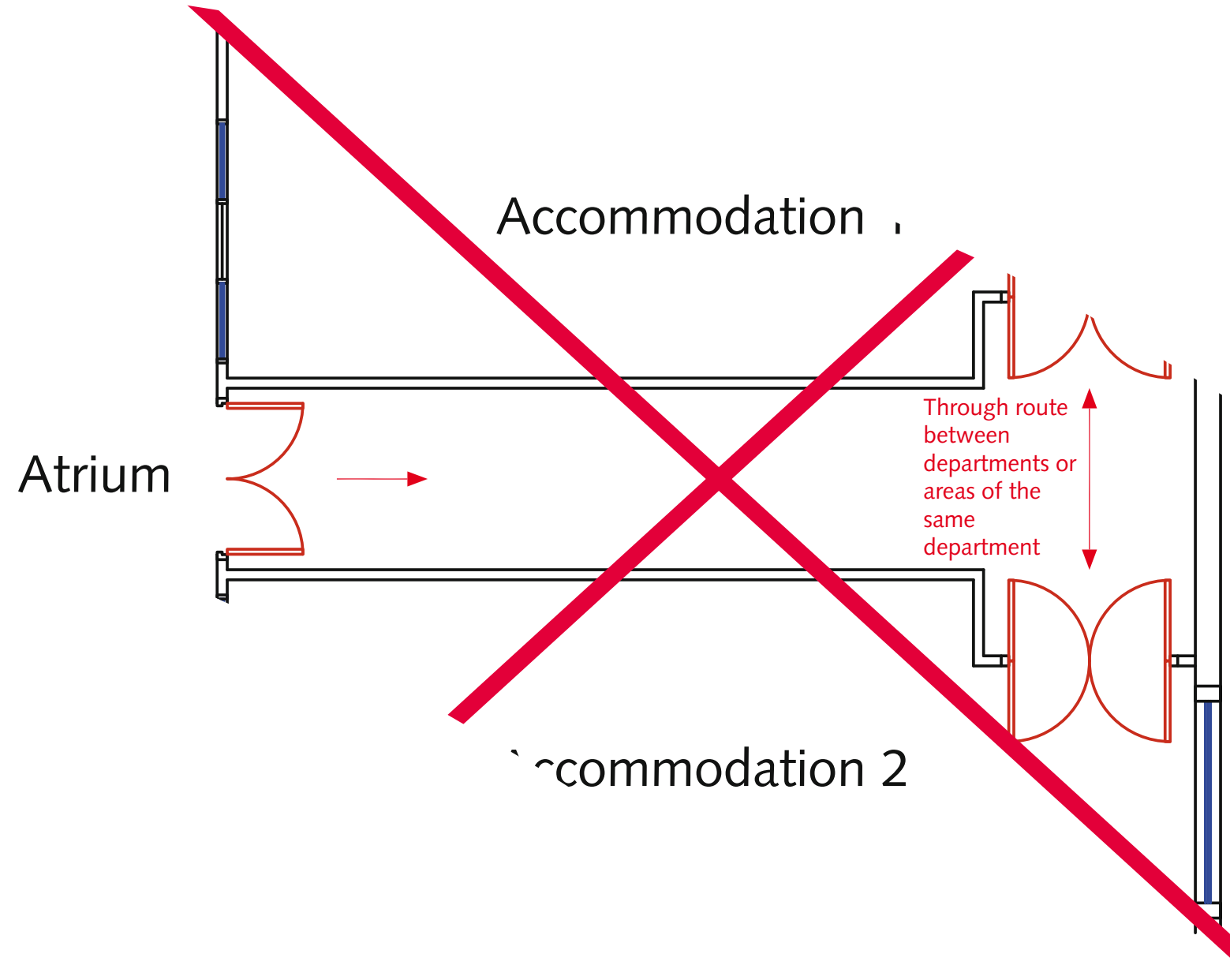
Department of Health

# Firecode – fire safety in the NHS
# Health Technical Memorandum 05-03: Operational provisions

*Part M: Guidance on the fire safety of atria in healthcare buildings*



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**Part M: Guidance on the fire safety of atria in healthcare buildings**

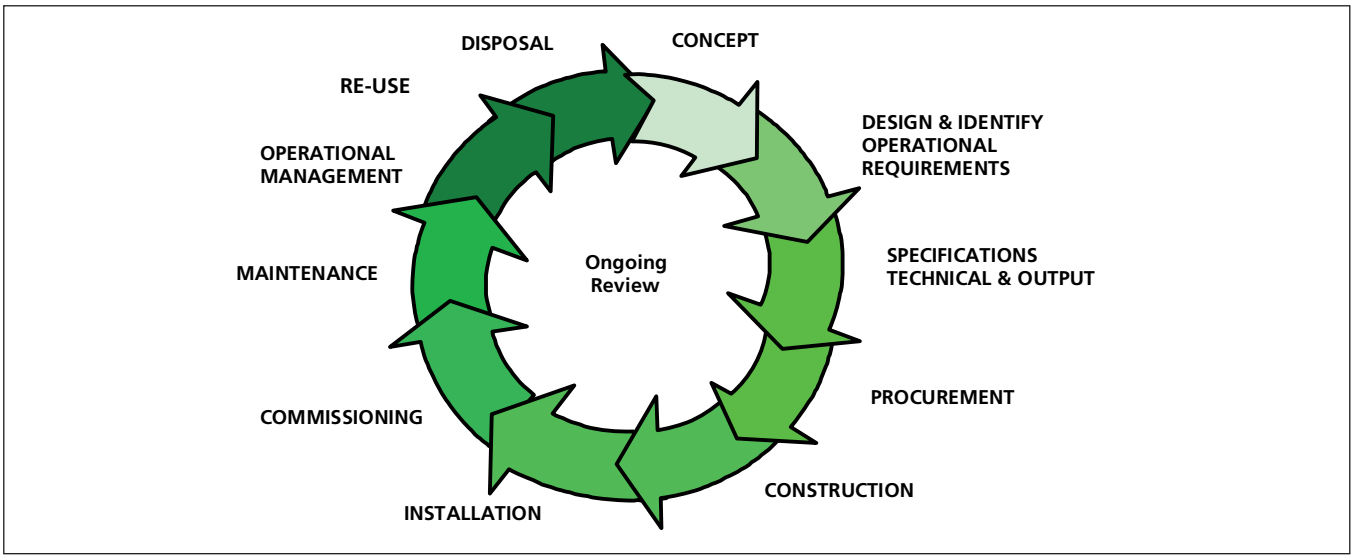
# Preface

## About Health Technical Memoranda

Health Technical Memoranda (HTMs) give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare.

The focus of Health Technical Memorandum guidance remains on healthcare-specific elements of standards, policies and up-to-date established best practice. They are applicable to new and existing sites, and are for use at various stages during the whole building lifecycle.

*Figure 1 Healthcare building life-cycle*




Healthcare providers have a duty of care to ensure that appropriate governance arrangements are in place and are managed effectively. The Health Technical Memorandum series provides best practice engineering standards and policy to enable management of this duty of care.

It is not the intention within this suite of documents to unnecessarily repeat international or European standards, industry standards or UK Government legislation. Where appropriate, these will be referenced.

Healthcare-specific technical engineering guidance is a vital tool in the safe and efficient operation of healthcare facilities. Health Technical Memorandum guidance is the main source of specific healthcare-related guidance for estates and facilities professionals.

The core suite of nine subject areas provides access to guidance which:

- is more streamlined and accessible;
- encapsulates the latest standards and best practice in healthcare engineering, technology and sustainability;
- provides a structured reference for healthcare engineering.

## Structure of the Health Technical Memorandum suite

The series contains a suite of nine core subjects:

Health Technical Memorandum 00
: Policies and principles (applicable to all Health Technical Memoranda in this series)

Health Technical Memorandum 01
: Decontamination

Health Technical Memorandum 02
: Medical gases

Health Technical Memorandum 03
Heating and ventilation systems

Health Technical Memorandum 04
Water systems

Health Technical Memorandum 05
Fire safety

Health Technical Memorandum 06
Electrical services

Health Technical Memorandum 07
Environment and sustainability

Health Technical Memorandum 08
Specialist services

Some subject areas may be further developed into topics shown as -01, -02 etc and further referenced into Parts A, B etc.

Example: Health Technical Memorandum 06-02 represents:

Electrical Services – Electrical safety guidance for low voltage systems

In a similar way Health Technical Memorandum 07-02 represents:

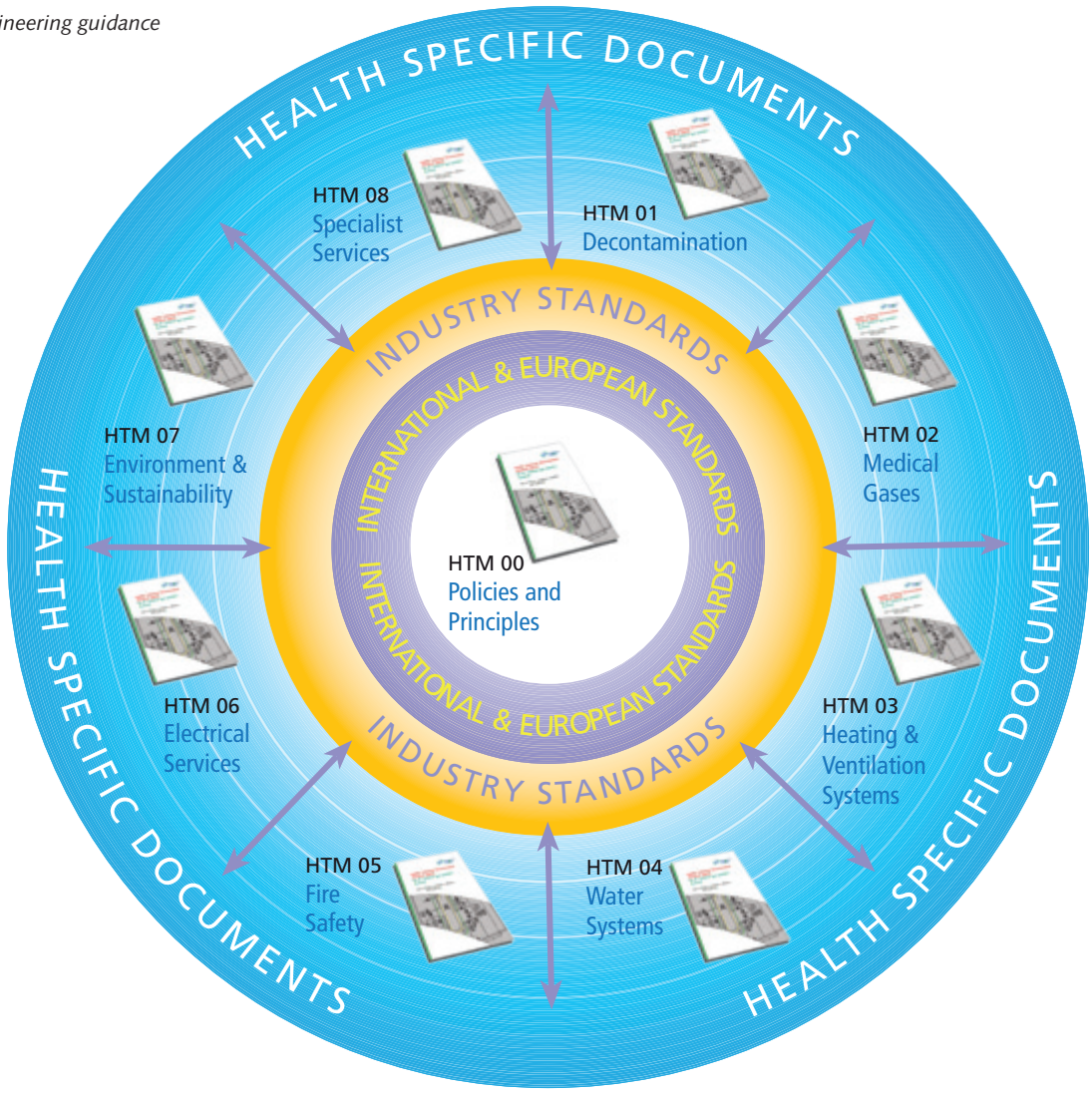
Environment and Sustainability – En$CO_2$de.

All Health Technical Memoranda are supported by the initial document Health Technical Memorandum 00 which embraces the management and operational policies from previous documents and explores risk management issues.

Some variation in style and structure is reflected by the topic and approach of the different review working groups.

DH Estates and Facilities Division wishes to acknowledge the contribution made by professional bodies, engineering consultants, healthcare specialists and NHS staff who have contributed to the production of this guidance.

*Figure 2 Engineering guidance*



# Executive summary

This Health Technical Memorandum sets out recommendations and guidance for fire safety of atria in healthcare buildings. It should not be quoted as if it were a specification, and any claims of compliance should be carefully examined to ensure they are not misleading.

It is intended to assist in determining the appropriate fire-safety measures to be applied to atria in healthcare premises, including those in the acute and primary care sectors.

This guidance recognises the special requirements of fire precautions in the design of atria within healthcare premises and should allow the current statutory regulations to be applied sensibly within a framework of understanding.

It recognises the interaction between:

- physical fire precautions;
- the dependency of the patient;
- fire hazards within the healthcare premises;
- management policies; and
- the availability of sufficient and adequately trained staff in achieving an acceptable level of fire safety within healthcare premises.

Users are responsible for ensuring the correct application of this guidance.

The primary remit of healthcare organisations with regard to fire safety is the safety of patients, visitors and staff. For all premises under their control, NHS organisations will need to select and effectively implement a series of measures to achieve an acceptable level of fire safety, taking into account:

- this guidance;
- the relevant guidance contained in other parts of Firecode;
- all relevant legislation and statutes; and
- the advice and approval of building control and fire authorities.

# Contents

# 1 Introduction and scope

1.1 An atrium within a building can provide not only a readily identifiable beacon to guide visitors to the main building's entrance but also a welcoming introduction to the building and the facilities inside.

1.2 The architectural potential of atria allows for natural light to penetrate to internal areas of the building, creating stimulating spaces and reducing the institutional appearance.

1.3 It is common practice for atria to be incorporated into the design of modern healthcare premises, but their potential impact on the fire safety of the building needs to be considered.

## General application

1.4 This Health Technical Memorandum provides guidance on the additional fire precautions that may become necessary when an atrium is incorporated into the design of a healthcare building.

1.5 It should be read in conjunction with other documents intended to give guidance on the means of escape and other fire-safety measures applicable to the premises.

1.6 It also provides guidance on managerial and organisational issues that need to be considered to ensure that the fire-safety issues associated with an atrium are effectively controlled as part of an integrated fire-safety strategy.

1.7 The recommendations of this Health Technical Memorandum should be applied to each atrium formed by the conversion, extension, adaptation, modernisation or refurbishment of an existing building, and should be incorporated into the design of any new healthcare building that includes an atrium.

1.8 Risk assessments undertaken in compliance with the Regulatory Reform (Fire Safety) Order 2005 should also be considered in determining the suitability of applying the measures contained within this document.

1.9 The recommendations of this Health Technical Memorandum cannot take account of all the circumstances that may be found in healthcare buildings, but are intended to highlight the health service aspects which need to be considered.

## Existing guidance

1.10 The guidance in this Health Technical Memorandum supplements and should be read in conjunction with that contained in other documents of the Firecode suite.

1.11 Guidance specific to fire-safety measures associated with atria in healthcare premises has been lacking since the withdrawal of BS 5588-7; this Health Technical Memorandum maintains the continuity of specific healthcare-related guidance.

1.12 The additional guidance provided in this Health Technical Memorandum is considered necessary as atria provide a route by which smoke and fire may spread from storey to storey much more rapidly than they would in an equivalent building without an atrium. Such spread of fire and smoke can have a significant effect on the number of persons initially at risk, the time available for escape, and the activity of fire-fighters.

1.13 For healthcare buildings in particular, there may be high numbers of older people or people with a disability in the atrium at any one time. These people may require additional time and assistance to escape. To address these concerns, atria should be provided with higher standards of fire protection than would normally be provided within similar buildings put to a different use.

# 2 Glossary of terms

For the purposes of this document the following terms are defined:

**Atrium (plural atria):** a space, or system of conjoined spaces, within the building that adjoins more than one storey.

Shafts used solely for stairs, escalators, lifts, or services are not classified as atria.

**Atrium base:** the plan area of the lowest floor level within the atrium.

**Atrium enclosure:** the walls and, where applicable, the roof or other structure that form the boundary of the atrium space(s).

**Available Safe Escape Time [ASET]:** the calculated time available between ignition of a fire and the time at which tenability criteria are exceeded in a specified space in a building.

**Compartmentation:** the fire-resisting elements including walls, floors, and where applicable, roofs and/or other structures used in the separation of one fire compartment from another.

**Commercial enterprise:** any undertaking established on healthcare premises or within part of a healthcare building to which persons, including members of the public, may resort for the purposes of trading or business, whether such transactions are for gain or not, and whether the undertaking forms the whole or part of a private venture or a healthcare organisation's activity.

**Emergency lighting:** the lighting provided for use when the power supply to the normal lighting fails.

**Escape lighting:** that part of the emergency lighting which is provided to ensure that the escape routes are illuminated at all material times.

**Fire 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.

**Fire engineering:** the application of scientific and engineering principles to the protection of people, property and the environment from fire.

**Fire load:** the sum of the calorific energies that could be released by the complete combustion of all the combustible materials in a space including the facing of the walls, partitions, floors and ceilings. The following fire loads are referred to in this Health Technical Memorandum:

- **Limited fire load:** an arrangement of combustibles in discrete islands of up to 10 $m^2$ each with a fire load density of less than 115 $MJ/m^2$, and each island separated from adjacent combustibles by at least 4 m, or protected by a sprinkler system.
- **Significant fire load:** a fire load other than one that is limited.

**Fire load density:** the fire load divided by the floor area that contains the fire load.

**Fire plume:** the buoyant gas stream rising above a localised area undergoing combustion. The following plume types are referred to in this Health Technical Memorandum:

- **Axisymmetric plume:** a coherent fire plume rising into a surrounding space of essentially uncontaminated air away from physical obstructions and with a broad appearance of symmetry about its longitudinal axis.
- **Spill plume:** a rising fire plume emanating from beneath the edge of a lower-level soffit where its buoyant rise continues into a space of greater height.

**Fire resistance:** the ability of an element of building construction, component or structure to fulfil, for a stated period of time, the required load-bearing capacity, fire integrity and/or thermal insulation and/or other expected duty in a standard fire-resistance test.

**Healthcare building:** a hospital, treatment centre, health centre, clinic, surgery, walk-in centre or other building where patients are provided with medical care.

**Height of an atrium:** the level of the surface of the highest point of the floor of the highest storey adjacent to the atrium measured from the lowest level of the atrium base.

**Mechanical smoke-exhaust ventilation system:** a ventilation system intended to exhaust smoke by means of electrically powered fans.

**Natural smoke-exhaust ventilation system:** a ventilation system intended to exhaust smoke by means of buoyancy forces due to difference in density of the air arising from the effects of temperature differences.

**Occupant dependency:** the categorisation of occupants on the basis of their likely need for assistance to effect their safe evacuation in an emergency. The following categories are referred to in this Health Technical Memorandum:

- **Independent:** occupants will be defined as being independent:
    a. if their mobility is not impaired in any way and they are able to physically leave the premises without staff assistance; or
    b. if they experience some mobility impairment and rely on another person to offer minimal assistance. This would include being sufficiently able to negotiate stairs unaided or with minimal assistance, as well as being able to comprehend the emergency wayfinding signage around the facility.
- **Dependent:** all occupants except those classified as "independent" or "very high dependency".
- **Very high dependency:** those whose clinical treatment and/or condition creates a high dependency on staff. This will include those in critical care areas, operating theatres, coronary care etc and those for whom evacuation would prove potentially life-threatening.

**Place of safety:** a place where persons are in no danger from fire.

**Required Safe Escape Time (RSET):** the calculated time available between ignition of a fire and the time at which occupants in a specified space in a building are able to reach a place of safety or relative safety.

**Smoke control:** any technique for dealing with smoky gases within the building, or other structure, in order to protect the structure, the contents, the means of escape, or to assist fire-fighting operations.

**Smoke layer:** the observable zone of buoyant smoke that collects beneath a roof, soffit or layer of warm air.

**Smoke logging:** the condition arising when the accumulation of smoke results in the smoke layer descending to a point that affects a significant proportion of the surrounding space.

**Stratification:** the phenomenon whereby the upward movement of the smoke plume may cease due to a lack of buoyancy usually as a result of the ambient temperature at ceiling level being significantly higher than that at the level where the fire starts.

**Travel distance:** the horizontal distance to be travelled by a person from any point within the floor area to the nearest adjoining compartment, escape stairway or external exit, having regard to the layout of walls, partitions, fittings and furniture.

**Voice alarm system:** a sound distribution system that provides means for automatically broadcasting speech messages and warning signals.

# 3 The fire-safety implications of atria in the healthcare environment

## Smoke and fire spread

3.1 Smoke and fire may spread from storey to storey significantly more quickly when an atrium is included in a building's design – the atrium provides a route by which smoke and fire can spread to areas of the building that are somewhat remote from the fire incident itself.

3.2 Since by definition an atrium is higher than a single storey, the plume resulting from a fire is likely to rise further than it would do in a similar building without an atrium. As the fire plume rises, it will entrain the surrounding air, resulting in a much larger volume of smoke than would be the case if there were no atrium.

3.3 The combination of increased quantities of smoke and the potential for that smoke to spread far beyond the area of the fire itself may result in many more building occupants being at risk simultaneously from the fire than would be the case in a similar building without an atrium. Such a scenario may require the simultaneous evacuation of patients from a number of departments across multiple floors.

3.4 The large volumes of corrosive smoke produced and the capacity for that smoke to spread via the atrium may result in damage to the building which is out of proportion with the fire incident itself.

## Utilisation of the atrium space

3.5 An atrium often accommodates the main reception area. Most visitors to the building will therefore make use of the atrium both as their introduction to the premises and as a route through to the building's amenities and healthcare departments.

3.6 For many visitors, this will be the first time that they have entered the building. They will be unfamiliar with the building layout and the facilities for escape should a fire prevent their exit via the main entrance.

### Balconies and bridges

3.7 In some cases, an atrium is provided with balconies and/or bridges at the upper levels. Where provided, these facilities can be used for access to departments adjacent to the atrium and to afford communication between areas and departments on opposite sides of the atrium. A rising smoke plume produced by a fire at a lower level may impact significantly on the safety of those required to make use of the bridges or balconies for their escape.

3.8 Atrium balconies and bridges have been used to provide seating and waiting areas as well as other facilities such as coffee shops. However, such practice not only introduces additional fire loads to the atrium space, but also presents a static occupancy whose evacuation in the event of a fire within the atrium and possibly the adjacent areas will need to be managed.

3.9 The provision of a balcony and/or bridge seating area presents particular fire-safety challenges. Such seating areas may be many storeys above the atrium base and, as a result, users of these areas may be relatively remote from a fire. However, since any smoke plume is likely to rise above the atrium base and result in smoke filling downwards from the top of the atrium, occupants of seating areas on the upper level of the atrium are potentially at a greater risk during the early stages of a fire incident than any other occupants of the atrium.

3.10 Occupants of seating areas on balconies or bridges above the atrium base may be sufficiently remote from any fire incident and its direct effects that the risk associated with the smoke produced by a fire on the atrium base may go unnoticed, which could delay their evacuation.

### Commercial enterprises

3.11 Commercial enterprises such as coffee shops, restaurants and newsagents may be provided in an atrium. Where this is the case, the fire load density of the area occupied by each commercial enterprise

is likely to be significantly greater than that presented by most hospital departments.

**3.12** Where the atrium is put to such uses, it may be difficult to adequately control the fire loading of the space and in particular the transient fire loads associated with restocking the commercial enterprises.

**3.13** The occupant-to-staff ratio is often significantly larger in the atrium than in any other department of the healthcare building. In addition, most staff present in the atrium are unlikely to be employed directly by the healthcare organisation that operates the premises. In some cases, the only directly employed members of staff present within the atrium are those manning the reception desk, the remainder of staff being employed by the owners of commercial enterprises.

**3.14** It is unlikely that members of staff not directly employed by the healthcare organisation will take responsibility for evacuating occupants beyond the commercial facility in which they are employed. Hence the safe and controlled evacuation of occupants of the atrium space may rely on the actions of the limited number of staff present who are directly employed by the healthcare organisation unless additional staff are made available as part of the emergency response procedures.

**3.15** Given that the atrium space might have many uses, it is likely that several parties will each have responsibility for separate parts of the atrium's facilities. Such an arrangement can result in a lack of overall ownership and sufficient management responsibility for the atrium, its contents and the use to which it is put.

**3.16** In circumstances where more than one party has responsibility for the activities undertaken within the atrium, particular attention should be paid to the duties of responsible persons to cooperate with each other and to coordinate their activities as detailed in the Regulatory Reform (Fire Safety) Order 2005.

# 4 Technical recommendations

4.1 The aims and objectives of these technical recommendations are to support the stated aims of the Department of Health's fire-safety policy, these being to minimise the impact of fire on life safety, delivery of service, environment, and property.

4.2 These technical recommendations seek to deliver a level of fire safety equivalent to that of a similar building without an atrium.

## Relationship to other departments

4.3 As described earlier, the inclusion of an atrium in a healthcare building increases the potential that fire and smoke may rapidly spread beyond the initial incident of fire. To minimise the risk of a large fire developing and spreading through the atrium, departments that present a specific fire hazard should not be located within the atrium.

4.4 With the exception of "atrium" and "commercial enterprises", applicable examples of fire hazard departments are included in Table 1 of Health Technical Memorandum 05-02 – 'Guidance in support of functional provisions for healthcare premises'.

4.5 Where a fire hazard department (other than "atrium") is to be located adjacent to an atrium, the fire precautions detailed in Table 1 of Health Technical Memorandum 05-02 should be applied to the hazard department as a minimum.

4.6 Departments that provide care for very high dependency patients should not be located adjacent to an atrium, nor should any part of the department or their supporting facilities be located within the atrium.

4.7 Departments that provide care for dependent patients should only provide access to the atrium via circulation spaces.

## Use of atria

4.8 Most of the visitors to a healthcare building will make use of the atrium space and its facilities. Whilst in the main these users will be independent, a significant number may still require some degree of assistance.

4.9 Many of the uses to which an atrium may be put will result in a static occupancy (that is, where people are mostly stationary for long periods). Where this is the case, suitable management arrangements must be put in place to ensure the safe evacuation of all the atrium's occupants in the event of a fire affecting the atrium (see Chapter 6, 'Organisation and management').

4.10 The following facilities should not be provided in an atrium:

- sleeping accommodation;
- nursing or medical care; or
- seating areas such as dayrooms or lounges for use by in-patients.

## Fire loads

4.11 Unless the atrium is empty and contains no combustible materials, it is considered to contain a fire load. In most circumstances, use of the atrium space will introduce a fire load. The nature of the fire load and the area that it occupies will largely determine the extent of fire precautions that should be applied to the atrium space.

4.12 The fire load within an atrium should be controlled either through active measures or through the limitation of combustible materials in terms of type, quantity and proximity.

4.13 The atrium is considered to have a limited fire load:

- where all the combustible materials are arranged in discrete islands of up to 10 $m^2$ with a fire load density of up to 115 $MJ/m^2$; and
- where each island is separated from other areas of combustible materials by at least 4 m or is protected by a sprinkler system.

The calorific values (MJ/kg) can be obtained from numerous fire engineering sources including PD 7974-1.

**4.14** The atrium is considered to contain a significant fire load where the arrangement and/or nature of combustible materials do not meet the above parameters.

**4.15** Wherever a significant fire load exists within an atrium, control measures must be applied to limit the quantity of combustible materials that may become involved in any fire incident, and hence the size of fire, within the atrium. Such control measures may include:

- limiting the type and quantity of combustible materials that may be present in any portion of the atrium; or
- active measures such as automatic sprinkler systems intended to extinguish, or limit the size of, the fire involving those combustible materials.

**4.16** To calculate the performance of other fire-safety measures, the actual fire load and size of potential fire resulting from the ignition of the combustible materials within the atrium should be determined.

**4.17** Details of the fire load should be included in the fire strategy report. This report should be referred to by those responsible for managing the atrium when considering any potential changes to the quantity or nature of the combustible materials present or the use to which the atrium is put.

**4.18** Where the atrium has no access to adjacent accommodation above the atrium base level, there is no requirement to control the fire load present within the atrium other than those measures detailed in Health Technical Memorandum 05-02.

## Means of escape

### Fire detection and alarm

**4.19** Adequate means of detecting a fire and raising the alarm is of vital importance to ensure:

- a timely response to the fire incident;
- the commencement of the evacuation process where appropriate; and
- the initiation of active fire protection systems and early fire-fighting intervention.

**4.20** The need for fire detection and alarm applies irrespective of whether or not the fire load within the atrium is limited.

**4.21** The detection and alarm system for the atrium should be designed in accordance with Health Technical Memorandum 05-03 Part B – 'Fire detection and alarm systems' and BS 5839-1 and should form an integral part of the fire detection and alarm systems for the remainder of the building.

**4.22** Particular consideration should be given to alarm-signal audibility levels within the atrium, since it may not be appropriate to reduce sound-pressure levels from those stated in the British Standard.

**4.23** The atrium space should be configured as a separate zone on the fire detection and alarm system.

**4.24** The interaction of alarm signals between the atrium zone and adjacent zones should be in accordance with the fire alarm strategy for the remainder of the building.

#### *Automatic fire detection*

**4.25** When designing the detection system, careful consideration should be given to the type of detection devices used.

**4.26** Detectors should be positioned so as to provide an L1 level of detection coverage.

**4.27** Where practicable, automatic detection should be provided in any area that contains combustible materials as well as within the atrium volume. Particular attention should be given, where applicable, to the need for the automatic detection system to initiate active fire protection measures such as smoke-control systems.

**4.28** Consideration should be given to the potential for stratification, which may prevent the fire detection system from operating effectively at upper levels.

**4.29** At the design stage, the ongoing maintenance of the detection and alarm system should be considered, in particular the need for access equipment to reach higher-level detection. Such consideration should be taken in the context of the intended utilisation of the atrium space and the potential impact that the use of such access equipment may have on the operation of the atrium's facilities.

**4.30** Manual call-points should be provided at all exits from the atrium and at intermediate locations, as

required, to meet recommended travel distances to a call-point.

### *Fire alarm warnings*

**4.31** The fire alarm warning system should be designed as an integral part of the evacuation strategy and be arranged so as to minimise distress and disturbance to patients and staff. However, designers should be aware of the likelihood that the atrium's occupant-to-staff ratio will be higher than in any other department of the healthcare building. As a result, greater emphasis should be placed on the self-evacuation of the atrium's occupants.

**4.32** Automatic fire-alarm warning signals should be clear and distinctive so as not to be confused with other signs and signals that may be present.

**4.33** Where the atrium represents a place where significant numbers of the public may be present, consideration should be given to the use of a voice alarm system. This is intended to provide information about the nature of the incident and to accurately direct people's escape in a controlled fashion. Such systems, when properly designed, significantly increase the effectiveness of alarm signals and efficiency of occupant response.

**4.34** Voice alarm systems should be designed in accordance with BS 5839-8.

## Emergency escape routes

**4.35** Where the atrium's occupants are independent, the maximum travel distance before there is a choice of escape routes should be no more than 18 m. This should be reduced to 15 m where occupants are not considered to be independent.

**4.36** A minimum of three exits should be provided from the atrium base, arranged such that at least two exits remain available in the event of a single fire.

**4.37** A minimum of two exits arranged such that at least one remains available in the event of a fire should be provided from each balcony or bridge.

**4.38** Exits should be provided so that the maximum travel distance is limited from any point within the atrium to:

- the circulation space of an adjoining compartment;
- a hospital street;
- a stairway; or
- a final exit.

**4.39** Depending on the occupancy loadings of each balcony or bridge, additional exits may be required (see table below).

| Minimum number of exits | |
|---|---|
| Maximum number of occupants | Minimum number of exits |
| 600 | 2 |
| More than 600 | 3 |

**4.40** Where the atrium's occupants are independent, the maximum travel distance should be limited to 45 m unless otherwise justified by engineering analysis and consideration of the available safe escape time (ASET) and the required safe escape time (RSET).

**4.41** Travel distance should be limited to 30 m where occupants are not considered to be independent.

**4.42** The minimum clear width of escape routes in the atrium base and on each balcony and bridge should be 1200 mm for an occupancy loading up to 200 people per area. Where the occupancy of the atrium base, balcony or bridge is more than 200 people, the minimum clear width of escape routes should be increased by 275 mm for every additional 50 people, or part thereof.

**4.43** Evacuation from adjacent accommodation into the atrium should only be considered when supported by the local fire evacuation procedures and appropriate management.

**4.44** Particular consideration should be given where evacuation through the atrium at levels above the atrium base involves the evacuation of mental health facilities.

## Escape lighting

**4.45** Guidance on emergency escape lighting is contained within BS 5266-1. For hospital buildings, this is supplemented by Health Technical Memorandum 06-01 – 'Electrical services: supply and distribution' and CIBSE's 'Lighting guide LG2: Hospitals and healthcare buildings'.

## Escape signage

**4.46** Clear escape-route signage is essential for directing the atrium's occupants to a place of safety. The need for clear escape signage is particularly important where escape routes are provided through departments that would not usually be accessed by these occupants.

**4.47** Escape and evacuation plans complying with ISO 23601 should be conspicuously displayed to assist those unfamiliar with the building to identify specific fire-safety measures including appropriate escape routes, locations of safe refuge and assembly points. These plans may also prove useful to attending fire response and fire-fighting personnel.

**4.48** Escape signage should comply with BS 5499-4.

## Atrium enclosure

**4.49** An atrium should be enclosed to maintain compartmentation between the atrium and adjacent accommodation, with construction that provides a minimum period of fire resistance of at least 60 minutes (integrity, insulation and, where applicable, load-bearing capacity).

**4.50** The period of fire resistance may be reduced to 30 minutes in healthcare premises where all of the following criteria are met:

- most of the occupants are considered to be independent;
- the fire alarm system operates on a single-stage basis;
- the evacuation strategy is based on an immediate and full evacuation of the building; and
- the emergency escape routes are remote from the atrium.

### Glazed elements forming part of the atrium enclosure

**4.51** Where the atrium enclosure incorporates glazed elements, those glazed elements must maintain the minimum period of fire resistance (integrity and insulation) of the atrium enclosure.

**4.52** In circumstances where the rise in smoke temperature within the atrium can be demonstrated not to exceed 140°C above ambient temperature, and there are no balconies or bridges on the atrium side of the enclosure, any glazed elements incorporated into the atrium enclosure at levels above the atrium base need not meet the requirement for insulation.

**4.53** Glazed elements forming part of the atrium enclosure must include appropriate framing structures that are certified to provide at least the same minimum period of fire resistance as the atrium enclosure.

**4.54** Glazed elements forming the external façade of an atrium need not provide a minimum period of fire resistance. The only exceptions to this are those areas of the external elevation that require fire resistance for reasons of limiting external fire spread.

**4.55** Since the behaviour of glazing systems in a fire, other than those specifically tested to provide a minimum period of fire resistance, is unpredictable, they should not be considered suitable where the enclosure of the atrium is required to be fire-resisting.

**4.56** Non-rated glazing systems are more likely to fail when subjected to temperature gradients; minor imperfections in the surface of the glass may increase the likelihood of premature failure when heated. Additionally, the use of such glazing systems is likely to permit a fire in the accommodation adjacent to the atrium to spread into the atrium enclosure. This is likely to result in a spill plume flowing into the atrium that may present a significantly larger volume of smoke than would be expected to be produced by a plume rising from a fire on the atrium base. As a consequence, unless this has been explicitly taken into account by the smoke-control design, any smoke ventilation provided in the atrium may be overwhelmed. This could result in smoke logging of the atrium space, which may in turn necessitate the evacuation of the atrium's occupants even though the fire has originated in an adjacent department.

## External fire spread

**4.57** To restrict the spread of fire from the atrium to adjacent buildings, adjacent compartments and/or adjacent sites, sufficient separation is required in terms of either distance or fire resistance (see Health Technical Memorandum 05-02 for determining the minimum distance required).

## Smoke control

**4.58** In circumstances where the atrium has access to adjacent accommodation above the atrium base level, or the atrium is not considered to have a limited fire-load, smoke-control measures are necessary to prevent the spread of smoke to areas adjacent to the atrium.

**4.59** Where the atrium has no access to adjacent accommodation above the atrium base level, the compartmentation enclosing the atrium space

should be sufficient to prevent the spread of smoke to adjacent areas. Therefore, additional passive or active smoke-control measures are not required.

### Passive smoke-control measures

**4.60** Openings at all levels within the atrium enclosure should be limited to doors provided with protected lobbies unless appropriate active smoke-control measures have been provided. The protected lobbies should:

- have the same period of fire resistance as the atrium enclosure;
- be sized such that the length of the lobby is at least 1.5 m;
- not form part of a communication through-route between departments or areas of the same department (see Figure 1).

**4.61** The fire doors to protected lobbies should not be provided with hold-open devices unless justified by a detailed risk assessment that includes a consideration of the following:

- the impact of the potential loss of integrity of the atrium enclosure;
- the potential for smoke-layer stratification;
- the potential for a delayed activation of the fire detection system and subsequent release of the lobby doors;
- the risk of smoke permeating into an adjacent department before the lobby doors are released.

**4.62** The findings of this risk assessment should be recorded in the fire strategy and the fire-safety Health Technical Memorandum as appropriate.

### Active smoke-control measures

**4.63** Where active smoke-control measures are required, an appropriate smoke-exhaust system should be provided within the atrium space that is automatically activated either by the detection and alarm system or by other suitable means. Such smoke-control measures should be designed to maintain a steady buoyant layer of smoke at least 1 m above the uppermost opening in the atrium enclosure.

**4.64** Where balconies or bridges are provided within the atrium, the smoke-control measures should ensure that:

- smoke is maintained at least 3 m above the balcony or bridge level; and
- the temperature of the smoke layer does not exceed 200°C for at least the period of time required to evacuate any occupants of the balcony or bridge.

**4.65** Where active smoke-control measures are provided, suitable arrangements for replacement air should be incorporated into the atrium design to ensure the correct operation of the smoke-exhaust system.

**4.66** Inlets for replacement air should be located at low level within the atrium and sized appropriately such that the velocity of air drawn in through the inlets is no greater than 2 m/s.

**4.67** Where automatic entrance doors are used to provide replacement-air inlets, consideration should be given to the potential conflict with security measures, particularly outside the hours that the atrium operates, and the need for an alternative power supply capable of driving the doors open should the mains supply fail.

**4.68** Power supplies for active smoke-control measures should be provided in accordance with BS EN 12101-10.

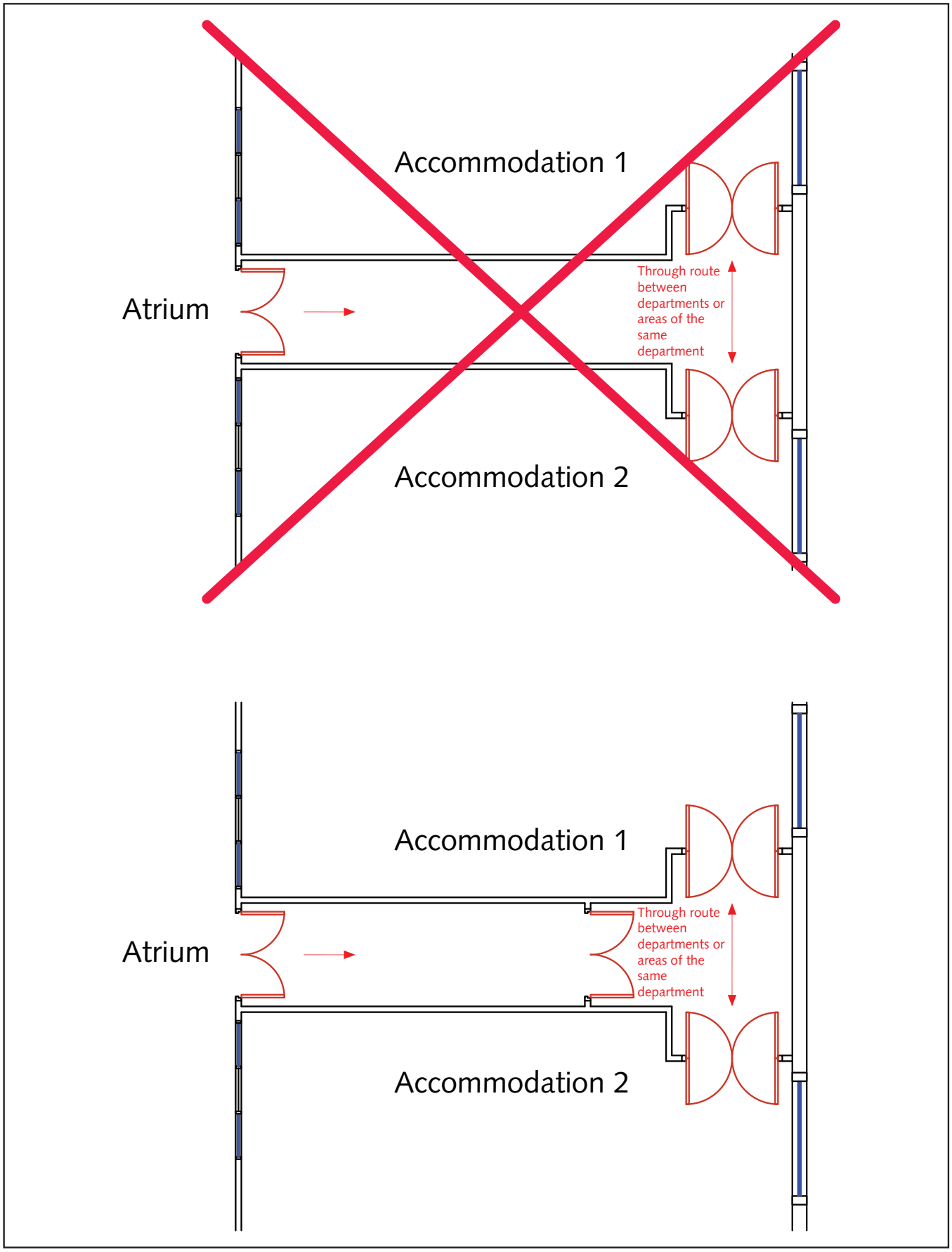
#### *Natural smoke-exhaust ventilation systems*

**4.69** Natural smoke-exhaust ventilation systems rely largely on the pressure differential arising from a natural phenomenon known as "stack effect". Movement of air and smoke within an atrium is driven by the temperature differentials between the external and internal climates. Provided that the temperature of air inside the atrium is higher than that outside, opening outlet vents at high level in addition to low-level inlet vents will cause smoke within the atrium to rise and vent to the outside.

**4.70** Whilst smoke and air will move out through the vents at high level (due to pressure within the smoke layer inside the vent being higher than that outside the building), cooler air will be drawn into the lower-level inlets because the pressure at low level inside the atrium is less than that outside.

**4.71** For this pressure differential to exist, there needs to be a point at some height within the building where the pressure inside is equal to that outside (referred to as the neutral pressure plane). Any openings in the atrium enclosure above the neutral pressure plane will exhibit airflow outwards from the atrium to the surroundings through any leakage

*Figure 1 Protected lobbies must not form part of a through-route*



path that might exist. Any openings in the atrium enclosure below the neutral pressure plane will exhibit airflow inwards towards the atrium where leakage paths exist.

**4.72** Where inlet and exhaust vents are the same size, the neutral pressure plane will be approximately midway within the smoke layer. If the inlet vent area is smaller than the exhaust vent area, the neutral pressure plane will move upwards. By considering (i) the inlet and exhaust vent areas, (ii) their relative positions and (iii) potential leakage paths, it is possible to manipulate the neutral pressure plane to raise it to a specific height. The design of a natural smoke-exhaust ventilation system should control the neutral pressure plane above the openings in the atrium enclosure.

**4.73** Natural smoke-exhaust ventilation systems can be affected by a number of external factors. For example, where the atrium's internal temperature is less than that of the outside air (such as when the atrium is air-conditioned), opening high-level and low-level vents may result in a reversal of the stack effect, thereby forcing smoke and air out of the low-level vents and drawing air in through the high-level vents.

**4.74** Care should be taken to ensure that the arrangement of vents is such that prevailing winds do not affect the operation of the smoke-exhaust system, as adverse wind pressures acting on the ventilation openings may detract from the system's operation.

**4.75** Natural smoke-exhaust ventilators should comply with BS EN 12101-2.

### *Powered smoke-exhaust systems*

**4.76** Powered smoke-exhaust systems use a fan or a series of fans to extract smoke either local to the potential fire or from a smoke reservoir at the top of the atrium.

**4.77** Whilst a powered system is less likely to be adversely affected by changes in wind and ambient temperatures, care must be taken to ensure that the fan or series of fans are specified with consideration for the maximum design wind velocity to cater for all adverse wind pressures.

**4.78** The powered smoke-exhaust system fan or series of fans must be specified in terms of:

- the required extract rate;
- the minimum time for which they are expected to run; and
- the maximum temperature at which they are expected to operate.

**4.79** When a powered smoke-exhaust system is brought into operation, the normal hospital ventilation system should cease to operate unless specifically allowed for in the design of the smoke-exhaust system.

**4.80** Powered smoke-exhaust ventilators should comply with BS EN 12101-3.

## Sprinklers

**4.81** A sprinkler system will reduce the risk of a fire developing and spreading, and will limit the quantities of heat and smoke produced. The design of certain types of smoke-control system may also require a sprinkler system to be installed to restrict the size and hence the smoke production of a fire.

**4.82** Where the extent of the fire load present within the atrium is not clearly defined, the sprinkler system should be capable of effectively controlling a fire anywhere within the atrium.

**4.83** Where a discrete fire load or separate fire loads are clearly defined and their extent is adequately controlled or restrained, partial sprinkler coverage may be provided only to those defined fire loads.

**4.84** The design of the sprinkler system should take into account the reduced effectiveness of sprinkler heads when they are located high above the seat of a fire.

**4.85** Where the atrium provides access to adjacent accommodation above the atrium base level, an automatic sprinkler protection system should be provided unless the fire load is otherwise suitably controlled.

**4.86** The design of a sprinkler system should comply with the recommendations of BS EN 12845; however, where a partial coverage sprinkler system is provided, as described above, the recommendations for 60-minute fire separation between sprinklered and non-sprinklered areas need not be applied within the atrium.

## Facilities for fire-fighting

**4.87** Health Technical Memorandum 05-02 provides guidance on adequate facilities for fire-fighting and rescue activities. However, it is likely that the fire-and-rescue service may need to release smoke and

heat from the atrium after the fire has been suppressed.

**4.88** Where a smoke-exhaust system has been provided, it will not generally be necessary to provide additional facilities for use by the fire-and-rescue service.

**4.89** Where a smoke-exhaust system has not been included as part of the fire-safety measures, it will be necessary to provide smoke-clearance facilities for operation by the fire-and-rescue service.

**4.90** For an atrium no higher than 18 m, the smoke-clearance system may be provided by means of natural exhaust vents in the atrium roof, which are operated under control of the fire-and-rescue service. The total area of vents should be not less than 10% of the maximum plan area of the atrium.

**4.91** A mechanical smoke-clearance system may be provided instead of natural exhaust vents. However, a mechanical smoke-clearance system should be provided in any atrium that is higher than 18 m.

**4.92** A mechanical smoke-clearance system should be designed to provide replacement air changes every hour based on the total volume of the atrium as follows:

- four air changes per hour in a sprinklered atrium or where the atrium has a limited fire load (see paragraph 4.11 'Fire loads'); or
- six air changes per hour in a non-sprinklered atrium.

**4.93** Power supplies for the smoke-clearance system should be provided in accordance with BS EN 12101-10.

### Ventilation controls for the fire-and-rescue service

**4.94** In addition to the normal ventilation controls provided for the fire-and-rescue service as described in Health Technical Memorandum 05-02, controls should also be provided to allow the control of active smoke-control systems, whether they are natural smoke exhaust or powered smoke exhaust.

**4.95** Such controls should allow either:

- the powered smoke-exhaust ventilation system to be manually switched on to full operation or to be switched off; or
- natural smoke ventilators to operate fully to an open position or to be closed.

**4.96** Where a smoke-clearance system is provided, controls for use by the fire-and¬rescue service should be located in a suitable position within either the atrium base or an adjoining compartment adjacent to the atrium entrance. The controls should allow the clearance system to be manually turned on/off.

## Segregation of hospital services

**4.97** To ensure that a fire within an atrium cannot disrupt or damage any of the services supplying hospital departments, it will be necessary to segregate hospital services from the atrium.

**4.98** Services supplying hospital departments should not be routed through atria spaces. Where this is not practical, they should be accommodated within enclosures that provide a minimum period of fire resistance of at least 60 minutes.

**4.99** Piped medical gases should not be routed through an atrium (see Health Technical Memorandum 02-01 – 'Medical gas pipeline systems' for further guidance).

# 5 Fire engineering considerations

5.1 The details in the following sections are not intended to provide a guide for fire engineering calculations and models, but are intended to provide:

- an aide-mémoire to those tasked with developing fire engineering solutions; and
- a starting point for those without a fire engineering background who may be asked to comment on or accept a fire-engineered solution.

Experience of numerous healthcare design projects has shown that many of the issues discussed here have required further consideration by the design team and have led to proposals being rejected and/or alternative solutions being sought.

## Fire loads

5.2 Determining the appropriate fire loads for the purposes of fire engineering calculations requires specific knowledge of the nature and quantities of combustible materials likely to be present in the atrium space.

5.3 Generally, details regarding the contents of the atrium space are unlikely to be finalised by the time that engineering calculations are required to determine the fire protection measures appropriate for the atrium. Therefore, it is usual for assumptions to be made regarding the nature and quantity of combustibles or average fire-load densities that may be present.

5.4 All such assumptions should be documented and sufficiently detailed to allow all stakeholders to consider the basis of such assumptions and to afford some degree of validation of the assumptions being made.

5.5 The utilisation of the atrium is likely to result in some fire loads that are fixed (such as reception desks and seating areas), whilst other fire loads may only be present infrequently or at certain times of the year (such as health promotions or seasonal decorations).

5.6 If transient fire loads are likely to be introduced (such as for the restocking of commercial enterprises or for quantities of personal belongings), a consideration of such fire loads should be included in the fire engineering submission.

5.7 Commercial enterprises such as shops and cafeterias present particular challenges when incorporated within an atrium space. Not only does the commercial enterprise represent a particular fire load, but the activities of the commercial tenant are invariably beyond the direct control of building management. Also, it is not uncommon for building managers to not have access to the commercial outlet outside its usual hours of operation.

5.8 Where commercial outlets are provided within the atrium, fire load assumptions should:

- define the fire load attributable to each commercial outlet;
- include a significant margin to reflect the potential difficulties of day-to-day management control; and
- consider the possible impact on intervention due to the potential for limited access.

5.9 Sufficient separation, in terms of distance or fire resistance, should be provided to each commercial outlet to prevent the involvement of other fire loads within the atrium space.

## Controlling fire loads

5.10 It is inherent in any fire engineering solution that the fire load should be controlled within the limits considered by the fire engineering study. In practice the management process required to adequately control the fire loads present is not straightforward.

5.11 It is often the case that the utilisation of the atrium space incorporates significant fire loads associated

with commercial enterprises. Whilst it is usual for the activities of commercial tenants to be regulated by means of a tenancy agreement, day-to-day control of individual tenants and their activities, which may affect the fire loads present within the atrium, is considerably more difficult. Clear parameters are necessary to ensure that the activity of commercial tenants can be practically managed.

**5.12** Where an atrium provides the main entrance to the building, it is common for the space to be utilised for health promotion displays, charitable sales and/or seasonal decorations, all of which are likely to increase the overall fire load in the atrium.

**5.13** The design team should consider the potential for such additional fire loads and should provide practical parameters to assist in the management and control of any such additional fire loads. Such details should be provided in a useful format such as a number of display boards for a health promotion or a number of tables for a charitable sale. They should include:

- the quantity and nature of combustibles that may be permitted within the atrium space without compromising the fire engineered solution;
- the appropriate location(s) for additional fire loads; and
- the minimum separation between any additional fire loads and:
  - (i) the building structure,
  - (ii) fixed fire loads,
  - (iii) any other additional fire loads, and
  - (iv) any sprinkler head, where fitted.

## Fire plumes

**5.14** Where active smoke-control measures are required, the specification of the smoke-exhaust system is largely dependent on the amount of smoky gases produced by the fire. The most significant effect on the quantity of smoke rising in the smoke plume is the amount of air that is entrained into the fire plume as it rises.

**5.15** The entrainment of air into the fire plume is largely dependent on the geometry and surface area of the rising plume:

- Where the plume from a fire originating on the floor rises away from the walls and is unobstructed in its ascent, air is entrained from all sides. In these cases, the plume geometry is considered to be axisymmetric – that is, the plume will appear to be approximately symmetrical about the centre line from its base to the extent of its rise.
- Where a plume results from a fire originating on the floor close to a wall, the rising plume entrains air only from the sides that are away from the wall.
- Where a plume rises beneath an obstruction, such as a lower-level ceiling or the underside of a balcony, the vertical movement of the plume is halted and the hot gases will turn and move sideways until they reach the edge of the horizontal structure. At this point the hot gases will turn again and effectively spill over the edge of the low-level structure before continuing their vertical rise.

A number of mathematical formulae have been developed to allow calculation of the mass flow of air entrained into a rising plume; however, these are beyond the scope of this Health Technical Memorandum.

**5.16** A reasonable approximation to compare the characteristics of each of the above plume types is that the mass flow of air into a plume against a wall is approximately half that of an axisymmetric plume resulting from a similar sized fire and rising over a similar height.

**5.17** The mass flow rate of air entrained into a spill plume can be more than twice that of an axisymmetric plume from a similar sized fire and rising over a similar height.

**5.18** Ensuring that the correct plume type and corresponding mathematical formulae are used in developing the fire engineering solution is of vital importance in determining the appropriate parameters for the operation of smoke-control systems.

## Maintenance of smoke-control systems

**5.19** In some cases, smoke-control systems have been deployed with little consideration given to the process of maintaining such systems in an operational healthcare building. In particular, where mechanical smoke-exhaust ventilation has been provided, routine maintenance requirements

can have an adverse effect on the building's occupants.

**5.20** The periodic testing of mechanical smoke extract can introduce significant levels of noise and disturbance, which can be of particular concern when such effects are experienced in areas that may be occupied by in-patients and are adjacent to the atrium.

**5.21** Where the healthcare premises operate 24 hours a day, it may not be possible to test the mechanical smoke extract system without disturbing patients.

**5.22** Since it will be necessary to test the operation of active smoke-control measures using both their primary and secondary supplies, the maintenance regime must ensure coordination with the testing of the standby generators where these are used as the secondary supply for the smoke-control system.

**5.23** Since testing of the standby generators usually takes place for a minimum duration to minimise disruption, there is a limited opportunity to complete the maintenance tests for the smoke-control system using the secondary supply where this is provided by the generator.

**5.24** Whilst it is possible to verify the opening of passive vents and the running of mechanical extract fans during routine maintenance testing, it is not usually possible to test the effectiveness of the smoke-control system once it has been commissioned.

## Evacuation process

**5.25** In a healthcare building, it is likely that most of the occupants will exhibit reduced mobility or cognitive impairment, and this should be considered in any calculations (for example the required safe escape time (RSET)).

**5.26** It is likely that when visitors to a healthcare building encounter a fire, their expectation is that they will be cared for by staff and their safe evacuation will be controlled by others.

**5.27** As previously described, in an atrium it is likely that there will be insufficient staff on hand to adequately control the safe evacuation of all the atrium's occupants.

**5.28** It is necessary to determine the roles and responsibilities for all staff that are present, whether directly employed or otherwise, should a fire occur within the atrium.

**5.29** Where facilities such as a waiting area, cafeteria or restaurant are provided within the atrium space, it is also usual for toilet facilities, accessed from the atrium, to be provided. Such provision is likely to include an accessible toilet whose occupants may be delayed before starting their evacuation. It may be necessary for the safe evacuation of disabled users to ensure that appropriate staff assistance is provided.

**5.30** Where escape routes from the atrium pass through adjacent departments, sufficient staff should be available to direct those evacuating from the atrium to a suitable place of safety, whilst also minimising the disturbance to patients and the impact on the department's preparations in readiness for their own evacuation should it be necessary.

## Fire incident control

**5.31** The organisational response to a fire incident usually relies on the coordination of a small team of responders. In healthcare premises, occupants of a compartment involved in a fire are evacuated to a place of relative safety initially by those members of staff present within the compartment at the time of the fire. Additional members of staff are tasked with assisting in the evacuation of patients and other occupants from the compartment involved in the fire as appropriate.

**5.32** The task of coordinating such responses and of getting additional members of staff to assist in the evacuation process is far more complex where the evacuation is taking place from multiple compartments or on multiple levels simultaneously. In the case of an atrium – particularly one with seating areas on balconies or bridges at several levels – it is likely that the complexities of coordinating a safe evacuation of all the atrium's occupants will place a significant burden on the organisation's incident command and control until the arrival of the fire-and-rescue service.

**5.33** Where waiting or seating areas are provided within the atrium, it should not be assumed that staff from an adjacent compartment will be immediately on hand to ensure the safe evacuation of the atrium's occupants, even though the waiting or seating area may form part of the same department. It is possible that staff in the adjacent compartment will be occupied in the treatment and/or care of patients and on hearing an intermittent alarm signal may complete this activity before helping the atrium's occupants to evacuate.

**5.34** The use of an automatic voice alarm can greatly reduce the pre-movement time of occupants in waiting areas, thus reducing the reliance on staff assistance in the event of a fire.

## Potential effects on patients in adjacent areas

**5.35** It is usual for the atrium enclosure to include windows and other glazed elements, which allow light from the atrium space to permeate into the adjacent accommodation. If a fire occurs, these windows may provide a view of the smoke rising within the atrium and the gradual descent of the smoke layer from the atrium roof or soffit.

**5.36** It has been observed in many fire incidents that those witnessing a fire will become spectators of the event until they feel directly threatened by the fire or the fumes it produces. Such behaviour may impede the safe evacuation of the atrium's occupants or those in adjacent areas.

**5.37** Where areas adjacent to the atrium accommodate patients that are not able to evacuate without assistance, witnessing the atrium filling with smoke may increase patients' anxiety and exacerbate their condition, particularly if staff are unable to provide assistance or reassurance due to their being involved in the evacuation of the atrium's occupants.

# 6 Organisation and management

6.1 An atrium in a healthcare building presents specific fire-safety challenges.

6.2 The effective management of fire safety within the atrium is of critical importance in ensuring the safety of the atrium's occupants and potentially those occupying adjacent departments, should a fire occur within the atrium.

## Roles and responsibilities

6.3 Effective fire-safety management requires that the roles and responsibilities of staff involved are clearly defined and communicated. It is essential that an appropriate individual is nominated to take ownership and responsibility for the day-to-day fire-safety matters associated with the atrium.

6.4 The nominated person, and where appropriate their deputies, should be available on site at all times that the atrium is in use:

- to ensure that adequate fire-load control is being exercised; and
- to provide assistance and advice to the senior person tasked with coordinating the emergency response to a fire incident.

6.5 The nominated person, and where appropriate their deputies, should have sufficient authority and capacity and be provided with sufficient training to allow them to undertake their roles effectively. In particular, the nominated person or their deputies will be required to understand the parameters of the fire load considered in the fire-safety design and the constraints placed on the use of the atrium.

6.6 Since the atrium's occupant-to-staff ratio is likely to be significantly larger than in any other department of the healthcare building, it is essential that those staff present within atrium operate effectively to ensure the safe evacuation of the atrium's occupants in the event of a fire.

6.7 Each member of staff on duty within the atrium, whether directly employed by the healthcare organisation or employed by others (such as commercial tenants), should clearly understand their roles in the management of fire safety and in coordinating the safe evacuation of the atrium's occupants.

6.8 Where waiting areas associated with adjacent departments are located within the atrium space, it is important to ensure that the responsibility for the safe evacuation of occupants of those waiting areas (or similar facilities) is clearly defined.

6.9 It is necessary to determine whether responsibility for the evacuation of departmental areas located within the atrium rests with the departmental staff or those on duty within the atrium.

## Emergency action plans

6.10 Each atrium space should have a written emergency action plan that provides details specific to that area and which is coordinated with the emergency action plans of adjacent departments and the organisation's major incident plan.

6.11 The emergency action plan should include:

- means for raising the alarm in case of fire;
- the arrangements for managing and coordinating the evacuation of the atrium's occupants;
- the number of staff on duty during periods when the atrium is occupied;
- the number of staff required to assist in a fire emergency;
- the procedures in place to ensure that staff identified as being required to assist are available during all periods when the atrium is occupied;
- a detailed description of the evacuation process including the process and responsibilities for evacuating commercial enterprises, departmental areas and common facilities such as toilet areas;
- the availability of equipment and the methods to be used for the movement or evacuation of

those occupants with mobility or cognitive impairment;

- means for first-aid fire-fighting;
- periodic and formally recorded staff training in all these matters.

**6.12** The emergency action plan should be continually monitored and should be reviewed whenever there is a significant change in the management, staffing, utilisation or internal layout of the atrium.

## Staff training

**6.13** To minimise the potential for fire and to ensure that the emergency action plan can be effectively implemented, training will be needed for all relevant staff members.

**6.14** An analysis of staff training needs should be undertaken to ensure that members of staff receive training relevant to the fire hazards, control measures and emergency action plan for the atrium.

**6.15** All members of staff, whether directly employed by the healthcare organisation or employed by others, should receive fire-safety and emergency training as determined by the training needs analysis.

**6.16** Further guidance on the fire-safety training of staff in healthcare premises can be found in Health Technical Memorandum 05-03 Part A – 'General fire safety'.

# 7 References

Regulatory Reform (Fire Safety) Order 2005.

Health Technical Memorandum 05-02 – 'Guidance in support of functional provisions for healthcare premises'.

Health Technical Memorandum 05-03 Part B – 'Fire detection and alarm systems'.

Health Technical Memorandum 06-01 – 'Electrical services: supply and distribution'.

'Lighting guide LG2: Hospitals and healthcare buildings'. CIBSE.

Health Technical Memorandum 02-01 – 'Medical gas pipeline systems'.

Health Technical Memorandum 05-03 Part J – 'Guidance on fire engineering of healthcare premises'.

Health Technical Memorandum 05-03 Part A – 'General fire safety'.