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Preface

1. Every year many construction site workers are killed or injured as a result of their work; others suffer ill health, such as dermatitis, occupational deafness or asbestosis. However, the hazards are not restricted to those working on sites. Children and other members of the public are also killed or injured because construction activities have not been adequately controlled. The construction industry's performance has improved over the past decade, but the rates of death, serious injury and ill health are still too high.

2. These deaths, injuries and ill health cause pain and suffering. They also cost money. A HSE survey found that accidental loss wasted 8.5% of the tender price, even on a site which had no serious (reportable) accidents.

3. This book is part of HSE's series of health and safety guidance for construction. The aim is to help all those involved in construction to identify the main causes of accidents and ill health and explain how to eliminate the hazards and control the risks. The guidance is simple but comprehensive. It will refer to other relevant documents so that you can build up a clear and comprehensive package.

4. Each piece of guidance will have general relevance to everyone involved in the construction process, from clients and designers, to contractors, individual workers and safety representatives. But some documents will be particularly relevant to specific groups depending on the subject they address.

Introduction

5. Fires can and do kill or injure and cause serious human suffering and financial loss. The potential dangers are particularly severe on many construction sites, where high-risk activities such as hot work are frequently combined with circumstances where fires can spread quickly and escape may be difficult. This guidance is about preventing fires from starting and ensuring people's safety if they do.

6. The guidance is aimed at construction projects involving substantial fire risks and is relevant to all who have a role in the development, management and application of fire safety standards on construction sites. Construction fire safety needs to be taken into account from early procurement stages right through to final handover. Therefore, the guidance is relevant to clients, designers and project planners as well as those more directly involved with the management of construction work on site. While the generality of the guidance is applicable to all construction sites, it is to be recognised that specialised projects, such as tunnelling, require particular consideration to satisfactorily address the fire risks, especially to provide adequate general fire precautions. These may necessarily be in excess of those described in this guidance.

7. Not all the safeguards in this guidance will be relevant in all circumstances. What is needed depends on the extent and nature of the risks . This is important since it should not be assumed that small-scale construction work is necessarily low risk. For instance, minor welding repairs undertaken in an oil refinery could have catastrophic consequences if they are not properly controlled. In such cases, application of the appropriate safeguards described in this document are vital.

8. This guidance is concerned with the safety of those carrying out construction work. It does not deal with fire-safety requirements for the occupants of completed buildings. However, where construction work takes place in occupied or part occupied buildings, construction managers need to take account of the implications for occupier staff. Effective liaison between constructors and occupiers is essential - this guidance indicates what issues should be addressed..

9. The commercial consequences of construction fires can be devastating. There are several thousand construction fires annually. These fires not only put workers' lives at risk but can also result in damage ranging from tens of thousands to many millions of pounds invariably leading to severe delays in the project programme.

10. Construction companies and property developers may find it difficult to arrange insurance cover on potentially high-risk projects unless they can demonstrate good fire safety standards. On larger projects, insurers will normally require compliance with at least the standards set out in *Fire prevention on construction sites* or the *Joint Code of Practice on the Protection from Fire of Construction Sites and Buildings Undergoing Renovation*. The Joint Code is produced by the insurance and construction industries. The authors have been consulted during the development of this HSE guidance and there is nothing in this document that conflicts with recommendations in the Joint Code.

11. Fire legislation changed in October 2006 with the introduction of the Regulatory Reform (Fire Safety) Order 2005 (RRO) and the Fire (Scotland) Act 2005 (FSA). Although there are detailed differences between the RRO and the FSA, the fundamental requirements are generally the same.

12. The Construction Design and Management Regulations 2007 also place duties on duty holders in relation to fire safety.

13. The RRO/FSA sets out who has responsibility for enforcement relating to fire safety.

14. Although the legislation has changed, the requirements/duties in relation to general fire precautions and process safety have not changed in practice.

15. In outline the legislation requires that those with control over construction work can demonstrate that they have:

    - recognised the risks in their workplaces;
    - assessed the extent of those risks;
    - come to an informed decision on the necessary action to reduce them; and
    - ensured that the actions decided are implemented.

16. Where the responsible person (see legal section for definition) implements any preventative and protected measures, they must do so on the basis of the principles specified in Part 3 of Schedule 1 of The Regulatory Reform (Fire Safety) Order 2005.

17. Dutyholders may find it easier to incorporate fire matters into their wider risk management strategies rather than attempting to deal with them as separate issues. In particular, other types of emergencies such as security alerts and flooding may involve similar risk management principles although the detailed requirements to deal with them may differ.

How to use this guidance

18. This guide is divided into two parts:

19. **Part 1** explains what fire risk assessment is and how you might go about it. Fire risk assessment should be the foundation for all the fire precautions in your premises.

20. **Part 2** provides further guidance on fire precautions. The information is provided for you and others to dip into during your fire risk assessment or when you are reviewing your precautions.

21. Part 2 is divided into the following sections.

    - Legislation
    - Reducing potential fuel sources.
    - Reducing ignition sources.
    - General fire precautions.
    - Emergency procedures.
    - Temporary accommodation units.
    - Sleeping accommodation.
    - High risk buildings
    - Multi storey buildings

22. There are a number of appendices to this guidance. Some of them are illustrative. Readers may wish to use the material in them to develop their own management responses to fire risks, but they are not intended to be definitive for all situations. At the back of the book is a reference section, which will help you to find more information.

Part 1 fire risk assessments

23. Legislation requires a suitable and sufficient fire risk assessment to be carried out by a responsible person (the employer or persons in control). Details of legislation can be found in Part 2

24. As with assessments of risk from other hazards, the fire risk assessment should be based on the following approach:

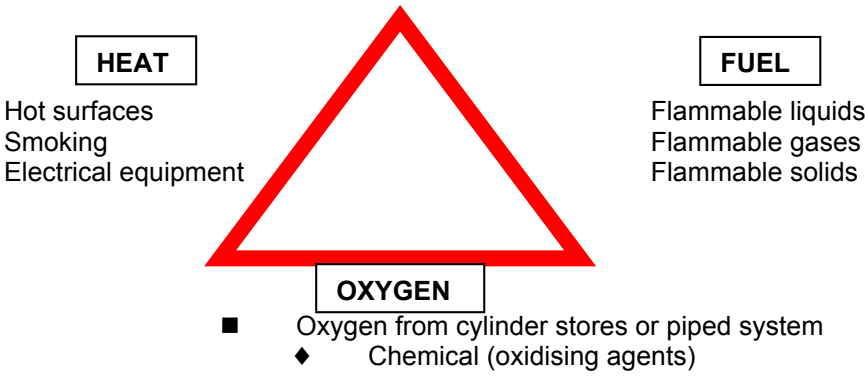
- Step 1 – identify the hazards;
- Step 2 – identify people at risk;
- Step 3 – evaluate, remove, reduce and protect from risk;
- Step 4 – record, plan, inform, instruct and train; and
- Step 5 – review.

Step 1 – identify the hazards

25. The basic principles which follow are relevant to fire risk assessment in all circumstances. However it is important to note that there will be different things to consider for new builds compared to the refurbishment of an existing building. For a new build, your assessment will include: its location, the type of construction materials and methods. For example one modern construction method is the use of timber frames. Whilst completed buildings have the standards of fire protection required by Building Regulations, during construction and before final fire protection is in place the building may be more vulnerable than those using alternative construction materials and methods. and its location, eg in more modern construction the building could be timber framed and more vulnerable to fire before the external finishes are in place. For a refurbishment project it will be important to take into account, amongst other things, the age and construction of the premises, eg the building could have a relatively heavy fire load due to lathe and plaster ceilings and walls, wooden panelling and floors. There may also have been changes to the fabric of the building that could have significant consequences in a fire.

26. For a fire to start, three things are needed:

- a source of ignition;
- fuel; and
- oxygen.



27. If any one of these is missing a fire cannot start. Taking measures to avoid the three coming together will therefore reduce the chances of a fire occurring.

28. The remainder of this step will advise on how to identify potential ignition sources, the materials that might fuel a fire and the oxygen supplies which will help it burn.

1.1 Identify sources of ignition

29. You can identify the potential ignition sources in your premises by looking for possible sources of heat that could get hot enough to ignite material found on your site. These sources could include:

    - smokers' material, eg cigarettes, matches and lighters;
    - naked flames, eg gas or liquid-fuelled open-flame equipment;
    - bonfires;
    - plant and equipment, eg fuel and vehicle exhausts;
    - electrical – faulty or misused electrical equipment;
    - poor electrical installations, eg overloads, heating from bunched cables and/or damaged cable;
    - hot processes/hot work, eg welding by contractors;
    - light fittings and lighting equipment, eg temporary lighting, halogen lamps too close to stored products;
    - electrical, gas or oil-fired heaters (fixed or portable), room heaters in temporary office accommodation or welfare cabins;
    - heat sources, such as gas, electric, cooking equipment, microwaves;
    - friction-generated heat from mechanical equipment;
    - static charge from mechanical equipment;
    - use of oxy-fuel equipment assessment;
    - spontaneous ignition and self heating, eg oil soaked rags, paint scrapings; and/or
    - deliberately introduced (arson)

1.2 Identify sources of fuel

30. Anything that burns is fuel for a fire. Many materials which can burn have to be used during construction work. Reducing the quantity of material on site reduces the chances of fire occurring and limits the extent of any fire which should start. Stocks of high fire hazard material should be managed to balance production needs with the need to reduce the risk of fire. Limit the material present at worksites to what is needed for half a day or a single shift and return unused material to the stores when the work is finished. Where combustible or flammable materials have to be used, select the least flammable alternatives.

31. You need to look for the things that will burn and are in enough quantity to provide fuel for a fire or cause it to spread to another fuel source. Some of the most common fuels found on site include:

    - building products, such as some composite panel and timber;
    - rubbish;
    - flammable liquids such as paints and varnishes;
    - protective coverings;
    - scaffold sheeting;
    - volatile flammable substances such as paints thinners
    - LPG, eg bitumen boilers, site huts and similar areas; and/or
    - acetylene.
    - Packaging materials

32. Ways of reducing the risk by tackling fuel sources on site include:

- reducing the amount of combustible material on site
- following the general requirements for the storage of all combustible materials;
- ensuring there is adequate separation between flammable materials.
- removing, covering or treating large areas of flammable wall and ceiling linings to reduce the rate of which a fire could spread;

- trying to avoid storing more volatile flammable materials; and
- being aware of the changing flammability of materials as they are used;

1.3 Identify sources of oxygen

33. The main source of oxygen for a fire is in the air around us. On construction sites this will be natural airflow through doors, windows and other openings.

34. Additional sources of oxygen can sometimes be found in materials used or stored on site such as oxidising materials, they can provide a fire with additional oxygen and so help it burn. These chemicals should have identification on their container (and Control of Substances Hazardous to Health data sheet) by the manufacturer or supplier who can advise as to their safe use and storage, eg oxygen supplies from cylinder storage. Examples include:

- oxygen used in welding processes; and
- oxidising materials (which carry this symbol ).

35. Checklist

    - Have you identified all potential ignition sources?
    - Have you identified all potential fuel sources?
    - Have you identified all potential sources of oxygen?
    - Have you made a note of your findings?

Step 2 – identify people at risk

36. As part of your fire risk assessment, you need to identify those at risk if there is a fire. To do this you need to be aware of where you have people working on site or people who are affected by your site, such as contractors, visiting dutyholders and members of the public in nearby premises etc. It is also important to look at those affected if the site is partially occupied. When parts of a completed refurbishment or new build are handed over to the client on a phased sequence it is important to ensure that all those who may be affected by fire in either the construction site or the occupied premises have been identified. .

37. You must consider all the people who use or could be affected by your site, but you should pay particular attention to people who may be especially at risk such as:

    - employees who work alone, eg security staff;
    - people who are in isolated areas, eg maintenance staff, staff on cranes, and reach trucks;
    - people who are unfamiliar with the site, eg new subcontractors or visitors;
    - people with language difficulties; and
    - other people in the vicinity of the premises.

38. Check list

    - Have you identified who is at risk?
    - Have you identified why they are at risk?

- Have you made a record of your findings?

Step 3 – evaluate, remove, reduce and protect from risk

39. The management of the site and the way people use it will have an effect on your evaluation of risk. Management may be your responsibility alone or there may be others, for example in refurbishment work, such as the building owners or managing agents, who also have responsibilities. In multi-occupied buildings all those with some control must co-operate and you need to consider the risk generated by others in the building.

3.1 Evaluate the risk of a fire occurring

40. The chances of a fire starting will be low if your site has few ignition sources and if combustible materials are kept away from them.

41. In general, fires start in one of three ways:

    - accidentally, such as when smoking materials are not properly extinguished or when lights are too close to combustibles;
    - by act or omission, such as when electrical equipment is not properly maintained, or when combustibles are allowed to accumulate near to a heat source, or by storing LPG next to an electric fire or other source of heat; or
    - deliberately, such as an arson attack involving setting fire to external rubbish skips placed too close to the building.

42. Look critically at your site and try to identify any accidents waiting to happen and any acts or omissions which might allow a fire to start. You should also look for any situation that may present an opportunity for an arsonist.

3.2 Remove or reduce the hazards

43. Having identified the fire hazards in Step 1, you now need to remove those hazards if reasonably practicable to do so. If you cannot remove the hazards, you need to take reasonable steps to reduce them if you can. This is an essential part of fire risk assessment and as a priority, this must take place before any other actions. This should be considered even before site work starts, for example designers can specify a non-flammable paint or the sequence of build can be altered to enable permanent fire protection to be included as early as possible such as stair enclosure early on to improve means of escape for those constructing the building or early installation or installation of fire mitigation methods such as fire detection and suppressant systems as early as possible. Altering the sequence of work to achieve such installations may also allow better control of working at height.

44. Ensure that any actions you take to remove or reduce fire hazards or risk are not substituted by other hazards or risks. For example, if you replace a flammable substance with a toxic or corrosive one, you must consider whether this might cause harm to people in other ways.

3.2.1 Remove or reduce sources of ignition

45. There are various ways that you can reduce the risk caused by potential sources of ignition, for example:

- wherever possible, replace a potential source with a safer alternative;
- operate a safe smoking policy – allow smoking in designated smoking areas and prohibit smoking elsewhere;
- replace naked flame and radiant heaters with fixed convector heaters;
- restrict the movement of and guard portable heating appliances;
- separate ignition hazards and combustibles, eg ensure sufficient clear space between lights and combustibles, and consider building fire-resistant enclosures for hot work processes;
- control, inspect and monitor ignition hazards, eg temporary lighting, halogen lamps, display lighting or lights too close to combustibles;
- ensure electrical, mechanical and gas equipment is installed, used, maintained and protected in accordance with the manufacturer's instructions, including any equipment located in temporary accommodation;
- strictly control hot processes/hot work by operating permit-to-work schemes;
- check all areas where hot work (eg welding) has been carried out to ensure that no ignition has taken place and no smouldering or hot materials remain that may cause a fire;
- ensure that no one carrying out work on gas fittings, which involves exposing pipes that contain or have contained flammable gas, use any source of ignition such as blow-lamps or hot-air guns; and
- take precautions to avoid arson.

3.2.2 Remove or reduce sources of fuel

46. There are various ways that you can reduce the risks caused by materials and substances that burn, for example:

    - plan to reduce storage of combustible materials (eg just–in-time ordering);
    - keep stocks of flammable liquids and gases, in use in open areas, to a minimum.
    - keep flammable liquids and gases which are not in use in dedicated storage areas, externally, where only the appropriate staff are allowed to go, and keep the minimum required for the operation;
    - do not keep flammable solids, liquids and gases together;
    - keep areas containing flammable gases well ventilated, eg LPG cylinders should be kept outdoors in a secure cage;
    - remove or treat materials that are provided to protect finished goods,
    - develop a formal system for the control of combustible waste by ensuring that waste materials and rubbish are not allowed to build up and are carefully stored until properly disposed of, particularly at the end of the day eg in lockable metal skips;
    - take action to avoid any parts of the site, and in particular storage areas, being vulnerable to arson or vandalism; and
    - check all areas where hot work (eg welding) has been carried out to ensure that no ignition has taken place and no smouldering or hot materials remain that may cause a fire later.

47. Further guidance on removing and reducing hazards is given in Part 2.

3.2.3 Remove or reduce sources of oxygen

48. You can reduce the potential source of oxygen supplied to a fire by:

    - closing all doors, windows and other openings not required for ventilation, particularly out of working hours;
    - eliminating or, if not possible, reducing the amount of oxidising materials and not storing oxidising materials near or within any heat source or flammable materials;
    - controlling the use and storage of oxygen cylinders, ensuring that they are not leaking, are not used to 'sweeten' the atmosphere, and that where they are located is adequately ventilated; and

- in the later stages of the project, shutting down ventilation systems that are not essential to the function of the premises should be considered.

3.3 Evaluate the risk to people

49. In step 2 you identified the people who are likely to be at risk should a fire start anywhere on site, and earlier in step 3, you identified the chances of a fire occurring. You now need to evaluate the actual risk to those people should a fire start and spread.

50. To evaluate the risk to people on your site, you will need to understand the way fire can spread. Fire is spread by three methods convection, conduction and radiation.

51. **Convection** – fire spread by convection is the most dangerous and causes the largest number of injuries and deaths. When fires start in enclosed spaces such as buildings, the smoke rising from the fire gets trapped by the ceiling and then spreads in all directions to form an ever-deepening layer over the entire room space. The smoke will pass through any holes or gaps in the walls, ceiling and floor into other parts of the building. The heat from the fire can get trapped in the building and the temperature rises.

52. **Conduction** – some materials, such as structural steel, pipe work and ducting can absorb heat and transmit it to the next room, where it can set fire to combustible items that are in contact with the heated material.

53. **Radiation** – radiation heats the air in the same way as an electric bar heater heats a room. Any material close to a fire will absorb the heat until the item starts to smoulder and then burn.

54. Smoke produced by a fire also contains toxic gases which are harmful to people. A fire in a building with modern fittings and materials generates smoke that is thick and black, obscures vision, causes great difficulty in breathing and can block the escape routes. It is essential that the means of escape and other fire precautions are adequate to ensure that everyone can make their escape to a place of total safety before the fire and its effects can trap them in the building. In evaluating this risk to people, you will need to consider situations such as:

    - fire starting on a lower floor affecting the only escape route for people on upper floors;
    - fire starting in storage areas and affecting hazardous materials (such as gas cylinders);
    - fire developing in an unoccupied area that people have to pass by to escape from the building;
    - fire spreading rapidly through the building because of combustible structural elements and/or large quantities of combustible goods;
    - fire or smoke spreading through a building via routes such as vertical shafts, service ducts, ventilation systems, partially installed walls, partitions and ceilings;
    - fire and smoke spreading through a building due to the incomplete structure or poor installation of fire precautions, eg fire doors not installed or incorrectly installed services penetrating fire walls; and
    - fire and smoke spreading through the building due to absent fire doors/compartmentation or fire doors being wedged open.

3.4 Remove or reduce the risks to people

55. Having evaluated and addressed the risk of fire occurring and the risk to people (preventative measures), it is unlikely that you will be able to conclude that no risk remains of a fire starting and presenting a risk to people on your site.

56. You now need to reduce any remaining fire risk to people to as low as reasonably practicable by ensuring that adequate fire precautions are in place to warn people in the event of a fire and allow them to safely escape. The term general fire precaution (GFP) is used to describe the structural features and equipment needed to achieve this aim. It covers:

    - escape routes and fire exits;
    - fire-fighting equipment;
    - fire detection
    - raising the alarm;
    - making emergency plans; and
    - limiting the spread of fire (compartmentation).

57. The GFPs needed will vary from site to site. Sometimes they will be very simple and other times much more complicated depending on the risks involved, but they all need to take account of the size of the site, the number of people present and the nature of the work being done.

Step 4 – record, plan, inform, instruct and train

58. In step 4 there are four further elements of the risk assessment you should focus on to address the management of fire safety in your premises. In some sites with simple layouts, this could be done as part of the day-to-day management. However, as the sites get larger it may be necessary for a formal structure and written policy to be developed. Further guidance on managing fire safety can be found in section 2.

4.1 Recording the significant findings and action taken

59. If you or your organisation employs five or more people, you must record the significant findings of your fire risk assessment and the actions you have taken.

60. Significant findings should include details about the:

    - fire hazards you have identified in step 1 (you do not need to include trivial things like a small tin of solvent-based glue);
    - actions you have taken or will take to remove or reduce the chance of a fire occurring (preventive measures);
    - people who may be at risk;
    - actions you have taken or will take to reduce the risk to people from the spread of fire and smoke;
    - general fire precautions, ie escape routes and fire exits, fire-fighting equipment and raising the alarm;
    - actions people need to take in case of fire, including details of any people nominated to carry out a particular function (your emergency plan); and
    - information, instruction and training you have identified that people need and how it will be given.

61. You may also wish to record discussions you have had with staff or staff representatives (including trade unions).

62. Even where you are not required to record the significant findings, it is good practice to do so. On some simple sites, record keeping may be no more than a few sheets of paper (possibly forming part of a health and safety folder), containing details of significant findings, any action taken and a copy of the emergency plan.

63. The record could take the form of a simple list which may be supported by a simple plan of the site. On more complex builds, it is best to keep a dedicated record including details of significant findings, any action taken, a copy of the emergency plan, maintenance of fire-protection equipment and training. There is no one ‘correct’ format specified for this.

64. You must be able to satisfy the enforcing authority, if called upon to do so, that you have carried out a suitable and sufficient fire risk assessment. Keeping records will help you do this and will also form the basis of your subsequent reviews. If you keep records, you do not need to record all the details, only those that are significant and the action you have taken. It might be helpful to include drawings/illustrations. This can also help you check your fire precautions as part of your ongoing review.

65. The findings of your fire risk assessment will help you to develop your emergency plan, the instruction, information and training you need to provide; the co-operation and co-ordination arrangements you may need to have with other responsible people; and the arrangements for maintenance and testing of the fire precautions. If you are required to record the significant findings of your fire risk assessment then these arrangements must also be recorded.

66. Checklist

    - Have you recorded the significant findings of your assessment?
    - Have you recorded what you have done to remove or reduce the risk?
    - Are your records available for inspection by the enforcing authority?

4.2 Emergency plans

67. Your emergency plan should be based on the outcome of your fire risk assessment and be available for your workers, their representatives (where appointed) and the enforcing authority. They should be produced before the work begins and any control measures identified should be in place from the start of the work.

68. (This guidance concentrates on fire. However, there may be other problems, such as flooding in excavations, tunnels, work near the sea or rivers, waterworks, etc, or risk from asphyxiation or toxic gases. These should be integrated within fire procedures.)

69. The purpose of an emergency plan is to make sure that the physical measures will work effectively if they are ever needed and to ensure that the people (including non-English speakers) on your site know what to do if there is a fire and that the premises can be safely evacuated.

70. Some emergencies may require total evacuation of the site, eg where it comprises a single multi-storey structure. Some emergencies may only require partial evacuation, eg where a series of separate structures are present on the site. Careful thought needs to be given to ensuring that the means provided are appropriate and capable of achieving the desired goal.

71. On existing occupied sites, liaise and agree emergency procedures with the other occupiers. Ensure that the means are in place to let each other know straight away if an emergency does arise. If simultaneous evacuation is needed, make sure the escape routes are of sufficient capacity to achieve this.

4.3 Inform, instruct, co-operate and co-ordinate

72. You must give clear and relevant information and appropriate instructions to people on your site, such as sub contractors and visitors, about how to prevent fires and what they should do if there is a fire.

73. The information and instruction you give should be based on your emergency plan and must include:

    - the significant findings from your fire risk assessment;
    - the measures that you have put in place to reduce the risk;
    - what staff should do if there is a fire;
    - the identity of people you have nominated with responsibilities for fire safety; and
    - any special arrangements for serious and imminent danger to persons from fire.

74. If necessary, you must also co-operate and co-ordinate with other responsible people who use any part of the site/premises.

STEP 5 – review

You should constantly monitor what you are doing to implement the fire risk assessment to assess how effectively the risk is being controlled.

76. Because site changes rapidly and often the workforce is transient, you need to ensure the risk assessment reflects these changes and the control measures necessary. You should consider the potential risk of any significant change before it is introduced.

77. Reasons for review could include:

    - changes to work activities or the way that you organise them, including the introduction of new equipment;
    - alterations to the building, including the internal layout;
    - the introduction, change of use or increase in the storage of hazardous substances;
    - the failure of fire precautions, eg fire-detection systems and alarm systems;
    - significant changes to types and quantities and/or methods of storage of goods; and
    - a significant increase in the number of people present.

78. Do not amend your assessment for every trivial change, but if a change introduces new hazards, you should consider them and, if significant, do whatever you need to do to keep the risks under control. In any case, you should keep your assessment under review to make sure that the precautions are still working effectively.
79. If a fire or ‘near miss’ occurs, this could indicate that your existing assessment may be inadequate and you should carry out a re-assessment. It is good practice to identify the cause of any incident and then review and, if necessary, revise your fire risk assessment in the light of this.

80. Records of testing, maintenance and training etc are useful aids in a review process.

81. Checklist

    - Have your staff received any fire safety training?
    - Have you carried out a fire drill recently?
    - Are personnel aware of specific tasks if there is a fire?
    - Are you maintaining a record of training sessions?
    - Do you carry out joint training and fire drills in multi-occupied buildings?
    - If you use or store hazardous or explosive substances, have your staff received appropriate training?

Part 2: Detailed guidance on fire risk assessment and fire precautions

Section 1: Legislation

82. The three main fire regulations that govern construction are:

- The Regulatory Reform (Fire Safety) Order 2005 (RRO) England and Wales;
- the Fire (Scotland) Act 2005 (FSA) Scotland; and
- The Construction (Design and Management) Regulations 2007.

What does this mean for construction?

83. Currently, the CDM Regulations require dutyholders to ensure that suitable and sufficient steps (so far as is reasonably practicable) are taken to prevent the risk of injury to any person, during construction work, from fire and explosion. This means they have to take measures to reduce the likelihood of fire due to work process (including storage).

84. The RRO/FSA introduces a risk-based approach. This requires the responsible person to carry out a risk assessment to demonstrate that the fire safety precautions are adequate. Principles of prevention are identified in the RR(FS)O/F(S)A that are similar to general risk assessment guidance: avoidance; replacing dangerous by less dangerous materials; provision of protective measures etc. The fire-risk assessment will help to identify risks which can be removed or reduced, and to decide the nature and extent of the fire precautions you need to take (see part 1 of this guidance).

85. The person (or people) in control of the premises/site will be the responsible person. This would normally be the principal Contractor on a construction site. If there is more than one responsible person in any type of premises, eg a multi-occupied complex, every person must take all reasonable steps to co-operate and co-ordinate with each other. This is particularly important where construction work such as refurbishment underway whilst premises remain occupied.

86. Unless the responsible person has sufficient training or knowledge, a competent person(s) must be appointed to assist in the task. The competent person must have sufficient training, experience and knowledge, as well as other qualities, to do the job.

87. The above Regulations also require dutyholders to have general fire precautions in place:

    - to reduce the risk of fire and the risk of fire spreading;
    - to provide a means of escape;
    - to make sure the means of escape can be safely and effectively used, ie is clear from obstruction, has emergency lighting and is protected where necessary;
    - to fight fires;
    - to raise the alarm;
    - for emergency procedures and training; and
    - to mitigate the effects of the fire.

Enforcement on construction sites

88. Because of the overlapping nature of construction-related and other fire-safety legislation, inspectors from different agencies have different enforcement powers to

deal with fire matters during the course of construction work. They include inspectors from:

- the Health and Safety Executive;
- local authorities;
- the local fire authority;
- Crown Premises Inspection Group (Inspectors appointed by the Home Office and are responsible for inspecting Crown occupied premises such as government buildings; and
- Defence Fire Services Inspection Group (Inspectors responsible for premises occupied by the Armed Forces of the Crown).

89. Legislation distinguishes between the general fire precautions and fire risks that arise from the construction process.

'General' and 'process' fire precautions

- Process fire safety matters, ie precautions to prevent fire starting in the first place. Process matters include the safe use and storage of flammable materials and precautions to ensure that work processes do not start fires.
- General fire precaution (GFP) matters deal with the actions needed should a fire occur. GFP matters include raising the alarm, means of escape, fire-fighting facilities and emergency planning.

90. The flow chart and diagrams in Appendix 1 indicate which inspector is the appropriate one for enforcement in a particular circumstance. Enquiries for the particular issue concerned are best directed towards the agency that has the enforcement power.

91. Even if inspectors do not have formal enforcement powers for the situation concerned, they may still visit construction sites for other reasons. They may address fire matters, but if they do not have enforcement powers for the site, they can refer the matter to the appropriate authority for possible enforcement action.

Section 2: Reducing potential fuel sources

92. There are two ways of addressing fire in construction:

    - prevent it happening in the first place (process fire safety); and
    - prepare for and deal with the consequences if it does happen (general fire precautions GFP).

    Prevention is always better than cure, but both are necessary for construction fire safety.

93. The precautionary measures needed depend on the risks involved. However big the construction project, a risk assessment will always be required. In some cases only simple assessments will be required, but in others much more complicated issues will need to be decided. Ask the question: 'If somebody asked us to justify what we've done, could we really do it or would we just be guessing?'

Reducing the amount of combustible material

94. Many materials which can burn have to be used during construction work. The risk of fire decreases as such material is reduced and the smaller any fire will be. There has to be enough material at hand to do the work, but this needs to be balanced against the need to reduce the risk of fire. Limit the material present at worksites to what is needed for half a day or a single shift and return unused material to the stores when the work is finished. Where combustible or flammable materials have to be used, select the least flammable alternatives.

95. The amount of material kept on site, which can burn, should be minimised. The need to store such material varies greatly during the life of a site, but try to avoid stockpiling it unless it really is necessary. This can significantly reduce the fire loading and ease congestion on the site.

The changing flammability of materials as they are used

96. Construction work can alter the flammability of substances including nominally flame retardant ones. For instance, when worked on, solid materials (even nominally fire-resisting ones) produce dust, crumbs or other fine material which are always more easily ignited than the bulk material. Remember this when planning construction fire precautions, especially when hot work is used.

General requirements for storage of all combustible materials

97. Ideally, combustible materials need to be stored outside buildings under construction, especially volatile flammable materials such as liquefied petroleum gas (LPG). If combustible materials are stored inside buildings, they need to be kept in an area where the safety of staff is not threatened in the case of a fire. For example, do not put paint stores next to emergency exits or under any means of escape, eg steps/staircases.

98. Access to stores should be controlled so that material does not become dispersed haphazardly around the site.

99. If storage outside the structure is not possible, internal stores need to be arranged to limit the spread of fire. Internal stores, especially in more enclosed buildings, may need to be separated from the rest of the structure by a partition providing at least 30 minutes fire resistance to British Standard BS 476: Part 20, 1987. Good quality plaster-board will usually achieve this and can be very useful for constructing small internal stores. Doors should be fire resisting and self-closing (see paragraph ???.

Storage of more volatile flammable materials

100. Extra precautions are needed with highly flammable liquids with flashpoints below 32 °C, eg with many solvents, adhesives, LPG, flammable gas and oxygen cylinders, especially when stored internally (see Figure 1).

Figure 1 When large amounts of LPG are stored, provide purpose built, secure accommodation for it

101. Good ventilation is needed to prevent dangerous levels of gases or vapours accumulating in internal stores. High and low openings in the external wall help to achieve this. The openings should not ventilate into the surrounding structure. Openings representing 1 % of the total floor and wall area are sufficient for flammable liquid storage. For flammable gas and oxygen cylinders, openings representing 2.5 % of the total floor and wall area are usually sufficient.

102. Locate external stores in the open air, in a well-ventilated area that is shaded from the sun and at least 3 m away from the site boundaries, buildings, drains or excavations (where leaking gas may collect).

103. External stores should be enclosed by a 1.8 m high-wire mesh fence for security if the above cannot be achieved. This is:

- unless the building itself is fire resisting (there should be a fire-resistant partition between the store and the building. This fire-resisting partition should protect the building to a distance of 3 m each side of the store and to a height of 9 m above it. The fire protection could be a separate partition or the same area of the wall of the building constructed with fire resisting material, glazing and doors); and/or
- unless seal drains and seal excavations are present or, a spillage retention wall is placed around the store.

104. Volatile flammable materials may need to be stored inside buildings for security reasons. Any building used for this purpose should be separate from that undergoing construction work. Such a building not need to be fire resisting if it is in a safe location. However, it should be of a generally non-combustible construction and be provided with ventilation.

105. Whatever form the storage area takes, unless it is small enough to ensure that no one will be trapped in the event of a fire, it should have at least two exits, both unlocked whenever anyone is in it. (A single exit may be adequate when the travel distance does not exceed 12 m.) Lock the storage area whenever it is unattended.

106. Small quantities of LPG (ie less than 300 kg) may be kept in a lockable wire cage with only one exit. Clearly mark the cage and situate it at least 1 m away from site huts, boundaries, excavations or other features.

107. Small quantities (for example up to 50 litres) of flammable materials such as paints, solvents and adhesives can be stored in lockable steel chests.

108. Do not store anything other than flammable materials in flammable material stores. Avoid accidental spillage inside the store by banning the decanting of liquids within it. Flammable liquids, solids and gases should be kept in separate stores.

109. **Never** store LPG cylinders in unventilated metal boxes or huts. If there is a leak, gas will build up to a dangerous level and may explode when ignited.

110. Always store oxygen cylinders separately from cylinders of flammable gases such as LPG and acetylene.

111. For more information on the storage of LPG, read LP Gas Association Code of Practice 7 *Storage of full and empty LPG cylinders and cartridges*. For information on

the storage of flammable liquids, read HSE guidance note HSG51 *The storage of flammable liquids in containers*.

Rubbish disposal

112. All construction sites, especially in the latter stages such as fit-out, can generate large amounts of mostly combustible and easily ignitable rubbish. Implementing simple site rules can prevent the accumulation of rubbish (see Figure 2).

113. **Figure 2** Most construction rubbish can burn. Make sure that it is swept up and removed from the site as soon as possible

114. The following should be considered.

- Setting and ensuring that site rules are followed, eg contractors must clear rubbish daily or more often.
- Providing facilities for storage of rubbish, eg skips.
- Keeping flammable rubbish, such as contaminated rags, in a closed-top, fire-resisting container, eg a metal dustbin.
- Situating rubbish skips outside and at least 3 m from the structure and other buildings.

115. If a skip is less than 3 m away from other structures, precautions to prevent skip fires spreading to the structure include:

- situating the skip against a fire-resisting wall, eg brick;
- using a chute made of non-combustible materials, such as those complying with BS 1703:1977;
- restricting the amount of flammable material placed in the skip; and
- emptying the skip before it contains a significant fire load.

Protective coverings

116. Protective coverings are a common feature during fit-out stages where final fixtures, such as doors, handrails, floor coverings and panels need to be protected against damage. Such coverings can be a substantial contribution to the overall fire load in circumstances where ignition sources are common. Particular risks occur where protective coverings are used to protect features in fire escape stairways – this should be avoided. The risk can be reduced by using covering materials that are flame retardant. Those complying with the Loss Prevention Council Standard LPS1207 satisfy flame-retardant criteria. Though they have greater fire-retardant properties, they can still burn and therefore at least one fire escape stairway should be kept free of such protective coverings.

117. Risks arising from protective coverings can be reduced by:

- installing vulnerable features needing protection as late as possible in the fit-out stage; and
- ensuring that the coverings are to flame-retardant specifications wherever possible. This may require liaison with suppliers of vulnerable items and/or protective coverings.

Scaffold sheeting

118. In practice, external scaffolds may prove a valuable escape route in the event of fire, even if they are not specifically intended for this purpose (see Figure 3). If scaffolds are sheeted with flammable materials, not only do they contribute to the fire loading, but it would also be unacceptable to rely on them as a significant means of

escape. If such reliance is anticipated, scaffold sheeting should be to flame-retardant standards and this is recommended in other circumstances as well. (Sheeting complying with the Loss Prevention Council Standard LPS 1215 satisfies flame-retardant criteria.) If major or sole reliance on escape via a scaffold during fire is anticipated, the need for and extent of sheeting needs to be carefully considered. Where possible, it should be incomplete in the vicinity of escape ladders and stairs. Not only does this reduce the fire load, it also minimises smoke logging in escape routes and eases fire brigade access.

119. **Figure 3** Where sheeted scaffolds form part of the escape route, avoid sheeting the access points so that smoke can escape and the fire brigade can gain access. Some scaffold components have been omitted for clarity

Handling more volatile flammable substances

120. Flammable liquids, especially highly flammable liquids, need careful handling. Practices to limit the likelihood of spills and the release of flammable vapour concentrations are required. In particular:

- provide drip trays to contain spillage during dispensing and decanting;
- carry out operations in well-ventilated areas;
- use proper handling aids when dispensing from large containers;
- keep flammable liquids in secure closed-top containers during conveyance;
- do not carry contaminated rags and dispose of them safely, containers should be of metal construction and be suitably covered with a metal lid; and
- ensure that any clothing becoming soaked in flammable liquids is removed and replaced with fresh clothing..

121. Further information is given in HSE guidance note HSG140 *The safe use and handling of flammable liquids.*

LPG

122. LPG is widely used across the entire range of construction activities. It is probably the largest single contributor to the risk of fire on construction sites and has been involved in many serious fires and explosions, particularly where there have been leaks in site huts.

Precautions for all uses of LPG

123. The following are important precautions.

- Turn off cylinder valves before connecting or disconnecting any equipment. Hoses should never be kinked during disconnection, connection or at any other time. This damages the hose and can easily lead to accidental release of LPG.
- Check LPG cylinders and associated fittings before use. If there are any signs of leaking or damage, do not use them. While they may be detected by smell or the hiss of escaping gas, soapy water is a more reliable method of checking for leaks.
- During use, secure cylinders in an upright position unless designed to be used in another position, eg on an LPG-fuelled forklift truck. If there is any smell of gas during use, turn off the main cylinder valve immediately and make sure the cause is investigated, determined and put right.
- Many appliances will be provided with recommended lighting instructions and these should be followed. In general, the appliance valve should be closed before the cylinder valve is opened. If the lighting procedure fails, gas should be allowed to disperse before attempting to relight.
- Handle cylinders carefully. Mishandling of cylinders can damage valves and repeated abuse can also lead to serious structural weakness.

124. LPG appliances brought onto site need to be constructed, installed, used and maintained to appropriate standards. For example, there are several relevant British Standards including:

- BSEN 521: 1998;
- BSEN 1596: 1998;
- BS 5482: Part 2, 1997;
- BS 7261: 1990;
- BS 5440: Parts 1 & 2, 2000

125. When purchasing LPG equipment, make sure it complies with these or other equivalent standards.

126. Properly install all appliances and keep them maintained by those who are competent to do so. Ensure that fixed installations are installed and maintained by registered gas engineer.

127. Adequate ventilation is needed when LPG appliances are used. Where there are fixed installations inside buildings, permanent ventilation openings are required which need to be kept clear.

128. Unless the flame can always be seen by someone in attendance whenever the appliance is used, fit a flame-failure device.

129. Use appliances in accordance with the manufacturer's instructions. Ensure that the instruction booklet is available to the user or that a notice is placed on the appliance.

130. Different appliances are designed to work at different inlet pressures. The correct gas regulator must always be used with the appliance concerned. Check with the manufacturer or a registered gas engineer if there is any doubt.

131. Ensure that replacement hoses are of an appropriate standard such as BS 3212: 1991. Use proprietary crimped ends rather than worm drive 'Jubilee' clips. The latter can cause leaks if they are too loose or damage the hose by over-tightening.

Precautions for some particular uses of LPG

132. The following are important precautions during common LPG applications.

133. Bitumen boilers

- LPG cylinders should be kept at least 3 m from the burner or boiler, or protected by an appropriate heat shield. Where the cylinders are remote they should be sited clear of traffic to prevent damage to the hose (which should be suitably robust, steel reinforced braid, for example).
- Never leave boilers unattended while the burner is alight.
- Do not tow or move boilers while the burner is alight.
- When possible, avoid taking tar boilers and similar equipment onto roofs. If this cannot be avoided they should be placed on a non-combustible insulating base to protect the roof from ignition. Equipment should be under the supervision of an experienced operator and sited where spillages can be easily controlled.

134. Site huts and similar areas

- If equipment leaks or heater flames fail, flammable vapour is able to build up inside site huts and can result in a fire or explosion. It is especially dangerous if vapour accumulates out of hours.
- Site huts need to be adequately ventilated at high and low levels and heaters should be properly maintained. Make sure heaters have flame-failure devices incorporated so that the gas supply is shut off if the flame fails.

- Where cylinders are an integral part of the appliance (eg cabinet heaters) they may be kept inside the site hut, but where they are separate from the heater, keep them outside the hut and connected to the heater by the shortest practicable length of suitable hose or piping.
- In both cases, the fuel supply must be turned off at the appliance and the cylinder after use (and especially when the site closes overnight or at weekends). Always keep heaters clear of obstruction, eg clothing.
- Do an end of day check.

135. Transport of LPG

136. Use open vehicles to transport cylinders upright. Ideally, LPG should not be carried on vehicles with other flammable materials, eg paints, solvents, etc. If this is unavoidable, the other materials should be kept in a closed-steel chest or box and well away from the cylinders. Two dry powder extinguishers should be carried, nominally 2 kg and 6 kg.

137. Drivers carrying more than two cylinders of LPG need to have received instruction and, if necessary, training about LPG hazards and what they have to do in an emergency. The driver should also carry, in the cab, a Transport Emergency Card ('Tremcard') containing details of the load carried and appropriate emergency action. The purpose of this is to provide the emergency services with reliable information about the problem they are faced with as soon as they arrive on the scene.

138. Acetylene

139. Acetylene is a flammable gas that, at elevated temperatures and pressures, or following impact of the cylinder, becomes unstable and liable to spontaneous decomposition. As a result, acetylene in cylinders, once suspected to be unstable, constitutes a serious fire and explosion hazard.

140. In these circumstances, fire brigade safe working practices include the establishment of a hazard zone of up to 200 m around the incident and leaving the cylinders involved undisturbed for up to 24 hours or more prior to removal. All activities in the designated hazard zone have to cease and the area is evacuated, with significant implications for the businesses operating in the area.

141. Therefore, it is important that the use of acetylene on construction sites be eliminated wherever reasonably practicable and alternative methods of cutting and welding be adopted. Some sites have banned the use of acetylene and it is important checks are made before taking it on site.

142. Where there is no alternative to the use of acetylene:

- its presence must be minimised and the number of spare cylinders stored on site should be kept to the absolute minimum;
- acetylene cylinders should be removed from the workplace and returned to the storage area as soon as the period of work has been completed. The cylinders should be removed from the site as soon as their use is complete;
- gas cylinders must be secured in a vertical position, preferably by mounting on purpose-built trolleys, and fitted with a regulator and flashback arrester;
- equipment and hoses used with oxyacetylene and similar equipment should be in good condition, set up in accordance with the manufacturer's instructions and be subject to a visual inspection before each period of use; and
- gas welding and cutting procedures should only be carried out by a competent person or under the supervision of trained personnel.

Demolition

143. Demolition work can involve a high risk of fire and explosion. In particular:

- dismantling of tank structures causing ignition of flammable residues; and/or
- disruption and ignition of buried gas services.

144. Buried and other service pipes should always be assumed to be present on a site unless it is positively confirmed that they are not. Identify the location of gas service pipes before any demolition work begins. The client or local supply company will often be able to provide indications of where pipes and cables are located, but this should always be accompanied by a survey of the site. A competent person should do the survey using service pipe locating devices. Once the locations of all service pipes are identified, make arrangements to ensure that they are disconnected from the mains supply by a competent person and purged of any residual gas. It is extremely dangerous to merely assume that this has been done. It needs to be confirmed by a formal process in which a competent person, usually a representative of the local supply company, gives authoritative assurance of disconnection and clearance.

145. Even if removal of the pipe services is not an intended part of the demolition job, it is still important to locate and isolate services to avoid damaging them. In some cases, it may be necessary for supply systems to remain charged. In such cases, particular care will be needed in implementing systems of work to minimise the risk of contact.

146. Storage tanks often contain residues of flammable materials even tiny amounts of which can result in flammable and explosive concentrations. This is especially dangerous when hot work dismantling methods including oxy acetylene cutting or methods generating ignitiosn sources such as angle grinding are used. Such methods should only be used after the tank has been thoroughly cleaned and certified gas and residue free by those who specialise in such work. This work is potentially extremely dangerous and specialised. Those doing it must be competenct..

147. A full description of the extensive precautions needed in this work is beyond the scope of this guidance. Further information is contained in HSE guidance note CS15 *The cleaning and gas freeing of tanks containing flammable residues*. Primary measures include:

- clearly identifying the contents of tanks and associated pipework;
- cleaning tanks and pipework before dismantling work begins;
- keeping to clearly defined systems of work during dismantling (permit-to-work (PTW) systems will be appropriate, see paragraphs ????; and
- avoiding hot work wherever possible, for example, by the use of hydraulically-powered shears.

Section 3: Reducing ignition sources

Smoking

148. In accordance with current UK legislation, a ‘no smoking’ policy must be established throughout the site with the exception of designated areas where smoking will be allowed. The designated safe areas where smoking is allowed should be of a low fire risk design, away from any flammable materials and provided with tin ashtrays filled with sand.

149. Bring the smoking rules to the attention of all workers and visitors to the site. Display the appropriate signs, particularly in high-risk or communal areas such as canteens and site access points.

Plant and equipment

150. Plant and equipment should be appropriate for the task and consideration should be given to the area where it is sited (eg it may be acceptable to use a small generator in an open, well-ventilated building constructed of non-combustible materials. However, this would not be appropriate in a unprotected, framed construction such as timber).

151. Consideration should also be given to the storage of plant and equipment in relation to fire risk.

152. Select plant, both electrical and engine driven, to match the demands placed upon it to prevent overheating during use, especially in dusty conditions.

153. Maintain all plant properly, and in particular, air filters and intakes should be regularly cleaned in dusty conditions. Ensure that air intakes are positioned so that air is free from flammable gases and vapours.

154. Operating and refuelling (especially with petrol) should not take place within a confined space; it should be in the open air or in well-ventilated spaces away from ignition sources. Bulk flammable liquid storage tanks should be bunded to current standards.

155. Temporary lights can easily become an ignition source if broken or abused. Ideally, lamps should be securely fastened to a solid backing (see Figure 4). If they are mounted on tripods, make sure that the tripod cannot be dislodged or overturned. Make sure that electrical equipment is not inadvertently covered and that due care is taken in positioning, especially halogen lamps and heaters, to ensure that they cannot ignite any combustible material nearby.

Figure 4: Left: a lamp attached to a tripod Right: a lamp bolted to a solid backing

156. Protect plant and equipment when used in areas where a potentially flammable atmosphere may occur, such as in LPG, highly flammable liquids (HFLs) storage areas and/or paint spraying or floor laying with HFLs. Only use electrical equipment that is certified as constructed to a suitable standard, eg ATEX British Standard or an equivalent explosion protection standard. Equipment that is not explosion protected should be kept a safe distance away, usually at least 4 m from any areas where there is a risk of ignition. Where explosive atmospheres might occur, the workplace has to be classified into hazardous areas (zones) and the right category of explosion-protected equipment has to be used in such zones. More detailed advice on zoning is contained in BS EN 60079-10:1996 and HSE guidance note HSG140 *The safe use and handling of flammable liquids*. Regulation 7 of the DSEAR Regulations refers (see DSEAR ACOP L138).

Use of oxy-fuel equipment

157. Workers should be competent in the use of oxy- fuel equipment, understand and follow appropriate work practices.

158. Provision and maintenance of the correct equipment are key factors in preventing incidents. Detailed guidance is given in HSE guidance note HSG139 *The safe use of compressed gases in welding, flame cutting and allied processes*, and in the British Compressed Gases Association Code of Practice No 7, but the following precautions address more common problems.

- Regulators and hoses should be of a recognised standard, eg BS EN ISO 2503: 1998 and BS EN 559: 1994 respectively.
- To avoid confusion hoses should be colour coded as:
    - blue – oxygen;
    - red – acetylene; and
    - orange – propane.
- Non-return valves at the torch/blowpipe inlet on both gas lines are strongly recommended, as is a flame arrester with a cut-off valve, sometimes known as a '**flashback arrester**', at the pressure regulator outlet from acetylene gas cylinders (see Figure 5). Indeed, it is considered good, safe working practice and is highly advisable to similarly fit a **flashback arrester** at the pressure regulator outlet from other fuel gas and oxygen cylinders also. All such safety devices should be to an appropriate standard, such as BS EN 730: 1995.
- Use proprietary hose assemblies with hose connectors crimped to hose ends. Worm drive fasteners ('Jubilee clips') are not recommended. They may be the wrong size and over-tightening them can damage the hose.
- Make sure that oil or grease does not contaminate the oxygen supply. Only use components that have been specially cleaned and supplied for oxygen use.
- Always check equipment visually for damage before use, especially the hoses. Any badly damaged or suspect hoses should be discarded from use. When you have assembled the equipment, always check for leaks by applying a soap solution around joints and watching for bubbles.
- Gas cylinders should be secured in an upright position. Hose length should be kept to a minimum. This reduces the likelihood of damage and should help to ensure that the hose is not damaged by the hot work.

Figure 5: Typical equipment used in gas welding and allied processes. Note (a) flashback arresters and (b) non-return valves

159. Permit-to-work (PTW) systems

160. All hot work generating heat, sparks or flames can cause a fire. To avoid this, PTW systems should be considered. Where hot work is not carried out often, and where the risk of fire is low, the need for formal systems of management control is less. However, as the amount of hot work and the risks associated with it increases, the need for formal PTW systems increases. They are particularly useful where there are numerous hot work operations taking place and where there is a lot of combustible material present, both incidentally and as part of the building structure.

161. PTW systems are formal management documents. They should only be issued by those with clearly assigned authority to do so and the requirements stated in them must be complied with before the permit is issued and the work covered by it is undertaken. Individual PTW systems should relate to clearly defined individual pieces of work. Do not use PTW documents as blanket authorisations to carry out hot work anywhere on the site at any time; they should only be issued just prior to intended hot work duty. (More general standards for site-wide hot work can be set out in site rules.)

162. PTW systems should normally include:

- the location and nature of the hot work intended;
- the proposed time and duration of the work;
- the limits of time for which the permit is valid; and
- the person in direct control of the work.

163. Precautions to be taken and reflected in the PTW before, during and after the work include:

- clearing the surrounding area of all loose combustible material;
- checking for combustible material, where work takes place on one side of a wall or partition, on both sides;
- having suitable extinguishers at hand and a careful watch maintained for fire during the work and following completion;
- protecting combustible material which cannot be cleared;
- examining the hot work area thoroughly for some time after the work has finished. (Typically this will be at least an hour, but ignition can sometimes occur much later than this. Inform the night security guards where hot work has been going on and ask them to check these areas); and
- in view of the potential risk, it is a sensible precaution for all hot work to stop by a safe period before the end of the day.

164. You may not need a fully-documented PTW system where the risks arising from hot work are low. However, precautions such as having a fire extinguisher are still required. Site rules are an effective means of making these precautions clear to those carrying out such work.

Electrical installations

165. Electrical installations, especially temporary ones, should be of sufficient capacity for the intended use and designed, installed, inspected and maintained by competent personnel. The installation should meet BS 7671: 2008 requirements for electrical installations, which includes a special section on construction sites. Do not allow ad hoc additions or alterations to the electrical installation by personnel who are not competent. Electrical equipment should meet standards that reflect the adverse conditions on most construction sites such as:

- BS EN 60309-1: 1999;
- BS 7375: 1996;
- BS EN 60439-4: 1991; and
- BS 4363: 1991.

166. Some common electrical faults posing fire risks include:

- use of flat twin and earth cable as extension leads instead of suitable flexible cable;
- overloading of sockets in site accommodation;
- cable laid in or near combustible material, frequently in roof and ceiling voids;
- accumulation of rubbish against distribution boards poses similar fire risks and often occurs when installations are located in quiet parts of the site;
- intentional defeating of safety devices, such as fuses or circuit breakers;
- mechanical damage to cables, often as a result of inappropriate routing of cables;
- make-shift cable joints made without correct proprietary connectors; and/or
- use of non heat-resistant glass or broken glass cover over a halogen lamp (poor heat-resisting glass covers have been known to ignite flammable vapours being emitted from a freshly applied solvent based covering laid on to floors).

167. The proper use of electrical safety devices, such as residual current devices (RCDs), can reduce the risks of fire arising from electrical faults. However, they do not

substitute for properly designed, installed, inspected and maintained electrical installations under the supervision of an electrically competent person.

168. In order to design and install a system which is safe with adequate capacity, those responsible need to be informed about its likely use. Electrical systems need to be periodically checked to ensure that they remain safe and free from damage or deterioration. They should also be checked before any addition, extension or modification is carried out. On most sites, and particularly larger ones, this will require some form of systematic electrical inspection and maintenance regime.

Bonfires

169. The burning of any vegetation or rubbish on site should be avoided unless absolutely necessary, and should only be considered in very limited situations such as site clearance for major road construction.

170. There is environmental legislation governing the rare circumstances where site burning may be permitted and contractors **must** check with clients, local authorities and the Environment Agency before contemplating any site burning.

171. If, under exceptional circumstances, site burning is permitted, it must be subject to a fire risk assessment and be controlled by a permit system. The following rules **must** be built into the permit system.

- Prior approval and necessary permits **must** be obtained from all of the relevant authorities.
- Only light fires, on an open site, on designated ground and far enough removed (typically 10 m) so that there is no risk of setting adjoining material, storage areas or structures alight.
- Large open bonfires can easily get out of control. Limit the amount burnt in one go to what can be dealt with in an incinerator, eg a 50 gallon spent oil drum which has been properly cleaned of flammable residues and provided with ventilation holes may be used in a controlled manner for this purpose.
- Never leave fires unattended until they are completely out, damping down if necessary.
- Attendants should have the correct fire extinguishers or other suitable equipment to hand.
- Material should be checked for dangerous items such as empty cylinders, aerosol cans and flammable substances, before it is brought to the fire.
- Do not light fires on windy days.
- Do not site bonfires where flames, smoke and any air-borne debris might affect overhead electrical lines.

Figure 6 Avoid lighting bonfires unless you really need to. If you do, make sure you follow points (a) to (e)

172. Petrol or other similar accelerants should **never** be used to start or fuel any fire on any construction site. Use paper or similar kindling to start bonfires instead.

Arson and site security

173. Arson is a real, substantial problem and risk on all sites, particularly where there are trespassers. Measures should be in place to prevent unauthorised access, especially by children. Care is needed to ensure that no gaps develop in the fencing/hoarding around the site.

174. Securely store (or if necessary remove) flammable liquids, LPG and other combustible materials while the site is closed.

175. Some sites may be particularly vulnerable to arson, especially those with a high fire loading or in localities with a known history of vandalism and arson, or where protective hoarding is not possible. In such cases, additional security measures beyond a perimeter fence should be considered, for instance:

- regular out-of-hours security patrols or a permanent security presence;
- security lighting;
- liaison with the local police force; and/or
- closed circuit television monitoring (CCTV).
- Skips are often a target and there vulnerability should be considered

176. Security staff need to be alert to the possibility of detecting fire and know what to do if they discover it.

177. Arson is sometimes thought to be committed by site employees, eg unexplained skip fires. Site managers and site security staff should be aware of this potential and the need to be alert for signs of it during their inspections.

Section 4: General fire precautions

178. If there is a fire, people need to be able to evacuate the structure and possibly the construction site itself to reach a place of safety. **It cannot be over-emphasised that the main aim is to ensure everyone reaches safety if there is a fire**.

179. Buildings are often at their most susceptible during the construction phase. Some timber frame structures are vulnerable to rapid fire spread and possible collapse in the early stages of construction as the timber is not protected. Other building types may be more at risk later on in the contract when there is an increased amount of flammable material such as packing or solvents.

180. The term general fire precaution (GFP) is used to describe the structural features and equipment needed to achieve this aim. It covers:

- escape routes and fire exits;
- fire-fighting equipment;
- raising the alarm;
- making emergency plans; and
- limiting the spread of fire (compartmentation).

181. The GFPs needed will vary from site to site. Sometimes they will be very simple and other times much more complicated depending on the risks involved. But, they all need to take account of the size of the site, the number of people present and the nature of the work being done. Individual elements of GFPS must be considered as part of the overall package and not in isolation.

182. The purpose of this section is to help decide which GFPs are appropriate in particular construction circumstances. An essential requirement is that GFPs and people's ability to escape should not depend on ad hoc arrangements, such as the use of manipulative devices, eg portable or throw out ladders, or rely on rescue by others, such as the fire brigade.

Means of escape

183. Escape routes need to be available for everyone on the site. On open-air sites and unenclosed, single-storey structures, such routes may be both obvious and plentiful. However, in more complicated structures, especially where work is above or below ground, more detailed consideration will be needed.

- Proper provision is needed for all workers and visitors wherever they are and however transient the activity, eg workers on the roof or in a plant or lift gear room.
- During the course of construction, escape routes are likely to change and possibly become unavailable. It is important that replacement routes are provided and identified early.
- Building designs often incorporate fire escape routes for the eventual occupiers. For new buildings, these should be installed at the earliest stage possible to make them available for those undertaking the construction work. For buildings being refurbished, try to arrange the work to make use of existing escape routes and keep them available.
- In an emergency escape via a scaffold is difficult. Try to minimise reliance on it. Where possible, provide well-separated, alternative access from a scaffold to escape routes in the main building floor. (If this is not possible, see paragraph ……)
- There should normally be at least two escape routes offering escape in different directions.

184. Escape routes need to be clear, uncomplicated passageways, properly maintained prominently signed (see paragraph…..) and kept free of obstruction.

185. A basic principle of escape routes is that any person confronted by an outbreak of fire, or the effects from it, can turn away from it or pass it safely to reach a place of safety (see Figure 7).

Figure 7 Avoid creating dead-ends

186. Where this cannot be realistically accommodated, it is important to ensure that the risk of being trapped by a fire in dead-end situations is minimised. The risk can be reduced by ensuring that anybody in a dead end does not have to pass through an area of higher fire hazard to reach a place of safety, and keeping the distance they have to travel in the dead end as short as possible. For example:

- where operations of high fire risk are carried out, such as laying floor coverings or work on pipes which have carried flammable materials, nobody should have to negotiate their way past the work area or plant to make their escape; and/or
- combustible materials should not be stored or allowed to accumulate at the exits from dead ends, such as by doorways from rooms or along the escape routes from dead ends that are narrow or restricted, such as along corridors.

Travel distance

187. In a fire the effects of smoke and heat can spread quickly. It is important not to over-estimate how far people can travel before they are adversely affected by fire. Appropriate distances to reach safety will depend on a variety of matters, including how quickly the fire grows, the structure and layout of the building, the location of the fire and where people are relative to this.

Table 1 Maximum Travel distances

		Fire hazard	
	Low	*Normal*	*High*
Enclosed structures:			
Alternative	60 m	45 m	25 m
Dead end	18 m	18 m	12 m
Semi-open structures:			
Alternative	200 m	100 m	60 m
Dead end	25 m	18 m	12 m

Notes

Semi-open structures are completed or partially constructed structures in which there are substantial openings in the roof or external walls, which would allow smoke and heat from any fire to readily disperse.

Alternative escape routes should, where possible, proceed in substantially opposite directions. The principle is that they are sufficiently apart that any fire should not immediately affect both routes. As such, they should not be less than 45 ° apart.

Dead-end travel distances are significantly restricted. This is so people have time to negotiate their way past any fire between them and the exit before it threatens their escape.

Low-hazard areas are those where there is very little flammable or combustible material present and the likelihood of fire occurring is low. Examples could be steel or concrete clad framework or structures in pre-fitting-out stages.

Normal-hazard areas will cover the majority of situations. Flammable and combustible materials are present, but of such a type and disposition that any fire will initially be localised.

High-hazard areas are locations where significant quantities of flammable or combustible materials are present of such a type that in the event of a fire, rapid spread will occur, possibly accompanied by evolution of copious amounts of smoke or fume. Normal precautions,to minimise the fire load, should ensure that such areas are rare on construction sites. Examples of where they might occur are demolition or refurbishment work involving oil-contaminated wooden floors or linings, and fixing floor and wall coverings using flammable adhesives.

188. Table 1 gives maximum travel distances to a place of safety which experience has shown can be considered acceptable for a variety of situations. The distances given are from the fire to an exit from the structure, typically a door, leading to the outside at ground level, or to a stairway or compartment protected against fire (see *Stairways*, paragraphs ….. and *Compartmentation*, paragraph …..).

189. The travel distances are measured as the person walks and not as the crow flies. Care should be taken to minimise obstructions so that maximum travel distances are not exceeded. It is sensible to arrange the work to keep travel distances as short as possible.

Stairways

190. Careful consideration needs to be given to the means of escape from work areas above or below ground level. It is especially important to ensure that the stairways and ladders are located or protected so that any fire will not prevent people using them.

191. Except for small two-storey buildings with travel distances well within those given in Table 1 for dead-end travel, there is normally a need for at least one stairway to be protected against any fire in the main work area affecting it. In the finished building, this is typically provided by situating the stairway in its own dedicated, fire-resisting shaft. In these circumstances, the travel distance is measured from the worksite to the door of the protected stairway.

192. Protected stairways will be a feature in many buildings. Therefore, it is a sensible precaution to install these and make them available as early as is practicable, in the construction of new structures, before fire risks increase such as when fitting-out starts.

193. Ceiling, wall or floor coverings which, if ignited, would allow the fire to spread rapidly, or the effects from it to be exacerbated, should not be used in escape stairways. The ideal surfaces are plaster or concrete, which may be painted or sealed as appropriate. Protective coverings in escape stairways should be flame retardant (see paragraph …..).

194. Where possible, it is sensible to try and provide alternative protected stairways. For structures which are more than four storeys above ground, this is considered essential. With the exception of small basements, on subterranean structures, at least one stairway should exit to the open air at ground level.

Doors

195. Doors giving access to protected stairways should be fitted as early as possible. They need to be fire resistant and fitted with effective proprietary self-closing devices (see Figure 8(a), (b)). Where necessary, gaps between doors and their frames

should be suitably fitted with intumescent strip and smoke seals. The nominal minimum period of fire resistance considered appropriate for protected stairways is 0.5 hour, which the doors should be designed to meet. An appropriate constructional standard for doors to comply with is BS 476: Part 22, 1987, and for their installation BS 8214: 1990.

Figure 8(a) Fire doors need to be kept closed and clearly marked when they form part of the escape route

Figure 8(b) This escape route will quickly fill with smoke in a fire because no fire door is fitted

196. The doors leading to the protected stairway and the final exit from it should open outwards in the direction that people will escape. Revolving doors are not considered suitable as they can jam. For similar reasons avoid sliding doors.

197. The doors must be easily and immediately openable from the escape side, other than by use of a key. If security is required, proprietary fastenings should be used, such as those which comply with BS EN 1125: 2008 or other relevant standards. Security doors and turnstiles should be configured in such a way that they do not prevent rapid egress from the site in case of an emergency.

198. If it is necessary to protect a stairway to ensure safe travel distances, the integrity of the enclosure containing the stairway is critical to its safe use in an emergency. Check that the doors are properly maintained and closed correctly. It is also important to check that there are no other openings present or made, eg for pipes, wiring and ductwork. If there are, infill them at the earliest opportunity. In refurbishment work, do not assume that there are no holes breaching the enclosure of protected stairways in the existing structure. Any gap that may cause a fire to spread from one side to another should be suitably fire stopped with fire-resisting materials. Fire can also spread rapidly over false ceilings.

External escape stairs and ladders

199. If the nature of the work means it is not reasonable to provide or maintain an internal protected stairway, external temporary escape stairs may be provided instead. Adequate stairways can be constructed from scaffolding (see Figure 9); you can use wooden treads and platforms. The important requirement is that the external wall against which the stairway is erected should be imperforate and afford a nominal period of 0.5 hour fire resistance for 9 m vertically below the stairway and 1.8 m either side and above, as measured from the stair treads. This means that all doors, apart from the uppermost one leading onto the external stairway should have 0.5 hour fire resistance and be self-closing. Any other openings, including windows, which are not of fire-resisting construction, should be suitably protected, eg with plasterboard, proprietary mineral fibre reinforced cement panels or steel sheets.

Figure 9 Temporary scaffold based escape routes need to be protected from fire inside the building. The windows inside the shaded area need to be blocked off with fire-resisting material

200. In the open air, such as work on the initial framework of a structure, it is unlikely that an imperforate barrier will be available to separate the escape stairway from the work area. In such circumstances, unless the travel distances are well within those given in Table 1 for dead-end travel, at least two alternative routes should be provided. These should be well apart, ideally at opposite ends. If the structure or building is within a sheeted enclosure, eg for weather protection, environmental or safety reasons, at least one of the routes should be outside the enclosure (see Figure 10).

Figure 10 In this job, hot work on the roof and window renovation using blowlamps and substantial amounts of flammable substances mean the fire risk is high. Escape via ladders

inside the sheeting could be difficult so external access is provided at one end. Some scaffold components have been omitted for clarity, eg roof edge protection is required. The escape route should lead away from the enclosure where possible

Escape route sizing

201. While stairways, etc may be adequate for normal entry and exit, it is important not to overestimate their capacity in an emergency when 'bottlenecks' can easily occur. Recommended widths are related to the number of people expected to use them in an emergency. For example, a stairway (in a building under construction) serving two floors should normally be a minimum of 1 m wide to adequately cater for about 200 people. However, if the door leading to or from this is only 750 mm wide, the escape route via this door is only considered adequate for about 100 people.

202. More detailed advice on the size of escape routes can be found in the BS 9999 series of standards, and in Approved Document B and the Technical Standards that support the Building Regulations and Building Standard (Scotland) Regulations respectively. The majority of structures will be built in compliance with one of these. Therefore, in most cases, the early installation of these escape routes will provide adequate means of escape during construction work. However, if during the construction work the number of people present is greater than the design maximum of the finished building, additional escape routes, or increased sizing of these might well be necessary.

203. When temporary escape routes are required for changes in level you should consider the installation of proprietary all-l metal system staircases. These can be adapted to any scaffold. If there are practical reasons why these cannot be used, such as a lack of space, , under certain limited circumatances ladder may be acceptable instead of stairs. Remember that fire precautions duting the build should be considered at the design stage to ensure there is enough space for adequate precautions.

204. Remember, the speed at which people can escape via ladders is much slower. In emergencies, the number using a vertical ladder, which staggers every 6 m, is considered to be ten able-bodied people. For a ladder with a maximum rake of 60° to the horizontal and 6 m length between platforms, it is considered that 30 able-bodied people could use it.

Assembly points

205. All designated escape exits from the structure should give direct access to an unenclosed space in the open air at ground level. From here, there should be an unobstructed passageway from the structure to a place of safety where people can assemble and be accounted for. Regard needs to be given to the size and location of these assembly points:

- on small sites – the pavement outside may be adequate;
- on larger sites – arrangements may have to be made to make use of an area such as a car park; and
- on sites such as chemical refineries – a safe refuge such as a plant control room might have to be used. Where the site is in operation, a responsible person from the company should be consulted regarding a safe assembly point.

206. Where the construction site is surrounded by a hoarding or fence and the assembly point is outside this, an adequate number of gates giving access to the assembly point will be needed. There should be clear and unobstructed access to the gates, which should be unlocked and available for use at all times that people are at work on the site.

Emergency signs

207. Escape routes need to be clearly indicated by proper signs (see Figure 11). The Health and Safety (Safety Signs and Signals) Regulations 1996 set the standards for these signs. They should comprise a white pictogram on a green background supplemented with text if appropriate. Signs which comply with BS 5499: Part 1,2002 will meet the requirements of the Regulations. See HSE guidance L64 *Safety signs and signals: Guidance on regulations* for further details.

Figure 11 Emergency signs

208. Signs need to be large enough so that they can be clearly seen and positioned where they are least likely to be obstructed or obscured by smoke. Typically this is about 2 m above the floor, but the layout of the site may make alternative positioning more appropriate.

209. If emergency lighting is required (see *Emergency lighting*, paragraph ….), it may be convenient to use units which incorporate the appropriate fire safety sign. Signs containing photo-luminescent materials can also emphasise escape routes where lighting is poor.

210. Supplementary signs may also be required to clarify escape procedures, eg to inform how to open the door if this is not obvious, or where a patent security device is fitted, such as a 'Push bar to open' sign. Similarly, where there is danger that a fire exit may become obstructed, a conspicuous 'Keep clear – Fire escape' sign should be displayed. Signs complying with BS 5499: Part 1: 2002 are acceptable.

211. Signs need to be sufficiently durable to withstand site conditions, securely fastened and properly maintained (including kept clean).

212. If circumstances alter and any sign becomes inappropriate it should be removed. For example, if an escape route is changed it is imperative that signs giving misleading or confusing information are taken down and signs indicating the new route are displayed.

213. Training should be given this to workers for whom English is not their first language so that they fully understand the signage in a fire emergency to ensure their safe escape.

Fire alarms

214. The aim of any fire warning system is to ensure that people on the site are alerted to make their escape before a fire becomes life-threatening. The essential requirements of the fire warning signal are that it is distinctive, clearly audible above any other noise and is recognised by all the people on site.

215. The sophistication of the method of giving warning of fire will vary from site to site. For example:

(a) only on very small open-air sites, or those involving small buildings and structures, may 'word of mouth' be adequate;
(b) on a very limited number of open-air sites, or those involving buildings and structures with a very limited number of rooms, such that a shout of 'fire' might not be heard or could be misunderstood, a klaxon, whistle, gong or small self-contained proprietary fire alarm unit may well be needed; and/or
(c) it is expected on the majority of sites, that a wired-in system (see Figure 12) of call-points and sounders will be required to provide an effective fire warning system. For example, one that meets the requirements of BS 5839: 1; 2002 + A2: 2008.

(d) Consideration should be given to visual alarm systems for noisy areas or where there are workers who suffer from a hearing impairment

Figure 12 A temporary, wired-in fire alarm during major renovation of a large and complex multi-storey building

216. Fire alarm systems will often be fitted as part of the construction work. Alternatively, buildings may have a wired-in fire alarm system already installed. Try and plan the work to install the fire alarm system as early as possible, and where a system is already installed, keep it in working order for as long as possible. Where they are relied on during the construction phase, it is vital that existing systems are not inadvertently disabled, for instance during work on electrical systems in refurbishment work. If they are disabled for any reason, alternative arrangements need to be provided.

217. There is not normally any need for automatic fire detectors to be fitted during construction work. However, if there are locations where a fire might occur and develop unnoticed until it threatens peoples' means of escape, detectors may be appropriate. Domestic type smoke detectors are not considered appropriate on complex multi-storey sites. However, they may be suitable for use on smaller sites, where, despite being comparatively quiet, they could still be effective.

218. Indicator panels sometimes form part of more sophisticated alarm systems. They can provide information on the location of the fire, though this may prove erroneous if a call point is activated elsewhere than in the vicinity of the fire. However, providing people are aware of the constraints of the system and understand what the signals mean, they can help inform what emergency actions have been taken, and be of use to the attending fire brigade.

219. When a fire is detected and the alarm raised, all should make their immediate escape without delay. If it is possible that a false alarm could cause significant problems, procedures to verify the outbreak of a fire should be developed. For example, on raising the alarm, perhaps by activation of a call-point, an intercom system might be provided adjacent to this to allow verbal confirmation. This could be to a control centre from which the main alarm is then raised. Alternatively, the person in the control centre might be in radio contact with somebody on the fire floor. Safeguards need to be built into such procedures to ensure that while anyone is on site the control centre is **always** occupied (including during breaks), and if the system for verbal communication fails, effective sounding of the alarm is not delayed.

220. The operation and effectiveness of the fire alarm system over the entire site should be:

- routinely checked and tested by a responsible person; and
- periodically serviced and any necessary rectification or repair carried out by a competent person having the appropriate level of training and experience.

221. The work should be carried out in accordance with the supplier's instructions, or where relevant, to an appropriate standard, for example BS 5839: Part 1, 1988. Keep records of the work carried out. It is particularly important to check the effective operation in practice of the alarm systems that rely on verbal communications described in paragraph …...

222. It is especially important to ensure that as the site develops, the alarm system is modified so that effective coverage of the entire site is maintained.

223. General means for communication should be tested daily, eg portable radios should be checked at the start of shifts. Servicing should be in accordance with supplier recommendations.

Fire-fighting equipment

224. As well as providing fire extinguishers for specific activities, such as hot work or LPG storage, they should also be located at identified fire points around the site. Unless the equipment itself is predominantly red in colour and the location self evident, identification of the fire point is can be achieved by providing a stand which is substantially red in colour, or providing an appropriate safety sign (ie, one which complies with the Health and Safety (Safety Signs and Signals) Regulations 1996 or BS 5499: Part 1: 2002.

225. The primary purpose of fire extinguishers is to tackle incipient fires to preventing them becoming larger. Putting out larger fires is the fire service's role, and as such, should not be tackled by site workers.

226. The extinguishers should be appropriate to the nature of the potential fire. For:

- wood, paper and cloth, use a water, foam or multi-purpose dry powder extinguisher;
- flammable liquids, use a dry powder or foam extinguisher; and
- electrical objects, use a - carbon dioxide (CO_2) or dry powder extinguisher.

227. Extinguishers should conform to a recognised standard, such as BS 5423: 1987 or BS EN 3: 1996. It is also important that there is an appropriate scheme to ensure they are regularly checked and properly maintained. This is not only to ensure that they are available and ready for use, but that accidents do not occur to the person using them.

228. Examine fire extinguishers and hose reels at least annually in accordance with a recognised procedure, such as that in BS 5306: Part 3, 2000 and BS 5306: Part 1, 1976 respectively. The work should be carried out by a competent person who has received appropriate training. The date and results of the examinations should be recorded, often on a service sticker attached to the individual piece of equipment, so that the particular extinguisher or hose reel checked is identifiable.

Figure 13 A selection of fire extinguishers. Fire extinguishers complying with BS EN 3: 1996 are red with a coloured zone identifying the extinguishing agent (eg blue for dry powder)

229. The number and type of extinguishers present depends on the fire hazard. For a typical spread of fire hazards, the following is considered to provide a reasonable level of cover per 200 m^2 of floor area with not less than two each of (a) and (b) on each floor:

- one 9 l water or foam; and
- one CO_2 extinguisher (at least 1.1 kg).

230. *Note* Dry powder extinguishers (at least 9 kg) may be provided in addition or substituted for any of these extinguishers, especially where the nature of the fire hazard warrants this.

231. Hose reels may also be used instead of the water-based extinguishers. One per 800 m^2 of floor area is recommended, but make sure it can reach all points of the area to be covered. Hose reels should be of an appropriate standard, such as BS 5306: Part 1 2006, and as with extinguishers they need to be regularly checked and properly maintained.

232. It is important that everyone knows how to use the fire-fighting equipment. All fire-fighting equipment should have clear operating instructions with it. Those carrying out higher risk activities, such as hot work, need to be competent in the use of the fire-fighting equipment provided and training will normally be required to achieve this.

233. Larger and more complex structures, such as multi-storey buildings, may have fixed fire-fighting systems installed. These may range from dry and wet risers to

automatic sprinkler systems. While dry and wet risers are not usually for fire fighting, they will help the fire brigade to tackle a fire quickly. The continued availability of these in existing buildings and their early commissioning in new buildings is therefore recommended. Similarly with sprinkler systems, it is worth planning the work so that these are available for as much of the construction phase as possible. Where risers are provided, liaison should be established with the fire brigade and the access points should be reviewed periodically.

234. Recognition should be made that sprinkler provision may have allowed for reduced fire resistance or extended travel distances, and this should be incorporated into any fire evacuation planning at construction stage.

Compartmentation

235. To stop a fire spreading, a building can be sub-divided by fire-resisting walls and floors (ceilings). This is called compartmentation and a possible example of this was discussed in the protected stairway (see *Stairways*, paragraph ….). Compartmentation might also form a major part of the fire strategy for the completed building, especially for the larger and more complex structures. The early installation and completion of compartments can also provide protection during the construction phase. It should be given priority when planning GFPs, but in practice, there will be limits on how early compartmentation can be installed. Any openings need to be protected to an equivalent standard of fire resistance to the rest of the compartment. Work activities also need to be carefully monitored to ensure that any holes or gaps remaining after services are installed are correctly filled in.

236. Larger, more complex and prestigious buildings may entail fire-safety engineering solutions, making use, for example, of smoke control systems. The installation of the complete fire-safety engineered package of safeguards is recommended to be completed as soon as possible in the build. However, this cannot always be achieved and temporary compartmentation may be needed during the construction phase, eg of an atrium.

237. Temporary compartmentation, providing a nominal period of 30 minutes fire resistance, may be achieved by a timber studding framework faced with 12.5 mm thick plasterboard, skimmed with 5 mm of plaster to protect the joints (see Figure 14). Alternatively, mineral fibre reinforced cement boards can be used. Typically, boards need to be fixed to both sides of the studding. However, where it is concluded that the compartmentation is required to contain a fire on one side only, boards may only be needed on that side. Take the advice of the supplier on the methods of fixing and finishing needed to achieve the period of fire resistance in such circumstances.

238. It is essential to maintain the integrity of compartments. Compromised compartments (eg with unprotected openings) don't work either during construction or in completed buildings and can undermine fire precautions catastrophically.

Figure 14 Plasterboard partitions such as this can form effective compartmentation. It is important that all gaps are filled in. In this case, there are holes in the top of the partition and service ducts in the side rooms that need to be sealed.

Emergency lighting

239. Normal lighting could well fail during a fire. If work carries on inside enclosed structures or at night, emergency escape lighting will normally be required to ensure that escape routes can be identified and used safely (see Figure 15). Escape lighting does not have to meet normal work standards but be adequate for people to use the route safely.

Figure 15 Typical emergency lighting units designed to operate in the event of mains failure. Emergency lights can usefully incorporate fire safety signs

240. For work at night on outdoor or substantially open sites, spill lighting from adjacent sites or locations (eg, from street lighting) may be enough to enable escape.

241. Within buildings and enclosed structures, escape lighting (especially in escape routes) will generally be needed in the following circumstances:

- underground or windowless accommodation;
- stairs without natural, borrowed or spill lighting;
- internal corridors without borrowed light, which is of sufficient length that the escape route would be unclear; and/or
- where work continues outside daylight hours.

242. In the event of failure of the primary lighting, the emergency escape lighting needs to come on immediately. It may be powered, eg by a battery or emergency generator supply. Lighting installed in compliance with BS EN 1838: 1999 is acceptable. If work is carried out in buildings in which such emergency lighting is already fitted, try to retain this for as long as possible. Similarly, if it is to be installed in a new building, try to arrange that the emergency lighting is done as early as possible.

243. The use of way-finding methods, such as photo-luminescent signs and paints, to indicate key escape route features can be useful. For example, to emphasise changes of floor level, stairs and ladders, and obstructions such as pipes or features which extend into the escape route.

244. The correct operation of the escape lighting systems should be:

- routinely checked and tested by a responsible person;
- periodically serviced and any necessary rectification or repair carried out by a competent person having the appropriate level of training and experience; and
- the work should be carried out in accordance with the supplier’s instructions or, where relevant, to the appropriate standard, for example BS EN 1838: 1999. Keep records of the work carried out.

245. Test escape lighting at a time of minimum risk, eg when the site is substantially unoccupied. Powered systems usually need to recharge, and photo-luminescent systems need to be reactivated after tests.

Section 4: Emergency procedures

246. The previous section described physical GFP measures. This section describes the management procedures to make sure that the physical measures will work effectively if they are ever needed. The key element is an effective emergency plan. This guidance concentrates on fire. However, there may be other potential problems for which emergency procedures and plans are necessary , such as flooding in excavations, tunnels, work near the sea or rivers, waterworks, etc or risk from asphyxiation or toxic gases. These should be integrated with fire procedures. Plan emergency procedures before the work begins and put general precautions in place to support these from the start of the work.

247. On existing occupied sites, liaise and agree emergency procedures with the other occupiers. Ensure that the means are in place to let each other know straight away if an emergency does arise. If simultaneous evacuation is needed, make sure the escape routes are of sufficient capacity to achieve this.

248. Some emergencies may require total evacuation of the site, eg where it comprises a single multi-storey structure. Some emergencies may only require partial evacuation, eg where a series of separate structures are present on the site. Careful thought needs to be given to ensuring that the means provided are appropriate and capable of achieving the desired goal.

249. As the nature of the work force changes it is important that any procedures are understood. If there are personnel on site who do not speak English, it is imperative that any instructions or procedures are made clear and they understand what is needed in the event of an emergency

Developing an action plan for fire

250. All emergency plans need to be clear, unambiguous and known to all who are on the site. When developing plans, consider the following aspects.

- Where will workers gather after evacuation from the site? (See *Assembly points*, paragraph ….)
- Who will be in charge of the situation and what will be their role? What information and/or training will that person need to carry out those functions? Fire wardens may need to be appointed to assist the person in charge (see *Fire wardens*, paragraph ……).
- How will the people in charge communicate with each other? (Radios etc.)
- How will you check that everyone has reached the assembly point, eg head counts or checking off against site security logs brought to the assembly point.
- Who will contact the emergency services.and how
- Who will meet the emergency services when they arrive and provide them with information. They will need to know of any particular risks, such as the location of LPG cylinders and the likely whereabouts of anyone unaccounted for who may still be on site.

- Consider workers whose first language may not be English.

251. The number of people involved in managing the emergency response should be kept to a necessary minimum. This will reduce the scope for confusion between different parties carrying out different tasks during the emergency. Nominate and train deputies to cover for key personnel when they are absent, eg for sickness or holidays.

Fire wardens

252. On larger sites, the appointment of fire wardens may be appropriate to:

- check that the site's fire precaution rules are observed, and that the GFPs remain adequate, available and in good order; and
- liaise with the fire brigade if there is a fire and provide information on access, people trapped and any special hazards, etc.

253. It is important that when such people are appointed, they are trained and given the necessary authority to carry out their tasks.

Liaison with the fire services

254. In some cases, it will be appropriate for those managing construction work to liaise with the local fire service before work starts. Where there is liaison, it is important that the fire service is kept informed of any changes affecting access and fire-fighting facilities as the work progresses.

255. Liaison with the fire service may be relevant, especially on large sites or if any of the following apply.

- A substantial risk to the public, eg where fire in a large city centre site may result in the need for large-scale evacuation of heavily occupied neighbouring areas.
- Where there are particular risks posed to firefighters, eg the presence of large numbers of gas cylinders or flammable liquids on site.
- Where the fire service's access to the site may be limited, ie if access roads are narrow and congested or there is no access available to one side of a large site.
- Where water supplies are limited or do not exist, eg a large factory development in a green field site.
- Where work takes place above 18 m (specialist access equipment may be required) and anywhere else where specialised rescue equipment may be needed, eg tunnels.
- Where sleeping accommodation is provided for construction employees.

256. Liaison with the fire service provides them with important information which they can use to plan their response, especially for higher-risk sites.

Monitoring GFPs and fire practices

257. It is important that escape routes are checked regularly. The frequency of this will depend on the complexity of the site and the rate of change. Usually at least a weekly check will be needed, and on larger and higher risk sites a daily check of the main escape routes.

258. Fire alarm systems should be checked weekly to ensure that they work and can be heard in real conditions. This should be at the same time each week and people should be informed that the alarm, at that time, is a test. Keep simple records.

259. Fire drills, in which the entire workforce evacuates the site, are a useful means of checking that the GFP routines are effective. However, it is recognised these can often be impracticable and of limited use due to the continually changing nature of sites and the workforce on them. But as the risks of, and from, fire increase and the number of people on site rises, the need for at least one drill increases (often when the main structure of the building is complete) in order to check for problems, such as 'bottlenecks', etc.

260. In the absence of periodic fire drills, it is still important to check that those on site really do know what to do if there is a fire. Asking individual workers 'What is the fire alarm?' and 'What would you do?' are a useful way of checking that the instruction and information has been adequate.

Fire instruction notices

261. Fire instruction notices (see Figure 16) should be permanently and prominently displayed on major escape routes, places where people meet, circulation spaces, etc. They should clearly outline:

- the action to be taken on discovering a fire including raising the alarm and first-aid fire fighting; and
- the action to be taken on hearing the fire alarm including evacuation, assembly and accounting for people.

262. On larger and higher risk sites, consider supplementing these notices with information specifically given to the individual, eg as a card with the pay packet or information during site induction procedures. Site visitors also need to be made aware of what to do if there is a fire.

Figure 16 Typical fire notice format with space for entering clear and concise instructions on what to do if there is a fire

Information, instruction and training

263. The fire instruction notices are only intended to serve as a reminder. All people on site, even if they are there for just a few hours, should receive sufficient information to know what to do in the event of fire.

264. The minimum information that needs to be given, and should be given to people the first day they are on site, is:

- the location and use of the escape routes from their working area; and
- the location and operation of the first warning system in their working area.

265. People will need to be regularly updated on any changes.

266. People required to perform specific functions in the event of fire should be given the additional instruction and training needed for them to carry out their duties. For example:

- anyone expected to use fire-fighting equipment, including an extinguisher, should be given instruction and, if necessary, training on the correct selection and use of this. In particular, they need to know when to tackle a fire and when to leave it;
- equipment such as oxyacetylene equipment, bitumen boilers, etc, can turn small fires into very big ones if they are left on during a fire. Those in charge of such equipment should be instructed to turn them off, where this can be safely achieved without danger to themselves; and
- fire wardens, where they are expected to liaise with the fire brigade, require information to carry out this role effectively. They need to be kept up to date with changes to the site, including those that might affect access for the fire brigade, the location and number of people on site, processes presenting a high fire risk and availability of water.

267. You must provide adequate fire safety training for your staff. The type of training should be based on the particular features of your premises and should:

- take account of the findings of the fire risk assessment;
- explain your emergency procedures;
- take account of the work activity and explain the duties and responsibilities of staff;
- take place during normal working hours and be repeated periodically where appropriate;
- be easily understandable by your employees and other people who may be on site; and
- be tested by fire drills.

268. Your training should include the following:

- what to do on discovering a fire;
- how to raise the alarm and what happens then;
- what to do upon hearing the fire alarm;
- the procedures for alerting contractors and visitors including, where appropriate, directing them to exits; and
- the arrangements for calling the fire and rescue service.

Section 5: Temporary accommodation units

269. This section concerns temporary accommodation units (TAUs) such as offices and canteens occupied by people at work on construction sites. The standards described only apply to accommodation provided during the construction phase. **They are not requirements for completed buildings**.

270. TAUs can vary from very simple single site huts (see Figure 17) or caravans to complex multi-storey composite units housing many staff.

271. TAUs are usually situated in the open air, but where they are located inside structures this gives rise to particularly acute risks, since smoke will accumulate very rapidly and escape routes become blocked very quickly. In addition, they can set the entire structure on fire, putting everyone on the site at risk.

272. Only use TAUs for their intended purpose. Offices in particular should not be used for storing materials, especially highly flammable ones such as paint.

273. Preventing fire is the primary aim, but being able to deal with it is also important. In simple cases, such as a single site hut located on an open site, little beyond basic precautionary measures are appropriate such as:

- keeping a tidy office;
- providing a fire extinguisher;
- enforcing smoking rules;
- correct installation and careful use of heaters and cooking equipment (see *LPG*, paragraph …; and
- properly installed and maintained electrical services (see *Electrical installations*, paragraph ….).

274. More extensive precautions in the following paragraphs are required as TAUs and the associated fire risks increase in size and complexity.

Location and fire integrity of TAUs

275. Ideally, TAUs should be located away from the building work (6 m) in the open air. If TAUs have to be located closer, the risk of a TAU fire spreading can be reduced if either the TAU or the part of the building adjacent to it is fire resisting. If TAUs are situated inside buildings or structures, their fire resistance needs to be considered more carefully. The Loss Prevention Council Standard LPS 1195 sets out fire resistance criteria which are appropriate in these circumstances.

276. This standard applies specifically to temporary buildings and not parts of existing buildings, but the same standard may be useful in informing what requirements the latter should meet.

277. Where TAUs are vertically stacked, the roof/floor assembly and the supporting members should be protected to achieve 30 minutes fire resistance (integrity, insulation and load-bearing capacity).

Means of escape

278. TAU complexes can be assembled in many different combinations. As they increase in size and complexity, careful consideration needs to be given to ensuring that:

- there are at least two means of escape in different directions;

- if escape is possible in only one direction, the escape route is adequately protected so that if it is ever needed it can be used; and
- sufficient escape stairs are provided and protected.

Raising the alarm

279. All TAU complexes should be provided with a means of raising the alarm. The nature of it will vary, but the main requirement is for it to be audible throughout the complex.

280. An electrical break-glass system complying with BS 5839: Part 1, 2002 + A2: 2008 is likely to be needed where:

- more than 20 are present at any one time;
- more than ten are present at any one time above the ground floor; and
- the complex comprises three storeys or more than five rooms.

281. For fewer people and smaller complexes, manually operated devices that are clearly audible to all those in the complex may be adequate, but self-contained, electrically operated alarms comprising actuation switch and sounder are preferred.

282. Test both manual and more sophisticated fire alarms weekly to check that they work and can be heard in real conditions. Keep simple records.

283. For individual and pairs of non-compartmented TAUs a shout of ‘fire’ is adequate provided it can be heard in practical circumstances.

284. For TAUs within the building under construction, the TAU alarm system should be integrated with that for the rest of the building.

Fire-fighting equipment

285. Provide all TAUs, however simple, with some form of fire-fighting equipment and a sufficient number of hand-held extinguishers. The most typical fire risk in TAUs involves materials such as wood and paper. Water-based extinguishers should be provided for this.

286. Where large pieces of electrical equipment are used, eg computers or photo-copiers, carbon dioxide extinguishers should be provided.

287. Provide TAUs where flammable liquids or similar materials are kept with dry powder extinguishers.

288. In kitchen and canteen areas, where cooking oils are used, fire blankets should be provided.

Staff instruction and training

289. Emergency plans should take TAUs into account as well as the rest of the site.

Section 6: Sleeping accommodation

290. The fundamental principles for minimising the risk of fire occurring and preparing for it if it does, need to be addressed in depth for sleeping accommodation. The details are beyond the scope of this guidance and specialist fire safety expertise will normally be required.

Within the building being constructed

291. Even though a partially completed building (of whatever type) might contain space suitable for contractors to sleep in, sleeping arrangements **must not** be allowed in the building during the construction phase.

In proprietary designed sleeping accommodation

292. It may be acceptable, in limited circumstances, for construction employees to sleep on some projects, eg in purpose-built accommodation (including hut-type dormitories) placed on site with adequate separation distances from the risk/building under construction. This accommodation needs to be fully fire risk assessed to identify needs the of fire-fighting apparatus, fire alarm and auto detection, emergency lighting, etc, and obviate such risks as cooking, smoking, flame or radiant heating etc (DCLG *Guide on Sleeping Accommodation*, refers).

293. Worker caravan parks are sometimes provided. Caravans are often highly combustible and fire can spread quickly between them if they are parked close together. Fire prevention and precautions need to be planned for caravan sleeping accommodation as much as any other, but particular attention should be given to:

- the area provided. It should be enclosed by a palisade, fence or hoarding such that there is no direct interconnecting route between the caravans and construction site areas;
- adequate space between vehicles. A minimum 6 m separation is recommended; and
- provision of adequate emergency alarm and fire-fighting equipment.

Section 8: Higher fire risk methods and materials of construction

294. Some methods of construction use technology, composite materials and conventional materials to produce buildings that are often cheaper and quicker to erect or have different properties to traditional buildings. Some of these components are produced off site, which are then assembled on site doing away with or reducing the use of many traditional wet trades such as bricklaying, plastering and plumbing.

295. Because of the nature of their component parts, for example timber, they are more vulnerable to fire during the construction-phase, when frames, supports etc are unprotected and exposed.

296. It follows that during construction, fire preventative measures should be of the highest order, with a high level of housekeeping, to ensure that additional fire loading is kept to a minimum. Any fire at this time, when the supporting frame is exposed, may result in rapid fire spread, accompanied by structural collapse.

297. From the start of the contract to hand over to the client, the person in control must be engaged in and aware of the control measures to be followed to prevent fires on site.

298. In these types of structures fire can spread rapidly, making effective fire fighting almost impossible and extremely hazardous. In such cases, the complete loss of the building is almost inevitable.

299. Because of the potential higher risk, extra precautions may be needed at certain vulnerable times of the build. The precautions listed below, in respect of high-risk buildings, are additional to the other fire precautions discussed in this guidance for all projects.

300. See appendix 2 for check list

Timber frame buildings

301. Timber is an accepted form of construction and has been used as a building material for centuries. Building Regulations require a range of features in finished buildings to meet the high standards of fire protection applied to any other type of structure. The protection of a timber frame from fire is provided by the materials which cover the frame (eg plasterboards, plaster skim, tiles in non-combustible frames, appropriate insulating material etc). However, as with any other building, during the construction phase before the protective measures in the completed building are installed high standards of control are needed to prevent/ control fires and protect people.

302. Dutyholders should consider the use of timber and/or materials that have received an appropriate fire protection/retardant treatment for timber buildings. This will not only provide additional safety during the construction phase, but gives added protection for the completed building.

303. The period of maximum vulnerability, during which fire may spread from one to another, must be considered in detail and minimised as part of the fire risk assessment.

304. Large timber-framed structures should be subdivided into fire compartments at the earliest stage possible to prevent fire spread and ensure safe travel distances can be achieved for any personnel within the structure (see table ……).

305. Where there are a number of timber-framed structures that are being built on one site, the risk of fire spread from one building to the next must be considered and controlled. For example, the installation of non combustible materials can help to achieve this. This protection should not compromise any emergency exits.

306. The risk of the fire spreading to an adjacent property outside the site perimeter should also be considered, and where necessary controlled.

Composite building panels

307. Composite panels (sometimes called sandwich panels) consist of two metal faces positioned on either side of a core of a thermally insulating material. These are bonded together so that the three components act compositely when under load.

308. Many of the thermal insulating products used in sandwich panel systems are combustible (eg expanded polystyrene (EPS), extruded polystyrene (XPS), polyurethane (PUR), polyisocyanurate (PIR)). When openly exposed to a fire they will burn.

309. Designers should consider the potential fire risks when specifying composite panels in the structure. The risk may be better controlled by specifying a non-combustible panel.

310. As with other high-risk construction methods, incorrect installation, such as poor joint detailing and inadequate support, can lead to exposing combustible material directly to a fire condition.

Civil engineering projects

311. In some specific civil engineering projects, such as tunnelling operations, fire risks will need to be especially assessed. For example, it may not be practical to achieve the recommended safe travel distances. Specific, fire-engineered measures may need to be implemented following assessment by a suitably qualified person.

Section 8: Guidance for multi-storey buildings (new or refurbished)

312. There are many definitions for high-rise buildings. The Building Regulations require additional measures on buildings above 18 m. The fire service class buildings above 30 m as high rise. The important factor, in relation to construction site fire safety, is that the risks associated with the build can be adequately controlled and the general fire precautions needed, in the event of a fire, are satisfactory to make possible the safety of any person on site.

Process fire safety considerations for multi-storey buildings

313. The problems in multi-storey buildings under construction or refurbishment relate to the process of building. For example, many of the safety features that make the completed building safe in fire terms, such as correct compartmentation or fire engineered solutions, are missing or incomplete.

314. Sites are often in built-up areas and within close proximity to other structures. The risks associated with this, such as access and risk to other properties, need to be considered from the design stage and onwards.

315. Incomplete or absent fire-engineered solutions or incomplete compartmentation of the structure may lead to a very rapid spread of smoke and flames. In these circumstances, a specific fire-risk assessment should be undertaken at the design stage to develop appropriate provisions, primarily to ensure that the building can progress whilst protecting workers or others. It may be necessary to put in temporary compartmentation or other fire-engineering solutions.

316. It is becoming more common for completed floors of multi-storey buildings to become occupied by the client while construction continues on the other levels. If this is being considered, it must be addressed at all stages including the design phase. At this stage, the fire-risk assessment must be completely re-evaluated. It may be that the occupier does not allow those involved with the construction process access to occupied parts of the building, in particular stairwells and escape routes. If this is the case, it will be necessary to ensure that adequate means of escape can still be provided for construction personnel and that the fire alarm systems for the occupied parts of the building, and that still under construction, are co-ordinated. Remember, an emergency in the occupied parts of the building could affect the construction site and vice versa. It must also be noted that the fire enforcing authority for the GFP may change from the HSE to the Fire and Rescue Authority.

317. The laws of physics dictate how high water can be pumped – so as the building progresses designers and principal contractors need to be aware and work with the fire brigade to address this, for example by early commissioning of rising fire mains as the building is constructed and before work commences inside.

General fire precautions on multi-storey buildings

318. The provision of adequate GFP, such as escape routes, the travel distances to a safe place, lighting and means of raising the alarm, are also complicated in all areas of a multi-storey building as it progresses. There are a number of sites where construction progresses at heights at which normal fire-protection measures may not be applicable.

319. Because of the extended times necessary to escape from the structure and to maintain the safe travel distances (table ….), compartmentation will be required. The

compartmentation will need to prevent smoke and flames both vertically **and** horizontally. The following actions should be undertaken at the earliest opportunity.

(a) Compartmentation should be created using temporary, fire-stopping materials having no less than one hour of fire resistance until the permanent fire-stopping arrangements can be put in place. Vertical risers, stair wells, lift shafts (including tower crane shafts) should be closed off at all levels with self-closing doors having one hour of fire resistance to separate them from the floors.

(b) The main stairways will probably provide the primary means of escape and, if this is the case, they will need to be provided with self-closing, fire-resisting doors (temporary if necessary) to protect their integrity. If the main stairways are not available then alternative protected routes will be needed. These alternative routes will have to take into account the number of personnel on the contract and safe travel distances.

(c) At least one staircase should be designated as the fire-fighting staircase for the use of the fire brigade during the course of an emergency.

(d) Any fire-fighting lift in the building should be commissioned and brought into service.

320. As the building extends, it is essential that the fire alarm extends with it so that it is audible and visible in all areas of the build at all times. The fire alarm should be an electrically-operated system throughout the height of the building, comprising: break glass (or similar); call points and sounders on all levels (it may be possible to install the hard-wired system as the building progresses but radio operated systems can also be considered); a link to an occupied office (or similar) from where the fire brigade can be summoned; and activated fire-fighting systems. Other elements of the emergency plan must be put in place to accommodate the size of the build.

321. On large buildings, it is likely that temporary lighting will be provided for work to be carried out in the interior. Careful consideration will be needed on the provision of emergency lighting should the power fail for any reason.

322. If fire-engineering solutions, such as sprinkler systems, are to be installed in the completed building, consider commissioning them as soon as possible to ensure the safety of personnel during the build phase.

323. Any controls identified in the risk assessment needed to enable personnel to exit the building in an emergency. These should be in place as soon as needed (whatever the height) and the site should not rely on the fire service to provide mechanical rescue.

Appendix 1

Which authority enforces fire safety

324. The law that determines the enforcing authority is complex. The following section aims to set out what the legal position is regarding enforcement of fire safety on construction sites.

325. Remember that legislation distinguishes between the general fire precautions and fire risks that arise from the construction process.

326. Process fire safety matters, are precautions to prevent fire starting in the first place and prevent spread. Process matters include the safe use and storage of flammable materials and precautions to ensure that work processes do not start fires.

327. General fire precaution (GFP) matters deal with the actions needed should a fire occur. GFP matters include raising the alarm, means of escape, fire-fighting facilities and emergency planning.

Process Safety

328. The enforcing authority for the construction site is determined by the Enforcing Authority Regulations), In most cases for a separate/ segregated construction site, this will be HSE. If the construction site is not separated from the normal activities of the premises then the usual enforcing authority for those premises (HSE/ local authority) will have enforcement responsibility for process safety. For most workplaces other than construction sites GFP are enforced by the Fire and Rescue authorities

General fire precautions for stand-alone construction sites (figures A and B below)

329. HSE is responsible for the GFP within the curtilage of the construction site. Fire and rescue authorities would enforce any site office and similar accommodation not within the site curtilage, ie separated by distance, such as a road.

330. In the case of sleeping accommodation, if within the curtilage of the site, it is for HSE to deal with. If outside the curtilage of the site, it is the responsibility of fire and rescue authorities.

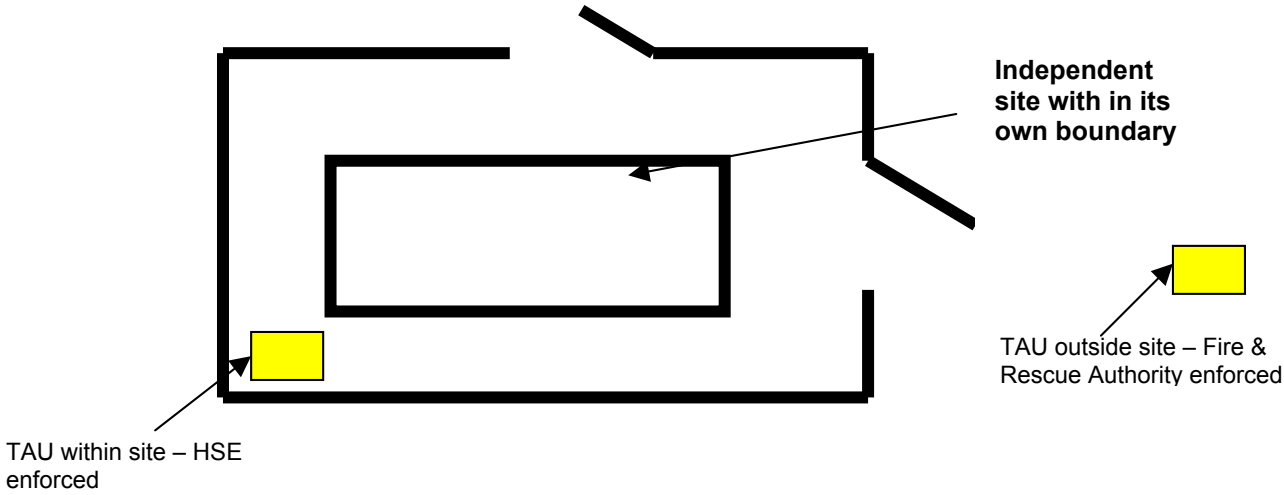
Construction site in shared location/premises (figure C below)

331. On any site contained within or that forms part of another premises, where it either remains or becomes occupied by persons other than those working on construction, GFP enforcement for the premises containing the construction site rests with the enforcer for those premises (ie they are responsible for the GFP of the construction site as well). This is to ensure that if a fire on the construction site can affect persons within the other premises or visa versa, the GFP are co-ordinated.

Minor construction work

332. Minor construction work is work that does not constitute a construction site as defined by CDM. The GFP requirements in respect of minor construction work, for example decorating, are covered by the general requirements of the RRO or the FSA, and responsibility for enforcement rests with the relevant enforcing authority for the premises in which the minor construction work is being carried out.

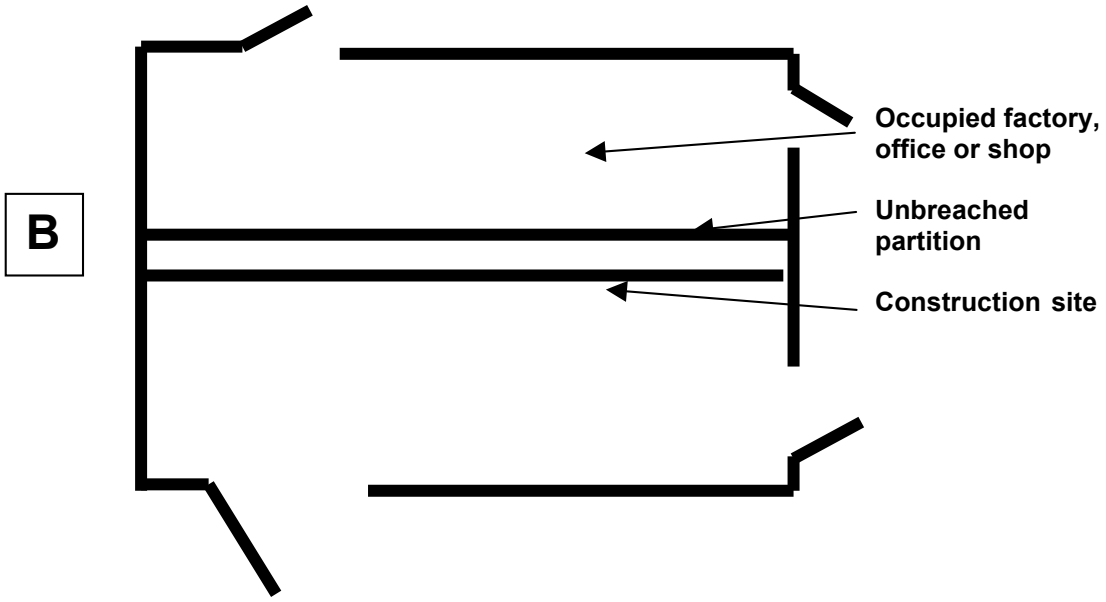
Figure A Independent construction site with its own boundary



333. Site A is a complete separate site (new or being refurbished). It is isolated, contained within its own site fence and the only people present are engaged in construction.

334. A fire on this site would not affect others. This is considered a separate premises so GFP are enforced by HSE. HSE will enforce process fire safety matters for the construction section.

Figure B Construction work is going on in the in one area and occupier activities are going on in the other.

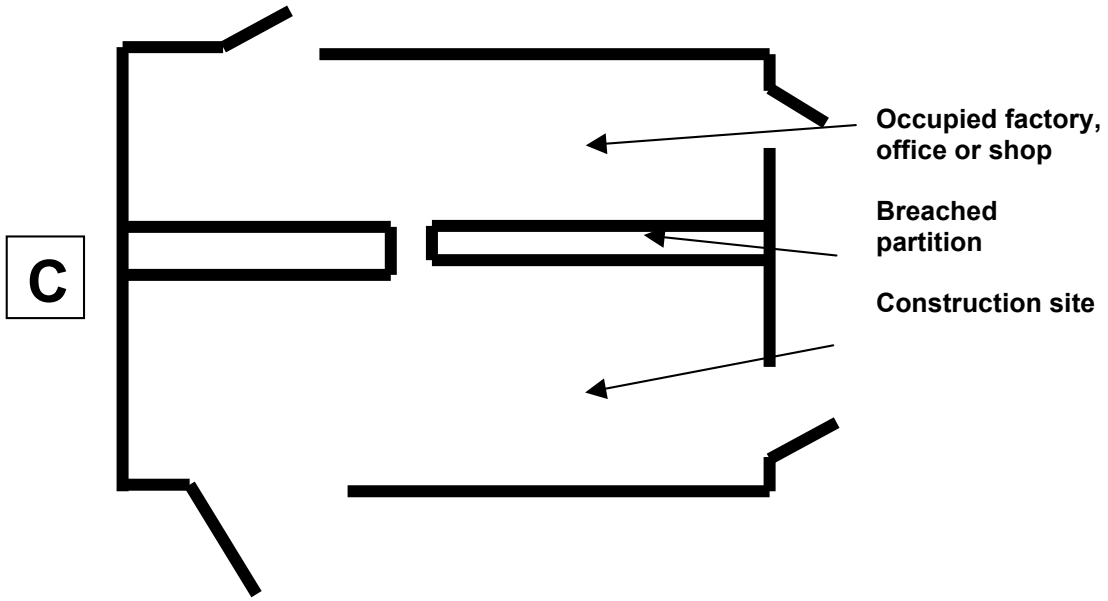


335. Site B represents an occupied building where the two sections are separated by an unbroken and continuous fire-resisting wall. The construction site should have its own fire fighting/alarm arrangements and adequate means of escape for construction staff. Similarly, the occupied section has all of its own arrangements in place. In effect,

the occupied and construction sections are considered as completely separate premises.

336. A fire on this construction site would not affect another area. Consequently, HSE enforces the GFP in respect of the construction activities. HSE will enforce process fire safety matters for the construction section.

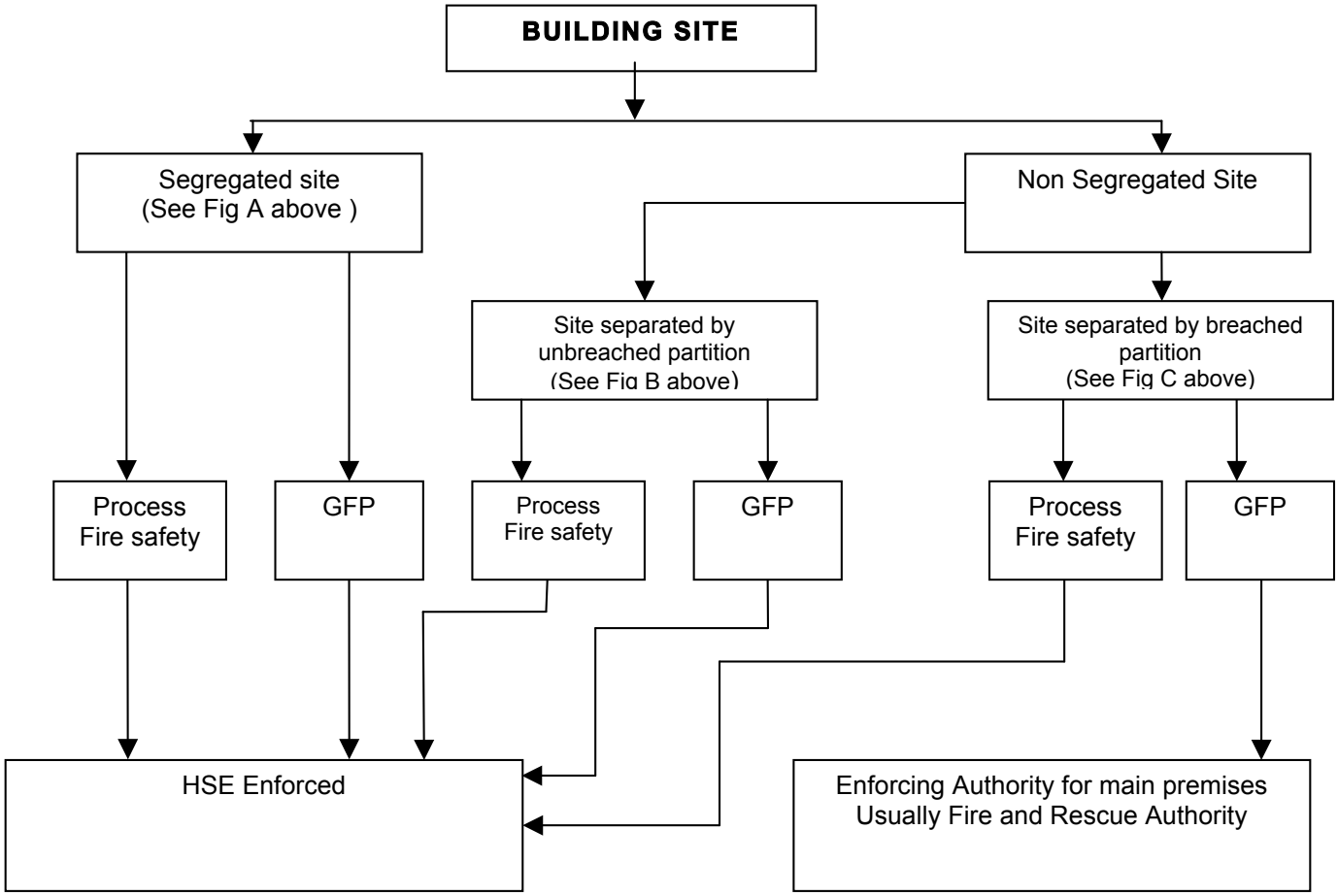
Figure C Is similar to site B except that the structure between the two does not provide suitable fire-separation.



337. As a result, a fire in the construction area will have implications for the occupied section and vice versa because fire and smoke can spread from one section to the other, and because parts of the escape routes are shared by occupier and construction staff. Consequently, the two sections are not sufficiently separated to form individual premises and any precautions need to be co-ordinated. The Fire & Rescue Authority will therefore be the enforcing authority for GFP requirements in the construction section and the occupied premises.

338. HSE will still enforce process fire safety matters for the construction section.

FLOW CHART TO SUMMARISE ENFORCEMENT ON CONSRUCTION SITES



339. **Process fire safety matters**, are precautions to prevent fire starting in the first place and prevent spread. Process matters include the safe use and storage of flammable materials and precautions to ensure that work processes do not start fires.

340. **GFP** (General fire precaution) matters deal with the actions needed should a fire occur. GFP matters include raising the alarm, means of escape, fire-fighting facilities and emergency planning.

Appendix 2

Process fire safety: How to stop fire occurring during the construction phase	
For all construction (including high risk)	**Additional for high risk such as timber frame**
Planning	
Precautions Should be considered at the design stage and before work starts. Materials, methods of construction and site processes should be selected to minimise fire risk. For example alternative specifications for materials which are fixed together using mechanical rather than hot means can reduce risk. Sites involving higher risk materials and processes will need higher standards of general fire precautions. Any design and specification changes which can be made to reduce the fire risk will reap benefits in the extent and nature of required GFPs. Reducing the risks is particularly important when there are constraints which cannot be removed such as location of site and space available. A detailed fire risk assessment and required controls needs 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. Process fire risks must be considered in conjunction with the general fire precautions which will be required at particular stages. A high degree of communication and cooperation is required between all parties including principal and sub contractors to ensure adequate controls are in place at all times.	Consider the use of timber and/or materials that have received an appropriate fire protection/retardant treatment. The stage when buildings are at their most vulnerable of fire spread from one to another must be well thought out and minimised as part of the fire-risk assessment. Adjacent properties outside the site perimeter should also be considered and, where necessary, controlled.
Reduce amount of combustible material	
Substitute with less combustible or fire-resisting materials. Soft landing system bags should be fire retardant. Reduce presence of protective coverings can contribute to the overall fire load. Install vulnerable features as late as possible and ensure coverings are to flame-retardant specifications wherever reasonably possible. Ensure discarded coverings disposed of correctly	Consider the use of timber and/or materials that have received an appropriate fire protection/retardant treatment for timber buildings. This is particularly important for high-risk buildings.

Storage	
Plan to reduce storage of combustible materials (just–in-time ordering etc). Keep combustible material away from TAU and buildings being constructed, and escape routes. Control access to stores to prevent materials being distributed across site	Storage of flammable materials on high-risk sites must be especially considered and all necessary controls put in place.
Rubbish disposal and housekeeping	
Good housekeeping is essential– untidy sites are usually unsafe sites. Flammable materials such as timber become a lot more vulnerable if waste materials, such as timber shavings, paper and flammable materials are left lying around. Regular disposal of rubbish from the active areas of construction will help to prevent an accidental fire starting or stop an arsonist. Keep rubbish away from Temporary Accommodation Unit, buildings being constructed and any escape routes Control disposal points, secure and empty regularly . Organise regular removal off site.	
LPG, acetylene or other fuel types	
There is always a risk of fire, therefore, tight controls are needed. Highly combustible materials must not be stored in a building under construction. On all sites, storage areas must be at least X? m from any building, and containers and drums must not be stored within X? m of any building or boundary fence unless the boundary is a wall that will resist fire for at least 30 minutes. Adequate ventilation is essential Acetylene or oxidising materials should be stored and secured in a separate facility  . (It may be units are permitted during normal working hours but then removed from site). Fuels for generators etc should be dispensed in a safe area away from combustible material	On all high-risk or timber-frame sites, storage areas must be at least 15 m from any building. Containers and drums must not be stored within 6 m of any building or boundary fence unless the boundary is a wall that will resist fire for at least 30 minutes.
Hot works	
Avoid hot work as far as possible and have the work done off site (eg alteration of any structural steel) or with other methods of construction (eg push-fit services instead of soldered). If hot work cannot be avoided, ensure	The aim of all dutyholders, such as designers, principal contractors and sub-contractors should be to design out any hot works in any vulnerable areas of high-risk buildings. If hot work cannot be avoided, ensure that a

that a hot work permit system is in place. Find a safe area for hot work (keep combustible materials away from any hot work). Any area of hot work must be actively monitored for at least one hour after completion and the area should be revisited two hours later. This means that hot work cannot be carried out near the end of the day (within at least two hours of the site being vacated).	**rigorous** hot work permit system is in place. Any area of hot work must be actively monitored for at least one hour after completion and the area must be revisited two hours later. This will mean that any hot work cannot be carried out near the end of the day (within at least two hours of the site being vacated).
Ignition sources	
Smoking	
Should only be allowed in safe, designated areas that are a good distance away the building.	All timber-framed and high-risk developments must be 'no smoking' sites and a smoking ban must be more vigorously enforced by the principal contractor. There must be a high standard of discipline to ensure that any smoking materials are kept safely away in a locker room.
Plant and equipment.	
Has the potential to increase the risk of fire (causes sparks, heats up or has flammable fuel), therefore each risk needs addressing.	It is common for contractors to be on site before arrangements have been made to provide a suitable power supply. Often they use generators. Immobile plant should be located in a safe area. Portable plant must be maintained, used and refuelled safely (eg a safe external refuelling area). A petrol generator should not be used within an unprotected timber building. In addition, it is recommended that a vulnerable building must be protected from any heat generated by working plant.
Electrical	
Fixed and portable electrical equipment should be used and maintained to control fire risk.	
Security/arson	
Arson is a regular cause of fire. Therefore, security has to be appropriate for the location of the site (both in terms of preventing arson and the consequence of a fire on any property adjacent to site and its occupancy, eg a petrol station or hospital). Good combustible material storage practices on site away from the secured site perimeter in secured compounds and containers can help deter opportunist vandals/arsonists.	Security can range from: in small sites in low risk areas, the safe storage of materials and site staff training, to out–of-hours security, CCTV and overnight lighting on larger sites in higher-risk areas; as a general rule, timber frame sites must be kept secure at all times with access ladders or stairs to upper levels made secure at the end of the day to prevent potential arsonists getting further into the building. Other possible access points such as windows should also be made secure as early as practical in the construction programme; and early plaster boarding and fire proofing of

	the ground floor level to reduce risk.
Site fires	
Avoid burning waste materials on site. Never use petrol or similar accelerants to start or encourage fires.	On high-risk builds, site fires should be prohibited.
Temporary accommodation	
As fire certificates are no longer issued by either HSE or fire authorities, the onus is placed on the firm (responsible person) to carry out a risk assessment, which defines the necessary precautions, and ensures these precautions are in place. TAUs should be located away from the building work (no less than 6 m) in the open air. If TAUs have to be located closer, the risk of a TAU fire spreading can be reduced if either the TAU or the part of the building adjacent to it is fire resisting. TAUs should be included in emergency plans. Litter skirts can be installed to stop extraneous material, such as combustibles, from accumulating under the units. The skirts also stop ignition sources, such as cigarettes, from blowing under the unit.	On timber-frame and high-risk sites, temporary accommodation, such as site offices should be separated from the building under construction by 20 m to establish a fire break. If this is not possible, other measures must be put in place to make sure the risk is controlled. TAUs should not be placed within high-risk buildings.
General fire precautions: What is needed in the event of a fire?	
For all construction	**Additional for high risk such as timber frame**
These need to be considered at the design stage and in conjunction with the assessment of fire risk from the processes, materials and build sequences to be followed. General fire precautions need to be planned at the design stage and considered for all stages of the project, including those where fire risks will be at their most critical. The emphasis should be on reducing the risk as far as possible. However, general fire precautions will always be needed to mitigate the effects of a fire occurring and ensuring the safety of anyone who might be affected by it. The complexity of GFP required will depend on the site specific risk assessment. A key principle should be to maximise the use of the finished building fire precautions to protect people during the construction work: on new build instal finished building fire precautions as early as possible; on	

refurbishment maintain as much as possible of existing building GFPS for as long as possible.	
Means of escape	
Need to consider the spread of smoke for all types of construction Travel distances to safety should be reduced to a minimum (see table X). The distances given are from the place of work to an exit from the structure, typically a door leading to the outside at ground level; or to a stairway or compartment protected against fire. Remember that routes in and out of the build may be incomplete and obstructions may be present. Make sure that: wherever possible, there are at least two escape routes in different directions; ladder access is only used for 10 people or less, ie, it is not suitable for complex, large two-storey properties or for members of the public or visitors); scaffolds include one or more stair tower. This could form part of the buttressing arrangements. Where buildings get higher than two and a half stories, ladders between lifts may not be right and offer only a limited emergency exit; and exit onto scaffold, if deemed part of escape plan, is easily accessible, ie not through a window opening unless it is full height with the panel removed or balcony opening; escape routes and exits are kept clear and are clearly signed (never locked when people are on site); emergency lighting is installed, if necessary, to enable escape. This is very important in enclosed stairways if normal lighting fails during a fire; and an assembly point is identified where everyone can gather and be accounted for.	In high-risk buildings, this should be approximately 25 m (12 m dead end). The speed of fire spreading through a timber or other high-risk structure means that there is a need to have very clear and effective emergency exit arrangements. If possible, stairs should be installed as the build progresses to give an internal exit route. This may not be achievable when sacrificial cassettes or crash decks are used. As such, the only means of escape is via the external scaffolding. Consideration needs to be given to the compliance with the travel distances above. Protected stairways may be necessary in many high risk buildings to ensure safe travel distances are maintained. Timber engineered 'I' beams are susceptible to structural collapse at an early stage and this risk will need to be reflected in the fire risk assessment.
Fire alarms	
Fire warning systems are needed on all sites other than very small sites. The type of alarm needed can range from manual bells or klaxons to sophisticated automatic systems. Whatever system is chosen, make sure that: it is appropriate for the size of the building, number of storeys and complexity;	In all, but very small, high-risk buildings, alarms should be interconnected (by protected cables or wireless) to enable all to hear (To BS 5839 temp alarms)

it can be heard by everyone working on site over normal background noise; it is located so it can be activated immediately (delay can be fatal); manual bells or klaxons are only used on very small sites if they can be operated away from danger; and on complex or multi-storey buildings, the alarm has an appropriate interconnected alarm (by protected cables or wireless) to enable all to hear (to BS 5839 temp alarms).	
Fire-fighting equipment	
Fire extinguishers should be: located at identifiable fire points at each storey exit; appropriate for the risk (for wood a combination of water or multi foam is necessary); and serviced and maintained by a competent person (often from the manufacturer). Those carrying out hot work should have appropriate fire extinguishers with them and know how to use them.	The fire-risk assessment may indicate that additional extinguishers are required especially near escape routes.
Compartmentation/stopping spread	
If fire safety (safe travel distances and preventing internal and external spread) cannot be achieved from a single fire zone (ie the whole structure), then consideration must be given to appropriate levels of internal compartmentation to protect escape routes and limit fire spread. A building can be sub-divided by fire-resisting walls and floors (ceilings).	The early installation and completion of compartments can provide protection during the construction phase. Any openings need to be protected to an equivalent standard of fire resistance to the rest of the compartment. This means that if doors are needed through the compartment, they need to be fire resisting. Work activities also need to be carefully monitored to ensure that any holes or gaps remaining after services are installed are correctly filled in (fire stopped). The final cladding should be put in place as soon as is reasonable to prevent external fire spread.
Emergency procedures **An emergency fire plan should be prepared for every site.**	
Small and low-risk sites only require very simple plans, but higher-risk sites will need more careful and detailed consideration, including: an emergency plan, which should be available before work starts, a responsible person to ensure that fire precautions are in place; an up-to–date plan that is appropriate for the circumstances and that makes clear who does what during a fire;	Higher risk sites will need more careful and detailed consideration. It is crucial to make arrangements to liaise with fire services during the pre-construction phase regarding access and water supply. If fire does occur, the fire services will need to know how the site is organised. It is useful to liaise with them beforehand so that they are aware of the site structure.

staff who know what they need to do if there is a fire; managers who need to make sure that everyone (including visitors) on their sites knows what to do. On larger high-risk sites, fire drills may be appropriate; fire drills, which are an important check for the principal contractor on whether induction and fire-safety plans work, and training for site workers; fire action notices, which should be clearly displayed where everyone on site will see them, for example at fire points, site entrances or canteen areas; on larger or more complex sites, fire wardens to ensure process and GFP controls are in order; arrangements to liaise with fire services; and arrangements to ensure instruction, information and training is given to all involved with work on the site.	

Appendix 3: Who does what?

341. Every dutyholder under CDM has to ensure the competence of those they appoint and reference should be made to the core competence criteria given in the CDM 2007 ACOP Appendix 4.

Reducing potential fuel sources

Clients

342. The client has a duty to provide the preconstruction information to designers and contractors even if the project is not notifiable, as in this instance there will not be a CDM co-ordinator. The client must take reasonable steps to obtain the relevant information even if they do not already have it in their possession

343. The client must take reasonable steps to ensure that management arrangements are in place for all projects, as well as ensuring that the principal contractor has prepared a construction phase plan for notifiable projects.

344. Provide information to the CDM co-ordinator on:

- site rules on fire safety standards at occupied premises;
- location of buried services;
- previous contents of tanks;
- previous uses of site and flammable materials likely to be present as a result;
- special precautions required for fire sensitive activities nearby, eg chemical processing;
- limits on site storage areas; and
- arrangements for, or limitations on, rubbish disposal.

345. Appoint competent and adequately resourced CDM co-ordinators and principal contractors. Ask questions where fire is an important issue, for instance construction work at a fuel storage depot or partial refurbishment of a heavily occupied city centre office block. Ask about:

- previous experience of similar work;
- internal arrangements already existing to address fire issues; and
- how candidates suggest dealing with the particular project's fire problems.

346. Where your activities overlap with those of a contractor, you might need to become involved in the operational management of site activities. However, the principal contractor has the main responsibility for co-ordinating site safety in these circumstances.

Designers

347. Consider your proposals in terms of the amount of flammable materials that are specified. If they are used only in small amounts the risk may be insignificant, but as the amount and variety of potentially flammable substances involved in a project increases, your role in their selection becomes increasingly important in controlling workplace

risks. Consider the whether design specifications have any effect on required working methods and eliminate possible fire hazards where were possible eg specify push fittings rather than soldered joints on pipework.

348. You need to know if the materials you are specifying are flammable or not, and if they are, to what extent. If you don't know, find out from manufacturers or suppliers. If less flammable alternatives are available, specify them unless there is a particular design reason why a more flammable one has to be used instead. Particular attention needs to be paid to the selection of:

- paints;
- solvents; and
- adhesives.

349. Consider if the use of such substances is really necessary. For instance, do you need to paint the wall of an underground car park at all?

350. The sequence of construction may have implications for fire loads. For example, if vulnerable internal fittings are designed for installation last, the need to protect them with potentially flammable coverings will be reduced.

351. Provide relevant health and safety information with your design for those who may need it during subsequent construction work. This could include:

- highlighting where significant amounts of flammable materials are specified; and/or
- information on intended installation sequences.

352. Pre-tender stage health and safety plans may need to consider site-wide fire issues and provide relevant information on fire risks, for example:

- location and nature of flammable substances on site;
- location of gas services;
- nature of nearby activities, especially if they are sensitive to site generated fire risks or pose fire risks to the construction work;
- details of any likely continued occupation of the site (especially in office or residential projects); and/or
- details of any intended construction processes or methods which lead to high fire risk.

353. It may also be possible and appropriate at the pre-tender stage to set out generally applicable site standards. This is more likely where premises are shared with occupiers and their needs have to be considered in the site arrangements. For example, there may be constraints arising from the occupiers needs on:

- rubbish removal and clearance; and/or
- the nature and location of flammables storage.

354. This does not detract from the principal contractor's duty to develop the subsequent construction phase plan, but it is legitimate for the CDM co-ordinator to describe the general limitations within which the construction phase plan has to be drawn up.

Principal contractors

355. Draw up the construction phase health and safety plan. This should describe the day-to-day standards to be observed on site. Site rules within the plan can be a particularly important part of controlling the accumulation of flammable materials. Site rules can include standards to be followed including:

- frequency of rubbish clearance by contractors;
- location and nature of rubbish storage facilities to be provided;
- frequency of emptying communal skips;
- bringing flammable substances onto site; and/or
- storage arrangements for any flammables brought onto site.

356. Make sure that contractors' and individuals' responsibilities in implementing fire precautions are clearly identified.

357. Make sure site workers are familiar with site rules and procedures. Prominent display of notices and/or inclusion of rules with pay packet slips are effective means. On larger sites involving higher risks and large numbers of contractors, site induction training may be more appropriate.

358. Whenever necessary give the construction phase health and safety plan, and rules contained in it, to subcontractors during the tendering process. Usually it is simpler for contractors to build decided fire safety standards into their tender proposals at this stage, than later on when it becomes more difficult to amend developed proposals.

359. Make sure parties are complying with the plan. Mere drafting of site rules in themselves will not ensure adequate standards are achieved on site. Arrange for positive inspection of fire safety standards. You can either do this yourself or delegate monitoring responsibilities to other parties.

360. Inspection regimes may vary from site to site. Where fire risks are low such as during the frame erection stage of a steel frame building, inspection for fire matters will be a low priority compared to potential falls during steel erection. However, fire safety will, for example, require much closer monitoring during the fit-out stage of an office refurbishment contract.

361. If poor fire safety standards or non-compliance with site rules are found during inspection, you will need to resolve such matters. Where risks are high, a formal and systematic approach for resolving shortcomings may be needed to ensure that action is taken. This is especially significant where many different contractors are present on the same site.

Contractors

362. Both you and your employees need to comply with site rules. Either the employing contractor or the principal contractor should be able to provide appropriate information. It will often be more convenient for the principal contractor to do this, eg through site induction procedures. However, this does not alter your duty to ensure your own employees are adequately informed. There should be clear understanding between principal contractors and contractors on how the information is to be provided and by whom.

363. Provide principal contractors with relevant information on fire safety matters. In particular, inform principal contractors where there are difficulties in complying with the health and safety plan or where fire safety issues are discovered that are not addressed by the existing plan. For example, inform principal contractors if:

- you need to bring significant amounts of flammable materials onto the site that were not envisaged in the health and safety plan;
- rubbish skips are not being emptied; and/or
- flammable material is discovered during work, eg groundworkers discover drums of buried waste or unforeseen gas services during excavations.

Reducing ignition sources

Clients

364. Ignition sources, on site during the construction phase, are largely outside your control, so you may not have much relevant or useful additional information to provide to CDM co-ordinators.

365. In some cases, you may wish to specify operational constraints to take into account the risks to your own employees who may be affected by the construction work, especially if the work is in high-risk areas such as in a chemical plant.

Designers

366. Ignition sources are usually on site more as a result of the way contractors carry out their work rather than the designs that they are attempting to construct. However, you can reduce the need for hot work in your designs. Ask the following questions.

- Can steel components be fabricated off site rather than being welded on site?
- Can steel sections be bolted rather than welded together?
- Can you specify push or thread fit plumbing connections rather than brazed jointing?

CDM co-ordinators

367. Successful control of ignition sources is largely dependent on detailed day-to-day site control, but some site-wide constraints may be appropriate for inclusion in the pre-tender health and safety plan, especially where such matters arise from constraints placed by the client, for example, the need for hot work permit-to-work systems for certain high-risk circumstances.

Principal contractors

368. The construction phase health and safety plan and site rules arising from it are a primary means of managing ignition risks. This is especially significant in situations where there are many trades on site requiring tight management control to ensure that they all comply with appropriate standards. The detail required in the plan will depend on the level and extent of risks on the individual site concerned. Construction phase plans can usefully consider the following.

- Permit-to-work systems. Are they necessary? If they are:
  - who will administer and control their implementation?
  - what sort of work will they apply to?
  - where on the site will they apply?

- Details of any smoking policy. If designated smoking areas are to be provided, where will they be?
- Scrutiny of proposals for high-risk work in detail, eg tank demolition. Subsequent agreement with the contractor concerned, of detailed safety method statement and confirmation of clear and specific rules relating to the work.
- Specification of any banned or restricted equipment or activities, for example:
  - unauthorised additions to electrical system;
  - use of blowlamps;
  - possession of lighters;
  - lighting of fires.
- Nomination of specified electrical contractor and clarification of their role.
- Details of site security arrangements and the allocation of clear authority to security staff to carry out their work.

369. You may need to amend site rules as circumstances change during construction.

370. Make sure that there is active monitoring for compliance with site rules. Allocate clear responsibilities for this and ensure that on-site managers are provided with the necessary authority to demand that shortcomings are rectified. You may wish to specify disciplinary action to deal with persistent breaches of site rules.

371. The construction phase plan and any site rules should be disseminated to contractors and the workforce.

Contractors

372. Consider information and standards provided in your tendering proposals.

373. Make sure that you and any of your employees are familiar with site rules and comply with them.

374. If you are carrying out work involving particular ignition risks, such as welding or plumbing, make sure your employees are familiar with the risks involved and competent to deal with fire if it breaks out. For instance, welders and plumbers should be familiar with the nature of permit-to-work systems, and the basic precautions required. You may need to co-operate with principal contractors in achieving this by providing information and training at sites.

375. Both you and your employees should inform the principal contractor of any relevant matters which arise during the work. For example:

- poor or damaged electrical installations or equipment;
- occurrence of any minor fires; and/or
- difficulties met in complying with site rules, for example if a need to use blowlamps develops but the site rules ban their use.

General fire precautions

Clients

376. Providing general fire precautions on site is often outside your control so you will have little role in providing them.

377. If during the construction phase existing precautions installed in your building need to be maintained, you should provide the CDM co-ordinator with relevant information. This might include:

- location of dry and wet risers;
- installation diagrams of the fire alarm system;
- operational status of equipment, eg are the sprinklers still connected?
- existing means of escape provision.

CDM co-ordinators

378. General fire precautions are a site-wide issue, so you need to address them in the pretender stage health and safety plan. Information on design conclusions relevant to construction phase fire safety should be included in the pretender health and safety plan. Principal contractors need this information to arrange for appropriate construction sequences so that, for example, protected stairways are installed at an early stage.

Designers

379. In new buildings and refurbishments, fire engineered solutions are sometimes used to meet building regulation requirements in completed buildings. In this case, the building, during construction, and personnel within may be at higher risks, for example, compartmentation may be incomplete, smoke vents or sprinklers non operational. The designer must consider the building process and minimise the risk as far as possible. It is also very important to pass any relevant information to the contractor to enable them to commission early the engineered solutions or put in place temporary measures to ensure the safety of site personnel in the event of a fire.

380. You will have little influence on the provision of temporary precautions provided solely during the construction phase, such as hand-held fire extinguishers. You have more potential in providing design features to improve general fire precaution standards during construction. The following matters can usually be considered. Many of them will be required anyway as part of the specification for the completed building. It should often be straightforward providing them for the benefit of construction workers as well as the final occupants.

- Arrange for wet and dry risers to be installed early in the construction sequence. This is important in high-rise projects.
- Arrange for compartmentation to be introduced at as early a stage as possible. This may not always be easy to achieve but can substantially reduce the spread of fire and smoke where it is feasible and should be considered in higher-risk projects.
- Arrange for fire doors to be installed at an early stage, especially in protected stairway escape routes. Temporary doors can be specified during the construction phase if necessary to avoid damage to the final items.
- Internal stairways are usually a fundamental part of the design and can generally be installed at an early stage to provide protected

means of escape. They also have the operational benefit of easing movement about the site.

- Consider installing permanent alarm systems at the start of the fit-out stage or before.

381. The above list contains some basic construction phasing issues. For instance, installation of primary stairways is dependent on, and affects, other design features. It is therefore important that you liaise with other designers and members of the project team on such matters.

Principal contractors

382. You need to address general fire precautions in the construction phase health and safety plan. Underlying design assumptions (such as phasing of stairway installation) should already have been made clear and indicated to you in the pretender health and safety plan from the CDM co-ordinator. You will need to ensure that those criteria are reflected in construction sequences and methods. Provide relevant information to the contractors concerned with those parts of the project. Both you and the contractor should be clear about who is doing what and when so that you can comply with design decisions.

383. The construction phase plan also needs to address detailed operational matters as well as the implementation of design criteria. Items could include:

- nature, amount and location of fire points;
- arrangements for inspecting and maintaining fire-fighting equipment;
- clarification of the arrangements for alarm and checking that it is effective;
- any arrangements for provision of emergency power and lighting. What is to be provided and by whom?
- work on protected means of escape requiring openings to be made in them. Can this be done at weekends or during slack times so that the minimum number of people are at risk if a fire occurs when the fire resistance of the escape route is compromised?
- clarification of the role of scaffolding as a means of escape;
- specific site rules, eg:
  - keep means of escape clear;
  - no horseplay with extinguishers; and
  - inform management if extinguishers are used.

384. Make sure parties follow the construction phase plan. Take positive action if they are not doing so.

Contractors

385. Make sure that you and your employees comply with site rules and other elements of the construction phase plan. Are you and your workers aware of relevant parts of the plan? In practice, this may often be achieved through the principal contractor informing your employees directly, but you should not merely assume this will happen. For example, if you think that site induction training will be provided, check that this is the case.

386. Inform the principal contractor of any problems in complying with the plan, non-compliance with it or shortcomings noted in it. It is especially important that anyone installing design features such as stairways, who anticipates or finds problems in complying with the standards or times specified in the plan, should tell the principal contractor.

Emergency procedures

Clients

387. If you share occupied premises with construction workers, provide information on existing emergency arrangements to the CDM co-ordinator. This could include information on the following:

- when you will have fire drills;
- limitations on the location of assembly points; and/or
- existing arrangements with local fire services.

388. If there is a need for the occupier and construction emergency arrangements to be integrated, you should co-operate with the CDM co-ordinator and the principal contractor to achieve this.

Designers

389. Fire brigade access may be easy once the building is finished, but you should consider the building footprint in relation to the access that will be available during construction, eg when roads will not be completed and the site will be obstructed by materials, plant, site huts, etc. In higher-risk projects such as tall structures with large numbers of contractors at work, you should consider this in more depth.

Principal contractors

390. You should devise an adequately detailed emergency plan (taking into account the risks involved) and ensure it is incorporated in the construction phase health and safety plan. The following elements should always be included:

- location of assembly points;
- instructions on what to do in the event of fire; and
- identification of who is in charge if there is a fire and a description of their role.

391. In low-risk situations, the contents of emergency plans may be very simple indeed. Where, if there is a fire, higher risks are involved, the following items may also need to be included in construction phase plans:

- regular fire drills;
- special arrangements for evacuation from high-risk areas, eg the LPG store;
- appointment of specialist fire wardens;
- regular liaison with local fire services;
- liaison with occupiers of shared premises; and
- fire-fighting training for those carrying out high-risk work.

392. If the nature of the site changes significantly, the emergency arrangements will need to be revised accordingly. For example, what is required during frame erection will be much less and very different from what is needed during the fit-out stage.

393. Make sure that everyone on the site is familiar with the emergency arrangements.

CDM co-ordinators

394. Pre-tender stage health and safety plans should include information available that would influence the development of the construction phase plan by the principal contractor, for example:

- available access for fire services;
- available areas for assembly points; and
- existing emergency arrangements on occupied sites.

395. The generation of emergency plans for the construction phase is the role of the principal contractor, so you will not normally be involved in this.

Contractors

396. Both you and your staff need to be familiar with the emergency arrangements. In practice, this will often be achieved by the principal contractor providing information. You should not merely assume that this will happen and should clarify with the principal contractor how the information is to be provided. This will normally be achieved during the tendering process.

397. Make sure that you and your employees co-operate with the principal contractor, eg attending induction training and participating in fire drills where required to do so.

398. Report any shortcomings to principal contractors, eg if any employees have not attended site induction training.

Temporary accommodation units (TAUs)

Clients

399. If you need to place restrictions on the siting of Temporary accommodation units tell the CDM co-ordinator and relevant designers at an early stage.

400. If you provide site accommodation, co-operate with the principal contractor so that the appropriate standards are met, especially if the accommodation is within the building or structure being worked on.

Designers

401. In most cases, you will be concerned with the finished building rather than the temporary accommodation during the construction phase. Even if you have no direct involvement with the design of TAUs, you should allow space for them when considering the general layout of the structure. Ideally, designs should allow space for TAUs to be sited outside the structure. If this is not possible, consider suitable locations for internal accommodation and inform the CDM co-ordinator of your conclusions.

CDM co-ordinators

402. Consider temporary accommodation needs in your pretender stage health and safety plans. You should not usually be concerned with the practical details of

operational TAU requirements. However, pretender stage plans should normally contain information on:

- any limitations on where TAUs can be sited; and
- any information from designers on TAU location.

Principal contractors

403. The construction phase health and safety plan should set out the arrangements for TAU provision. TAU arrangements are one of the first elements to be decided in the construction phase plan, since they are provided right from the start of construction.

404. Where large or higher-risk TAUs are involved, construction phase health and safety plans should normally consider:

- where the accommodation will be sited;
- the standards it needs to meet;
- necessary fire precautions; and
- who is responsible for providing satisfactory accommodation (eg principal contractor or nominated contractor).

405. Tell contractors about any site rules concerning TAU fire precautions. Contractors will especially need to know any limits or controls on storing materials inside TAUs to plan their work. Inform contractors of these matters at an early stage, preferably during the tendering process.

Contractors

406. Make sure that you and your employees know and comply with site rules and standards concerning TAUs. In practice, this may be achieved by instructions and information provided direct by the principal contractor, but you should not merely assume this will happen. If there is any doubt, liaise with the principal contractor to check that the necessary information or instruction has been provided.

407. Provide principal contractors with any relevant information. This could include information on:

- damage to the fire-resistant integrity of accommodation;
- non-compliance with site rules;
- a need for additional TAU material storage space; and/or
- damage to fire alarms or fire-fighting equipment.

408. If you have specific responsibilities for providing TAUs, you should provide them in accordance with both the principles in this guidance and requirements in the construction phase plan.

Sleeping accommodation

Clients

409. Contractors may need to provide sleeping accommodation for construction workers. If so, let the CDM co-ordinator know of any restrictions on where caravans or other sleeping accommodation can and cannot be sited.

Designers

410. If you are involved in the specification of cabins or sleeping accommodation for construction workers, you will need to make sure that your proposals meet high fire safety standards. More detailed advice is available from fire prevention officers.

CDM co-ordinators

411. Provide principal contractors with information in the pretender health and safety plan on where sleeping accommodation can be sited and any design criteria it should meet.

Principal contractors

412. Specify the detailed requirements for sleeping accommodation in the construction phase plan. If you are not sure what the standards should be, get specialist advice. The local fire prevention officer can help.

- Monitor compliance with those requirements.
- Make sure that the contractors know what the requirements are before their employees arrive on site and that employees know them when they arrive. This could be in the form of 'site' rules for the sleeping accommodation.
- **Under no circumstances must anyone sleep in the building under construction or refurbishment.**

Contractors

413. Make sure that sleeping arrangements for your employees are satisfactorily resolved with the principal contractor before your employees arrive on site.