department) can gain access to site at any time to

conduct their firefighting/prevention duties. Fire extinguishers, emergency lighting, fire alarms and fire signs must comply with current Civil Defence

### 1.7.2.2 Interpretation / Definitions

- 1 "Construction work" means the carrying out of any temporary or permanent building, civil engineering or engineering construction and includes:
  - (a) the construction, alteration, conversion, fitting out, commissioning, renovation, repair, upkeep, redecoration or other maintenance, (including the use of corrosive, flammable or toxic substances), de-commissioning, demolition or dismantling of a structure;
  - (b) the preparation for an intended structure, including site clearance, exploration, investigation and excavation, and the clearance or preparation of the site or structure for use or occupation at its conclusion;
  - (c) the assembly on site of prefabricated elements to form a structure or the disassembly on site of prefabricated elements which, immediately before such disassembly, formed a structure;
  - (d) the removal of a structure or of any product or waste resulting from demolition or dismantling of a structure or from disassembly of prefabricated elements which immediately before such disassembly formed such a structure; and
  - (e) the installation, commissioning, maintenance, repair or removal of mechanical, electrical, gas, compressed air, hydraulic, telecommunications, electronic or similar services which are normally fixed within or to a structure.
- 2 "Dangerous substance" means:
  - (a) a substance or preparation which meets the labeling guide for classification as a substance or preparation which is explosive, oxidising, extremely flammable, highly flammable or flammable;
  - (b) a substance or preparation which because of its physico-chemical or chemical properties and the way it is used or is present in or on site or premises creates a risk; and
  - (c) any dust, whether in the form of solid particles or fibrous materials or otherwise, which can form an explosive mixture with air or an explosive atmosphere;
- 3 "Explosive atmosphere" means a mixture, under atmospheric conditions, of air and one or more dangerous substances in the form of gases, vapours, mists or dusts in which, after ignition has occurred, combustion spreads to the entire unburned mixture;
- 4 "General fire precautions" has the following meaning:
  - (d) measures to reduce the risk of fire on the construction sites and premises and the risk of the spread of fire on them
  - (e) measures in relation to the means of escape from the construction sites and premises;
  - (f) measures for securing that, at all times, the means of escape can be safely and effectively used;
  - (g) measures in relation to the means for fighting fires on construction sites and premises;
  - (h) measures in relation to the means for detecting fire on the premises and giving warning in case of fire on the construction sites and premises; and
  - (i) measures in relation to the arrangements for action to be taken in the event of fire on the construction sites and premises, including—
    - (i) measures relating to the instruction and training of employees; and

(ii) measures to mitigate the effects of the fire.

5 "Responsible person" means:

- (a) in relation to construction site, the party (normally the contractor) responsible for the site;
- (b) in relation to workplaces other than the above (such as an office building), the owner, if the workplace is under his control;
- (c) in relation to any place of work not falling within (a) or (b) (e.g. site compounds or premises)
  - - (i) the party who has control of the place of work; or
    - (ii) the owner where the party in control of the place of work does not have control in connection with the construction works.

6 "Workplace" means any construction sites, site compounds, site premises or building provided on a permanent or temporary basis in connection with construction used or provided as a place of work and includes:

- (a) temporary accommodation units brought onto site to provide offices, canteens and welfare facilities or a part of them;
- (b) any place within the sites or premises to which such employee has access while at work; and
- (c) any room, lobby, corridor, staircase, road, or other place—
  - (i) used as a means of access to or egress from that place of work; or
  - (ii) where facilities are provided for use in connection with that place of work.

7 "Substance" means any natural or artificial substance whether in solid or liquid form or in the form of a gas or vapour;

#### **1.7.2.3 Duty for general fire precautions**

1 The responsible person shall:

- (a) take general fire precautions to ensure, so far as is reasonably practicable, the safety of his employees; and
- (b) in relation to relevant persons who are not his employees, take general fire precautions, as may reasonably be required to ensure their safety and that of the construction site.

#### **1.7.2.4 Duty for prevention of risk from fire form construction works**

1 The responsible person shall take suitable and sufficient steps to prevent, so far as is reasonably practicable, the risk of injury to any person during the carrying out of construction work arising from fire or explosion

#### **1.7.2.5 Duty for fire risk assessment**

- 1 The responsible person shall make a suitable and sufficient assessment of the risks to which relevant persons are exposed for the purpose of identifying the general fire precautions he needs to take to comply with the requirements of the Regulatory Document.
- 2 Any such assessment must be reviewed by the responsible person regularly so as to keep it up to date and particularly if:
  - 3 (a) there is reason to suspect that it is no longer valid; or

- 4 (b) there has been a significant change in the matters to which it relates including when the site, special, technical and organisational measures, or organisation of the work undergo significant changes, change in scope or extensions; or
- 5 Where changes to an assessment are required as a result of any such review, the responsible person must make them.
- 6 The responsible person must not employ a young person unless he has, in relation to risks to young persons, made or reviewed an assessment in accordance with the above duties.
- 7 As soon as practicable after the assessment is made or reviewed, the responsible person must record the following:
  - (a) the significant findings of the assessment, including the measures which have been or will be taken by the responsible person; and
  - (b) any persons or group of persons identified by the assessment as being especially at risk.
- 8 No new work activity involving a dangerous substance may commence unless:
  - (a) the risk assessment has been made; and
  - (b) the measures required have been implemented

#### **1.7.2.6 Duty for Fire Safety arrangement**

- 1 The responsible person must make and give effect to such arrangements as are appropriate, having regard to the size of his undertaking and the nature of its activities, for the effective planning, organisation, control, monitoring and review of the preventive and protective measures.

#### **1.7.2.7 Duty for elimination and reduction of risks from dangerous substances**

- 1 Where a dangerous substance is or is liable to be present in or on site and premises, the responsible person shall ensure that risk to relevant persons related to the presence of the substance is either eliminated or reduced so far as is reasonably practicable:
  - (a) replace a dangerous substance, or the use of a dangerous substance, with a substance or process which either eliminates or reduces the risk to relevant persons.
  - (b) Where it is not reasonably practicable to eliminate risk, apply control measures consistent with the risk assessment and appropriate to the nature of the activity or operation
  - (c) mitigate the detrimental effects of a fire.
- 2 The responsible person must:
  - (a) arrange for the safe handling, storage and transport of dangerous substances and waste containing dangerous substances; and
  - (b) ensure that any conditions necessary for ensuring the elimination or reduction of risk are maintained.
- 3 Temporary accommodation on site must be used for their intended purpose. They shall not be used for storing dangerous substances.

#### **1.7.2.8 Duty for fire detection and fire fighting**

- 1 In order to safeguard the safety of relevant persons, the responsible person must ensure that:
  - (a) the site is, to the extent that it is appropriate, equipped with appropriate firefighting equipment and with fire detectors and alarms; and

- (b) any non-automatic fire-fighting equipment so provided is easily accessible, simple to use and indicated by signs.
- 2 For the purposes of the above, what is 'appropriate' is to be determined having regard to:
- the dimensions;
  - Use of the site and work activities;
  - the equipment contained on the site;
  - the physical and chemical properties of the substances likely to be present; and
  - the maximum number of persons who may be present at any one time.
- 3 The responsible person must, where necessary:
- take measures for fire-fighting in the site, adapted to the nature of the activities carried on there and the size of the undertaking and of the environment concerned;
  - nominate competent persons to undertake and implement those duties and measures respectively, and ensure that the number of such persons, their training and the equipment available to them are adequate, taking into account the size of, and the specific hazards involved in, the environment concerned; and
  - arrange any necessary contacts with external emergency services, particularly as regards fire-fighting, rescue work, first-aid and emergency medical care.
  - A person is to be regarded as competent for the purposes of the above shall have sufficient training, experience and knowledge and other qualities to enable him properly to undertake the duties in relation to Fire prevention and control.

#### 1.7.2.9 Emergency procedures

- 4 Where necessary in order to safeguard the safety of any person on a construction site, the responsible person shall prepare and implemented suitable and sufficient arrangements for dealing with emergency, including procedures for any necessary evacuation.
- 5 The procedures shall take account of:
- the type of work for which the construction site is being used;
  - the characteristics and size of the construction site and the number and location of places of work on that site;
  - the work equipment being used;
  - the number of persons likely to be present on the site at any one time; and
  - the physical and chemical properties of any substances or materials on or likely to be on the site.
  - The procedures shall ensure that steps are taken to ensure that every person to whom the procedures extend is familiar with its arrangements and that they are tested and put in effect at suitable intervals.

#### 1.7.2.10 Emergency routes and exits

- 1 Where necessary in order to safeguard the safety of relevant persons, the responsible person must ensure that routes to emergency exits from premises and the exits themselves are kept clear at all times.
- 2 The following requirements must be complied with in respect of sites where necessary (whether

due to the features of the site, the activity carried on there, any hazard present or any other relevant circumstances) in order to safeguard the safety of relevant persons—

- (a) emergency routes and exits must lead as directly as possible to a place of safety;
- (b) in the event of danger, it must be possible for persons to evacuate the site as quickly and as safely as possible;
- (c) the number, distribution and dimensions of emergency routes and exits must be adequate having regard to the use, equipment and dimensions of the premises and the maximum number of persons who may be present there at any one time;
- (d) emergency doors must open in the direction of escape;
- (e) sliding or revolving doors must not be used for exits specifically intended as emergency exits;
- (f) emergency doors must not be so locked or fastened that they cannot be easily and immediately opened by any person who may require to use them in an emergency;
- (g) emergency routes and exits must be indicated by signs; and
- (h) emergency routes and exits requiring illumination must be provided with emergency lighting of adequate intensity in the case of failure of their normal lighting.

#### **1.7.2.11 Liaison with the emergency services**

- 1 Liaison with the emergency services is essential. In particular, on large or complex developments, the fire and rescue service should be provided with site plans detailing the following:
  - (a) access for emergency service vehicles
  - (b) fire-fighting shafts
  - (c) fire lifts and temporary hoist facilities
  - (d) dedicated emergency escape routes and staircases
  - (e) sprinkler installations
  - (f) floor-load limitations
  - (g) positions of dry riser inlets and wet risers
  - (h) fire points
  - (i) temporary buildings and accommodation
  - (j) hazardous items such as gas cylinders, gas mains, electrical risers, temporary holes in floor slabs etc.
- 2 Liaison with the local fire and rescue service should also include the arranging of site inspections and familiarisation tours for fire and rescue service crews.

#### **1.7.2.12 Fire protection during construction**

- 1 Construction works should be designed and planned to allow the earliest possible installation of fixed fire protection features. These will aid the protection of the building and improve the means of escape of those working within the structure.
- 2 Such measures include:
  - (a) fire-protective materials on structural steelwork

- (b) automatic fire detection systems
  - (c) automatic sprinklers and other fixed fire-fighting installations
  - (d) fire escape staircases
  - (e) compartment walls
  - (f) fire doors
  - (g) fire stopping to lift shafts, service ducts and voids.
- 3      Wet or dry rising mains, where planned, should be progressively commissioned as the project progresses.

#### **1.7.2.13 Water supplies for fire fighting**

- 1      Adequate water for fire fighting must always be available. Whether this is achieved by utilising the fire hydrants fixed to existing street mains or by providing a fixed dam, the amount of water likely to be required should be discussed with the fire authority as part of the liaison process.
- 2      All fire hydrants must be clear of obstructions and suitably marked. Particular care should be taken to ensure that site plant, delivery lorries or workers' cars are not parked close to or over hydrants.

**Construction Site Safety****1.7.2 Appendix 1****Safety questionnaire**

- 1 This questionnaire has been worded so that the correct answer is **YES**. If you answer **NO**, you may wish to give more thought to the problem.

**Assessing fire risk**

- 2 Has a suitable and sufficient fire risk assessment been carried out?
- 3 Have any shortcomings highlighted by the risk assessment been rectified?
- 4 Have employees been made aware of the significant findings of the fire risk assessment?
- 5 Has a competent person been appointed to continually assess the fire risk and to develop and update the fire safety plan?
- 6 Is it necessary to appoint Fire Wardens to oversee any site evacuation?
- 7 If so, have they been appointed and their duties and areas of responsibility made clear?

**Flammable materials**

- 8 Are flammable materials, especially flammable waste materials, cleared away on a daily basis?
- 9 Is there safe, secure storage for highly flammable liquids?
- 10 Are LPG bottles securely stored in a facility which enables any leakage of gas to safely disperse?

**Bonfires**

- 11 If bonfires are allowed on site and are really necessary, are they properly supervised?
- 12 Are bonfires lit during working hours?
- 13 Are bonfires properly extinguished well before the end of the working day?

**Smoking**

- 14 Is smoking prohibited in all site accommodation and enclosed work areas?
- 15 Is there a non-smoking policy on site?
- 16 Is a means of safely disposing of smoking materials provided in places where smoking is permitted?
- 17 Are there adequate and clear official 'No Smoking' signs at each entrance to all site accommodation and in other areas where smoking is not permitted?

18 Is any total or partial smoking ban actively enforced?

#### **Hot work**

19 Where required, has a Hot Work Permit been issued?

20 If so, does it specify that hot work must cease a specified period (e.g. 1 hour) before the end of the working day?

21 When hot work takes place is the correct type of fire extinguisher provided?

22 Are the correct precautions being taken where flame-cutting and welding takes place?

23 Are checks being made at the end of work to see that nothing is left smouldering?

24 Are cavities, eaves and other voids checked at the end of work?

#### **Heating appliances**

25 Are heating appliances correctly sited, installed and maintained?

26 Are fuel supplies, such as propane and butane, kept outside and piped into the building?

27 Are combustible materials being kept well away from heaters and stoves?

#### **Electrical appliances**

28 Are all electrical work or repairs carried out by competent electricians?

29 Are the correct fuses fitted to electrical appliances?

30 Is only one appliance being used from each socket?

31 Are all electrical appliances being inspected and tested regularly?

#### **Staff training**

32 Is everyone on site trained in fire prevention?

33 Are all staff properly trained in the procedures to be followed in case of fire?

34 Are all (or sufficient) staff trained in the selection and use of fire-fighting equipment?

35 Have fire marshals been appointed and trained?

36 Is the location of the fire assembly point known to everybody?

#### **Fire extinguishers**

37 Are all fire extinguishers serviced regularly, checked and recharged as necessary?

38 Are all fire extinguishers of the appropriate type?

- 39      Are all fire extinguishers clearly identified and easily accessible?
- 40      Is there an up-to-date fire plan for the site?
- 41      Is the fire plan updated as necessary?

**Fire alarm**

- 42      Is the fire alarm tested weekly?
- 43      Is a different call point used for each test?
- 44      Can the fire alarm be heard clearly in all parts of the premises?
- 45      Is someone nominated to call the fire and rescue service in case of fire?

**Fire drills and records**

- 46      Are fire drills held on a regular basis?
- 47      Are records kept of all drills and tests of equipment?
- 48      Are the records readily available for inspection?

## Construction Site Safety

### 1.7.3 Dangerous Substances

#### Legislation

##### 1.7.3.1 Key points

- 1 A risk assessment must be carried out before dangerous substances are stored, transported or used. In some cases, a method statement and/or a Permit To Work will also be required.
- 2 These Regulations cover the flammable or explosive properties of dangerous substances used in the workplace.
- 3 People who use dangerous substances must be fully aware of their hazardous properties, adopt methods of controlling the risks and be trained in the use of portable fire extinguishers.
- 4 Electrical apparatus and naked flames should not be used near dangerous substances, particularly if they are being sprayed.
- 5 Good ventilation is essential wherever dangerous substances are used or stored.
- 6 Smoking policies and waste disposal policies must be established and diligently monitored.

##### 1.7.3.2 Introduction

- 1 Dangerous substances are widely used on building and construction sites. The main hazards are fire and explosion, and everything possible must be done to lessen the risks.
- 2 Safety is divided into three areas:
  - (a) the storage of substances
  - (b) the safe handling and transport of substances
  - (c) the uses to which substances are put.

##### 1.7.3.3 The Management of Health and Safety at Work

- 1 The Contractor must make a suitable and sufficient assessment of every work activity to identify any hazard that employees or any other person might encounter as a result of the work being carried out.
- 2 When hazards are identified, it is the Contractor's duty to either eliminate the hazard or to put control measures in place to reduce the risks to health and safety arising out of the hazards, as far as is reasonably practicable.
- 3 If an identified hazard requires health surveillance, the Contractor must make it available to employees. The surveillance must be appropriate, taking into account the risks to their health and safety that have been identified.
- 4 The Contractor must provide employees with clear and relevant information on any risks that exist in the workplace and of control measures that are in place to reduce those risks.
- 5 Employees, in turn, have a duty under these Regulations to tell their Contractor of any work

situation which presents a risk to the health and safety of themselves or of any other person.

#### 1.7.3.4 Dangerous Substances and Explosive Atmospheres

- 1 Contractors must control the risks to safety from fire and explosions. These Regulations apply at all places of work where:
  - (a) a dangerous substance is present (or is liable to be present) at the workplace
  - (b) the dangerous substance could be a risk to the safety of people as a result of fires, explosions or similar energetic events.

#### Definitions

- 2 A 'dangerous substance' is:
- 3 '*any substance or mixture of substances that can put people's health or safety at risk from fire and explosion.*'
- 4 Dangerous substances are:
  - (a) any substance or mixture of substances that is classified as explosive, oxidising, extremely flammable, highly flammable or flammable
  - (b) any dust, whether in the form of solid particles or fibrous materials, which can form an explosive mixture in air.
- 5 An 'explosive atmosphere' is:
- 6 '*a mixture of air and one or more hazardous substances in the form of a gas, vapour, mist or dust, which will explode after ignition has occurred.*'
- 7 In the construction industry, many dangerous substances are used, or created by, work activities, for example:
  - (a) the storage and use of solvents, adhesives and paints
  - (b) the storage and use of flammable gases such as oxygen and acetylene during cutting and welding
  - (c) the storage and use of LPG for work processes, heating or cooking
  - (d) the creation of large quantities of airborne dust, for example as a result of wood-machining or sanding, and the handling and storage of bulk waste dust
  - (e) the storage and decanting of vehicle fuels and lubricants
  - (f) the storage and handling of liquid flammable wastes such as fuel oils
  - (g) many 'hot work' activities such as the hot-cutting of tanks and drums that have contained flammable materials.

#### 1.7.3.5 Contractors' duties

- 1 Contractors must assess and eliminate or reduce risks from dangerous substances.
- 2 Complying involves:

### Assessing risks

- 3 Before work is carried out, Contractors must assess the fire and explosion risks that may be caused by dangerous substances. This should be an identification and careful examination of:
  - (a) dangerous substances in the workplace
  - (b) work activities involving those substances
  - (c) ways in which those substances and work activities could harm people.
- 4 The purpose is to help Contractors to decide what they need to do to eliminate or reduce the risks from dangerous substances. If there is no risk to safety from fires and explosions, or the risk is low, no further action is needed. If there are risks then Contractors must consider what else needs to be done.

### Preventing or controlling risks

- 5 Contractors must put control measures in place to eliminate risks from dangerous substances, or reduce them as far as is reasonably practicable. Where it is not possible to eliminate the risk completely Contractors must take measures to control risks and reduce the severity of the effects of fire or explosion.
- 6 The best solution is to eliminate the risk by replacing the dangerous substance with another substance, or using a different work process.
- 7 This is called substitution.
- 8 In practice, this may be difficult to achieve. However, it may be possible to reduce the risk by using a less dangerous substance, e.g. by replacing a low flashpoint liquid with a high flashpoint one. In other situations, it may not be possible to replace the dangerous substance. For example, it would not be practical to replace petrol with another substance at a filling station.

### Control measures

- 9 Where the risk cannot be eliminated, these Regulations require control measures to be applied in the following priority order:
  - (a) reduce the quantity of dangerous substances to a minimum
  - (b) avoid or minimise releases of dangerous substances
  - (c) control releases of dangerous substances at source
  - (d) prevent the formation of a dangerous atmosphere
  - (e) collect, contain and remove any releases to a safe place (for example, through ventilation)
  - (f) avoid ignition sources
  - (g) avoid adverse conditions, e.g. exceeding the limits of temperature or control settings, that could lead to danger
  - (h) keep incompatible substances apart.
- 10 These control measures should be proportionate to the degree of risk as highlighted in the risk assessment and be appropriate to the nature of the activity or operation.

### Mitigation

- 11 In addition to control measures, Contractors must subsequently put in place mitigation measures. These measures should be consistent with the risk assessment and appropriate to the nature of the activity or operation, and include:
- (a) reducing the number of employees exposed to the risk
  - (b) providing explosion-resistant plant
  - (c) providing explosion suppression or explosion relief equipment
  - (d) taking measures to control or minimise the spread of fires or explosions
  - (e) providing suitable personal protective equipment.

### Preparing emergency plans and procedures

- 12 Arrangements must be made to deal with emergencies. These plans and procedures should cover safety drills and suitable communication and warning systems, and should be in proportion to the risks. If an emergency occurs, workers tasked with carrying out repairs or other necessary work must be provided with the appropriate equipment to allow them to carry out this work safely.
- 13 The information in the emergency plans and procedures must be made available to the emergency services to allow them to develop their own plans if necessary.

### Providing information, instruction and training for employees

- 14 Employees must be provided with relevant information, instructions and training.
- 15 This includes:
- (a) the dangerous substances present in the workplace and the risks they present, including access to any relevant safety data sheets and information that applies to the dangerous substance
  - (b) the findings of the risk assessment and the control measures put in place as a result (including their purpose and how to follow and use them)
  - (c) emergency procedures.
- 16 Information, instruction and training need only be provided to other people (non-employees) where it is required to ensure their safety. It should be in proportion to the level and type of risk.
- 17 The contents of pipes and containers must be identifiable to alert employees and others to the presence of dangerous substances.

### Places where explosive atmospheres may occur

- 18 In relation to construction site activities, this could include bottled gas/petrol storage areas. These duties include:
- (a) identifying and classifying (zoning) areas where potentially explosive atmospheres may occur
  - (b) avoiding ignition sources in zoned areas, in particular those from electrical and mechanical equipment (suitable electrical IP rating)

- (c) where necessary, identifying the entrances to zoned areas by the display of signs
  - (d) providing appropriate anti-static clothing for employees
  - (e) before they come into operation, verifying the overall explosion-protection safety of areas where explosive atmospheres may occur.
- 19 Decisions on the zoning of areas and the appropriate actions to take must be made by someone who has been trained and is competent to do so.

#### **1.7.3.6 Personal Protective Equipment**

- 1 Where a risk has been identified by a risk assessment and it cannot be adequately controlled by other means that are equally or more effective, then the Contractor must provide and ensure that suitable personal protective equipment is used by employees. In essence, personal protective equipment (PPE) may only be used as a last resort. In deciding which type of PPE to issue, the Contractor must take into account the risk that the PPE is being used to protect against, and ensure that the PPE will fit the wearer and allow them to work safely.
- 2 If more than one item of PPE is being used, the Contractor must make sure that individual items of PPE are compatible so that each item does not adversely affect the performance of another.
- 3 Whilst the Contractor must, as far as possible, ensure that any personal protective equipment supplied must be worn, the employee in turn must ensure that they wear the equipment provided and know the procedures for reporting loss or defect to the Contractor.
- 4 Dangerous substances and explosive atmospheres require the prevention of:
  - (a) inhalation of fumes and vapour given off by dangerous substances
  - (b) skin contact with dangerous substances
  - (c) eye injuries resulting from splashes of dangerous substances.

#### **1.7.3.7 Provision and Use of Work Equipment**

- 1 The Contractor must only supply work equipment that is correct and suitable for the job and ensures that the equipment is maintained and kept in good working order.
- 2 Where the use of the equipment involves a specific risk to the health and safety of employees, it must be restricted to competent specified workers.
- 3 This relates to only the provision and use of work equipment that allows dangerous substances to be handled (including decanting), transported, used and disposed of in a safe manner.

#### **1.7.3.8 Control of Substances Hazardous to Health**

- 1 The Control of Substances Hazardous to Health does not apply to dangerous substances by virtue of their explosive or flammable nature. However, they may apply if these substances also possess certain other hazardous properties. This would be identified as part of the COSHH assessment carried out on the substance.

#### **1.7.3.9 Construction (Design and Management) CDM**

- 1 Under CDM measures to be taken need to be specified:-

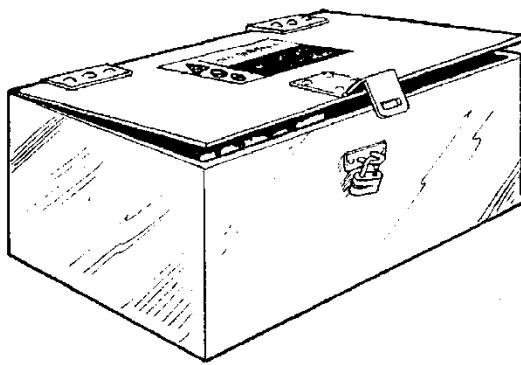
- (a) To prevent the risk from fire, explosion or any substance likely to cause asphyxiation.
- (b) To detect and fight fires in relation to work carried out on construction sites.

#### 1.7.3.10 Competence and training

- 1 The Contractor must provide employees with adequate information, instruction, training and supervision to enable them to carry out any work task safely and without risk to their health.

#### 1.7.3.11 Storage of dangerous substances

- 1 On most building or construction sites, dangerous substances will be used at some time during the construction phase. Depending upon the nature of the work to be undertaken it may be necessary to store bulk quantities of dangerous substances, either:
  - (a) in an external, secure, purpose-built compound, where site conditions allow
  - (b) in a suitable, secure internal storeroom if, because of the nature of the site, external storage is not possible.
- 2 Alternatively, small quantities, from, say, 200 ml containers upwards will often be taken to the place of work by the person doing the job.
- 3 Where small quantities of dangerous substances for daily use are required in the workplace, metal lockable bins may be used.



#### Storage in the open air

- 4 Where it is necessary to store dangerous substances in bulk, a store should be built:
- (a) on a concrete sloping pad with a sump to catch any leaks or spillage
  - (b) with a low sill all around, sufficient to contain the contents of the largest can or drum stored + 10%, i.e. bunded
  - (c) surrounded by a 1.8 meter high wire fence
  - (d) so that it is protected against direct sunlight
  - (e) at least 2 meters away from nearby buildings or boundaries, except that, where the boundary of the store forms part of a solid wall, cans or drums may be stacked up against that wall up to 1 meter from the top.

5 Cans or drums should be stored:

- (a) so that their contents can be easily identified and removed in the event of any leak or damage
- (b) on their sides and chocked to prevent movement.

6 Stores or bins must be kept locked and only sufficient amounts for each day's requirements should be removed, as and when needed.

7 They may be marked with suitable signs such as 'Flammable Liquid' or 'Flammable Gas'.

8 Additionally, if an assessment shows that an explosive atmosphere may be present in a particular area, appropriate numbers of the sign below must be displayed.

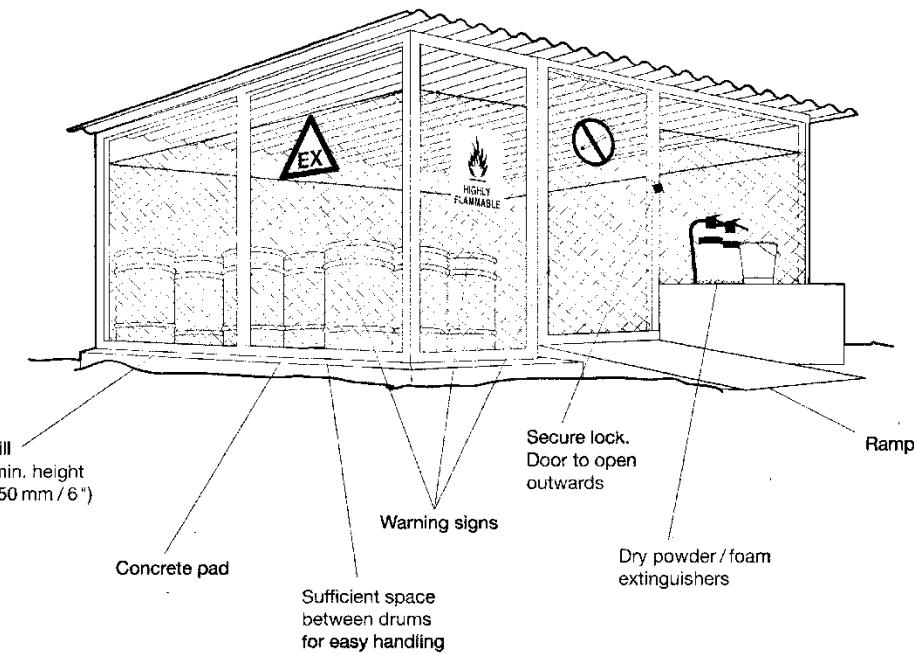
9 The sign comprises a yellow background and black graphics. Signs must conform to BS 5499 Safety signs and colours.



10 Naked flames, smoking, matches or lighters must not be allowed in the area of the store, and proper prohibition signs must be clearly displayed as well as other signs already indicated.

11 Any lighting within a store must be flameproof to the appropriate standard, and under no circumstances should electrical sockets be permitted.

12 Where there is a need for electrical apparatus (other than lighting) within a store, the supply must be permanently wired in using intrinsically safe equipment.



**Other points to be noted.**

- 13 Stores should not be built below ground level, because the vapours from spillages and leaks will not be able to disperse.
- 14 Adequate cross-ventilation at both high and low level is necessary.
- 15 The store should always be kept locked when unattended.
- 16 A door sill of approximately 150 mm in height should be provided to catch any leaks or spillages in order to retain the liquids inside the building.
- 17 A quantity of absorbent material, to soak up any spilt liquids, and a suitable container for the collection and safe disposal of the contaminated absorbent, should be provided at the store.
- 18 The use of mobile phones in or immediately adjacent to the store should be prohibited. Notices to this effect should be provided and prominently displayed.
- 19 Any shelves or racking in the store should be of a non-ferrous metal or other non-combustible construction.

**Storage inside a building**

- 20 A separate building should be provided, if possible, solely for the storage of dangerous substances where protection from the weather or security is required. Ideally, it will be constructed from fire-resisting materials and it should be at least 2 metres away from other buildings or boundaries.
- 21 A risk assessment should be carried out to determine whether the risks of storing dangerous substances in such a location are acceptable. If not, either additional control measures must be put in place or alternative arrangements made for storing the substances.
- 22 Where a separate building cannot be provided, and the store forms part of an existing structure, the surrounding walls and roof of the store must be fire-resisting and the door should be of the fire-resisting type and open outwards.
- 23 It is recommended that the maximum quantities that may be stored in cabinets and bins are no more than 50 litres for highly flammable liquids (and flammable liquids with a flashpoint below the maximum ambient temperature of the workroom/working area) and no more than 250 litres for other flammable liquids with a higher flashpoint of up to 55°C.

**Other points to be noted.**

- 24 Stores should not be built below ground level, because the vapours from spillages and leaks will not be able to disperse.
- 25 Adequate cross-ventilation at both high and low level is necessary.
- 26 The store should always be kept locked when unattended.
- 27 When not in use, containers of flammable liquids needed for current work activities should be kept closed and stored in suitable cabinets or bins of fire-resisting construction and which are designed to retain spills (110% volume of the largest vessel normally stored in it).

- 28 A quantity of absorbent material, to soak up any spilt liquids, and a suitable container for the collection and safe disposal of the contaminated absorbent should be provided at the store.
- 29 Signs should be positioned on or near the store stating, for example 'Highly Flammable' or 'Flashpoint below 32°C'. All signs should conform to BS 5499 Safety signs and colours.
- 30 Naked flames, smoking, matches or lighters must not be allowed in the store, and signs stating this must be clearly displayed.
- 31 The use of mobile phones in or adjacent to the store should be prohibited. Notices to this effect should be provided and prominently displayed.
- 32 Any lighting or other electrical apparatus must conform to EN 60079-14.
- 33 Any shelves or racking in the store should be of a non-ferrous metal or other non-combustible construction.

#### **1.7.3.12 Handling and use of dangerous substances likely to cause an explosive atmosphere**

- 1 The use of any dangerous substance, including decanting small quantities for daily use from bulk containers, must be the subject of a risk assessment.
- 2 The findings of the risk assessment will indicate the maximum quantity of the dangerous substance that can be taken to the place of work and the safe working practices to be observed once it is there and being used.
- 3 Generally, only enough of the dangerous substance to enable the work-in-hand to be carried out should be taken to the place where it is to be used. Clearly, actual quantities will depend on the work activity and also the organisational arrangements for controlling the fire risks in the workroom/ working area.
- 4 Decanting, mixing or sampling should not be carried out in a store. It should be done in the open air or in a separate room constructed of fire-resisting materials.
- 5 Funnels should be used to prevent spillage whilst decanting is taking place and drip trays should be used to catch any spillage that may inadvertently occur.
- 6 Any spillage should be soaked up using proprietary absorbents, dry earth or dry sand.
- 7 Metal bins with lids should be provided for any used absorbents to be placed in and these should be emptied regularly and carefully.
- 8 Consideration must be given to the disposal of any waste as it may well be classified as hazardous waste.
- 9 In general, where work involves the use of a dangerous substance that has the potential to create an explosive atmosphere inside a room, all electrical power should be turned off unless all electrical fittings are intrinsically safe by design. If space heating is needed, it should be flameproof and incapable of causing the ignition of any vapours present in the atmosphere.
- 10 The build-up of concentrations of vapours must be avoided and dispersed, if necessary, by natural or mechanical ventilation. If mechanical ventilation is necessary, a flameproof motor, not in the

ventilation trunking, should be used.

#### **Other points to be considered**

- 11 Naked flames, welding and heating torches, and smoking materials should be prohibited in any area where an explosive atmosphere may be present.
- 12 Metal bins with lids must be provided for offcuts, waste or rags. They should be emptied regularly.
- 13 A suitable container with a lid should be used for any brushes or scrapers which require soaking, to remove residues of dangerous substances. This should be placed in a safe area well away from any possible source of ignition.

#### **1.7.3.13 Spraying of dangerous substances**

- 1 New covering materials, such as paints, varnishes and lacquers, and the techniques for applying them, have been developed and extensive use of spray painting equipment can now be seen on construction sites,
- 2 Using a spray gun for spraying dangerous substances is most likely to introduce an airborne explosive mist into the workplace, creating a hazard both to the user and to other workers in the area. Such work must only be undertaken by fully trained and competent employees and in a situation where all appropriate precautionary measures are in place. A risk assessment must be carried out and other controls such as 'permits to work' and 'permits to enter' (for those people involved in the job, by implication, excluding all others), implemented as necessary.

#### **Points to be noted**

- 3 Identify the material carefully and always follow the manufacturer's instructions on preparation, use and application.
- 4 Always use the correct type of spraying equipment. Never make do, just because the proper equipment is not immediately to hand.
- 5 If alternative control measures are not available or adequate, protective clothing and respiratory protective equipment must be used.
- 6 Always use the hygiene and washing facilities provided.
- 7 Do not introduce ignition sources into the working area.
- 8 Do not smoke or use naked flames in the working area.
- 9 Always place warning signs in approaches to the area where the work is being carried out, and at entrance points to areas in which dangerous substances are being used. Use physical barriers, if necessary, to stop unauthorised persons entering the area.

#### **1.7.3.14 Empty tanks and containers**

##### **Bulk tanks and drums**

- 1 Do not cut or heat any empty tanks, containers or drums unless they have been certificated as

being free of flammable vapours that could explode. Current opinion recommends reducing the length of time that such certification is valid for. Under most circumstances, the cutting work should be planned to start immediately the 'gas-free' certificate is issued.

- 2 Special care is necessary when demolishing or dismantling disused bulk-tanks. By disturbing the tank or heating the residues left inside, you may cause an explosive concentration of vapours.
- 3 Entry into any disused tank or vessel that may be regarded as a confined space should be avoided by doing the work from outside, if possible. Often, there will be a need to clean residues and if entry to a confined space is unavoidable, a safe system of work must be followed and the work carried out under a Permit to Work system.
- 4 There are a number of factors to consider when the work involves large tanks. The first would be what the contents were. Oil storage tanks may have held so called 'heavy fuel oil' and these will undoubtedly have been insulated. It is quite likely that the insulation system will have been asbestos. If the tanks once held petrol, it may have been leaded fuel. This means that the exposure to lead fumes during cutting should be considered.
- 5 It is normal for large tanks, whether above or below ground, to be emptied and cleaned by a specialist contractor before dismantling. The contents are generally removed by a large vacuum tanker and then the inside of the tank is steam cleaned. Most of this work can be carried out from the outside and it is only to carry out the final clean that entry is required. Operatives carrying out this final clean must be trained in confined space working and provided with all the normal gas detector, rescue equipment and PPE that would be expected for confined space working.
- 6 Having been cleaned, the tank is tested and a 'gas-free' certificate issued. It should then be cut up as soon as possible. The implication of not doing so is that it is practically impossible to completely clean a tank, particularly where its construction incorporates internal ribs, welds and other internal features which could harbour residue of the content. These may well become fume and if the concentration becomes high enough then the atmosphere inside the tank may become explosive if ignited.
- 7 It is important to be aware that even so called cold cutting techniques such as hydraulic shears may cause sparks and so leaving the cutting even until the next day is simply not an option.

#### 1.7.3.15 Fire

- 1 Fires involving flammable liquids usually fall into one of two categories:
  - (a) flowing liquid fires
  - (b) contained liquid fires.
- 2 Powder extinguishers are the most suitable type for tackling a flowing liquid fire. The use of foam or carbon dioxide extinguishers may be effective on a small, flowing liquid fire.
- 3 Foam extinguishers are the most suitable type for use on contained liquid fires. Powder or carbon dioxide extinguishers may also be used, but operators should be aware of the short duration of small carbon dioxide extinguishers and the possibility of reignition of any residual vapours being given off when an ignition source is still present.
- 4 **DO NOT USE A WATER EXTINGUISHER FOR ANY FIRE INVOLVING HIGHLY FLAMMABLE LIQUIDS, BECAUSE THE WATER WILL CAUSE A VIOLENT REACTION AND MAKE THE LIQUID OVERFLOW.**

- 5 Suitable portable fire extinguishers should, wherever possible, be sited in pairs (so as to minimise the risk of failure) and in strategic positions adjacent to the store.

#### Colour of fire extinguishers

- 6 Colour-coding by agent or medium (see below) enables a trained person to rapidly identify the type of extinguisher needed in an emergency.

Extinguishing medium	Colour of panel
Water	Red
Foam	Cream
Powder (all types)	Blue
Carbon dioxide	Black
Wet chemical	Yellow

- 7 Other information concerning its use may also be displayed on the body of the extinguisher.
- 8 Training in the correct type of extinguisher to use and the safe way to operate fire-fighting equipment is essential and should be undertaken by **all** staff who work with dangerous substances. The use of the **wrong** extinguisher in the **wrong** way would have serious consequences.
- 9 Advice on training can be obtained from extinguisher manufacturers or the local fire station.

## Construction Site Safety

### 1.7.3 Appendix 1

#### Safety questionnaire

- 1 This questionnaire has been worded so that all the correct answers are **YES**. If you answer 'NO' to any question perhaps you need to give the matter more attention.

#### Dangerous substances

##### General

- 2 Has a risk assessment been carried out?
- 3 Does it indicate that other methods of managing the situation are required, such as a method statement or Permit to Work system?
- 4 Have employees been made aware of the significant findings of the risk assessment?

##### Storage in the open air

- 5 Is the base of the store built of concrete and sloped?
- 6 Is there a low level sill surrounding the base?
- 7 Is there a ramp for access to the store over the sill?
- 8 Is a sump provided to catch any leakages or spillages and is the capacity large enough to contain any leakages or spillages?
- 9 Is there a roof or cover over the store to protect the contents from direct sunlight?
- 10 Is there an adequate separation distance between the store and adjacent buildings or boundaries?
- 11 Are appropriate signs displayed, for example 'Highly Flammable' or 'Flashpoint Below 32°C'?
- 12 Are the correct fire extinguishers provided and positioned adjacent to the store?

##### Storage in buildings

- 13 Is the storage building used exclusively for the storage of dangerous substances?
- 14 If the store is part of a multi-purpose building, is there adequate fire separation from the rest of the building?
- 15 Are appropriate signs displayed, for example 'Highly Flammable' or 'Flashpoint Below 32°C'?
- 16 Is there a sill across the doorway to prevent leakages or spillages reaching the open air and is the capacity large enough to contain any leakages or spillages?
- 17 Is there adequate cross-ventilation at both high and low level?

18 Is there the required separation distance between the store and adjacent buildings or boundaries?

#### **Storage at the place of work**

19 Is there a lockable metal cabinet available to store small quantities for daily use?

20 Is it marked with appropriate safety signs?

#### **Decanting**

21 Is decanting done only in the open air or in a fire-resisting building?

22 Is the decanting located away from any source of heat or ignition?

23 Are dangerous substances only decanted into small, correctly marked containers with effective closures?

24 Are funnels correctly used to assist decanting?

25 Are drip trays positioned to catch any leakages or spillages?

26 Are suitable absorbents or spill kits available to contain any spillage?

27 Are metal bins available for used absorbents to be placed in?

28 Are these bins emptied regularly?

29 Is contaminated absorbent safely, carefully and properly disposed of?

#### **Use of dangerous substances**

30 Where dangerous substances are used, is adequate ventilation provided?

31 If there is a need for mechanical extraction, is the electric motor out of the line of discharge of the fumes?

32 Are there signs stating 'No Smoking' or 'Naked Lights'?

33 Are metal waste bins with lids provided for dangerous substances that are no longer required?

34 Are the correct warning notices provided?

35 Are serviceable fire extinguishers of the correct type provided and positioned adjacent to the workplace?

36 Are containers with lids provided for cleaning brushes?

#### **Spraying**

37 Have the materials in use been clearly identified?

38 Are the correct precautions in relation to use and storage being observed?

- 39 Is the correct spraying equipment being used?
- 40 Is the correct protective clothing and equipment, including RPE, being worn?
- 41 Are the necessary precautions being taken to avoid all ignition risks?
- 42 Are warning notices correctly displayed?
- 43 Are barriers in use if necessary?
- 44 Are serviceable fire extinguishers of the correct type provided and positioned adjacent to the workplace?

**Empty tanks and containers**

- 45 Are the necessary precautions being taken against the risk of explosion in storage tanks awaiting demolition or dismantling?
- 46 Has an explosive gas-free certificate been obtained prior to any hot work? (NB Check how long the certificate is valid for.)
- 47 Is a Permit to Work system used when work is being carried out on disused or redundant tanks?
- 48 Are authorising Permits to Work to deal with all the confined space issues being obtained before any entry into a tank is made?
- 49 Has thought been given to the possibility of contamination around the tank from leakage or spillage?
- 50 Has advice been sought from a competent person before work begins?

**Fire****Emergency procedures**

- 51 Are the correct types of fire extinguisher provided and suitably positioned adjacent to the store or workplace?
- 52 Have the staff been correctly trained to use them?
- 53 Are there procedures to call the fire and rescue service?
- 54 Is there a telephone available to call the fire and rescue service?
- 55 Is the address of the site displayed on prominent notices conveniently located in offices and near telephones?
- 56 Are suitable absorbents or spill kits available to contain any spillage?

## Construction Site Safety

### 1.7.4 Liquefied Petroleum Gases

#### 1.7.4.1 Key points

- 1 A risk assessment must be carried out before dangerous substances are stored, transported or used. In some cases a method statement and/or a permit to work will also be required.
- 2 Liquefied petroleum gases (LPG) are normally found as compressed liquids, usually of commercial butane or propane.
- 3 LPG is a colourless odourless liquid that floats on water but vaporises to form a gas which is heavier than air. A stenching agent is normally added.
- 4 A release or spillage of LPG can form a large vapour cloud of flammable gas capable of ignition from some distance.
- 5 LPG is stored on site in fixed tanks, refillable cylinders or non-refillable disposable cylinders (cartridges).
- 6 Storage should be in secure, non-combustible, well ventilated areas away from other risks and sources of ignition.
- 7 All LPG cylinders and regulators for use with fixed heaters, cookers and lighting in site huts must be kept outside and piped in using rigid copper piping.
- 8 Staff who work with LPG must be suitably trained in the hazards and use of LPG, such as not rolling cylinders. .
- 9 In the event of a leak, do not attempt to operate electrical apparatus or switches.
- 10 If a fire breaks out that involves LPG cylinders:
  - (a) immediately inform the fire and rescue service of the whereabouts of all cylinders on site, including details of whether they are full or empty
  - (b) if in any doubt as to the safety of the overall situation, evacuate the site and put a security cordon in place.

#### 1.7.4.2 Introduction

- 1 LPG is a mixture of hydrocarbons that are a gas or vapour under normal conditions of temperature and pressure, but can be turned into a liquid by either the application of pressure or the reduction of temperature.
- 2 LPG can be found in numerous locations, in various sizes of cylinder and can be put to a variety of uses on building and construction sites. Uses range from the heating of bitumen boilers, site huts and offices to providing a fuel for hand tools and cutting equipment.
- 3 If used properly and safely, LPG is a convenient and valuable source of energy. Misuse or carelessness can cause serious accidents.

#### Legislative requirements

#### 1.7.4.3 Dangerous Substances and Explosive Atmospheres

- 1 The nature of LPG, particularly in its gaseous form, will result in areas where it is used or stored

coming within the requirements of these Regulations.

#### **1.7.4.4 The Management of Health and Safety at Work**

- 1 All work activities must be the subject of a risk assessment, including those that involve the use of LPG and other flammable substances. The Contractor must make a suitable and sufficient assessment of every work activity in order to identify any hazard that employees or any other person might encounter as a result of the work being carried out.
- 2 Once those hazards have been identified, the Contractor's must put control measures into place in order to remove or reduce those hazards as far as is reasonably practicable.

#### **1.7.4.5 Construction (Design and Management) CDM**

- 1 Under CDM measures to be taken need to be specified:-
  - (a) To prevent the risk from fire, explosion or any substance likely to cause asphyxiation.
  - (b) To detect and fight fires in relation to work carried out on construction sites.

#### **1.7.4.6 Provision and Use of Work Equipment**

- 1 Any equipment used in conjunction with the use, handling or storage of LPG is classified as work equipment under these Regulations. Every Contractor must ensure that all persons who work with or supervise others in the use of LPG or LPG equipment have available to them adequate health and safety information and, where appropriate, written instructions regarding the use of that equipment.
- 2 Equipment that is used in conjunction with LPG which is hired-in or purchased second-hand must also comply with the requirements of the Regulations.
- 3 Every Contractor must ensure that all persons who work with, or supervise others in the use of LPG equipment, have received adequate training for the purposes of health and safety, and be aware of any risks in the use and precautions to be taken in the case of an accident.

#### **1.7.4.7 Personal Protective Equipment**

- 1 These Regulations require that, where a risk has been identified by a risk assessment and it cannot be adequately controlled by other means which are equally or more effective, then the Contractor must provide and ensure that suitable personal protective equipment is used by employees. In essence, personal protective equipment (PPE) may only be used as a last resort. In deciding which type of PPE to issue, the Contractor must take into account the risk that the PPE is being used to protect against, and ensure that the PPE will fit the wearer and allow them to work safely.
- 2 If more than one item of PPE is being used, the Contractor must make sure that individual items of PPE are compatible so that each item does not adversely affect the performance of another.
- 3 While the Contractor must, as far as reasonably practicable, ensure that any personal protective equipment supplied is worn, employees must ensure that they wear the equipment provided and know the procedures for reporting loss or defects to the Contractor.
- 4 In the context of these Regulations they are preventing:

- (a) skin contact with LPG in its liquid form
- (b) jets of gaseous LPG entering the eyes or impacting on the skin
- (c) the inhalation of gaseous LPG when a released cloud of LPG is confined. Entry into such areas should only be undertaken by trained persons when absolutely necessary.

#### **1.7.4.8 Manual Handling Operations**

- 1 Every Contractor should, as far as is reasonably practicable, avoid the need for employees to undertake any manual handling operations at work which may involve a risk of injury.

#### **1.7.4.9 The Control of Substances Hazardous to Health**

- 1 These Regulations do not apply to LPG by virtue of its flammable nature, but they will apply by virtue of its other hazardous properties.

##### **Definitions**

- 2 **Liquefied petroleum gas** means any commercial butane, commercial propane or a mixture of the two.

##### **Commercial butane**

- 3 This is usually stored in blue cylinders and is generally known as Camping Gaz or Calor Gas.
- 4 It consists mainly of butane and butane isomers. The remaining components are predominantly propane and propane isomers, pentane and pentane isomers.
- 5 Because of the low vapour pressure, butane cylinders are not generally used outside.

##### **Commercial propane**

- 6 This is usually stored in vessels or in red cylinders.
- 7 It consists mainly of propane and propane isomers. The remaining components are predominantly butane and butane isomers, ethane and ethane isomers.

##### **LPG properties**

- 8 LPG is a colourless, odourless liquid or gas which normally has a smell or 'stench' added before distribution.
- 9 As a liquid, it is lighter than water and will float before evaporating.
- 10 As a gas, it is approximately twice as heavy as air and will sink and flow into sumps and underground excavations or workings. It will also sink into drains but, because its density is approximately half that of water, it will not flow through drains which are water trapped.
- 11 It is capable of ignition at some distance from the original leak. The resulting flame can travel back to the source of the leak.
- 12 Any release of liquid under pressure to the atmosphere results in its rapid conversion to gas. This

gas has a volume of about 230 (butane) and 270 (propane) times that of the liquid.

- 13 The expansion during a rapid release of pressure results in a rapid drop of temperature, which for propane can approach its boiling point of 45°C. Leakage of liquid LPG will result in the release of large volumes of highly flammable gases.
- 14 For example, 1 litre of liquid propane spilt in a workplace will evaporate to make approximately 270 litres of gas. If it is diluted with air to 2%, this will give 13,750 cubic litres of an explosive gas/air mixture - enough to fill a room 3 m x 2.3 m x 2 m.

#### **Properties of liquefied petroleum gases**

Property	Commercial butane	Commercial propane
Density in comparison to water	0.57	0.5
Density in comparison to air	2	1.5
Litres per tonne	1745	1995
Boiling point	-2°C	-45°C
Pressure at 15°C	1.5 bar	7.0 bar
Expansion ratio	1:230	1:270
Levels of flammability	1.9%-8.5%	2.0%-10.9%

- 15 The use of LPG equipment in confined spaces, and small, poorly ventilated spaces (such as basement and sub-basement boiler houses, toilets and kitchens) can give rise to a highly flammable or explosive atmosphere, if the equipment should leak.

#### **Flammability**

- 16 Following mechanical failure of LPG equipment, or any other event which causes the release of LPG, the resulting gas will form a flammable mixture with air at gas concentrations between approximately 2% and 10%.
- 17 Ignition of released LPG, where the concentration exceeds 2%, can result in fire or, if confined, an explosion. If a leak does not ignite immediately, and the LPG and air mixture drifts from the point of release, it will gradually become more diluted.
- 18 However, should the concentration still exceed 2% and ignition occur, this could cause a flash or cloud fire-back to the point of release.
- 19 A leak of LPG may be noticed either by the smell or the noise of the gas escaping. There may also be condensation or frosting on the outside of the cylinder.
- 20 Leaks must not be traced with a lighted match or naked flame as this would almost certainly cause an explosion. Only soapy water or a proprietary leak-finding fluid should be used.

- 21 If it is suspected that LPG has leaked inside a building, no attempt should be made to touch any electrical apparatus.
- 22 **DO NOT turn light switches or sockets or any other electrical appliance either ON or OFF.**
- 23 Open all doors and windows, if it is safe to do so, and leave immediately. Do not re-enter the building until advice has been sought and you are told it is safe to do so.

#### **Workplace exposure limits**

- 24 The maximum levels of exposure for LPG, are:
  - (a) 1,000 ppm (0.1 %) for long-term exposure (reference period: 8 hours)
  - (b) 1,250 ppm (0.125%) for short-term exposure (reference period: 15 minutes).
- 25 During any maintenance work involving release of pressure, especially in confined spaces, care must be taken that these exposure limits are not exceeded.

#### **Inhalation**

- 26 LPG gas is not toxic, but at concentration levels above about 10,000 ppm (1%) in air, propane becomes a slight narcotic. At higher levels, it becomes an asphyxiant by displacing oxygen.
- 27 In a sufficiently high concentration, a person will suffocate and die.

#### **Cold burns**

- 28 The release of liquid propane onto unprotected skin will cause cold burns. This is due to the rapid vaporisation of the liquid, withdrawing heat from the affected area of the body.
- 29 The release of liquid, or significant amounts of gas at vessel pressure, can also cause the adjacent fittings to cool. This may be sufficient to cause cold burns if the fittings are subsequently touched by unprotected hands.
- 30 Suitable skin and eye protection must be worn whenever there is the possibility of a release of liquid LPG.
- 31 **In the event of a cold burn, treat as for a bum from a hot object. Flush with copious amounts of cold water and seek medical help.**

#### **Environmental hazards**

- 32 A small unignited release of LPG would not pose a serious danger to the environment.
- 33 The gas, being heavier than air, will 'roll' and sink to the lowest point, such as basements or excavations. This may result, if in the flammable range, in a fire or explosion, even if a naked source of flame is a considerable distance from the original leak.
- 34 A fire and explosion would be instantaneous on ignition and would be limited to immediate damage. The fire might devour only escaping LPG and then the danger will have passed with no lasting environmental damage.

35 The fire will burn fast and the explosion will be intense, but both may be over very quickly.

#### 1.7.4.10 Storage

1 LPG can be stored on construction sites in one of three ways:

- (a) in fixed storage tanks
- (b) in refillable cylinders
- (c) in non-refillable cylinders (i.e. disposable cylinders).

##### Fixed storage tanks

2 Whilst most LPG used on construction sites can be found in cylinders, on some larger sites there may be a need for bulk storage. In view of the large capacity, it is essential that the positioning of any storage tank is carefully planned and discussed with the local Fire Prevention Officer.

3 LPG tanks should be positioned on a level concrete base to provide a stable foundation. For short-term installations it may be satisfactory to stand the tank on concrete slabs, but advice must be sought from the tank or gas suppliers.

4 Tanks should not be sited close to any ditches, cellars or drains, and delivery and emergency vehicles must easily reach them.

5 All access roads must be clear of obstruction and the entire area kept free from weeds and other vegetation.

6 Tanks over 2,250 litres liquid capacity should be electrically bonded and earthed.

7 All bulk storage tanks must have good all-round ventilation. On non-secure sites, tanks should be protected against vandalism by a chain link fence at least 2 m high.

8 Motorway type crash barriers should surround the installation to minimise damage by motor vehicles. Installations must be clearly labelled:

#### HIGHLY FLAMMABLE LPG: NO SMOKING OR NAKED LIGHTS

9 Signs must conform to BS 5499 Safety Signs and Colours.

##### Separation

10 Adequate separation must be maintained between bulk storage tanks and adjacent buildings or boundaries.

11 As a guide, the distances detailed in the table should be followed:

##### Separation distances of bulk LPG tanks

Gas capacity	Water capacity		Minimum distance*
tonnes	litres	gallons	metres
Under 0.2	450	99	2.5
0.2-1	451-2,250	100-495	3
"1-4	2,251-9,000	496-1,980	7.5

*"Minimum distance from boundaries, buildings or sources of ignition*

- 12 Where possible, LPG storage areas should not be positioned under power cables.
- 13 Where this is unavoidable, the **minimum** distances between the extremity of the vessel or cylinders to the nearest cable should be:
  - (a) up to 1 kV - 1.5 m
  - (b) 1 kV or above- 10 m.

#### 1.7.4.11 Cylinders

##### Handling

- 1 Care must be taken when moving cylinders around the site, especially by hand or on rough ground. A full 47 kg cylinder has a total mass of about 90 kg and, before moving by hand, requires a manual handling assessment. Cylinders must not be rolled, even when empty.
- 2 Cylinders should be handled with care and, wherever reasonably practicable, moved using suitable equipment. They should not be moved unprotected in dumper trucks or on forklift trucks. The valve on a cylinder should not be used for lifting or to lever the cylinder into position. Damage to the valve can result in a non-controllable release of LPG under high pressure. Throwing cylinders from any height or dropping them is prohibited, as in such circumstances damage to the valve, shroud and cylinders is even more likely.

##### Damaged cylinders

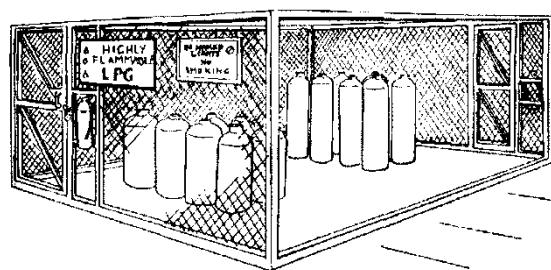
- 3 Before use, cylinders should be examined. Any damaged or faulty cylinder should **not** be used. The cylinder should be labelled and put in a safe place for return to the supplier.
- 4 If a cylinder is found to be leaking (usually from the valve) and the leak cannot be stopped, the cylinder should be carefully removed to a well-ventilated open space free from sources of ignition. It should be left with the leak uppermost, marked faulty, and notices displayed prohibiting smoking or other naked lights. General access should be prevented by barriers or otherwise. The supplier of the cylinder and, if necessary, the fire and rescue service, should be informed immediately.
- 5 Under no circumstances should attempts be made to dismantle or repair defective cylinders.

##### Refillable cylinders

- 6 A level base of compacted earth, concrete or paving slabs should be provided and surrounded

by a secure chain link fence at least 2 m high. A hard standing should be provided for the delivery and dispatch of cylinders. The area should be kept weed and vegetation free. If the compound is more than 12 m square, two exits should be provided in opposite corners of the compound. If less than 12 m square, one gate will suffice. Gates should open outwards and always be left unlocked when someone is in the compound. There should be sufficient shelter to prevent cylinders from being exposed to extremes of weather.

- 7 Signs must be clearly displayed indicating the presence of LPG, and prohibiting smoking and the use of any naked flame in the area of the store.
- 8 LPG cylinders must be stored with their valves uppermost. They must be stored away from oxygen, highly flammable liquids, oxidisers, toxic or corrosive gases or substances. A distance of at least 3 m must be kept between LPG cylinders and other such substances, although they may be kept in the same compound.



#### **Separation**

**LPG store**

- 9 Any store for refillable LPG cylinders must be located away from boundaries, buildings, fixed sources of ignition or electrical equipment by at least the distances detailed in the table below.

<b>LPG storage (including empties)</b>	<b>Separation from building/boundary</b>
under 1,000kg	3m
1,001-4,000 kg	4 m

- 10 The store must be sited at least 3 m away from any cellars, drains or other excavations into which a leak of gas would collect.
- 11 No cylinder should be stored within 1.5 m of any compound fencing.
- 12 If only a small compound is used, 3 m x 3 m for example, cylinders may be stored against the inside of the compound fencing, providing this fence is not within 3 m of any boundary.
- 13 Empty cylinders must be stored with their valves securely closed to prevent any residue of gas escaping, or air being drawn into the cylinder.
- 14 Stocks should be grouped in batches of not more than 1000 kg and batches separated by a minimum 1.5 m gangway.
- 15 Where lighting is necessary, it should be mounted well above ground level and not less than 2 m above the cylinders.
- 16 Any equipment not in use, such as portable hand equipment, should be isolated so as not to be accessible to trespassers. Any cylinders not required should be returned to the storage compound or other secure position.

**Non-refillable cylinders**

- 17 Non-refillable LPG cylinders for use with small portable equipment such as blowlamps may be stored in a lockable metal container.
- 18 Care should be taken when changing cylinders to ensure that connections are correctly made and that there are no leaks.
- 19 Always dispose of empty containers safely and in accordance with the manufacturer's recommendations. Do not, under any circumstances, puncture or throw 'empty' cylinders onto a fire.

**Additional storage details for small LPG containers**

- 20 These are often non-refillable (e.g. cartridges) but small refillable cylinders (e.g. Primus) should also be stored in the same way.
- 21 Although only containing small quantities of gas, they must not be stored in occupied site huts.
- 22 They should be kept in a secure, non-combustible, well-ventilated external enclosure. The store should have warning signs: 'Highly Flammable - LPG' and prohibition signs: 'No smoking/naked lights'.
- 23 The disposal of cartridges after use requires care as they still contain gas. Under no circumstances should cartridges be thrown on fires. Small numbers of empty cartridges may be disposed of by including them in normal refuse.

**General transportation of LPG cylinders**

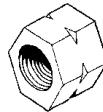
- 24 When loaded onto vehicles, cylinders must be kept upright and secured. Vehicles must be equipped with a dry powder extinguisher and a first-aid kit. They must also display warning notices.
- 25 Do not overload the vehicle and, if using a closed vehicle, ensure that any cylinders are removed from the vehicle at the end of each journey.
- 26 If a cylinder leaks during a journey, close the valve immediately. If this is not possible, move the vehicle to open ground away from buildings and people, and inform the emergency services.

**Use of LPG in cylinders**

- 27 Everyone with any responsibility for the storage and transportation of LPG must understand the characteristics and hazards of the LPG product they are using.
- 28 They should understand the fundamentals of fire fighting and control of leakages. They should also have knowledge of the procedures for dealing with emergencies.
- 29 It is not possible to cover all aspects of the use and application of LPG, but the following checklist gives the main points for its safe use and handling. Please note that this list should not be regarded as exhaustive.
  - (a) Never use or store a gas cylinder on its side, unless it is a special cylinder for use on LPG-fuelled plant and vehicles. Liquefied gas may escape, causing concentrations of gas, and

- operatives may suffer frostbite because of the very low temperature of the escaping liquid.
- (b) Propane cylinders must never be stored indoors because any leak will lead to large concentrations of explosive mixtures.
  - (c) Only hoses suitable for use with LPG installations or appliances should be used and these should be inspected frequently for wear.
  - (d) Cylinders must not be dropped during handling, nor brought into violent contact with other cylinders or adjacent objects.
  - (e) Before and after use, valve protection caps and plastic thread caps or plugs should be fitted to prevent accidental leakage.
  - (f) LPG cylinders should not be used below ground level as any leakage of gas will collect at the lowest point and will not disperse.
  - (g) Regulators must be handled with care. Damaged regulators should not be used, but should be replaced or sent for specialist repair.
  - (h) Hoses and fittings should be examined before use. Damaged items must be replaced.
  - (i) LPG cylinders are fitted with a left-hand thread or push-on connection. Union nuts and couplers have grooves on the outside corners of the nuts confirming this. Always use the correct size spanner to tighten or loosen connections. Hand tight connections will permit leaks.

**Left-hand threaded nut showing grooves on face corners**



- 30 Over-tightening will damage threads and cause leaks. Checks for leaks should be carried out using soapy water or other proprietary detector.
- 31 **NEVER USE A MATCH OR OTHER NAKED FLAME.**
- 32 Before connecting any cylinder of LPG to equipment, it is essential that all fires, flames or other potential sources of ignition, including any smoking materials, are extinguished. Where it is reasonably practicable to do so, cylinders should be changed in the open air.
- 33 If a leak is found, the gas supply must be turned off at the cylinder immediately.
- 34 Flexible hoses should be in good condition and be protected or steel braided if they are likely to be subjected to damage by abrasion. Hoses must conform to BS 3212 (Specification for flexible rubber tubing, rubber hose and rubber hose assemblies for use in LPG vapour phase and LPG air installations).
- 35 Before use, inspections should be carried out on all LPG appliances and equipment. The inspection should cover testing for leaks, cleaning, adjusting, checking hoses, hose clips and ferrules.
- 36 Empty cylinders should always be treated as new ones and returned to a properly designated central storage area for collection. Under no circumstances should an LPG cylinder, either full or empty, be left around the site or buried during site operations.

### Regulators

- 37 LPG regulators should be suitable for the equipment with which they are to be used. They should be suitable for either propane or butane and be set to the correct pressure. They should be capable of passing the correct flow capacity.
- 38 It is dangerous to use regulators set at the incorrect pressure.

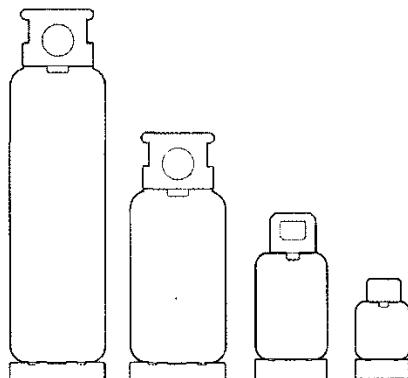
### 1.7.4.12 Bitumen boilers and cauldrons

- 1 The majority of, if not all, bitumen boilers or cauldrons are fuelled by LPG to melt the block bitumen. Such a boiler or cauldron must be sited on a level non-flammable base, away from areas where site traffic may damage hoses or gas cylinders.
- 2 Ensure that any LPG cylinder is at least 3 m away from the boiler or cauldron to which it is attached.
- 3 Full cylinders, not attached, should be kept at least 6 m away from the boiler or cauldron and protected from heat.
- 4 Supply hoses should be checked for crushing, damage to the metal braiding or impregnation with bitumen. Any unserviceable hose must be replaced.
- 5 The sequence for lighting is as follows:
  - (a) Remove the burner from the boiler or cauldron.
  - (b) Have the source of ignition ready before turning on the gas.
  - (c) Light the burner, ensuring that the gas is turned on slowly.
  - (d) Replace the burner beneath the boiler or cauldron.
- 6 If frost forms on the outside of the cylinder, the gas flow rate is too high. Either use a smaller burner or couple two or more cylinders together by means of a manifold.
- 7 Never leave a bitumen boiler or cauldron unattended when the burner is alight.
- 8 Never move a bitumen boiler or cauldron with the burner alight.
- 9 If a bitumen boiler or cauldron is overfilled, overflows or boils over, the LPG cylinder valves must be turned off immediately. Any spillage should be contained using dry sand or earth and then left until cool. No attempt should be made to remove or recover any spillage of hot bitumen.
- 10 A dry powder extinguisher, of a minimum 4.5 kg in size, should be provided whenever a bitumen boiler or cauldron is used.

### 1.7.4.13 Gas-operated hand tools

- 1 There are two types of LPG cylinder available for use with portable tools:
  - (a) disposable
  - (b) refillable.

- 2 These cylinders come in various shapes, sizes and colours, depending on the manufacturer. They range in size from the very small (0.5 kg) to the very large (47 kg).



#### Range of LPG cylinder sizes

- 3 All LPG cylinders used with portable equipment should be positioned upright and secured (if possible). Cylinders used with cutting equipment should always be placed on purpose-made trolleys.
- 4 Before changing a cylinder, always make sure that all valves are closed.
- 5 Hoses must never be kinked to try to shut off gas when changing torches. It does not work and can lead to a gas escape.
- 6 Always replace valve protection caps and plastic thread caps.
- 7 Flames from portable tools must not be allowed to play on LPG cylinders.
- 8 When work has been completed, turn off the cylinder valves and allow the flame from the portable torch to burn out.
- 9 Closure of torch valves rather than cylinder valves will retain gas in hoses which, if damaged, will allow gas to escape.
- 10 Hoses and torches must never be put into site toolboxes while still attached to the cylinder.
- 11 Manufacturers' operating pressures must be strictly observed and must **NEVER** be exceeded.
- 12 Do not interfere with preset pressure regulators.

#### 1.7.4.14 LPG for use in site huts and other small buildings

- 1 All LPG cylinders and regulators for use with fixed heaters, cookers and lighting within site huts, must be kept outside and the gas supply piped in using rigid copper piping. The use of flexible hosing is permitted only between the cylinders and change-over valves or manifolds, and for the

final connection to appliances, but this must be kept as short as possible.

- 2 All pipework should be exposed and easily accessible for inspection, but located to prevent accidental damage. Any work on LPG pipework or other parts of a fixed installation, including testing, must only be carried out by appropriately trained persons.
- 3 Ventilation for heaters and cookers must be permanent and adequate. It should be divided equally between vents at high and low level.
- 4 A two-burner cooker in a site hut needs approximately 150 mm x 150 mm ventilation. A 3 kW convector heater needs approximately 225 mm x 225 mm ventilation.
- 5 Inspections of all appliances must be carried out before use. If soot forms or smells occur, do not use or allow the appliance to be used. Find out the reasons for the problem and have it put right.

### **Enclosed spaces**

- 6 Before using LPG equipment in an enclosed space, it is essential to carry out a risk assessment. It is essential to ensure that there is adequate ventilation, which may have to be forced. This is necessary to ensure full combustion and also to make certain that the products of combustion, other fumes and excess oxygen from any cutting apparatus are removed. Proper safety precautions and atmospheric monitoring should be considered.
- 7 Wherever practicable, cylinders used with operations in confined spaces should be located in a safe area, preferably in the open air. The supply pressure should be reduced to the lowest practicable level on leaving the source of supply.
- 8 Where cylinders are used below ground level, the number must be kept as small as possible. All cylinders and hoses should be removed as soon as work has finished or if it is interrupted for a substantial period, e.g. overnight.

### **Fire**

#### **Action in an emergency**

- 9 Instructions for dealing with incidents involving LPG will vary for each situation. The most important thing is to avoid endangering anyone's life. The following actions should be taken by anyone discovering a fire.
  - (a) In case of fire, **no matter how small**, call the Civil Defence (Fire Department).
  - (b) Whilst waiting for the fire and rescue service to arrive (*if it can be done safely*), turn off all cylinder valves to cut off the fuel supply and remove the cylinders from the area.
  - (c) If the actions in 2 above cannot be completed safely, and thereby starve the fire of further LPG, evacuate the site and impose a cordon to stop anyone inadvertently entering the area.
  - (d) **Never** attempt to use a water extinguisher to put out an LPG fire. Dry powder extinguishers are the most suitable type to use. The use of the wrong extinguisher in the wrong way could have serious consequences.
  - (e) Training in the correct type of fire-fighting equipment to use, and the safe way to operate it, should be undertaken by **all** staff who work with LPG. These staff must be trained to recognise when the situation is getting out of control and they should also evacuate the

area.

- (f) When the fire and rescue service arrives, inform the Fire Officer of the situation including:
  - (i) the location and contents of all the cylinders
  - (i) details of any security cordon that you have implemented
  - (ii) confirmation that all people who were known to be in the area have been accounted for or details of anyone that is unaccounted for, and
  - (iii) if possible and required, offer them the data information sheet relating to the cylinder(s) involved.

#### **Remember**

- (g) that cylinders fitted with pressure relief valves can produce gas jets which will extend a considerable distance.
  - (h) if cylinders are exposed to a severe fire or are engulfed in flames, no attempt should be made to fight the fire. Evacuate everyone from the area.
  - (i) where a flame from a leaking gas cylinder is extinguished but the valve is still open, gas will continue to escape and there will be a danger of a gas cloud forming and the risk of an explosion.
  - (j) any cylinder involved in a fire should be clearly labeled that it has been involved in a fire and removed from the area to a safe place. Contact the suppliers -they will give advice and arrange for the cylinder(s) to be collected,
- 10 Instructions concerning emergency procedures should be clearly displayed and all employees should be made aware of them.
- 11 Data information sheets are available from product manufacturers giving advice in case of an accident involving LPG cylinders. A copy of each sheet should be available for inspection and those sheets relating to the cylinders involved should be given to upon request the Civil Defence (Fire Department).

#### **1.7.4.15 Fire-fighting equipment**

- 1 Selected and suitable employees should be trained in the use of fire-fighting equipment.
- 2 Advice on the training of staff can be obtained from the LPG supplier or fire and rescue service.
- 3 Portable fire extinguishers, sited in pairs to minimise the risk of failure, should be positioned at strategic points wherever LPG is stored or used. As a general guide, no fewer than two 4.5 kg dry powder extinguishers or equivalent should be provided for every 20 large cylinders (47 kg) stored.

#### **1.7.4.16 Training**

- 1 Most accidents involving LPG are due to ignorance of basic safety precautions.
- 2 All persons using LPG cylinders, tools or equipment should be suitably instructed in the hazards associated with LPG, and the precautions to be taken in its use.
- 3 An LPG safety questionnaire is attached at Appendix 1.

ARAB ENGINEERING BUREAU

## Construction Site Safety

### 1.7.4 Appendix 1

#### LPG safety questionnaire

- 1 This questionnaire has been worded so that all the correct answers are YES. If you answer 'NO' to any question you may need to give the matter more attention.

##### Storage

- 2 Has a risk assessment been carried out?
- 3 Has specialist advice been sought prior to the location of fixed or moveable storage tanks?
- 4 Is there the required separation distance between the storage tanks and adjacent buildings or boundaries?
- 5 Is the base supporting the tanks level?
- 6 Is the base paved or concrete?
- 7 Is there a chain link fence surrounding the tank?
- 8 Are there barriers to prevent collision?
- 9 Are the correct warning signs displayed?
- 10 Are there outward opening exits from the cylinder storage compound?
- 11 Are the exits non-self locking?
- 12 Is the area kept weed free?
- 13 Are all access areas being kept clear?
- 14 Are the correct type of fire extinguishers provided?
- 15 Are all cylinders stored upright?
- 16 Are the LPG cylinders 3 m from cylinders containing any other products?
- 17 Are cylinders being handled safely?
- 18 Is the LPG being grouped in not more than 1,000kg?
- 19 Are there 1.5 m wide gangways?
- 20 Is lighting provided?
- 21 Is lighting at least 2 m above the tallest stack?

**Transportation**

- 22 Have drivers received adequate training?
- 23 Are cylinders transported upright and secured?
- 24 Is the vehicle equipped with the correct type of fire extinguisher?
- 25 Is the vehicle equipped with a first-aid kit?
- 26 Does the vehicle carry suitable warning notices?
- 27 If using a closed van, are all gas cylinders offloaded at the end of each journey?

**Use of LPG cylinders and appliances**

- 28 Are valve caps and protectors replaced after every use?
- 29 Are regulators being handled carefully?
- 30 Is the correct size of spanner being used to tighten connections?
- 31 Is all equipment, such as hoses and clips, being inspected regularly for leaks?

**Bitumen boilers and cauldrons**

- 32 Is there a fire extinguisher of the correct type readily available?
- 33 Is the boiler or cauldron standing on a non-flammable level base?
- 34 Is the cylinder in use with the bitumen boiler or cauldron, a minimum of 3 m away?
- 35 Are any cylinders not in use a minimum of 6 m away?
- 36 Are hoses inspected regularly for damage or bitumen impregnation?
- 37 Are cylinders ice-free when the boiler or cauldron is alight?
- 38 Should manifolds coupling two or more cylinders be used?
- 39 Are bitumen boilers always attended when alight?

**Hand tools**

- 40 Are cylinders being used in the upright position?
- 41 Are purpose-made trolleys being used for cylinders used in conjunction with cutting equipment?
- 42 Are hand tools being used at the manufacturer's recommended operating pressures?
- 43 Are connecting hoses being regularly checked for wear and damage?

44      Are cylinder valves being turned off on the completion of work?

45      Is there a fire extinguisher of the correct type readily available?

#### **Site huts and other buildings**

46      Are LPG cylinders, supplying heaters and other appliances, fixed outside the building?

47      Is the gas fed into the building by the provision of fixed copper piping?

48      Are fixed installations only installed, modified and by competent engineer?

49      Is the final, short flexible hose as short as possible?

50      Are all pipes in use readily accessible for inspection?

51      Is there plenty of ventilation at high and low levels?

52      Are weekly inspections being carried out on all appliances?

53      Is there a fire extinguisher of the correct type readily available?

#### **Fire precautions**

54      Are written procedures provided and displayed prominently?

55      Is there a telephone available to summon the fire and rescue service?

56      Are the correct types of fire extinguishers provided?

57      Are your staff trained in the use of fire extinguishers?

58      Are your staff and visitors aware of the site emergency evacuation alarm and procedure?

59      Are personnel aware of pressure relief valves?

60      Are product data sheets available?

**Construction Site Safety****1.7.4 Appendix 2****Retrieval of orphaned compressed gas cylinders**

The cylinder retrieval arrangements in place for the major national companies are listed below.

Parent company	Collection company	Contact numbers

**Notes**

- 1 If a cylinder is no longer needed, it should be returned to the local dealer of the company owning the cylinder.
- 2 Until such time as they are collected, 'orphaned' cylinders should be stored in a safe and secure manner.

## Construction Site Safety

### 1.7.5 Vehicle Fuels (including Petrol, Diesel and LPG)

#### 1.7.5.1 Key points

- 1 A risk assessment must be carried out before dangerous substances are stored transported or used; in some cases a method statement and/or a permit to work will also be required.
- 2 Petrol is a flammable liquid that can be used for equipment such as generators and stored on site in small quantities in containers designed for the purpose. It has a flashpoint below 21 °C.
- 3 Diesel is a heavy mineral oil with a flashpoint much higher than that of petrol and is normally used as fuel for large commercial vehicles and construction plant.
- 4 Liquefied petroleum gas (LPG) is a compressed liquid, usually propane or butane, stored in cylinders. It is commonly used for heating, cooking or powering small vehicles such as dumper trucks or forklifts. It is heavier than air and has a flashpoint much lower than that of petrol.
- 5 Sources and safe storage of fuels should be recorded and carefully monitored.
- 6 Staff who work with flammable fuels must receive training in their safe handling and use prior to beginning work and must receive regular training in the use of fire extinguishers. Water **must not** be used on any liquid fuel fires.
- 7 The disposal of waste fuel is likely to be hazardous waste and should be managed accordingly.

#### 1.7.5.2 Introduction

- 1 Vehicle fuels are classified as 'dangerous substances'. As such, there will be a risk of fire involved in their transportation, storage and use.
- 2 Wherever flammable liquids are stored or used a list of the substances present must be maintained, along with details of their quantities and location, which should be readily available for use by the fire and rescue service.
- 3 When used correctly and safely, petrol, diesel and LPG are useful fuels for the engines of vehicles and plant. When abused, they can cause explosions which can severely burn or even kill.

#### 1.7.5.3 Legislative requirements

- 1 Contractors are should familiarise themselves with the content of Sections G1, G3 and G4 with regard to:
  - (a) the practical aspects of safe transportation, storage and use of dangerous substances (diesel and petrol) and LPG in the workplace
  - (b) general advice on fire fighting, including the selection and use of hand-held fire extinguishers.

#### 1.7.5.4 Petrol

- 1 Whilst the majority of construction plant will run on diesel oil, some small items of plant will have petrol-fuelled engines, for example:
  - (a) chainsaws

- (b) small portable generators
  - (c) disc cutters.
  - (d) there will, therefore, be a need on occasions for petrol to be stored on site. This assumes that only small quantities of petrol will be stored on site.
- 2 Petrol, like many other flammable liquids, can give off large volumes of flammable vapours at room temperature. These vapours, when mixed with air, can ignite with violent and devastating consequences. Spilled petrol, if not contained, can flow to a source of ignition and then flash back to the source of the spillage. It is a dangerous substance to have on site unless adequate controls are implemented.
- 3 Petrol should ideally be stored outdoors to permit the dispersal of fumes from leakage. However, it is acknowledged that in some circumstances, for example the refurbishment of a city-centre building which has no open land, it may be necessary to store small quantities of petrol inside the building.
- 4 Petrol should be stored in suitable containers that enable the safe filling of petrol-powered machinery without spillage. Where necessary a funnel should be made available.
- 5 Containers must be robust, have tight fitting lids to prevent the leakage of liquid and vapour and be otherwise suitable for the purpose. Ideally containers will be of metal construction as these are more resistant to fire. These are usually of 5 litres capacity and the convention is that green containers are used for unleaded petrol.
- 6 All containers should be clearly labeled "Petroleum Spirit" or 'Highly Flammable' so that people on site are aware of the contents and any precautions that they must take.
- 7 Containers should, where reasonably practicable, be stored in the open air at ground level (singularly or in stacks). This enables leaks to be quickly seen and any vapours to be easily dispersed. They should not be stored on the roof of a building.
- 8 Where the best option of storing containers outside is not reasonably practicable they may be kept in suitable storerooms, preferably separate buildings, specifically designed for the purpose.
- 9 Other activities, including filling and emptying containers, must not be carried out in the designated storage area. This is to prevent other activities that are a higher risk causing a fire, which then spreads to involve the larger quantities in storage.
- 10 Any lighting equipment in any installation must conform to EN 60079-14 Explosive atmospheres - electrical installation design, selection and erection.
- 11 Electrical socket outlets are not permitted within any store where petrol or other flammable materials are stored.
- 12 Suitable fire-fighting equipment, such as a foam or dry powder extinguisher conforming to EN 3, must be positioned in close proximity to the store.
- 13 The store should not be sited under a staircase or other means of escape. A sill should be provided (not less than 150 mm in height) across the doorway of the store to prevent any leakage of petrol flowing out, along with measures to prevent any leakage of petrol into the drains or sewers.

14 The height of the sill should be adequate to contain a spillage of 110% of the volume of the largest container in the store or 25% of the aggregate capacity, whichever is the greater.

15 All reasonable precautions must be taken to prevent fire or means of ignition being brought close to any container.

### **Outdoor storage**

16 Petrol must be stored away from other storage areas and processes. There must be a minimum distance of 2 metres between a petrol storage area and any:

- (a) occupied building
- (b) site boundary
- (c) process area
- (d) fixed sources of ignition
- (e) flammable liquid storage tanks.

17 Where higher risk activities (processes) are taking place, such as oxyacetylene cutting, the safety distance should be increased to a minimum of 4 metres.

18 The above distances may be reduced if fire walls to specific dimensions and standards of fire resistance are built.

19 Any outdoor petrol storage area should be secure both during working hours and at night. It might be considered that the normal site security arrangements are sufficient or that a dedicated secure store is required, in which case a welded mesh, palisade or chain-link fence of 1.8 metres high is the minimum requirement.

20 The features of any petrol storage area should not limit the means of escape in a fire.

21 Storage areas and a space of 1 metre around them will be classified as a Zone 2 hazard area and as such:

- (a) any electrical fittings must be of the appropriate standard
- (b) there must be no sources of ignition
- (c) there must be no accumulation of combustible materials such as rubbish or vegetation.

### **Indoor storage**

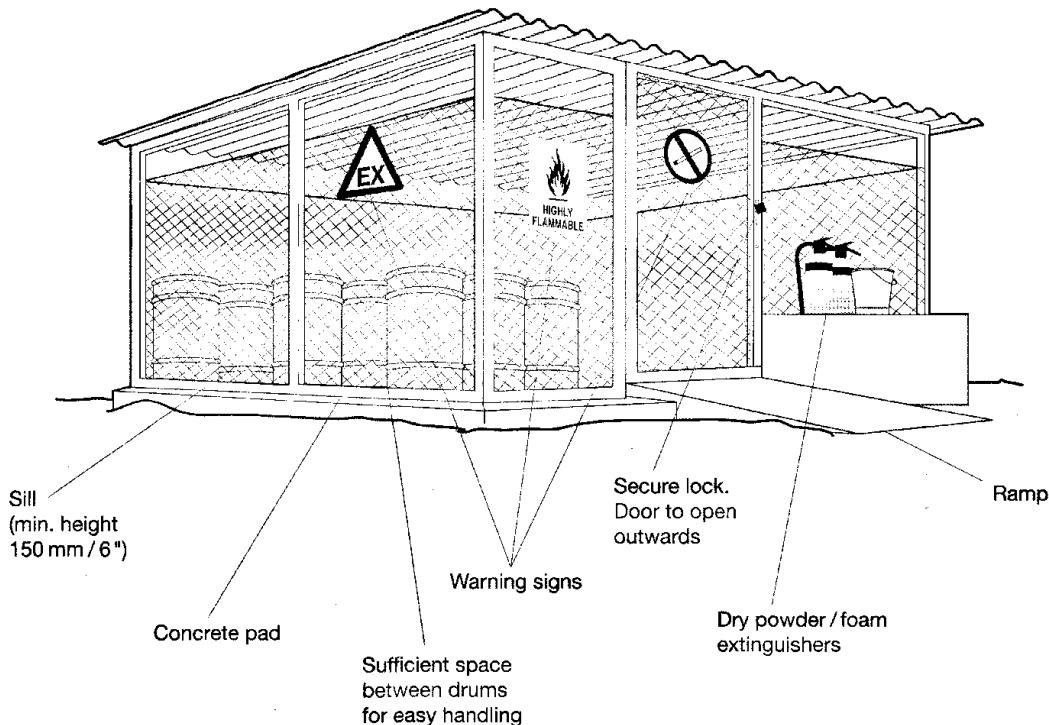
22 Where petrol is stored indoors at a place of work, a maximum of 50 litres may be stored. A risk assessment must be carried out and measures implemented to ensure that so far as is reasonably practicable, storage is carried out so as to:

- (a) minimise the risks of fire and explosion
- (b) mitigate the effects of any fire and explosion that may occur.

23 In doing so, the risk assessment must consider the storage area with respect to:

- (a) the absence of any sources of ignition
- (b) effective ventilation

- (c) adequate security
- (d) prohibition of filling equipment inside the storage area
- (e) avoiding spills and dealing with any spills that do occur
- (f) keeping containers closed when not in use.



24 Where significant amounts of petrol will be stored indoors a specially designed storage building must be constructed. However, given the small quantities of petrol that will be stored indoors on most construction sites, it is not envisaged that such a structure will be required.

#### Bulk petrol storage tanks

- 25 Demolition or rebuilding work on a site may involve the removal of old petrol storage tanks. Before any work can be started to demolish or remove any tanks, they must be certified gas-free and cleaned. This is a hazardous operation and should only be done by skilled specialist contractors.
- 26 No attempt must be made by anyone other than a specialist contractor to enter a disused petrol tank.
- 27 **Note:** Lead which has settled into any remaining sludge can be a major health hazard in old petrol tanks. It may also be present in rust and scale.
- 28 Where any tank is to be left in temporary disuse, it must be sealed below the pump by disconnection, and then by stopping the suction pipe. The vent pipe should be left open to the air.

**Vehicle petrol tanks**

- 29      No welding, soldering or brazing operations should be performed on any vehicle fuel tank until it has been properly freed from gas or the contents made inert. This prohibition applies whether the tank is on or off the vehicle. A competent person should then authorise 'hot work' on the tank, preferably under a Permit to Work system.

### 1.7.5.5 Diesel oil

#### General requirements

- 1 The tank must have sufficient strength so that in normal circumstances it will not leak.
- 2 Appropriately designed and constructed supports for the tank must be used.
- 3 The tank must be so positioned to minimise the risk of impact damage by other vehicles and should not be placed within 10 metres of a watercourse or within 50 metres of a spring, well or borehole. The tank should also be positioned with consideration for future maintenance.
- 4 The tank must be situated within a secondary containment system (bund wall) which:
  - (a) has a capacity of 110% or more of the tank's capacity - or, if more than one container is stored, 110% of the largest container's storage capacity or 25% of the aggregate capacity, whichever is the greater
  - (b) is so constructed that its base and walls are impermeable to oil and water
  - (c) is strong enough to withstand being filled with either water or oil
  - (d) has walls which cannot be penetrated in any form by tank drainage
  - (e) if penetrated by a fill pipe or draw-off pipe, is adequately sealed to prevent leakage
  - (f) has valves, sight gauges and vents sited within it.
- 5 External fill pipes and draw-off pipes to the tank(s) should be positioned to minimise impact damage and, if **above ground**, should be properly supported. If underground, they should have no mechanical joints except where accessible.
- 6 They should be laid in a duct or sleeve to protect them from physical damage, and be protected against corrosion.
- 7 The whole system should have a leak detection system which should be tested regularly.

#### Fill pipes

- 8 All fill pipes should be fitted with an automatic overfill prevention device if filling takes place where the tank cannot be kept under constant observation.
- 9 All fittings should either be screw type or other fixed type coupling.

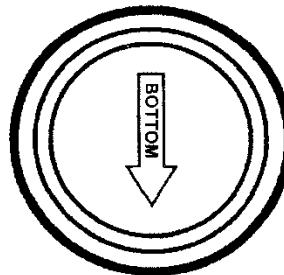
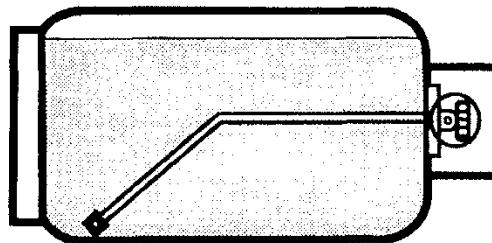
#### Dispensing fuel

- 10 Where fuel oil is to be dispensed into containers or vehicles, the outlet must be fitted with a valve or nozzle which closes automatically when not in use, and which cannot be fixed in the open position unless an automatic cut-off nozzle is used on the end of the hose.
- 11 The hose and nozzle should be housed in an enclosed secure cabinet with a drip tray when not in use, or have a lockable valve where the feed leaves the tank. Hoses should be kept locked or kept within the bund when not in use.
- 12 Any permanent valve or tap which opens directly from the tank must:

- (a) be located within the secondary containment system (bund wall)
  - (b) discharge vertically downwards
  - (c) be locked off when not in use.
- 13 Finally, no vent must discharge outside of the bund in the event of an overfill.
- Bulk diesel storage tanks**
- 14 The following points should be noted:
- (a) the storage tank should be of mild steel
  - (b) all bulk storage tanks should be placed on concrete or brick cradles
  - (c) storage tanks should be protected from impact damage by delivery vehicles or site traffic
  - (d) the tank should be in the open air, on level ground well clear of any openings, windows or doors
  - (e) the tank should be vented at the top
  - (f) protective gloves should always be worn when handling diesel oil. Skin contact may cause irritation leading to dermatitis and infection
  - (g) metal storage cans should be kept in a lockable store, which has a sill to prevent any spillage flowing out. Appropriate warning labels should be displayed prominently on the store
  - (h) a minimum distance of 750 mm between the tank and walls and 600 mm from the base is recommended to facilitate inspection
  - (i) the tank should be marked with its capacity and the type of material stored within it
  - (j) ensure that surfaces where deliveries are to be made and oil dispensed are protected by a surface impermeable to the oil stored and isolated from any drainage system
  - (k) protective gloves should always be worn to protect any exposed skin. Contact can lead to irritation and dermatitis
  - (l) metal storage cans should be kept in a lockable store with a sill to prevent spillage flowing out.
- Mobile bowzers**
- 15 Any mobile bowser should be fitted with a lock to any tap, valve or pipe through which oil is discharged and all pipes and valves should be locked shut within the bunded area of the bowser when not in use.
- 16 Where the oil is delivered through a permanently attached flexible pipe:
- (a) the pipe must be fitted with a hand pump or with a valve at the end which closes automatically when not in use
  - (b) the pump or valve must be fitted with a lock and locked shut when not in use
  - (c) the pipe must be fitted with a lockable valve at the end where it is connected to the bowser and kept locked shut when not in use
  - (d) any sight gauge must be fitted with a lockable valve which is locked shut when not in use.

### 1.7.5.6 Liquefied petroleum gas (LPG)

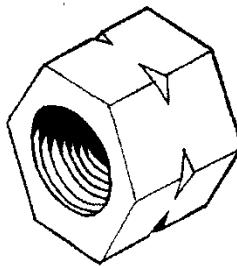
- 1 Every Contractor must ensure that all persons who work with or supervise others in the use of LPG equipment have available to them adequate health and safety information and, where appropriate, written instructions relating to the use of that equipment.
- 2 Containers of LPG are liable to explode if involved in a fire; pieces of the container may be projected over considerable distances.
- 3 Every Contractor must ensure that all persons who work with, or supervise others in the use of, LPG equipment, have received adequate training for the purposes of health and safety, and be aware of any risks in the use and precautions to be taken in the case of an accident.
- 4 LPG is used in the building and construction industry as a fuel for small plant vehicles, such as dumper trucks and forklift trucks.
- 5 Only the correct type of cylinder should be used as these are of special construction and designed specifically to be laid on their side for fitting to the truck and for operation.



- 6 The following safety points should be strictly observed:
  - (a) make sure you have the correct type of cylinder
  - (b) make certain it is correctly connected using the correct size of spanner to tighten the connection
  - (c) if you suspect a leak, do not use a lighted match or other naked flame. Only use soapy water or other proprietary leak detection fluid
  - (d) make sure all cylinder valves are turned off before you attempt to change the cylinder
  - (e) never interfere with preset reducing valves
  - (f) manufacturers' recommended operating pressures should never be exceeded

- (g) store additional cylinders safely
  - (h) only keep on site the minimum quantity of LPG that is needed for effective operations.
- 7 LPG cylinders are fitted with a left-hand thread or push-on connection. Union nuts and couplers have grooves on the outside corners of the nuts confirming this. Always use the correct size spanner to tighten or loosen connections. Hand-tight connections will permit leaks.

**Left-hand threaded nut showing grooves on corners**



**Storage of LPG cylinders**

- 8 All LPG cylinders not in use, empty cylinders awaiting return to the supplier and spare cylinders should be kept securely.
- (a) LPG cylinders should be stored above ground level well away from drains and other low lying areas.
  - (b) Stores in the open air should be sited as far from buildings as possible.
  - (c) LPG stores in buildings should be accessible directly from the outside and be well ventilated.
  - (d) LPG cylinder stores should not be used for the storage of petrol or other fuels (including acetylene).
  - (e) Full cylinders should be stored separately from empty cylinders; all cylinders being stored with their valves uppermost.
  - (f) Cylinders should be protected from direct sunlight.

**Fire fighting**

- 9 Fires involving petrol and other vehicle fuels are usually severe, may cause explosions and are generally best left to the fire and rescue service. Knowledge of what to do in the event of a fire is essential if injuries and deaths are to be avoided.
- 10 In most cases where vehicle fuels are involved in a fire, or are being heated by it, a rapid evacuation of the site and a call to the fire and rescue service will be the only sensible and safe courses of action.
- 11 However, where other, less hazardous materials such as timber are involved in a fire, which could spread to a fuel storage area or an area where construction plant is located, a decision based upon the risks to personal safety will have to be taken as to whether or not to attempt to fight the fire to prevent the situation escalating.
- 12 Generally, the fire and rescue service will not enter any structure that is on fire in which LPG cylinders are known to be present. They are more likely to create an exclusion zone around the

structure. It is of great assistance to them if the location of any LPG storage area is such that it can be cooled by a water spray from a distance.

**Disposal of Fuels**

- 13 Other materials contaminated by fuels such as PPE, rags, used spill kit materials, etc. should also be regarded as hazardous waste and should be segregated from other non-hazardous wastes.
- 14 LPG cylinders that are no longer required should be returned to a local dealer of the company owning the cylinder. Under no circumstances should the LPG cylinder be disposed of in a waste skip or metal recycling skip.

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