NHS National Services Scotland

NHSScotland Firecode

Scottish Health Technical Memorandum 82

Fire alarm and detection systems

Health Facilities Scotland
Property and Capital Planning

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Contents

Executive summary

This NHSScotland Firecode document provides guidance on the design and installation of fire detection and alarm systems in new and existing NHSScotland healthcare premises, or where upgrading or extensions to existing systems are considered.

It supplements BS 5839-1: 2002 + A2: 2008 by providing recommendations specific to NHSScotland healthcare premises and must therefore be read in conjunction with it. Version 4, this document, replaces all previous versions of SHTM 82 which are now superseded.

This document should also be read in conjunction with NHSScotland Firecode SFPN 11; 'Reducing unwanted fire signals in healthcare premises'; and other relevant NHSScotland Firecode documents. It covers a wide range of alarm and detection technologies from conventional systems to multi-sensor detectors in addressable systems together with information and guidance on design philosophy and includes technical recommendations.

Other forms of fire detection equipment not specifically covered by this SHTM may be acceptable in some circumstances. However, when an alternative system or component technology is adopted the onus rests with the designer to ensure that the core principles of early detection and fire warning systems in healthcare premises are still met, whilst minimising the number of unwanted fire signals (UwFS).

UwFS impact directly on the treatment, care and well- being of patients and may result in considerable disruption to appointment systems, out-patient and in-patient care, Accident and Emergency departments and treatment regimes generally. Where UwFS are persistent they can erode and undermine staff morale and are also disruptive and costly to the Fire and Rescue services who respond to them.

It is therefore important as an integral part of the fire safety management of healthcare premises that UwFS should be properly recorded, the cause investigated and wherever possible action taken to minimise the potential for them to be repeated. The elimination and control of UwFS is a significant consideration in the design and installation of fire alarm systems and components must be selected with this at the heart of design and procurement decisions. In any case the objective to reduce UwFS, or other technical considerations, must not compromise the safety of those who occupy the building.

Note: Where notes or other information appear in a text box, it is strongly recommended that the guidance it contains should be adopted and applied.

1. Introduction

Scope and purpose

1.1 This document provides guidance on the design and installation of new fire detection and alarm systems for NHSScotland healthcare premises that are in addition to, or different from, those covered by BS 5839-: 2002 + A2: 2008.

1.2 It applies to both new and existing premises and covers modifications or upgrades to existing fire alarm systems required by alterations or extensions to existing buildings. Whilst generally applicable, it is recognised that in secure units for the mentally ill additional requirements, or specific operational arrangements may be required as a consequence of the security arrangements that are necessary.

1.3 This document, used in conjunction with BS 5839-1: 2002 + A2: 2008, may also be used as good practice guidance for the design and installation of fire detection and alarm systems in non-NHSScotland healthcare premises.

1.4 The guidance is intended for those responsible for procuring, specifying, and designing, installing or approving fire alarm systems, for example:

- relevant estates and fire safety staff of an NHSScotland body;
- architects and mechanical and electrical consultants;
- fire safety consultants;
- building control officers;
- fire safety enforcement officers of the Fire and Rescue Service;
- designated third party independent certifiers.

1.5 It is assumed that those using this document will be competent to do so. A competent person for the purposes of this document is;

A person who has sufficient technical training and actual experience or technical knowledge and other qualities, both to understand fully the dangers involved, and to undertake properly the measures referred to in this document, including the statutory and NHSScotland Firecode provisions it refers to.

Occupant profiles

1.6 The dependency and behaviour of building occupants has a significant influence on the provision and appropriateness of fire precautions. The measures installed must therefore recognise and address the local needs of those at greatest risk.

1.7 For the purposes of this SHTM, occupants are categorised, taking into account their ability to act independently and respond to visual and audible signals, as well as their physical strength and mobility, as follows.

- independent patients are defined as being independent if their mobility is not impaired, they are capable of using stairs safely without assistance, can interpret the meaning of the fire alarm signal and respond to it appropriately, follow way-finding directional signs and get to an exit or designated refuge, and can leave the premises without staff assistance;
- dependent all patients other than those classified as 'independent' or 'very high' dependency;
- very high dependency are those whose treatment and/or condition incurs a high dependency on staff. This will include those in intensive care/intensive therapy units, operating theatres and those for whom significant interruption of care or the conduct of evacuation would be potentially life threatening.

1.8 Where the premises will be used solely as office accommodation or contain no patient access (including as part of the means of escape for patients), the fire detection and alarm systems should follow the recommendations of the relevant parts of BS 5839-1: 2002 + A2: 2008.

1.9 For consistency, patient profiles for dependent and very high dependency are used in this document. Where appropriate, supplementary guidance has been provided, highlighting the particular issues for dependent occupants that key stakeholders should consider.

Relationship to BS 5839-1

1.10 The British Standard for the design and installation of fire detection and alarm systems in buildings is BS 5839-1: 2002 + A2: 2008. It is a code of practice containing general recommendations covering a wide range of building types. Although applicable, it does not provide recommendations specific to the healthcare environment. Neither does it recommend whether or not a fire alarm system should be installed in any given premises. It also points out that, because of the many different systems it covers, simply referring to BS 5839-1: 2002 + A2: 2008 without further qualification will have little meaning.

1.11 This document has been prepared to satisfy the need for more specific guidance and supplements BS 5839-1: 2002 + A2: 2008 by:

a. applying the recommendations of the British Standard to healthcare premises occupied by dependent and highly dependent patients;

b. expanding on and interpreting specific clauses of the standard contained in paragraphs 1.10 and 1.11 a. above;

c. providing additional recommendations over and above those in BS 5839-1, which may in some cases modify that standard.

1.12 This document must therefore be read in conjunction with BS 5839-1: 2002 + A2: 2008. Where it changes any requirement of the British Standard, for example reducing audibility levels in patient areas, the change should be recorded on the relevant design, installation and commissioning certificates. The guidance contained in SHTM 82 modifies, but does not lower the standards specified in BS 5839-1: 2002 + A2: 2008.

1.13 Contracts for fire detection and alarm systems for premises with dependent and very high dependency patients will require compliance with BS 5839-1: 2002 + A2: 2008 and this document. Both the British Standard and this document contain only recommendations, and neither are specifications. It is recommended that contracts should include appropriate technical specifications interpreting these recommendations to suit the particular site in a risk appropriate way.

1.14 No additional recommendations relating to user responsibilities over and above those in BS 5839-1: 2002 + A2: 2008 are contained in this document. Those responsible for managing and maintaining fire alarm systems should therefore refer to BS 5839-1: 2002 + A2: 2008 for guidance on procedures, training, servicing and for the prevention of UwFS. The specific recommendations contained in NHSScotland Firecode SHTM 11 should be referred to when considering measures to reduce UwFS.

Function of fire alarms in dependent occupant environments

1.15 The function of fire alarms in premises accommodating dependent or very high dependency patients is to give warning to staff in the event of fire so that an early call to the Fire and Rescue Service may be initiated together with possible first aid fire fighting and patient evacuation. In contrast with most other types of building, these premises contain wards and patient areas where it may not be necessary or even desirable to give warning to all occupants. The extent to which control over the public alert signals etc. is necessary will depend largely on the overall fire safety strategy, tailored specifically to the occupant profile of the area in question.

Consultation

1.16 In planning a fire alarm system, it is important to establish the design and operational requirements for the system at an early stage. These must take into account the overall fire safety strategy and the specific evacuation procedures e.g. where mental health patients are present, and there is a risk of absconding, it may be inappropriate to immediately release magnetically locked final exits. Those involved in the system procurement, specification and design of the system must therefore consult all those concerned with the operational management of the system and the space it covers, for example:

- managers;

- fire safety advisers;
- estates and facilities management staff;
- building control officers/approved inspector;
- the Fire and Rescue service ;
- relevant healthcare staff (especially those who manage affected departments or who have a role in responding to alarms);
- insurers (where appropriate);
- installing contractors and equipment suppliers.

Where practicable, this should be carried out before awarding the contract for the system.

Other Firecode documents

1.17 This document is referred to in other documents within the NHSScotland Firecode suite which may contain recommendations on fire detection and alarm systems. This document should therefore be read in conjunction with the latest revisions of other relevant NHSScotland Firecode documents.

Certification of products and services

1.18 It is recommended that those who manufacture, supply or install fire alarm systems for healthcare premises should be certificated to the appropriate part of BS EN ISO 9001-2008: Quality management systems.

1.19 It is also recommended that preference be given to systems and components that have been independently tested for conformity against a relevant product standard. Similarly, installers should also have been independently assessed.

1.20 A number of third-party certification schemes now exist for fire alarm products and services e.g. the Loss Prevention Certification Board (LPCB) operates schemes for installers (LPS 1014) and alarm monitoring centres, commonly referred to as ‘central stations’ or ‘alarm receiving centres’ (ARCs) (LPS 1020). These schemes have been adopted by British Approvals for Fire Equipment (BAFE) and NHSScotland bodies are therefore advised to select products and services from suppliers who have attained appropriate third-party accreditation for the services or products they supply.

2. System technology

2.1 Addressable fire alarm systems in which signals from each detector and each call point are individually identified at the control panel, are of particular benefit and are preferred over conventional systems (see Appendix 2). Rapid identification of the source of an alarm will reduce incident response time and facilitate the earliest possible evacuation and first aid fire fighting. In the event of an UwFS, it can reduce the period of disruption. However, this is of less benefit in small healthcare premises, particularly if there are few rooms and mainly open plan wards. It may also be less appropriate for isolated buildings on a healthcare site, for example boiler houses.

2.2 In large healthcare buildings in particular, fire alarm systems using analogue or multi-sensor detectors (see Appendix 2) are preferred because of their potential to significantly reduce UwFS (see paragraphs 4.14–4.16). This is especially the case if the systems' controlling software uses algorithms to filter out UwFS. However, even simple multi-sensor detectors capable of giving a pre-alarm will be beneficial.

2.3 As older systems are replaced over time, the adoption of multi-sensor type detector heads in new systems will progressively reduce the rate of UwFS and therefore improve the reliability and performance of fire alarm systems.

2.4 Where additions to an existing system are necessary, or a fire alarm system is installed in an extension or alteration e.g. a new adjoining building or a commercial enterprise within a hospital, compatible system technology should be employed. This may require equipment from the same manufacturer to be used, unless addressable systems of different manufactures can be fully interconnected.

2.5 With older systems this may not always be possible, as compatible components may no longer be manufactured. If it is not possible to fully interconnect a new analogue or addressable system with an existing system, the new system should have its own control and indicator panel but be suitably interfaced with the existing system's panel. This will make provision for the future replacement of the existing system.

2.6 The system technology employed should be in accordance with the following guidance:

- up to 50 devices (that is, detectors/call points), the system may be of the conventional type;
- over 50 devices, the system should be analogue or multi-state addressable.

2.7 To ensure that the fire alarm system functions in a fully integrated manner, compatible system technology should be used throughout the site, with the possible exception of isolated buildings:

- requiring no more than 50 detectors/call points; or
- requiring more detectors but functioning entirely separately from the healthcare site and not dependent on staff in the healthcare premises to respond to alarms (other than summoning the Fire and Rescue Service).

2.8 Where a system comprises a number of separate but interconnected control or data gathering panels (a 'networked system'), the entire networked system should comply with all recommendations of BS 5839-1: 2002 + A2: 2008. In particular, the cable used for any network connections should comply with the requirements for 'enhanced fire resisting cables'.

3. Design philosophy

Protection

3.1 Fire detection and alarm systems in healthcare premises are primarily intended to give the earliest possible warning of fire for the protection of life, but they also serve a valuable role in protecting property. Early warning of fire can also be of considerable benefit in minimising disruption to the functioning of healthcare premises and in enabling the prompt resumption of service.

3.2 The extent of protection to be provided will depend on the particular local site activities. While in most cases it will be appropriate for all parts of a building to be protected, in a few it may be possible to omit detectors from certain low-risk areas if an assessment of the fire risk determines that they are not required (See Appendix 1: Definitions: System category L2 or L3 and paragraph 3.6).

The protection of exit routes, and life safety provisions generally, must not be compromised when considering the extent to which detectors can be omitted.

3.3 In assessing fire risk, account should be taken of the wider societal healthcare and economic consequences of a fire. Also, a fire in a non-patient access area may seriously affect patient care by:

- spreading to a patient access area;
- disrupting a service or function upon which patient care depends, for example heating, power supply, pharmacy, medical equipment or IT installations;
- causing prolonged loss of use of parts of the building due to fire fighting operations and subsequent building restoration;
- destroying critical patient or other records;
- damaging or destroying medical, diagnostic imaging or other essential equipment.

3.4 Detectors may only be omitted from an area that:

- is under continuous surveillance by staff; or
- has neither a high fire load nor significant ignition sources;

and in which all of the following conditions are satisfied:

- the area is not a patient access area;
- the area does not contain any equipment or services on which patients are dependent;

- the area does not provide a service of strategic regional or national healthcare importance that would be difficult to replace;
- the area does not contain contents of high value;
- there is adequate and appropriate fire separation between the area and adjoining patient access areas.

Note: High value may refer not only to financial considerations, but to the societal value of strategically important local, national or regional healthcare facilities.

3.5 Examples of areas where detectors may possibly be omitted are as follows:

- some administration offices (other than in-patient access areas); e.g. in a stand alone building where fire would have no impact on patient care facilities;
- telephone switchboards that are continuously manned.

Subject in any case to the pre-conditions identified in paragraph 3.4.

3.6 A Category L2 or L3 system should be provided for healthcare premises other than hospitals. A category L1 system should be provided throughout all parts of hospital premises.

However, detectors need not normally be provided in the following areas:

- voids and roof spaces of any depth that contain only:
  - MICC wiring, or wiring clipped to a metal tray or within metal conduit or trunking;
  - non-combustible pipework and ducts;
  - metal or plastic pipes used for water supply or drainage.
- bath/shower rooms;
- toilets in staff areas;
- small cupboards (less than $1m^2$);
- operating theatres.

In any case the omission of detectors should be subject to a fire risk assessment taking into account the specific matters identified in paragraph 3.4.

3.7 Detectors should only be omitted from other areas on the basis of an assessment of fire risk. However, the following areas should always be protected:

- all patient access areas;
- fire hazard rooms and areas;

- rooms or departments below patient access areas from which fire can spread vertically to affect patient access areas;
- hazard departments;
- stairways, lobbies, and corridors used as means of escape, where not in frequent use;
- commercial enterprises;
- atria;
- mechanical and electrical services plant-rooms (other than water tank rooms);
- toilets intended for use by the public.

3.8 The omission of detectors from any area should be the subject of consultation. (see paragraph 1.16).

Zoning

3.9 The building should be divided into zones to indicate the presence of fire in detection zones and give an alarm in alarm zones. Wherever possible, detection zones and alarm zones should correspond with each other. In non-patient access areas, it is permissible for an alarm zone to be made up of more than one detection zone but not vice versa (see Figure 1).

3.10 To facilitate progressive horizontal evacuation (PHE) in patient access areas, each sub-compartment should normally be a separate zone (see Figure 1). Hospital streets are usually sub-divided at sub-compartment boundaries. The alarm zones for a hospital street may therefore include several sub-compartments, but should correspond, as far as possible, with the boundaries of adjoining alarm zones.

3.11 The search distance criterion set out in BS 5839-1: 2002 + A2: 2008 need not apply where the system is addressable and the source of the alarm can be readily determined at the alarm panel; from the description (address) of individual device locations.

3.12 Atria, commercial enterprises and hazard departments should be separate detection/alarm zones.

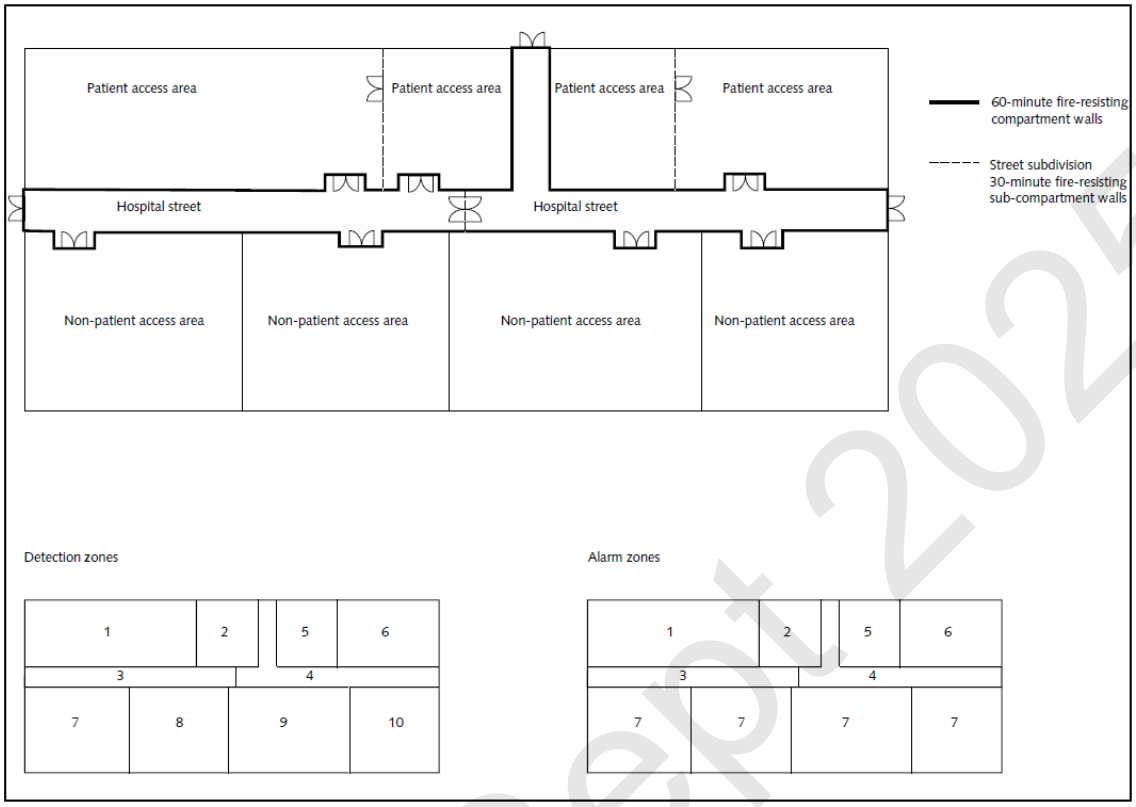

Figure 1: Zoning

Alarm

3.13 In most healthcare premises, the fire alarm signal is intended to inform the staff and not the patients e.g. premises where staff intervention is necessary to assist patients to evacuate, in-patient care facilities, elderly care where patients may be ambulant but require close supervision or assistance, mental health facilities, operating departments, intensive care units, high dependency units and other similar healthcare environments.

3.14 The audibility of the general alarm in those patient access areas where patients require assistance to evacuate should only be sufficient to warn staff (also see paragraph 3.15). The extent of the alarm should initially be restricted to those areas involved in the first phase of the evacuation.

3.15 In (at least) patient access areas a two stage alarm system should be operated so that the sub-compartment or compartment from which the alarm originated receives the ‘evacuate’ signal and adjacent sub-compartments and compartments receive the ‘alert’ signal (see Figure 2 for a typical two stage alarm arrangement). However, to operate a two-stage alarm, there must be sufficient acoustic separation to avoid confusion, between areas in which the ‘evacuate’ signal will be given and areas where the ‘alert’ signals will be given.

Note: Figure 2 is a simple schematic illustration of the cause and effect operation of a typical alarm installation in hospital premises. The building comprises three floors each with three alarm and detection zones. The diagram sets out the vertical and horizontal zones that should be provided with a concurrent alert signal, when an evacuate signal is given in any particular zone.

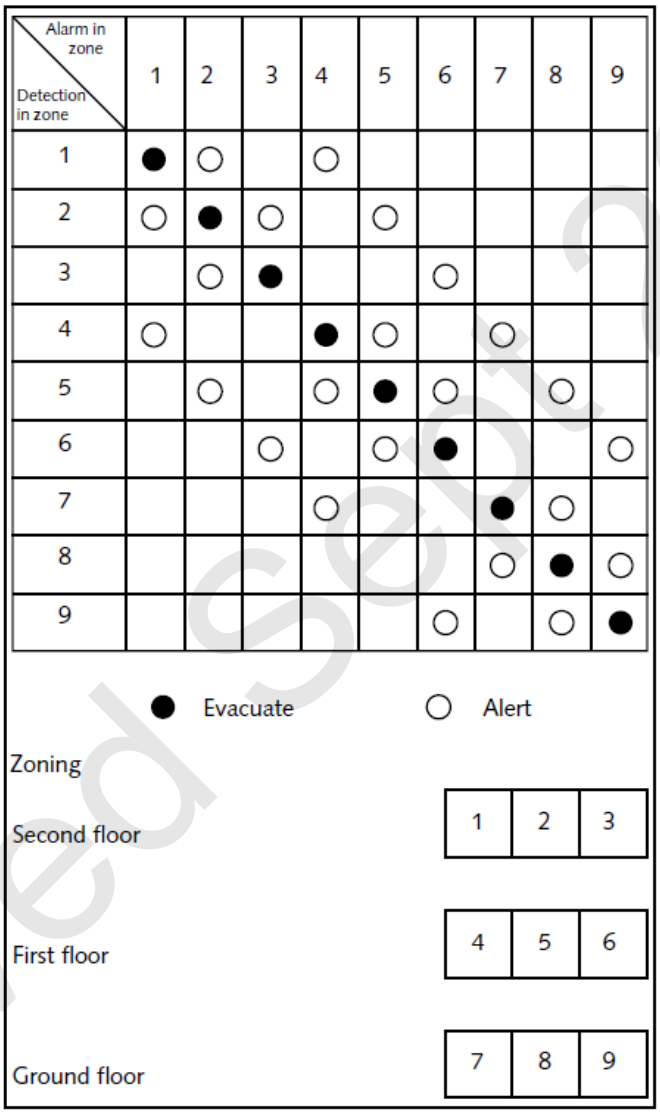

Figure 2: Cause and effect

3.16 Consideration should be given to providing, during the first phase, an ‘alert’ or ‘evacuate’ signal in other parts of the building from where escape may be difficult or protracted e.g. for example basements and roof plant rooms. It is essential that there are facilities to manually activate ‘alert’ or ‘evacuate’ signals in other areas so that subsequent phases of the evacuation can be controlled by staff or the Fire and Rescue Service.

3.17 To avoid unnecessary disturbance, staff who are required to perform specific tasks in the event of a fire, and may be in other unaffected areas of the building,

should be alerted by means other than the sounding of the fire alarm e.g. by a personal paging system.

3.18 Consideration may be given to the installation of a voice alarm system in appropriate areas. Refer to SHTM 82; supplement A; Automatic fire control systems and voice alarm systems for further guidance.

Dependent patients

3.19 The main purpose of the fire alarm system, where progressive horizontal evacuation (PHE) is adopted, is to alert staff. Non-ambulant occupants are likely to understand an alarm signal, but as a result of their medical state or treatment will be unable to evacuate unassisted, and this may cause confusion and distress. The role of staff is therefore to re-assure patients when they hear an alarm of fire, or to initiate and conduct an evacuation in accordance with the fire procedure when necessary.

Mental health patients

3.20 The alarm system serving a mental health facility should be configured in a manner appropriate to the needs of the patient profile.

3.21 It is possible that some mental health patients may react disruptively in response to the high sound pressure levels of an alarm, resulting in delay or hindrance of the evacuation. It is therefore recommended that the design of the alarm system takes account of the nature of the occupants and mitigates the potential for this to occur. For example, consideration should be given to the provision of alarm devices capable of producing musical output (see also paragraph 4.19). Such devices should be of a self contained, pre-recorded message type allowing for the broadcast of a coded alarm to alert staff with minimum disturbance to patients.

Very high dependency patients

3.22 The wellbeing of highly dependent patients is partly dependent on the consistent maintenance of the care conditions in their local environment. It is therefore essential that consideration is given to any fire precaution or measure installed that may be detrimental to their condition, such as the sudden loud noise of a fire alarm.

3.23 In areas where patients can escape unaided, and in non-patient access areas, the sound level of the alarm should conform to BS 5839-1: 2002 + A2: 2008.

3.24 Audible alarm devices should be provided in all areas of the premises. Alarm sounder devices should be sited so that staff is alerted without undue disturbance to patients. The audibility of the general alarm in areas where patients require assistance to evacuate need only be typically in the range 45–

55 dB(A), or 5 dB(A) above the notional noise level, whichever is greater. As far as possible, sound pressure levels in excess of this should be avoided.

3.25 In order to prevent sound levels being too high in some areas it is recommended that a large number of quieter sounders, rather than a few very loud sounders, are installed to provide a more even and level spread of the sound. Combined detector and sounder heads provide a much more even distribution of sound pressure throughout a given space and avoid localised peaks of sound pressure. Combination detector heads may also incorporate a visual alarm signal.

3.26 Visual alarm devices may be provided as an alternative to alarm sounders in areas where an audible alarm would be unacceptable e.g. in areas containing very high dependency patient areas, such as operating theatres, ITU and special care baby units.

3.27 In some healthcare premises, it may be desirable (or beneficial) to incorporate the use of a voice alarm system e.g. to reduce pre-movement time and initiate an early evacuation from an atrium space (see also SHTM 81: Part 3: Atria in healthcare premises; paragraphs 3.31 to 3.33). Any voice alarm system must comply with BS 5839-9.

System control and display of information

3.28 Information on the existence and source of an alarm is required for the following purposes:

- to enable the Fire and Rescue Service to be summoned and provided with the relevant address and incident information; and
- to allow staff to respond in accordance with local response and evacuation procedures;
- to ensure the Fire and Rescue Service can identify and attend the source of the alarm without delay.

3.29 In addition to undertaking normal system control functions, staff or the Fire and Rescue Service may also need to control the phased evacuation of the building.

Note: It is not generally part of the role of the Fire and Rescue to supervise or assist with the evacuation. On arrival, their role is to investigate and deploy their resources to deal with any fire. They will, however, assist with an evacuation where it is evident that harm from fire or smoke is likely occur, or where persons clearly need to be rescued and it is not within the capability of staff to do so. In hospitals where complex PHE evacuation procedures are adopted, they may also become involved for operational reasons e.g. to direct persons to use a specific exit route or refuge area in order to secure a clear access route for fire fighters and their equipment.

Responsibility for the safe conduct of an evacuation lies with those who manage the premises, other than in the exceptional circumstances described in this **Note**.

3.30 The siting of control and indicating equipment to facilitate a phased evacuation will depend on the evacuation procedures that are adopted for the premises and will therefore be determined by the local site circumstances. As a minimum, there should be a control and indicator panel at a staffed location from where the Fire and Rescue Service can be summoned, and also at the designated entrance at which the Fire and Rescue Service arrive. In addition, consideration should also be given to the security of control and indicator panels to prevent unauthorised use.

3.31 In large healthcare premises in particular, repeater control and indicator panels should also be provided at points where staff gather or congregate, where those not immediately affected by the incident can be kept informed as to the development and progress of the incident. This is recommended and commonly achieved by the use of repeater panels with alphanumeric text displays at nurse stations in wards and other key locations.

3.32 Where a site comprises a number of buildings and there is more than one fire alarm system, alarm signals should be relayed to a common 24 hour supervised location from where the Fire and Rescue Service can be summoned and from where staff with specific tasks can be alerted.

3.33 As a minimum, control and indicating equipment should be provided at the main entrance to the premises (or at the entrance at which the Fire and Rescue Service arrive, if different). Control and indicating equipment should also be provided in a location supervised 24 hours a day e.g. a telephone switchboard, where present.

3.34 Additional control and indicating equipment that displays the same information as the main panel should be provided in each management unit, and in any case so that the travel distance to an indicator panel does not exceed 60m. Further control and indicating equipment should be provided where necessary, consistent with the local evacuation procedure e.g. at the evacuation control point of any escape bed lift(s). This should be the subject of consultation (see paragraph 1.16).

3.35 Manual alert/evacuate controls for each alarm zone should at least be provided at the Fire and Rescue Service entrance, but may also be required at other locations depending on the local evacuation procedures.

Ancillary services

3.36 In healthcare buildings there are commonly systems, devices or facilities related to the means of escape and other fire precautions that may depend on the fire alarm system for their actuation. These may include:

- automatic door releases and door control systems;
- access control systems;
- ventilation and damper control systems;
- fuel supplies;
- lifts;
- fixed extinguishing systems (fire suppression systems);
- smoke control systems;
- stairway pressurisation systems;
- site signalling system;
- fire shutters.

3.37 It may not always be necessary to actuate ancillary services when the fire alarm system operates e.g. electrically controlled locks securing exit doors may not need to be released automatically if a manual means of override is present at the door, and the procedure and management arrangements are acceptable. Similarly, it is desirable in most cases to return passenger lifts to the ground floor and disable them; however, this would not be appropriate in the case of escape bed lifts. It is important, therefore, that the need to interphase ancillary devices or systems with the fire alarm is considered carefully in the context of the local fire safety strategy, statutory requirements and through consultation with relevant professionals (see also paragraph 1.16).

3.38 The logic for the actuation of ancillary services should be documented, preferably in the form of a cause and effect diagram that should be part of the agreed specification for the system. (see figure 2)

Automatic door releases and door control systems

3.39 Fire doors that are held open on automatic door release devices should conform to the following criteria:

- the door release mechanism should be fail safe conforming with BS 5839-3 and BS EN 1155 i.e. in the event of a fault or loss of power the mechanism should release automatically;
- doors fitted with an automatic door release should be linked to the alarm and detection system so that the doors release and close automatically when the fire alarm and detection system operates;
- all automatic door releases within a compartment or sub-compartment should be triggered by:
  - the actuation of any automatic fire detector within the compartment or sub-compartment;

  - the actuation of any manual fire alarm call point within the compartment or sub-compartment.

- automatic door releases must be provided with a ready means of manual operation from a position at the door.
- the interface between the detection device and the door release or other door access control system (to ensure the fail safe release of the door locking or hold open hardware) should comply with the requirements of BS 7273-4: 2007; actuation of door release mechanisms for fire doors.

3.40 As a minimum, automatic door releases should be arranged to automatically close doors, both within and forming the boundary of alarm zones where the 'evacuate' and 'alert' signals are activated.

3.41 Doors to protected stairway enclosures should not generally be held open by means of door hold open devices of any type. Further information is provided in SHTM 85; Fire precautions in existing healthcare premises, paragraphs 7.126 to 7.132.

Access control systems

3.42 Where installed, access control systems should automatically release (unlock) doors forming exits from alarm zones where the 'evacuate' signal is sounded.

3.43 The operational policy and procedures necessary to deal with the changes of patients wellness as treatment progresses, together with the diversity of reactions to noise and movement that affect them, may cause disruption, delay or other difficulties.

3.44 The alarm and detection system must be linked to any security locks that normally prohibit access to defined areas or the open air. The mode of operation should be configured so that security locks are only activated to areas required for use as part of the PHE process. For example, inadvertent operation of security locks to the exterior may divert essential resources to manage containment when they are actually needed to manage fire safety.

3.45 Security locks should be configured as part of the alarm and detection system in such a way as to facilitate patient containment where necessary, whilst maintaining appropriate evacuation arrangements.

Heating ventilation and air conditioning (HVAC)

3.46 Mechanical ventilation and air-conditioning systems should not normally be stopped when the fire alarm system operates. However, where the 'evacuate' signal is given, in an alarm zone containing a full or partial recirculation Heating Ventilation and Air Conditioning (HVAC) system, the recirculation should automatically divert to full extract and discharge the to open air.

3.47 Where required, manual controls to allow the Fire and Rescue Service to control ventilation plant should be sited either adjacent to the fire alarm control panel or adjacent to the relevant department entrance.

Lifts

3.48 Where lifts discharge into alarm zones in which the 'alert' or 'evacuate' signal is given, lift cars should return automatically to ground level or the final exit level, if different, and be disabled. Where the 'alert' or 'evacuate' signal is given at the ground level or final exit level, the lifts should be held at an alternative level and be disabled.

3.49 Escape bed lifts should not be controlled by the fire alarm system once they have been brought back into service by the operation of the 'evacuation control switch'.

Smoke control systems

3.50 Smoke control and extract systems in, for example atria, commercial enterprises and basements should only be actuated automatically when fire is detected in the areas they serve.

Communication with the Fire and Rescue Service

3.51 It is essential that, when an alarm of fire occurs in patient access areas, the Fire and Rescue Service is summoned immediately. As a minimum, staff should summon the Fire and Rescue Service using the 999 emergency service. However, it will normally also be desirable for fire alarm signals to be transmitted automatically to the Fire and Rescue Service or to a remote alarm receiving centre (ARC) from where the Fire and Rescue Service will be summoned.

3.52 Remote centres may be:

- NHS ARCs such as an ambulance control centre or a permanently manned telephone switchboard of another healthcare facility;
- central alarm receiving centres operated by non NHSScotland organisations or companies.

Preference should be given to remote centres that have third party certification.

3.53 Where other NHS premises are used, the standards of service and facilities offered should be at least equivalent to those of central ARC stations.

3.54 The Public Switched Telephone Network (PSTN) is not specifically designed for the transmission of fire alarm signals. Therefore, the use of digital communicators or auto-diallers is not generally recommended.

3.55 The fire alarm system should be connected direct to the Fire and Rescue Service or an ARC, unless it is monitored in a location that is continuously manned on a 24 hour basis by at least two persons whose duties include summoning the Fire and Rescue Service, and who have immediate access to a dedicated outgoing telephone line or a direct speech circuit to the local Fire and Rescue Service control room.

3.56 The method of transmitting alarms to the remote centre should be by a reliable continuously monitored connection such as a direct line or the British Telecom RedCARE system. Radio networks e.g. ambulance radio or Paknet, may be used provided that there is regular monitoring of the communications path, and the system is of proven reliability.

3.57 ARCs should be designed and operated in accordance with BS 5979.

3.58 SFPN 11; Reducing unwanted fire signals in healthcare premises; paragraphs 4.40 to 4.44; recognises the potential for disruption and unnecessary mobilisation of local Fire and Rescue Service appliances, and provides specific guidance on the actions to take if call delay to the Fire and Rescue Service is implemented. Before implementing such a procedure, NHSScotland bodies must consult the Fire and Rescue Service to ensure that there is a clear understanding of the precise response arrangements of the Fire and Rescue Service, and the precise actions that must be implemented by staff in the premises concerned. Patient safety must not in any circumstances be compromised by this process.

4. Technical recommendations

Manual call points

4.1 Although BS 5839-1: 2002 + A2: 2008 permits a 45m maximum distance of travel between any point in a building and the nearest manual call point, in patient access areas it will normally be appropriate to require a much shorter distance between call points to minimise the time between discovery of the fire and raising the alarm in order to ensure quickest possible attendance by trained staff and the Fire and Rescue Service. It is also important to minimise the time it takes to reach the nearest call point, so that the person raising the alarm can quickly return to the scene to assist in the evacuation of patients or the extinguishment of the fire.

4.2 Similar considerations make it appropriate in patient access areas for the manual call points to be located on the accommodation side of exits to protected stairways, usually in conjunction with the location of fire extinguishers, rather than on the stairway landings for the following reasons;

- call points sited in the occupied space are more likely to be on line of sight in the ward or department;
- in multi-storey hospitals there will normally be a two stage alarm consistent with the requirement for PHE; if people moving down the stairway operate a call point on a floor below the floor of fire origin, an evacuation signal may be given in the wrong area, while no evacuation signal may be given in the area where it is actually required. Careful siting of the call points will help to reduce the possibility of this happening.

Note: It is appropriate to site a manual break glass call point adjacent to the final exit to the outside from the stairway enclosure.

4.3 In order to ensure that the appropriate alarm signal is given in each area, and that an accurate indication of the location of the fire is given at the fire alarm indicating equipment, manual call points should also be sited on both sides of main doorways between detection zones (that is, on each direction of approach). This is particularly important in the case of main doorways between compartments and between sub-compartments.

4.4 With the above exceptions, the type, siting and location of manual call points should normally be in accordance with the recommendations of BS 5839-1: 2002 + A2: 2008.

4.5 Throughout healthcare premises, manual call points should be installed at a height not more than 1.2m above finished floor level.

4.6 In non-patient access areas, manual call points should be sited in accordance with the recommendations of BS 5839-1: 2002 + A2: 2008.

4.7 In patient access areas, manual call points should be sited as follows:

- at or close to each nurses' station;
- at each exit to a stairway (but not within stairway landing areas: see also paragraph 4.2);
- on both sides of main doorways between detection zones (in close proximity to the doors: see also paragraph 4.3).

4.8 The siting of manual call points in mental health facilities should take into account the potential for undesirable actuation. In many cases siting in staff supervised areas, the provision of lift flaps, or lift flaps combined with a local alarm device may be sufficient to control and discourage undesirable actuation by patients.

4.9 In circumstances where patients cause considerable problems with the operation of manual call points and where all other preventative measures have failed, the use of key operated call points may be considered appropriate, subject to the adoption of an appropriate management procedure.

4.10 In mental health units, the type of manual call points and their siting may deviate from the recommendations of BS 5839-1: 2002 + A2: 2008 if UwFS are likely to occur due to the deliberate operation of the alarm by patients. In these cases, manual call points need not comply with BS EN 54-2, or be readily accessible to patients; however, the call points should be easily and quickly accessible to staff and clear instructions given to all relevant staff on the method of operation and location of the call points.

Automatic fire detectors

4.11 Normally, the use of point type smoke detectors is appropriate in all areas for which this document recommends the installation of detectors. However, in areas where the installation of smoke detectors would result in frequent UwFS e.g. for example kitchens, point type heat detectors may be used.

4.12 Other types of fire detection are likely to be appropriate only in special circumstances. For example, beam type smoke detectors may offer efficient, economical fire detection in a large, open plan entrance hall or central warehouse. Line type heat detectors may be appropriate for use in service tunnels. Flame detectors might be considered if, for example, the materials likely to be ignited are low flashpoint flammable liquids. An aspirating smoke detection system may be appropriate for the protection of rooms or spaces containing critical equipment such as computer rooms.

4.13 In circulation spaces such as corridors and stairways, smoke detectors should normally be of the optical type, unless use of an ionisation chamber detector is

necessary in order to avoid UwFS. In other areas where smoke detectors are installed, either ionisation chamber detectors or optical detectors may be suitable, and the general guidance in BS 5839-1: 2002 + A2: 2008 on detector selection should be followed. However, choice of detector should take into account both the nature of the fire load (and hence the likely type of fire), and the importance of avoiding UwFS (see paragraphs 4.14–4.16 and NHSScotland Firecode SFPN 11). In any case the effectiveness of the fire detection components should not be compromised in order to avoid occasional UwFS e.g. by replacing the most appropriate detector head type with a less sensitive type.

Unwanted fire signals

4.14 Healthcare premises, particularly hospitals, are considered by Fire and Rescue Services to be a major source of UwFS. This does not necessarily reflect on the standards of fire alarm systems generally installed in healthcare premises, or on the standards of maintenance and control that usually exist.

The NHS is a major procurer and user of automatic fire detection in the UK, and there are many very large systems in healthcare premises. The greater the number of detectors that exist in a system, the greater will be the number of UwFS. Moreover, healthcare premises are occupied 24 hours a day, with unlimited access by the general public to large areas of the premises. There is therefore greater scope for activities to create UwFS than in many other buildings. The strictly disciplined, comprehensive and fully implemented fire procedures in healthcare premises probably result in the Fire and Rescue Service being made aware of a greater than average proportion of UwFS.

4.15 In any building, UwFS can result in loss of confidence in the fire alarm system and in premises where treatment is provided the disruption can be significantly detrimental to patient care e.g. disruption to appointment systems in out patient departments, disruption to emergency treatments in Accident and Emergency, disruption to operating departments, imaging services and laboratories. Since an immediate and appropriate response in the event of fire is essential to the safety of patients, any loss of confidence in the system will ultimately result in a lowering of the overall standard of fire safety.

It is therefore in the interests of NHSScotland procuring bodies that the design of any new installation, replacement or upgrade, takes into account the need to avoid UwFS as far as possible, without compromising the need for effective detection and early warning in the event of fire, consistent with the life safety requirements.

4.16 The causes of fire detection and alarm system activation can be broadly classed as one of two incident types: fire; or UwFS. Since normal activities may result in the uncontrolled emission of heat and/or smoke, resulting in an undesirable activation of the fire detection and alarm system, it is possible for an alarm generated by a fire incident to be classed as an UwFS e.g. fumes from bread in a toaster. Further information regarding the means of classifying,

recording, reporting and reducing UwFS can be found in SFPN 11: Reducing unwanted fire signals in healthcare premises.

Audible and visual alarms

4.17 Various types of alarm sounder are widely available and electronic sounders having an adjustable sound output will commonly be the preferred option. In any case it is important that there is a single type of fire alarm sounding device used throughout the premises. Care should be taken to ensure that the type of sounder chosen does not conflict with medical equipment such as monitoring systems with audible alarms.

4.18 As it is only staff that needs to be alerted in most patient access areas, there is little benefit to be gained from generating spoken messages through a voice alarm system. However, there may be some benefit in the installation of voice alarm systems in areas where large numbers of the public congregate or circulate, for example out-patient departments, reception areas or where the building contains an atrium space (see also SHTM 81 Part 3: Atria in healthcare premises). Voice alarm systems should comply with BS 5839-9: 'Code of practice for the design, installation and servicing of voice alarm systems'.

4.19 In those areas accommodating mental health patients, sounders should be of reduced volume, sufficient to alert staff without causing unnecessary anxiety amongst patients. The use of sound devices capable of broadcasting a pre-recorded message may be appropriate. In particular, devices that can include a short pre-recorded clip of music are effective and appropriate in circumstances where a discreet staff alarm is necessary.

4.20 The use of visual alarm beacons should be carefully considered. Many patients in mental health facilities exhibit photo-sensitivity and the inappropriate use of flashing beacons may lead to adverse patient reactions. See also paragraph 4.22 below.

4.21 Where a voice alarm system is provided in only part of the healthcare premises to give warning of fire, the voice message should be preceded by an alarm sound the same as that generated by the audible alarm devices used elsewhere in the healthcare premises. (see also SHTM 81 Part 3: Atria in healthcare premises).

4.22 Visual alarm devices should comprise flashing lights and should normally incorporate a sounder of low sound output e.g. 50 dB(A) at 1m, providing the same sound as that provided by the main alarm devices.

Note: Consideration should be given to the potential for adverse reaction to flashing lights by those with photo-sensitive epilepsy. In particular the colour red should be avoided since this is known to be the colour most likely to trigger epileptic reaction. Alternative colours may be used. In any case the flash rate should not exceed 130 flashes per minute.

4.23 Fire alarm technologies are developing rapidly and innovations are regularly introduced. Recent innovations include the introduction of combined multi sensor fire detector heads that incorporate a sounding device and visual strobe. One advantage of such devices is that the sound pressure is much more evenly distributed throughout the protected space, avoiding local peaks of sound pressure that may be disturbing to some people. Multi state detection sensors are particularly valuable in reducing the number of UwFS in premises where they are installed (see also Appendix 2: paragraphs.18-20: Multi sensor detectors). Specifiers and designers of systems should be mindful of developing technologies and select components that are most appropriate for the space to be protected.

Radio linked systems

4.24 A well designed and engineered radio linked system offers a number of advantages, such as ease of installation etc, most of which are discussed in BS 5839-1: 2002 + A2: 2008. Their main disadvantage is the need for periodic replacement of batteries, which may prove to be expensive, incurring a significant maintenance requirement. Systems are available that comply with the specific recommendations of BS 5839-1: 2002 + A2: 2008 relating to radio-linked systems, but not necessarily with the spirit of other recommendations in the standard.

4.25 The guidance in this document is not an obstacle to the permanent or temporary use of radio linked fire alarm system components, provided any system being considered is shown to have proven reliability and performance. Systems should comply with the standards specified in BS EN 54-25: Fire alarm and detection systems: components using radio links.

4.26 Where radio linked systems are being proposed, the space to be protected must be adequately and fully surveyed to ensure the robustness of radio communications can be sustained and will fulfil the design needs and objectives of the system. Such a survey should consider:

- the potential for radio frequency interference to other systems derived from the radio linked system emissions;
- the potential for radio frequency interference from other systems derived from the radio linked system susceptibility;
- the potential for data packet collisions with other existing or proposed data systems.

4.27 Subject to compliance with BS 5839-1: 2002 + A2: 2008 and this document, radio linked systems may be used to provide temporary protection in healthcare premises. This form of protection may be of particular value during contractors' operations in an area under refurbishment, where the normal system may not be operational, or during the construction of a new building. Temporary cover

may also be useful during replacement of an existing fire alarm system, perhaps before the new system is fully operational.

4.28 A fire alarm and automatic fire detection system using radion linked components should conform with EN 54-25: fire detection and alarm systems: components using radio links.

Electromagnetic interference

4.29 BS 5839-1: 2002 + A2: 2008 indicates that fire alarm systems may be affected by various sources of electromagnetic interference, such as transmissions from radios or cellular telephones, voltage transients etc. Such interference may result in UwFS, system faults, malfunction of processors or other forms of malfunction. In healthcare premises, there are often numerous sources of possible interference, either in use by the public e.g. for example cellular telephones, or in use for the treatment of patients e.g. diathermy equipment.

4.30 Experience has shown that some fire alarm systems are more resistant to the effects of electromagnetic interference than others. It is also known that installation parameters, such as the type of cable used, the method of termination, and even the material from which components such as junction boxes are manufactured, may have an effect on the immunity or otherwise of an installation, as opposed to the immunity of the equipment in isolation. If adequate care is not taken, mutual interference can also occur between fire alarm circuits e.g. ‘crosstalk’ between loops in an addressable system.

4.31 All systems should comply with the requirements of the Electromagnetic Compatibility Regulations 2006: BS 5839-1: 2002 + A2: 2008 and BS EN 54-25: fire alarm and detection systems; components using radio links.

4.32 Installation design and practices should minimise the susceptibility of the system to electromagnetic interference. Particular care should be taken in the selection of cable, the continuity and equipotential of screens along their length, the bonding of metal parts, such as the door of a control panel and the panel’s enclosure, and the termination of cables.

4.33 Account should be taken of the guidance contained in Scottish Health Technical Memorandum 06-01, which deals with the abatement of electrical interference.

Power supplies

4.34 The reliability and integrity of both the main and standby power supplies to the fire detection and alarm system should be of a high standard. It should not be assumed that the presence of two supplies (main and standby) is sufficient confirmation of the reliability of either supply.

4.35 The mains supply to the fire detection and alarm system should be derived from the healthcare premises essential services (automatically started standby generator-backed) supply.

4.36 The number of isolating devices between the incoming supply to the premises and the fire alarm control and indicating equipment should be kept to the minimum possible.

4.37 From the point at which the system i.e. from the point at which the supply is provided with the dedicated isolating protective device described in BS 5839-1: 2002 + A2: 2008, the circuit should be treated as a Category 3 circuit as defined by BS 7671 (IEE Regulations). Accordingly, the circuit should be suitably segregated from other circuits.

4.38 All cables associated with the fire alarm system, including power cables, should be rated 'enhanced' fire resistance as described in BS 5839-1: 2002 + A2: 2008, Section 2, Clause 26.2 and recommended in part (c) (3) of that clause. Mechanical protection for cables must comply with the recommendations of Section 2 Clause 26.

4.39 Standby battery supplies should be capable of maintaining the system as a whole in normal operation for at least 24 hours, after which there should be sufficient capacity to operate all sounders in the evacuation mode for at least 30 minutes.

Appendix 1: Definitions

For the purposes of this SHTM the following terms are defined;

Ancillary service: a device, facility or system which is required to operate when a fire alarm signal occurs.

Automatic door release: a device for retaining a fire door in the open position and releasing it so that it closes when a fire alarm occurs.

Central station: a continuously manned remote centre in which the information concerning the state of alarm systems is displayed and/or recorded and acted upon appropriately.

Circulation space: the communication routes both within a department/ management unit, giving access to other parts of the healthcare premises and to all necessary fire escape exits.

Compartment: a building or part of a building, comprising one or more rooms, spaces or storeys, constructed to prevent the spread of fire to or from another part of the same building, or an adjoining building.

Escape route: a circulation space or dedicated fire exit route, including a stairway and the hospital street.

Fire hazard departments: departments/management units which contain high fire loads and/or significant ignition sources (see Appendix 3).

Fire hazard room: rooms which, because of their function and/or contents, present a greater hazard of fire occurring and developing than elsewhere (see Appendix 3).

Healthcare premises: a building, or part thereof, used for the diagnosis of health conditions, medical treatment and/or medical care.

Hospital street: the main route of ingress, egress and circulation for staff, patients, visitors, supplies and services, constructed as a compartment.

Multi-sensor detectors: a detector monitoring more than one physical and/or chemical phenomenon associated with fire.

Notional noise level: the noise level which is exceeded for 10% of the noisiest period (for example daytime in wards) (L10 noise level).

Patient access areas: those areas of the healthcare premises to which patients have reasonable access either with or without supervision.

Phased evacuation: evacuation of different parts of the healthcare premises in a controlled sequence of phases, with those parts expected to be at greatest risk being evacuated first. (in hospitals, normally used in conjunction with PHE)

Pre-alarm warning: an early warning of conditions which might (or might not) represent a fire.

Progressive horizontal evacuation (PHE): the evacuation of patients away from a fire through fire resisting construction into an adjacent compartment or sub-compartment on the same level, free from the effects of fire or smoke, from which further escape is possible.

Protection: the presence of one or more detector(s) able to initiate actions needed for the safety of life or property in the event of a fire.

Radio linked system: a fire alarm system in which some or all of the interconnections between components are made by radio links.

Search distance: the distance that has to be travelled by a searcher within a zone in order to determine visually the position of a fire.

Staff alarm: a restricted alarm following the operation of an automatic detector given to certain staff to permit investigation prior to evacuation.

Sub-compartments: areas into which the building can be divided to reduce travel distance and which provide short duration (30 minutes) resistance to fire.

System type: a designation in BS 5839-1: 2002 + A2: 2008 to describe the function of the system. Type L systems are automatic detection systems intended for the protection of life. They are further sub-divided into:

a. **category L1**: systems installed throughout all areas of the building. The objective of a category L1 system is to offer the earliest possible warning of fire, so as to achieve the longest available time for escape;

b. **category L2**: systems installed only in defined parts of the building. A category L2 system should include the coverage necessary to satisfy the recommendations of this standard for a category L3 system; the objective of a category L2 system is identical to that of a category L3 system, with the additional objective of affording early warning of fire in specified areas of high fire hazard level and/or high fire risk;

c. **category L3**: systems designed to give a warning of fire at an early enough stage to enable all occupants, other than possibly those in the room of fire origin, to escape safely, before the escape routes are impassable owing to the presence of fire, smoke or toxic gases;

Note: To achieve the above objective it will normally be necessary to install detectors in rooms that open onto an escape route.

d. **category L4**: systems installed within those parts of the escape routes comprising circulation areas and circulation spaces, such as corridors and stairways. The objective of a category L4 system is to enhance the safety of occupants by providing warning of smoke within escape routes;

Note: The installation of detectors in additional areas is not precluded, and the system could then still be regarded as a category L4 system.

e. **Category L5**: systems in which the protected area(s) and/or the location of detectors are designed to satisfy a specific fire safety objective (other than that of a Category L1, L2, L3 or L4 system). Often the design is based on a fire risk assessment or forms part of a fire engineering solution. Protection may be provided to compensate for some departure from normal guidance elsewhere or as a part of the operating system for a fire protection system. Such a system could be as simple as one that incorporates a single automatic fire detector in one room (in which outbreak of fire would create undue risk to occupants, either in the room or elsewhere in the building). The system could comprise comprehensive detection throughout large areas of a building in which, for example, structural fire resistance is less than that normally specified for buildings of that type.

Note: The protections afforded by a category L5 system might, or might not, incorporate that provided by a category L2, L3 or L4 system.

Two-stage alarm: an arrangement in which the system gives an ‘evacuate’ signal in the compartment or sub-compartment of alarm origin and an ‘alert’ signal in neighbouring compartments/sub-compartments and/or other defined areas e.g. basements.

Unwanted fire signal (UwFS): an incident resulting in the undesirable activation of the fire detection and alarm system.

Zone: a geographical sub-division of the protected premises in which a function may be carried out separately from any other sub-division. The function may, for instance, be:

a. the indication of the occurrence of a fire (detection zone);

b. the giving of a fire alarm (alarm zone).

Appendix 2: Available system technology

Conventional systems

1. Up until the early 1980s, when new technology addressable systems (see below) were introduced into the UK, all fire detection and alarm systems employed similar methods of transmitting signals between fire detectors and control equipment. Basically, any zone of detectors comprises a single (usually two-wire) circuit, and each manual call point and fire detector within that zone is connected in parallel across the circuit.

2. In electrical terms, each device on the zone circuit simply acts as a normally open switch. When a manual call point is operated on such a system, or when a detector detects the presence of a fire, the 'switch' closes, resulting in virtually a short circuit i.e. low impedance, across the pair of wires. The low impedance on the circuit is sensed by the control equipment, which recognises this as a fire signal from one of the devices on the zone.

3. Electrically each zone is, therefore, a radial circuit, which terminates in the field at an 'end of line' device, such as a resistor. The resistor permits a small monitoring current to flow at all times. If a break occurs in the cable (an 'open circuit' fault) the monitoring current can no longer flow, and a fault warning is given at the control and indicating equipment. If a true short circuit occurs, this is also detected as a fault because the impedance is even lower than occurs when a detector or manual call point operates. Thus the system can detect, and distinguish between, an open-circuit fault (very high impedance), a fire signal (low impedance) and a short-circuit fault (very low impedance).

4. Each detector is a 'two-state' device (sometimes described as a 'digital' device) in the sense that it is either in the normal state ('switch' open) or fire state ('switch' closed). When one of the devices on a zone operates, the only information available is that there is a fire condition somewhere within the zone in question; the control panel cannot distinguish between one device operating and another device on the same zone operating, as the effect will be exactly the same.

5. Systems of the above type are still available and are now usually described as 'conventional' systems to distinguish them from 'addressable' systems.

Addressable systems

6. In an addressable system, there is some form of individual communication between each detector and the control equipment. Each circuit is therefore a form of simple data communications circuit, rather than simply an electrical circuit. Communication is normally achieved by some form of 'polling'; whereby

the control equipment interrogates each detector or manual call point in turn, and the devices respond with 'replies' that inform the control equipment about their present state. The time taken for the system to poll all devices on a single circuit must be sufficiently short to ensure that the delay between, for example, operation of a call point and sounding of the alarm is sufficiently short to satisfy BS 5839-1: 2002 + A2: 2008.

7. The principal difference between an addressable system and a conventional system is that, when a detector or call point operates in an addressable system, the identity of the device is known at the control equipment, whereas a conventional system cannot discriminate between the operation of one device and another device on the same circuit.

8. Within the software of the addressable system the device identity can be converted into a pre-programmed location (or address) displayed on a text display screen (such as an LCD or vacuum fluorescent display). A clear English text description of the exact location of a fire can therefore be displayed (for example, Room 120 2nd Floor).

9. Although the exact location of the fire can be displayed, compliance with current British Standards still requires that a more crude form of zone indication is also given. However, in a conventional system each zone is defined by an individual circuit, whereas in an addressable system, the devices within many zones may be connected to a single circuit. Since, in the event of a fire signal, the exact identity of the device involved is known, detectors and call points are configured into zones within the system software. This permits greater flexibility in zoning, and allows extra zones to be created at minimal cost.

10. The wiring in most addressable systems takes the form of a ring circuit (or 'loop'), which initiates and terminates at the control equipment. In the event of an open circuit fault, a warning is given, but communication with all devices is maintained, as there is still one signal path (instead of the original two) between each device and the control equipment. Radial circuits can be used, either wired directly from the control equipment or as 'spurs' off main loops.

11. If a short circuit occurs on an addressable loop that serves many zones, this could potentially result in loss of protection in all the zones concerned. To avoid this, short circuit isolators are employed. These isolate at least the section of the loop involved. By siting short circuit isolators at zone interfaces, it is possible to limit the loss of protection to the area of one zone (or at least to the maximum area permitted for a zone). In some systems, short circuit isolators are fitted to each detector base, so that no loss of protection occurs in the event of a short circuit.

12. Some addressable systems are capable of transmitting instructions to addressable devices on the loop, as well as receiving information from detectors or call points. Thus, for example, when a fire is detected, an addressable relay may be instructed by the control panel to operate, so closing doors, shutting down plant etc. In a small number of systems, alarm sounders

may also be addressable; this enables economies in wiring by installing sounders on the same addressable loops as fire detectors and call points.

Types of addressable system

Two-state

13. In the simplest of addressable systems, detectors are still of the two state type. The detectors themselves make the decision as to whether or not there is a fire. The only difference between these detectors and those in a conventional system is that, when the addressable detector generates a fire signal, it also transmits its identity. The rate of UwFS generated by a two state addressable system should, in theory, be no different from the rate generated by a conventional system.

Analogue

14. The majority of addressable systems are not of the two state type, but are of the analogue/addressable type. In these systems, the detectors themselves do not make any decision as to whether or not there is a fire. Instead, the detectors (often described in this case as 'sensors') simply transmit to the control equipment a signal level that represents the amount of heat, smoke or flame that is being sensed. The decision as to whether or not this signal level represents a fire condition is taken at the control equipment.

15. In the simplest analogue systems, the control equipment merely applies 'fixed thresholds' to the signal level from each detector. Thus, for example, above a certain threshold a 'pre-alarm warning' may be given, representing a state that requires investigation as it may be due to either a small fire or contamination of the detector by some non-fire products. At a higher threshold, a fire signal would be given. At a very low signal level, a fault signal may be given to indicate that the detector has become very insensitive. Such a system is thus four state (Fire, Pre-Warning, Normal, Fault), compared with the two state nature (Fire, Normal) of a conventional or simple addressable system.

16. Greater sophistication in analysis of the analogue signals is incorporated into some analogue systems in order to reject as many UwFS as possible. Analysis of the rate of rise of signal level may also enable earlier detection of fire, while eliminating certain types of false alarm.

17. Most analogue systems also have facilities to read off the current analogue values of all detectors on the system. This can enable identification of detectors that need to be cleaned or of detectors that are more prone to UwFS due to high levels of pollutants in their environment.

Multi sensor detectors

18. In the past, each detector head has been capable of sensing just one of the characteristic phenomena of fire (heat, smoke or flame) by just one technique (for example optical scattering or use of an ionisation chamber).

19. In multi sensor detector systems, each detector head incorporates more than one sensor and is therefore detecting more than one phenomenon. In some systems, by comparing the signals from the different sensors it is possible to avoid certain UwFS. For example, an optical detector close to a source of steam may produce UwFS, whereas a detector that also incorporates a heat or ionisation chamber sensor may not produce a false alarm in the same circumstances because there is insufficient signal level provided by the heat or ionisation chamber sensor.

20. Experience suggests that multi sensor detectors can significantly reduce UwFS, and are particularly effective in reducing UwFS in 'difficult' environments.

Appendix 3: Fire hazard rooms, areas and departments

The following are examples of fire hazard rooms:

- chemical stores;
- cleaner's rooms;
- clothes storage;
- dayrooms;
- smoking rooms;
- disposal rooms;
- laboratories;
- lift motor rooms;
- linen stores;
- patient bedrooms provided for:
  a. those suffering a mental illness;
  b. people with learning difficulties;
  c. elderly people.
- staff changing and locker rooms;
- staff (overnight) on-call rooms;
- store rooms;
- ward kitchens;
- x-ray film and record stores;
- all rooms within the main laundry in which delivery, sorting, processing, packing and storing are carried out.

The following are examples of fire hazard departments:

- atrium;
- boiler house;
- central staff change;
- central stores;
- commercial enterprises;
- central sterile supplies or healthcare sterilizing and disinfecting unit;
- flammable store;
- health records;

- laundry;
- main electrical switchgear;
- main kitchens;
- main stores;
- medical gas stores;
- pathology;
- pharmaceutical (manufacturing);
- refuse collection/incineration;
- works.

This list is neither exhaustive nor comprehensive and the evaluation of particular spaces should be subject to consultation and consideration of the risk presented to relevant adjacent spaces and within the space being considered.

Appendix 4: References

Acts and Regulations

The Electromagnetic Compatibility Regulations 2006. SI 2006 No 3418. HMSO, 2005. http://www.legislation.gov.uk/uksi/2006/3418/introduction/made

British Standards

BS 5839 -1: 2002: + A2 2008 Fire detection and alarm systems for buildings: Code of practice for system design, installation, commission and maintenance.

BS 5839 - 3: 1988: Fire detection and alarm systems for buildings: Specification for automatic release mechanisms for certain fire protection equipment.

BS 5839 - 6: 2004: Fire detection and alarm systems for buildings: Code of practice for the design and installation of fire detection and alarm systems in dwellings.

BS 5839 - 9: 2011: Fire detection and alarm systems for buildings: Code of practice for the design, installation and servicing of voice alarm systems associated with fire detection systems.

BS EN 54-2: 1997 + A1: 2006: Fire detection and alarm systems for buildings: Control and indicating equipment.

BS EN 54-4: 1998 Fire detection and fire alarm systems for buildings: Power supply equipment.

BS EN 54-25: 2008 Fire detection and alarm systems for buildings: components using radio links.

BS EN 54-11: 2001 Fire detection and fire alarm systems for buildings: Manual call points.

BS EN 1155: 1997 Building hardware. Electrically powered hold open devices for swing doors. Requirements and test methods.

BS 5979: 2007 Code of practice for remote centres for receiving signals from security systems.

BS 7671: 2008 + A1: 2011: Requirements for electrical installations. IEE Wiring Regulations. Seventeenth Edition.

BS EN ISO 9001- 2008 Quality management and quality assurance standards.

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SHTM 82, Supplement A; Automatic fire control systems and voice alarm systems.

SHTM 85; Fire precautions in existing healthcare premises.

SHTM 06 – 01 Electrical services supply and distribution.

Miscellaneous references

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Requirements for alarm receiving centres (LPS 1020). BRE Certification Ltd.