



Department  
of Health

# Health Technical Memorandum 00

## Policies and principles of healthcare engineering

2014 edition



March 2014

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This document is available from our website at <https://www.gov.uk/government/collections/health-technical-memorandum-disinfection-and-sterilization>

*Front cover photograph courtesy of Chelsea and Westminster Hospital NHS Foundation Trust*

# 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 (see diagram below).

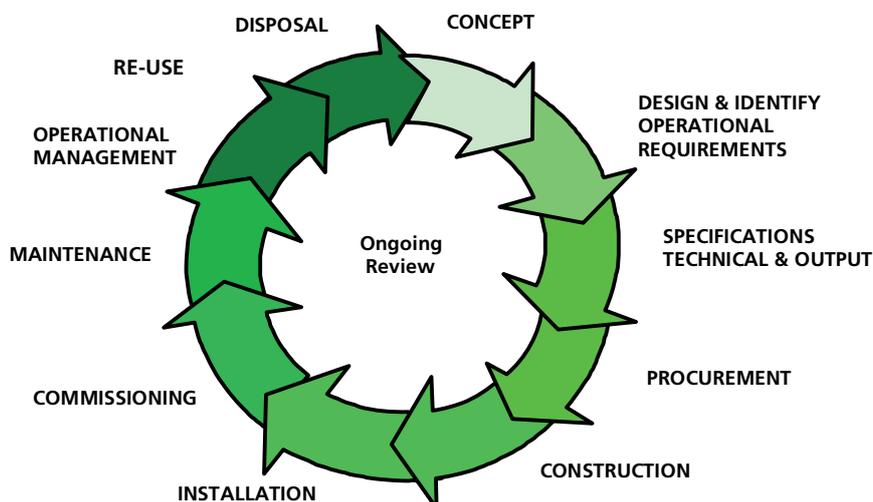
Healthcare providers have a duty of care to ensure that appropriate governance arrangements are in place and are managed effectively. The Health Technical Memorandum series provides best practice engineering standards and policy to enable management of this duty of care.

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)

Choice Framework for local Policy and Procedures 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

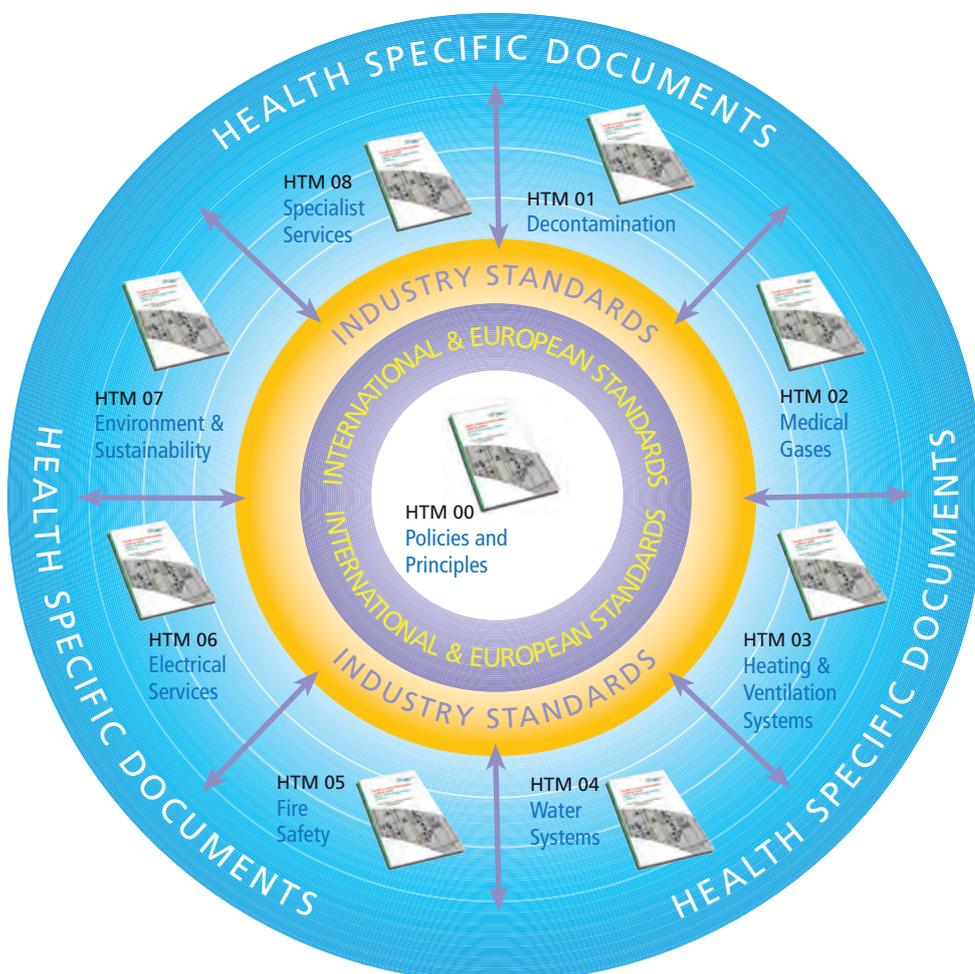
Health Technical Memorandum 06  
Electrical services

Health Technical Memorandum 07  
Environment and sustainability

Health Technical Memorandum 08  
Specialist services

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.

## Other resources in the DH Estates and Facilities knowledge series

### Health Building Notes

Health Building Notes give best practice guidance on the design and planning of new healthcare buildings and on the adaptation/extension of existing facilities.

They provide information to support the briefing and design processes for individual projects in the NHS building programme..

All Health Technical Memoranda should be read in conjunction with the relevant parts of the Health Building Note series.

### Activity DataBase (ADB)

The Activity DataBase (ADB) data and software assists project teams with the briefing and

design of the healthcare environment. Data is based on guidance given in the Health Building Notes and Health Technical Memoranda.

For ADB technical queries only, contact the ADB Helpdesk. Telephone number: 01939 291684; email: [support@talonsolutions.co.uk](mailto:support@talonsolutions.co.uk)

For new ADB customers and licence renewals only, email: [adblicencerenewals@dh.gsi.gov.uk](mailto:adblicencerenewals@dh.gsi.gov.uk)

## How to obtain publications

**Health Technical Memoranda** are available from the UK Government's website at:

<https://www.gov.uk/government/collections/health-technical-memorandum-disinfection-and-sterilization>

**Health Building Notes** are available from the same site at:

<https://www.gov.uk/government/collections/health-building-notes-core-elements>

# Executive summary

## Preamble

This is the 2014 edition of Health Technical Memorandum (HTM) 00 – ‘Policies and principles of healthcare engineering’. The document has been revised to reflect changes in legislation, guidance, the structure of the NHS, and government policy and direction on health and social care. The order of chapters has also been revised to address a wider audience. A summary of major changes since previous editions is provided at the end of this Executive Summary.

This 2014 edition supersedes all previous versions of HTM 00.

## Introduction

HTM 00 gives best practice advice and provides a generic overview for DH’s HTM series.

It is provided as a guide to issues relating to the management of engineering and technical service provision that can be applied to NHS and other healthcare facilities, that is, wherever NHS patients are treated.

## Scope

HTM 00, and the series it supports, provides specific advice and guidance on the design, installation and effective operation of a healthcare facility from an engineering technology perspective. While it is not intended to cover every possible scenario, for example the concept of “hospital at home” (in a domestic dwelling), the standards and principles it

advocates may be appropriate to follow in all locations where healthcare is provided.

Dependent on the requirements, this document should be read in conjunction with the relevant HTMs and Health Building Notes (HBNs).

## Aim of the guidance

The aim of HTM 00 is to ensure that everyone concerned with the management, design, procurement and use of the healthcare facility understands the requirements of the business-critical building and engineering technology in order to ensure optimum safety for all who are present in the building.

Only by having knowledge of these requirements can the organisation’s board and senior managers understand their duty of care to provide safe, efficient, effective and reliable systems which are critical in supporting direct patient care. When this understanding is achieved, it is expected that appropriate governance arrangements would be put in place, supported by access to suitably qualified staff to provide this “informed client” role, which reflect these responsibilities.

By following this guidance and applying it to the particular needs of their local healthcare organisation, boards and individual senior managers should be able to demonstrate compliance with their responsibilities and thereby support a culture of professionalism.

## Users of the guidance

Providers of NHS healthcare and operating facilities in England will be the main users of this document. However, other stakeholders, including regulators and inspectors, may also be interested and will expect that this best practice guidance is being followed or that, where this is not the case, healthcare providers can demonstrate how any best practice expectations are being met by equal and alternative means.

Commissioners of NHS-funded health and care should expect that the facilities to which they refer patients should provide a safe, caring environment that aids a patient's recovery and does not expose them to undue risk. Therefore the resilience and maintenance of critical engineering services and business continuity – linked to policies for emergency preparedness and the ability to respond to major incidents – should be high on a provider organisation's agenda.

Documented evidence that shows compliance with this guidance should provide supporting material to underpin evaluation within the NHS Premises Assurance Model (NHS PAM) and provide confidence of standards to the board of directors and the Care Quality Commission (CQC)

## Structure

Within this document, each section deals with a different aspect of engineering and technical management including design and installation, general engineering services, maintenance and training. Examples of procedures and commonly applicable statutes and legislation are included in the [Appendices](#).

- Chapter 1 outlines the policy context.
- Chapter 2 explains the scope and application of HTM 00.
- Chapter 3 considers appropriate professional and technical support and looks at development of operational

policies and advocates service-user involvement.

- Chapter 4 provides general guidance on the engineering, technical and environmental aspects of healthcare building design.
- Chapter 5 considers maintaining engineering systems to provide optimum performance and maximise the potential for critical service availability.
- Chapter 6 provides guidance on staff training, systems and operation and maintenance procedures.
- Chapter 7 provides an overview of the HTM suite.

## Recommendations

HTM 00 recommends that boards and chief executives, as accountable officers, use the guidance and the references provided:

- when planning and designing new healthcare facilities or undertaking refurbishments;
- when developing governance and assurance systems which take account of risk and the safety of patients, staff and visitors;
- to establish principles and procedures which:
  - recognise and address both corporate and individuals' responsibilities;
  - recognise the link between business-critical engineering systems and emergency preparedness capability;
  - reflect the important role that engineering policies and principles, as implemented by suitably qualified professional and technical staff, have in support of direct patient care.

Once boards and chief executives have embraced the principles set out within this document and taken the necessary actions, their duty of care responsibilities are more likely to be fulfilled, as will their ability to maintain public confidence in the NHS at local level.

## List of major changes since the 2006 edition

- Chapter 1 on policy and the legislative framework has been amended in line with the changes to the NHS landscape since the previous edition.
- The engineering services chapter has been expanded to include all aspects of building services healthcare engineering and renamed as “design and installation”.
- The “professional support” and “operational policy” chapters have been

combined into one chapter to aid understanding and improve the flow.

- The “overview of engineering services guidance” has been updated to reflect changes to the HTM portfolio. It has also been appropriately renamed as “Supporting Health Technical Memoranda”.
- The chapter on “emergency preparedness and contingency planning” has been eliminated and its content on emergency planning and resilience has been redistributed to Health Building Note 00-07 – ‘Planning for a resilient healthcare estate’. Measures appropriate to the reliability of engineering services have been retained and included within the chapter on design and installation.
- All chapters have been reordered within the document to improve the flow.

# Glossary of acronyms

**AE:** Authorising Engineer

**AP:** Authorised Person

**BIM:** building information modelling

**BMS:** building management system

**CDM:** Construction (Design and Management) [regulations]

**CFPP:** Choice Framework for local Policy and Procedures

**CHP:** combined heat and power

**CP:** Competent Person

**CQC:** Care Quality Commission

**DH:** Department of Health

**DP:** Designated Person

**HBN:** Health Building Note

**HSE:** Health & Safety Executive

**HTM:** Health Technical Memoranda(um)

**MHRA:** Medicines and Healthcare products Regulatory Agency

**NHS PAM:** NHS Premises Assurance Model

**PM:** planned maintenance

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# 1. Policy and regulatory overview

## Assurance of estates and facilities

**1.1** One of the government's key priorities is delivering better health outcomes for patients.

**1.2** The quality and fitness-for-purpose of the healthcare estate is vital for the delivery of high quality, safe and efficient healthcare, and this document sets out the general engineering principles used in the construction and operation of the healthcare estate.

**1.3** Quality and fitness-for-purpose of the estate are assessed against a set of legal requirements, standards and best practice guidance. Adhering to the guidance outlined in this Health Technical Memorandum (HTM) will be taken into account as evidence towards compliance with these legal requirements and standards.

**1.4** Where the principles of the guidance are not to be followed, organisations should document how the expectations are being met by equal and alternative means.

## Regulator requirements: standards of quality and safety

**1.5** The Care Quality Commission (CQC) regulates all providers of regulated health and adult social care activities in England. The CQC's role is to make sure health and social care services provide people with safe, effective, compassionate, high-quality care and to encourage care services to improve.

**1.6** At the time of preparing this document for publication, registration requirements are set out in the Care Quality Commission (Registration) Regulations 2009 (CQC Regulations) and include requirements relating to:

- safety and suitability of premises;
- safety, availability and suitability of equipment; and
- cleanliness and infection control.

### Note on amendment to the CQC Regulations

New regulations are due to come into effect during 2014 and will apply to all providers of health and social care that are required to register with the CQC.

**1.7** The CQC is responsible for assessing whether providers are meeting the registration requirements. Failure to comply with the CQC Regulations is an offence and, under the Health and Social Care Act 2008 (Regulated Activities) Regulations 2010, CQC has a wide range of enforcement powers that it can use if the provider is not compliant. These include the issue of a warning notice that requires improvement within a specified time, prosecution, and the power to cancel a provider's registration, removing its ability to provide regulated activities. The regulations stipulate that all premises and equipment used

must be safe, clean, secure, suitable for the purpose for which they are being used, and properly used and maintained.

## NHS Constitution

**1.8** The [NHS Constitution](#) sets out the rights to which patients, public and staff are entitled. It also outlines the pledges that the NHS is committed to achieve, together with responsibilities that the public, patients and staff owe to one another to ensure that the NHS operates fairly and effectively. All healthcare organisations are required by law to take account of this Constitution in their decisions and actions.

**1.9** Healthcare organisations need to “ensure that services are provided in a clean and safe environment that is fit for purpose, based on national best practice” [pledge].

In order to deliver on this pledge, it specifically advises NHS organisations to take account of:

- national best-practice guidance for the design and operation of healthcare facilities;
- the NHS Premises Assurance Model (NHS PAM).

## NHS Premises Assurance Model

**1.10** The NHS has developed, with the support of DH, the NHS Premises Assurance Model (NHS PAM), whose remit is to provide assurance for the healthcare environment and to ensure patients, staff and visitors are protected against risks associated with hazards such as unsafe premises.

**1.11** Primarily aimed at providing governance and assurance to boards of organisations, it allows organisations that provide NHS-funded care and services to better understand the effectiveness, quality and safety with which they manage their estate and facilities services and how that links to patient experience and patient safety.

**1.12** Key questions are underpinned by prompt questions which require the production of evidence. Healthcare organisations should prepare and access this evidence to support their assessment of the NHS PAM.

**1.13** The model also includes reference to evidence and guidance as a helpful aide-memoir to assist in deciding the level of NHS PAM assurance applicable to a particular healthcare site or organisation.

**1.14** NHS PAM is designed to be available as a universal model to apply across a range of estates and facilities management services.

**1.15** For more information on how to use the tool, visit the [NHS PAM website](#).

## Impact from, and adapting to, climate change

**1.16** Healthcare organisations need to be mindful of the Climate Change Act and the resultant measures that need to be taken, particularly with regard to flooding, drought, hot weather and freezing temperatures (for further guidance, see Health Building Note (HBN) 00-07 – ‘Planning for a resilient healthcare estate’).

**1.17** There are two main areas of focus for action with respect to climate change:

- Mitigation** – which reduces the impact of business functions on the climate through the lowering of carbon emissions from energy use, the reduction of water consumption, improved efficiency of transport etc. Under the Climate Change Act, the government has set up the CRC Energy Efficiency Scheme, which requires large public and private sector organisations to achieve energy-saving targets.
- Adaptation** – which requires measures be put in place to minimise the adverse effects of climate change (for example, flooding, storms, heatwaves and impact on air quality). With respect to buildings

and infrastructure, flooding is identified as the main threat by the current UK Climate Change Risk Assessment. The next update to this assessment is expected in 2017.

**1.18** All public sector bodies are required by government under the National Adaptation Programme (NAP) to put plans in place to address both the causes and consequences of climate change.

**1.19** The Sustainable Development Unit (SDU) has promoted the development of a sustainable development management plan (SDMP) by all healthcare provider organisations. Further details can be found on the [SDU's website](#).

## Health and safety legislation

**1.20** The Health & Safety Executive (HSE) is the national regulator for workplace health and safety. The following legislation places legal duties on various dutyholders (see also [Appendix B](#)):

- Workplace (Health, Safety and Welfare) Regulations
- Health and Safety at Work etc Act 1974, section 3
- Management of Health and Safety at Work Regulations, regulation 3
- Construction (Design and Management) Regulations
- Manual Handling Operations Regulations.
- Pressure Equipment Regulations
- Pressure Systems Safety Regulations
- Confined Space Regulations
- Fire safety regulations

For more information, visit the [HSE's website](#).

## 2. Scope and application of Health Technical Memorandum 00

### Note

This HTM was prepared for publication in March 2014. Readers should ensure that they use the latest or new edition of all legislation, British/European Standards and guidance that post-date the publication of this document

**2.1** HTMs are the main source of specific healthcare-related guidance for estates and facilities professionals. They give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare.

**2.2** HTM 00 is supported by the HTM suite of guidance. The aim of HTM 00 is to ensure that everyone concerned with the managing, design, procurement and use of the healthcare facility understands the requirements (including regulatory) of the specialist, critical building and engineering technology involved. The core guidance (including professional support) is applicable to all building engineering services including those not covered by HTMs (for example, steam, pressurised hot water and gas services).

**2.3** HTM 00 addresses the general principles, key policies and factors common to all

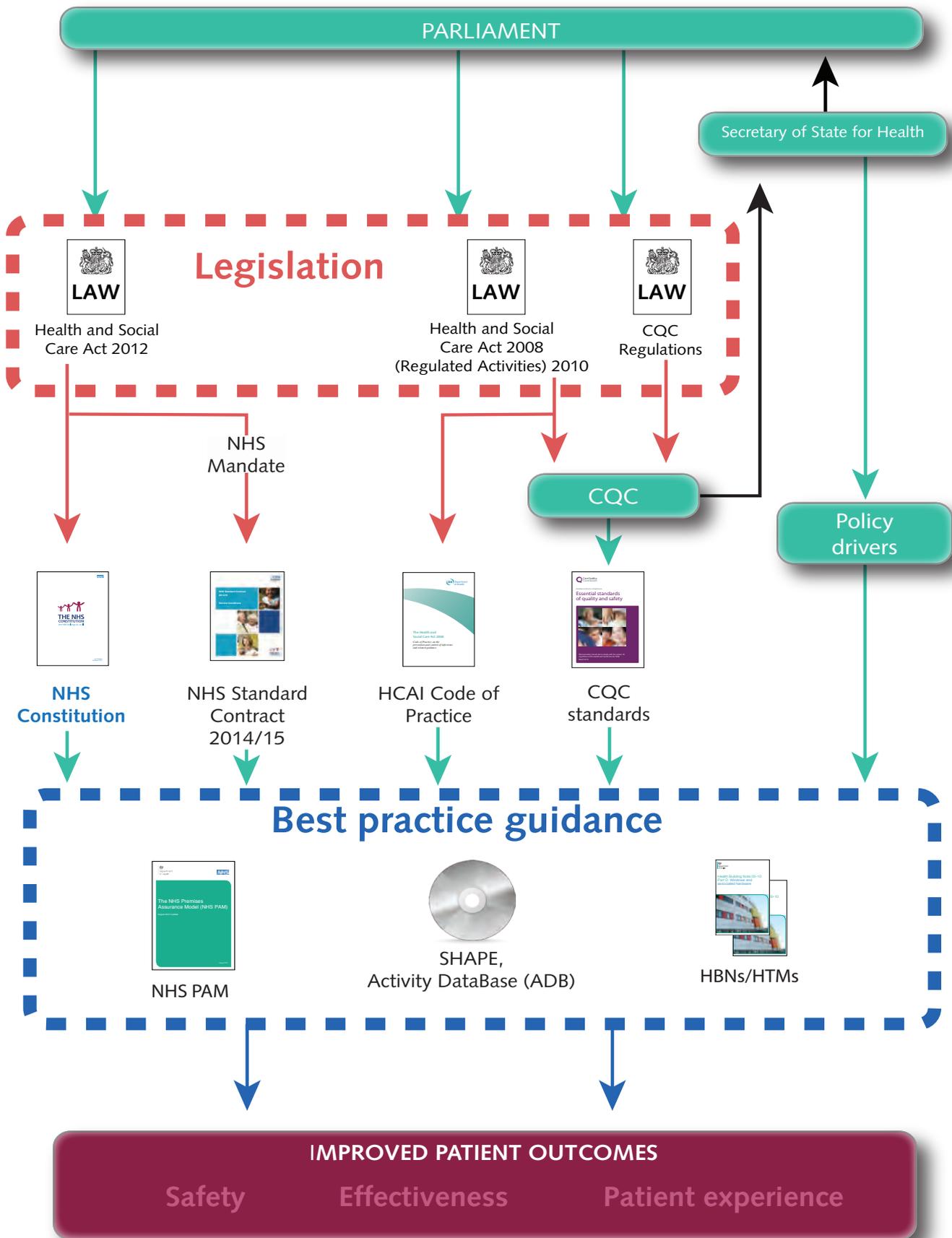
engineering services within a healthcare organisation. Key issues include:

- compliance with policy and relevant legislation;
- professional support and operational policy;
- design and installation;
- maintenance;
- training requirements.

### Principles of healthcare engineering

**2.4** Patients and staff have a right to expect that engineering systems and equipment will be designed, installed, operated and maintained to standards that will enable them to function efficiently, reliably and safely. Compliance with the guidance in the HTMs will help to meet these goals. See [Chapter 7](#) for an overview on the full list of current HTMs.

**2.5** Healthcare providers have a duty under the Health and Safety at Work etc Act to ensure that appropriate engineering governance arrangements are in place and are managed effectively. HTMs provide best practice engineering standards and policy to enable management of this duty of care.



**2.6** The special nature of healthcare premises and dependency of patients on the provision of effective and efficient engineering services (in most cases 24 hours a day, seven days a week) requires that engineering staff and systems must be resilient in order to maintain the continuity of health services and ensure the ongoing safety of patients, visitors and staff.

**2.7** Evidence suggests that a comfortable healthcare environment can have a strong influence on the healing cycle and patient experience (see HBN 00-01 – ‘General design guidance for healthcare buildings’). This needs to be achieved in a sensitive way, with design having regard to the function and purpose of the specific and adjoining areas.

## Engineering governance

**2.8** Engineering governance is concerned with how an organisation directs, manages and monitors its engineering activities to ensure compliance with statutory and legislative requirements while ensuring the safety of patients, visitors and staff is not compromised (see also [paragraph 4.98](#) on the Construction (Design and Management) (CDM) regulations).

**2.9** To help achieve this, healthcare organisations need to ensure that sound policies are approved by the board of directors. These should:

- ensure safe processes, working practices and risk management strategies are in place to safeguard all their stakeholders and assets in order to prevent and reduce harm or loss; and
- be backed up with adequate resources and suitably qualified, competent and trained staff.

**2.10** Responsibility and, more specifically, the duty of care within a healthcare organisation are vested in the board of directors and its supporting structure.

## Reviews

**2.11** Management should conduct regular reviews of the effectiveness of the healthcare organisation’s engineering structure and systems. The review should cover all controls, including strategic, operational, safety and engineering risk management.

## 3. Professional support and operational policy

**3.1** Managers of healthcare property and services need technical and professional support across a range of specialist services. This support should be embedded in the structure and responsibility framework of the organisation to ensure an adequate approach for each of the areas covered by the healthcare-specific technical engineering guidance.

**3.2** Within this HTM, a range of measures are discussed to meet the needs of each service. This section considers the principles, standards and common features that will be applicable as a core approach.

### Management and responsibility

**3.3** Healthcare organisations have a duty of care to patients, visitors and staff to ensure a safe and appropriate environment for healthcare. This requirement is identified in a wide range of legislation and common law.

**3.4** At the most senior level within an organisation, this responsibility does not need to include technical, professional or operational duties, but the “accountable officer” (see diagram below) should have access to a structure that delivers governance, assurance and compliance through a formal reporting mechanism.

### Note

Healthcare organisations should ensure that where facilities are provided under a PFI (Private Finance Initiative) arrangement, a clear understanding exists on the role and duties carried out by each party.

### Management structure

**3.5** To engage and deliver the duties required, a healthcare organisation may consider the structure shown in Figure 1. If a framework based on this structure is used for engineering governance, compliance is likely to follow, providing that operational policies are established and sufficient resources are deployed.

### Professional structure

**3.6** The chief executive and board carry ultimate responsibility for a safe and secure healthcare environment. Aspects of that responsibility can be assigned or delegated to other senior executives but an independent audit system should be in place to assure them that the responsibilities are being discharged properly.

**3.7** Senior executives may not always have the required specialist knowledge to support all services; therefore it may be necessary to engage external support.

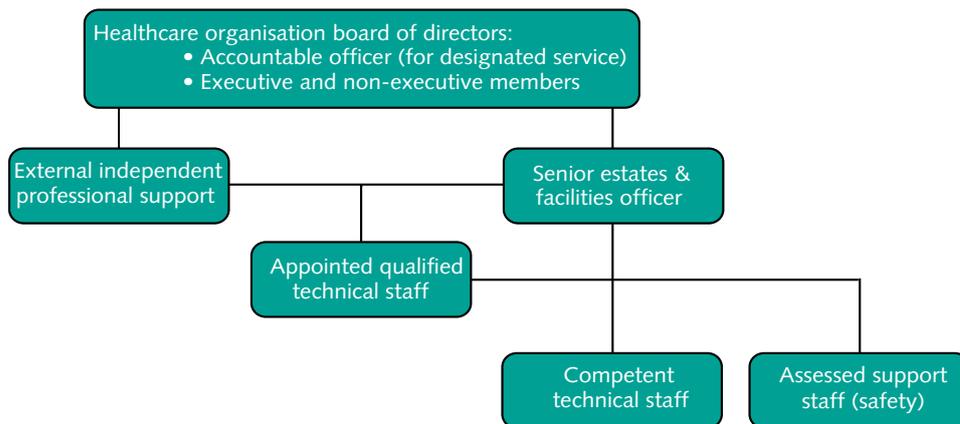


Figure 1 Management structure

**3.8** An independent adviser for audit purposes, assessment and operational advice may also be required.

**3.9** Figure 2 illustrates the structure that underlies the approach to compliance in HTMs. However, it does not show the reporting routes; it is for organisations to define these in their own operational policies.

**3.10** Within a specific service, other support staff for safety, quality and process purposes may be required.

**3.11** Certain healthcare organisations may have a very limited specialist installation. This will particularly apply to community trusts, hospices and small independent treatment centres. In these cases, a lower level of support might be appropriate. If this is to be considered, the arrangements should be carefully assessed, agreed with the Authorising Engineer (AE) and approved by the Designated Person (DP). They should be included in the operational policy for the service.

**3.12** It is possible for several organisations to share the same professional staff either individually or collectively; however, it is usual for the AE’s role to remain independent of the organisation, with particular regard to the audit process.

## Roles and responsibilities

See Figure 2 for a typical representation of responsibility structure.

### Designated Person (DP)

**3.13** This person provides the essential senior management link between the organisation and professional support, which also provides independence of the audit-reporting process. The DP will also provide an informed position at board level.

**3.14** The DP will work closely with the Senior Operational Manager (SOM) to ensure that provision is made to adequately support the specialist service.

### Senior Operational Manager (SOM)

**3.15** The SOM may have operational and professional responsibility for a wide range of specialist services. It is important that the SOM has access to robust, service-specific professional support which can promote and maintain the role of the “informed client” within the healthcare organisation. This will embrace both the maintenance and development of service-specific improvements, support the provision of the intelligent customer role and give assurance of service quality.

### Authorising Engineer (AE)

**3.16** The AE will act as an independent professional adviser to the healthcare organisation. The AE should be appointed by the organisation with a brief to provide services in accordance with the relevant HTM. The professional status and role required may vary in accordance with the specialist service being supported.

**3.17** The AE will act as assessor and make recommendations for the appointment of Authorised Persons (APs), monitor the performance of the service, and provide an annual audit to the DP. To effectively carry out this role, particularly with regard to audit, the AE should remain independent of the operational structure of the healthcare organisation.

### Authorised Person (AP)

**3.18** The AP has the key operational responsibility for the specialist service. This person will be qualified and sufficiently experienced and skilled to fully operate the

specialist service. They will be nominated by the AE, appointed by the healthcare organisation and be able to demonstrate:

- their understanding through familiarisation with the system and attendance at an appropriate professional course;
- competency;
- a level of experience; and
- evidence of knowledge and skills.

**3.19** An important element of this role is the maintenance of records, quality of service and maintenance of system safety (integrity).

**3.20** The AP will also be responsible for establishing and maintaining the validation of Competent Persons (CPs), who may be employees of the organisation or appointed contractors.

**3.21** Larger sites may need more than one AP for a particular service. Administrative duties such as record-keeping should be assigned to

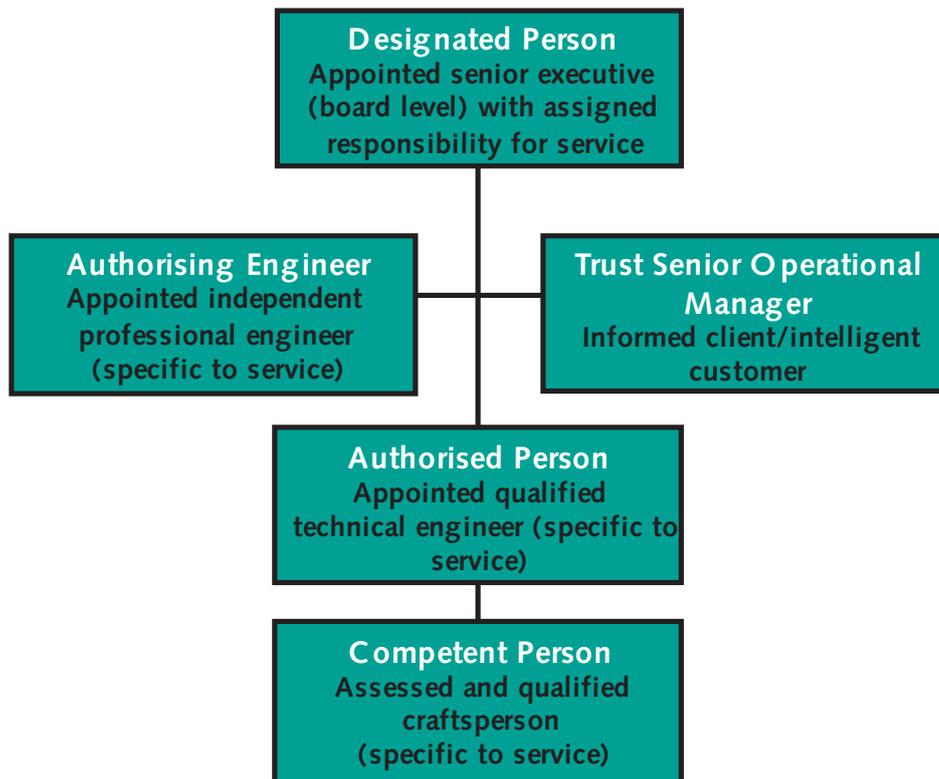


Figure 2 Professional structure

specific APs and recorded in the operational policies.

### Competent Person (CP)

**3.22** This person provides skilled installation and/or maintenance of the specialist service. The CP will be appointed, or authorised to work (if a contractor), by the AP. They will demonstrate a sound trade background and specific skill in the specialist service. They will work under the direction of the AP and in accordance with operating procedures, policies and standards of the service.

### Variation by service

**3.23** The particular detailed roles and responsibilities will vary between specialist services, and the guidance given in the appropriate HTM should be followed to ensure that the necessary safe systems of working are established and maintained.

### Operational policy

**3.24** The healthcare organisation's board of directors is responsible for setting overall operational policy, and it is the DP as the senior executive who has responsibility for implementation.

**3.25** The HTM series should enable an organisation to be aware of the issues relative to a particular service and support any operational policy that has to be prepared. This will be guided by factors such as the consequences of failure and the risks involved in their maintenance and management. Where services are covered by HTMs, the guidance therein should be followed to prepare operational policies. For other services, relevant guidance published by the HSE, regulating bodies, professional institutions or trade bodies should be followed.

**3.26** Where the operation of engineering services is vital to the continued functioning of the healthcare premises, operation and maintenance may require special consideration;

therefore, improving resilience within the critical engineering systems should be considered.

**3.27** Operational requirements should ensure that users are aware of the capacity of the specific system and any particular limitations.

### Operational considerations

**3.28** All safety aspects of operation associated with particular plant or equipment should be clearly understood by operational staff.

**3.29** Nursing, medical and other staff should be aware of the purpose of any alarm systems and of the course of action to be taken in the event of an emergency occurring.

**3.30** Staff responsible for engineering plant operation should be aware of the activities necessary to ensure the continued safe operation of the system and what action should be taken in an emergency.

**3.31** The AP responsible for engineering services should take a lead in explaining to users the function of the system, and organise adequate information and training about the system.

**3.32** Maintenance and safety are two closely related subjects. General safety is largely dependent on good standards of maintenance being attained and staff safety disciplines being exercised.

**3.33** Where necessary, training should be made available to ensure the knowledge and competency of operational staff. This should be appropriate to the role to be undertaken.

### Records/drawings

**3.34** The organisation should have accurate and up-to-date records and/or drawings. Where possible, these should be backed up electronically. They should be readily available on site, in an appropriate format, for use by any AP responsible for engineering services and CPs inspecting or maintaining them. Organisations should also be aware of the

increasing use of building information modelling (BIM) (see [paragraphs 4.101–4.103](#) on BIM).

**3.35** A unique reference number should identify the equipment. This should correspond to that shown on the records/drawings and other systems (for example, a building management system (BMS)). The records/drawings should indicate the type and make of the equipment.

**3.36** Database systems could be used to link plant reference numbers to locations on drawings and detailed records of the plant and its maintenance.

**3.37** A schematic diagram of the installation should also be available and displayed in each plantroom or service area, scheduling key components.

**3.38** When additions or alterations are to be made to existing installations, the AP responsible for engineering services should ensure that the current as-fitted information is available in an acceptable format. On completion of the work, the records/drawings should be updated and the service alterations noted and dated.

### Security

**3.39** To prevent unwanted interference with plant and controls, all means of service isolation, regulation and control should be located and secured in such a way that they can be fixed in the “normal” position and be free from unauthorised adjustments.

**3.40** In the case of those components that may have to be operated in an emergency, the fixing method should be capable of being overridden. Where such components are in public places, they should be within enclosures with quick-break seals.

**3.41** All plantrooms should be kept locked, signed and under access control. Signage should be displayed to alert individuals that they are entering a restricted area.

**3.42** A procedure in the operational policy for controlling access, including in the event of an emergency, should be established.

**3.43** Adequate means of engineering plant isolation and safe working areas should be provided for all operational and maintenance contingencies to allow temporary plant where required and safe working around equipment.

### Monitoring of the operational policy

**3.44** The DP is responsible for monitoring the operational policy to ensure that it is being properly implemented. This should be carried out on a regular basis, and the procedure for such monitoring should be set out in the operational policy.

**3.45** The responsibility for monitoring specific aspects may be delegated to appropriate key personnel. For example, the responsibility for monitoring the implementation of the permit-to-work procedure would normally be delegated to the AP. The details of such delegation should be set out in the operational policy.

### Contractors

**3.46** All contractors should comply with the organisation’s safety procedures. This should be clearly stated in the operational policy and in contracts.

**3.47** Any design, installation, commissioning or maintenance work should only be carried out by suitably qualified and authorised contractors. Evidence of current authorisation should be by sight of the correct certificate of approval.

**3.48** The operational policy should set out the responsibilities for monitoring the work of contractors. The AP responsible for the specific engineering services would normally coordinate this. The “call-out” procedures for a contractor, particularly in the event of a fault or an emergency, should be set out in the operational policy and in contracts.

### Medical equipment purchase

**3.49** The AP should be consulted during initial discussions on the purchase of any medical equipment that will be connected to the engineering services. This is to ensure that the system has sufficient capacity and can continue to deliver the required service. (See also guidance provided by the [Medicines and Healthcare products Regulatory Agency](#) (MHRA).)

**3.50** The healthcare organisation's policy should state the procedures to be followed and the personnel who need to be consulted before a new item of medical equipment is connected to an engineering service.

# 4. Design and installation

## Introduction

### Note

This chapter provides an overview of engineering services and is not a comprehensive guide. Because of its general nature, its content will be familiar to experienced healthcare engineers. It is intended particularly for those who are new to this work. It may also be helpful for commissioning organisations and regulators, giving an overall picture of the type of engineering services installed in healthcare buildings and the issues that need to be addressed.

**4.1** The engineering services of a healthcare facility support the delivery of patient care and help to maintain a healing and safe environment.

**4.2** At all stages of planning, design, operation and maintenance of healthcare engineering services, attention should be given to the level of care that the service supports. This will define the resilience and reliability that needs to be provided to ensure patient safety.

**4.3** Procedures and alternative equipment should be in place to allow for maintenance and unscheduled failure. This may be achieved through duplication, standby or portable alternatives to ensure a robust continuity of service.

**4.4** Detailed design and operational considerations are contained in the appropriate HTM (see [Chapter 7](#)), and failure procedures are offered in [Appendix A](#). See also HBN 00-07 – ‘Planning for a resilient healthcare estate’.

**4.5** All systems should work collectively and be resilient in the event of adverse conditions. They should be installed and maintained to a high standard and in accordance with statutory legislation, the HTM suite of guidance and industry standards related to the services.

**4.6** In any new development or alteration, the maintenance manager should be consulted at stages through the design development. There should be an opportunity to comment on the types of systems, plant and equipment which are proposed. It is important that the operational team have the competencies and resources to manage the systems. If new competencies or resources are unavoidable, a plan should be put in place to provide them.

**4.7** There needs to be adequate space for engineering plant and maintenance (see [paragraphs 4.113–4.116](#)).

## Utilities

### Engineering systems and equipment capacity

**4.8** All engineering systems and equipment should be fit for purpose and designed to have an initial capacity to safely accommodate peak maximum loads plus an additional suitable

allowance for future expansion, having particular regard in the case of water storage to infection risks. A regular review of systems capacity should be maintained to ensure that they are capable of meeting the demands required by the services being provided.

**4.9** Future expansion can take a number of forms, for example:

- actual spare capacity in a main distribution board; or
- physical space allowance to increase the main distribution board if required.

**4.10** Electrical maximum demand, fuel supplies, water, medical gases, drainage capacity etc should be monitored over time to provide an overall demand profile and avoid unexpected failures. It is also valuable to monitor the volume of use of all services to identify wastage, leakage or other activity that may require attention.

### Utility supplies

**4.11** Where new or changes to existing incoming utility services are required, discussions should take place with each utility company concerned to establish incoming service routes, capacity requirements, tariffs, meter locations, access provisions and wayleave requirements as soon as practical during the design process.

### Life expectancy of engineering plant and equipment

**4.12** All principal items of plant and equipment should have a indicative life expectancy as described in CIBSE Guide M – ‘Maintenance engineering and management’.

**4.13** Materials and components that will require maintenance and replacement during the life of the facility should be selected, located and fixed in such a way as to minimise future inconvenience and disruption and to avoid temporary closure of all or part of the facility.

### Metering

**4.14** Healthcare premises should be fitted with adequate provisions to monitor all primary incoming and subdistribution engineering services sufficient to comply with statutory legislation and to support energy efficiency. This should also support the review suggested in [paragraph 4.8](#) (see also Approved Document L and CIBSE TM39 – ‘Building energy metering’).

### Infection prevention and control

**4.15** Informed by a risk assessment as advocated by DH’s (2010) ‘Health and Social Care Act 2008: Code of Practice on the prevention and control of infections and related guidance’ (the HCAI Code of Practice), the design and installation of engineering services should incorporate adequate measures to minimise infection risks so far as is practicable (see also HBN 00-09 – ‘Infection control in the built environment’). In particular, precautions should be incorporated to ensure that within areas occupied by patients, staff and visitors:

- Ventilation provisions are adequately filtered with air changes and pressure differentials maintained in accordance with HTM 03-01 – ‘Specialised ventilation for healthcare premises’ and other guidance to reduce the risk of healthcare-associated infections.
- The extent and nature of water services should be balanced to provide optimum infection control by liaison between estate and infection control staff (see also HTM 04-01 – ‘The control of Legionella, hygiene, “safe” hot water, cold water and drinking water systems’ and its Addendum ‘*Pseudomonas aeruginosa*: advice for augmented care units’).
- All exposed surface finishes of engineering services and equipment are generally smooth, accessible and easy to wipe clean in line with manufacturers’ guidelines.
- Engineering services pipework, heat emitters, electrical trunking, luminaires,

accessories and specialist fixed control equipment are appropriately encased to present a smooth, exposed surface with gaps sealed with a suitable substance to control the potential harbouring and propagation of bacterial growth.

- Sloped surfaces are provided instead of horizontal surfaces to reduce the build-up of dust.
- All engineering components and equipment that are regularly handled by patients (such as light switches, nurse call units, door-entry controls, TV sets etc) are capable of being wiped clean and disinfected or sterilized between patient use.

## Mechanical services

### Heating

**4.16** General space-heating requirements may be met by a variety of systems including under-floor pipework, radiators, ceiling-mounted radiant panels or by air conditioning/ventilation systems. Designers should ensure that the most appropriate method is employed with regard to the healthcare environment being provided.

**4.17** The surface temperature of radiators should not exceed 43°C. Ceiling-mounted radiant panels can operate at higher surface temperatures as long as the surface is not easily accessible.

**4.18** Heating pipework that may be accessible to touch should be encased and/or insulated. Special care should be taken when facilities are being provided for older, confused or mental health patients, and where children may be present. See HSE's Health Services Information Sheet 6 – 'Managing the risks from hot water and surfaces in health and social care'.

**4.19** Care should be taken to ensure that heating design is coordinated with clinical needs, has regard to the impact of solar gain, is flexible to meet changing patient needs and

does not adversely affect the local temperature conditions of adjacent storage and preparation areas.

### Piped medical gases

**4.20** Piped medical gases, including oxygen, nitrous oxide, medical air, surgical air and medical vacuum installations should comply with the requirements of HTM 02-01 – 'Medical gas pipeline systems'.

**4.21** Provision of medical gases may require supplies from cylinders, bulk storage or on-site equipment and may be supplemented by specialist equipment for vacuum and scavenging systems.

**4.22** It is important to maintain continuity of supply and where appropriate have standby and contingency supplies available.

**4.23** Verification of quality is a fundamental requirement for the delivery of systems and should be maintained at all stages of installation and maintenance.

### Ventilation and cooling

**4.24** Ventilation systems should be designed in accordance with the requirements of HTM 03-01 – 'Specialised ventilation for healthcare premises'.

**4.25** Computer modelling of summer temperatures should be undertaken to ensure that the ventilation system and the control of solar gain are able to manage air temperatures within an acceptable range.

**4.26** It is important to achieve a balance between economy in capital and energy costs while creating appropriate levels of comfort through mechanical ventilation/comfort cooling (see CIBSE Guide A – 'Environmental design').

**4.27** Natural ventilation is always the preferred solution for a space, provided that the quantity and quality of air required and consistency of control to suit the requirements of the space,

are achievable. If this is not the case, a mechanical ventilation system will be required.

**4.28** Air movement induced by mechanical ventilation should follow the hierarchy of cleanliness, where such areas can be defined. The design should allow for an adequate flow of air into any spaces having only mechanical extract ventilation via transfer grilles in doors or walls. However, such arrangements should avoid the introduction of untempered air and should not prejudice fire safety (through the introduction of uncontrolled air) or privacy (through the positioning of transfer grilles).

**4.29** Local exhaust ventilation will be required where exposure (by inhalation) to substances hazardous to health cannot be controlled by other means. HSE publishes guidance notes, updated annually, on occupational exposure limits (EH40/2005 – ‘Workplace exposure limits’) for the control of exposure by inhalation of substances hazardous to health. The limits specified form part of the requirements of the Control of Substances Hazardous to Health (COSHH) Regulations.

### Hot and cold water systems

**4.30** Water storage and distribution systems should be designed and operated in accordance with:

- HSE’s ‘Legionnaires’ disease: the control of legionella bacteria in water systems – Approved Code of Practice and guidance on regulations’ (also known as ‘ACOP L8’);
- HTM 04-01 – ‘The control of Legionella, hygiene, “safe” hot water, cold water and drinking water systems’; and
- the Addendum to HTM 04-01 – ‘*Pseudomonas aeruginosa*: advice for augmented care units’.

See also HTM 07-04 – ‘Water management and water efficiency’.

**4.31** Hot water pipework that may be accessible to touch should be encased and/or

insulated. Special care should be taken when facilities are being provided for older, confused or mental health patients, and where children may be present.

### Internal drainage

**4.32** A system of soil and waste drainage including anti-siphon and ventilation pipework should be provided in accordance with BS EN 12056.

**4.33** Provision for inspection, rodding and maintenance should ensure “full bore” access and be located outside user accommodation. The location of manholes within the building should be avoided.

**4.34** At an early stage in the design process, proposals for the collection and discharge of chemical and radioactive-contaminated effluent should be discussed and verified with the sewerage undertaker. Some water authorities may impose restrictions on the quantity and rate of discharge of such effluent into public sewers (see Water UK’s (2011) ‘National guidance for healthcare waste water discharges’).

**4.35** Care should be taken in the routing (avoiding diagnostic, IT equipment etc) and the materials used for drainage. This should ensure that the risk from any possible leakage (jointing and pipework materials) is minimised and that drainage is suitable for the type of effluent that may be discharged.

**4.36** All drainage that may be used for the passage of contaminated effluent should be clearly labelled and be suitably rated for the particular contaminants being discharged.

### Electrical services

#### Electrical installations

**4.37** Electrical installations should comply with the current edition of the IEE Wiring Regulations BS7671 together with the Institution of Engineering and Technology’s (IET) Guidance

Note 7 – ‘Special locations’ and HTM 06-01 – ‘Electrical services supply and distribution’.

**4.38** Prior to final design, a full assessment should be made of the clinical and business continuity risks, the range of room types (including equipment requirements), occupation levels and resilience requirements. This will influence the extent and location of electrical services, the availability of alternative sources of electrical supply and the need for secondary power sources if appropriate.

### Electromagnetic compatibility

**4.39** Steps should be taken to prevent:

- mains-borne and electrical radio frequencies from affecting diagnostic and monitoring equipment, computers or other sensitive electronic equipment; and
- these types of equipment affecting systems in their vicinity.

Guidance on the avoidance and abatement of electrical interference is given in HTM 06-01 – ‘Electrical services supply and distribution’.

### Primary electrical infrastructure

**4.40** The primary electrical infrastructure, comprising the public electrical supply and electrical distribution system equipment for the facilities, should be an integral part of the whole site/building network. It should provide adequate capacity for both normal and all assessed business-critical needs taking the clinical risk category (as defined in HTM 06-01 – ‘Electrical services supply and distribution’) fully into account.

### Lighting

**4.41** Lighting services, including lighting controls, should comply with CIBSE’s:

- ‘SLL code for lighting’;
- Lighting Guide 2 – ‘Hospitals and health care buildings’; and
- Guide F – ‘Energy efficiency in buildings’.

**4.42** To achieve energy efficiency, lighting systems should be designed to:

- maximise use of natural daylight;
- avoid unnecessarily high levels of illumination;
- incorporate efficient luminaires, control gear and lamps;
- incorporate effective controls.

**4.43** Low energy or ultra-low energy lighting (including LED) should be considered as the main lighting source.

**4.44** Lighting and the appearance of luminaires should be coordinated with architectural design. In particular, decorative finishes should be compatible with the colour-rendering properties of lamps and spectral distribution of the light source. See Dalke et al (2004) ‘Lighting and colour for hospital design’.

**4.45** Where artificial lighting is provided in spaces where patients are examined or treated, it should enable changes in skin tone and colour to be clearly defined and easily identified. The quality of lighting will need to be considered if video consultation is likely to take place. Care should also be taken to ensure that patients subject to light sensitivity are not adversely affected.

**4.46** Where low energy lamps are used to replace conventional linear fluorescent fittings (T12 and T8) or incandescent lamps, care should be taken to ensure that the necessary lighting level and, if appropriate, colour is maintained to service the area.

**4.47** Lighting in areas where clinical procedures are carried out and/or medicines are handled, including stores, must be derived from lamps having suitable colour-rendering characteristics.

**4.48** When positioning light fittings, consideration should be given to ease of lamp replacement and to ensuring that any single lamp failure will not create hazards.

## Emergency lighting

**4.49** Emergency lighting, incorporating escape lighting and standby lighting, should be provided to meet the requirements of BS 5266-1 and building control (see also HTM 05-02 (Firecode) – ‘Guidance in support of functional provisions for healthcare premises’).

**4.50** Escape lighting should also be provided in accordance with:

- HTM 06-01 – ‘Electrical services supply and distribution’;
- HTM 05-02 (Firecode) – ‘Guidance in support of functional provisions for healthcare premises’; and
- CIBSE’s Lighting Guide 2 – ‘Hospitals and health care buildings’.

**4.51** Consideration should be given to the use of self-testing technology in accordance with BS 5266-1.

## External lighting

**4.52** The issue of light pollution should be taken into consideration when planning external lighting (see CIBSE’s Lighting Guide 2 – ‘Hospitals and health care buildings’). Where possible, external lighting should not shine excessively into adjacent properties.

**4.53** The following steps should be taken:

- Provide adequate lighting levels for safety and security of patients, staff and visitors and to support CCTV.
- Avoid excessive lighting.
- Use sensor-activated luminaires.
- Ensure luminaires are correctly orientated.
- Avoid lighting columns being used as a climbing aid/security risk.

## Patient/staff and staff emergency call systems

**4.54** Patient/staff and staff emergency call systems should comply with HTM 08-03 – ‘Bedhead services’.

**4.55** Patient/staff call points should be provided in all spaces where a patient/attendee may be left alone temporarily, for example clinical rooms and WCs.

**4.56** Staff emergency call points are for a member of staff to call for assistance from another member of staff. They should be provided in all spaces where staff consult, examine and treat attendees/patients.

**4.57** Consideration should be given to the location of staff emergency call points to ensure that the risk of accidental operation is minimal and that, where necessary, they can act as a deterrent to potential aggressors in addition to enabling a response to an incident.

**4.58** Dedicated call points for summoning the emergency care team may be provided. These are not standard installation and need to be specified for individual rooms where patients are at a high risk of suffering a cardiac arrest.

## Fire safety

### General fire safety standards

**4.59** Fire safety standards in healthcare premises need to be high owing to the vulnerability of occupants, loss of services, business continuity and reputation risk.

**4.60** To conform to the appropriate fire safety standards, the design and operation of healthcare buildings should meet the principles of ‘Firecode’ (the HTM 05 suite of documents). If a healthcare organisation or its construction partner(s) wishes to install a fire-engineered solution in place of a Firecode solution, the organisation’s fire safety manager/fire safety adviser should be consulted on the scope and extent of such a solution and be satisfied that it

meets the principles of Firecode (see HTM 05-01 – ‘Managing healthcare fire safety’).

**4.61** It is important to establish during the design stage those aspects of fire safety strategy that affect the design, configuration and structure of healthcare buildings. The design team should develop and verify their proposals with the healthcare organisation’s user group, fire safety adviser and building control authority or approved inspector.

**4.62** All staff should be familiar with the operational aspects of fire safety.

### Fire detection and alarm systems

**4.63** The design of the fire detection and alarm systems should take into account the number of compartments and subcompartments within the building and the fire evacuation strategy. It is important that the architect, design engineer and healthcare organisation’s fire safety adviser work together to ensure all fire risks are properly understood, addressed and incorporated into the overall design strategy.

**4.64** For specific guidance see HTM 05-03 Part B – ‘Fire detection and alarm systems’ and BS 5839-1.

## Other considerations

### Acoustics

**4.65** Consideration should be given at the earliest opportunity to the requirements for privacy and noise control. Guidance on sound attenuation requirements is given in HTM 08-01 – ‘Acoustics’.

**4.66** HTM 08-01 gives guidance on noise levels in rooms – both from mechanical services and other sources within the building, and from noise coming from outside. It is important to create an acoustic environment that allows rooms to be used for resting, sleeping, treatment, consultation and concentration.

**4.67** It is also important to consider sound between rooms. Noisy activities should not

interfere with the requirements of adjacent rooms. Private conversations should not be overheard outside the room. Good acoustic conditions improve patient privacy and dignity and promote essential sleep/rest patterns. Such conditions are key to healing.

### Building management systems

**4.68** All engineering plant and equipment associated with the internal environment should, where possible, be monitored and controlled by a BMS (see CIBSE’s Guide H – ‘Building control systems’). Effective systems should be in place for both off-site and on-site response to alarms.

### Security

**4.69** Measures should be incorporated into the design of all healthcare buildings to help protect the safety of patients, staff and visitors and the security of the premises. These measures include the use of access control, CCTV and alarms. (See also the HSE’s guidance on [violence in health and social care](#).)

**4.70** CCTV systems should be installed to monitor internal and external areas where there is a risk of attack or vandalism. Areas such as receptions, external entrances, medical gas cylinder storage areas, car-parking and pedestrian walkways may be at particular risk at night. CCTV can be intrusive and its operation must comply with the provisions of the Data Protection Act 1998 and the ‘CCTV code of practice’ (Information Commissioner’s Office, 2008). Priority should be given to ensuring patients’ privacy and dignity.

**4.71** Door-access control systems should be implemented in conjunction with other measures (such as linking them to CCTV systems and/or alarm monitoring systems).

**4.72** Internal and external lighting schemes should not allow any areas of shadowing/pooling and must support CCTV coverage to enable identification.

**4.73** Natural ventilation and night-time cooling of spaces should not compromise security measures.

**4.74** Where premises do not operate over a 24-hour period, external engineering plant and equipment, particularly security cameras and engineering service supplies, should be positioned and suitably protected to minimise the risk of damage or interference when the premises are closed.

See also NHS Protect's strategy document 'Tackling crime against the NHS: a strategic approach' and HBN 00-07 – 'Planning for a resilient healthcare estate'.

### Car-park barriers

**4.75** To improve site security, and control unauthorised parking, it may be necessary to install car-park barriers. Where barriers are required, all electrical services to them should be installed using external cable runs routed below ground level as far as is practical.

### Door-access control systems

**4.76** Healthcare buildings will generally require controlled access to the building at the staff entrance and, internally, to staff areas. It may also be appropriate for the control of access and egress in special patient areas (for example, maternity, baby care and critical care areas) and for infection control.

**4.77** Where possible, the access control system should be part of an integrated security solution that interlinks other physical security measures such as alarms, motion detectors, lift controls and CCTV systems.

**4.78** Any access control arrangements must take into account the fire safety strategy and must not compromise the means of escape at any time while the building or relevant parts of the building are in use.

**4.79** Where access control is deployed as a security measure to restrict access, due

consideration should be given to monitoring of the access point to prevent and avoid misuse.

### Lockdown

**4.80** Hospital sites also need to have lockdown capability. The ability of healthcare organisations to lock down their site or buildings fits in with their statutory responsibilities as category 1 responders as defined by the Civil Contingencies Act 2004 (see NHS Protect's (2009) 'Lockdown Guidance').

### Entertainment systems

**4.81** Entertainment facilities, such as television and radio/music systems, may be provided in waiting areas to mask sound transfer for confidentiality purposes or in staff rest areas to create a relaxing atmosphere. Entertainment services should comply with HTM 08-03 – 'Bedhead services'.

**4.82** Whenever background music or public address systems are installed, the sound quality should be such that it is intelligible and not subject to unwanted reverberations.

### IT and wiring systems

**4.83** The IT system should include the installation, termination, testing and commissioning of all switches, routers, hubs, distribution cabling (complete with cable containment system) and required terminal outlets. Special care needs to be taken to ensure the installation of IT cabling does not compromise fire compartmentation (see also [paragraph 4.63](#)).

**4.84** All recent hospitals will likely use structured wiring systems. Where upgrades to wiring systems are planned, therefore, a structured wiring system should be provided. This will permit a unified approach to the provision of cabling for:

- voice systems;
- data systems;
- imaging systems;
- alarm systems.

**4.85** While such a universal cabling system is initially more expensive than separate voice and data systems, it may be more cost-effective in the long run. Another advantage of a structured system is that resilience can be provided at a much lower cost than for individual systems.

**4.86** Where appropriate, specialists should be employed to assist in the design and installation of IT and telephone systems, including interfacing with service wiring and equipment suppliers to ensure a fully operational and reliable system.

**4.87** Telecommunications systems should comply with the requirements of the public telephone operator and British Standard specifications, in particular BS 6701.

### Medical equipment

**4.88** The MHRA is responsible for all medicines and medical devices in the UK by ensuring they work and are acceptably safe. It is important that their connection to a facility's engineering services provides the correct level of support and safety.

**4.89** Healthcare organisations should ensure that when procuring medical equipment, either as new or replacement, that the service connections are available and fit for purpose. Likewise, the equipment supplier should be made aware of the service available to provide assurance that the performance of the equipment will not be compromised.

### Lifts and escalators

**4.90** Lifts may be required for general passenger transportation, bed/stretchers transportation or service use. They may also be required in order to comply with the requirements of the Equality Act 2010 and/or Approved Document M of the Building Regulations.

**4.91** Consideration may be given to the installation of lifts that do not require a separate machine room, particularly in buildings with

fewer than three floors and/or where there is limited space available.

**4.92** For further guidance on the design of lift installations, see HTM 08-02 – 'Lifts' and BS EN 81-1.

### Lightning protection systems

**4.93** Lightning protection systems should be evaluated and, if necessary, installed in accordance with BS EN 62305.

### Audio induction loop systems

**4.94** Audio induction loop systems should be provided in main receptions, seminar rooms and waiting areas in accordance with the Equality Act 2010. They may be fixed or portable.

**4.95** They should comply with the requirements of BS EN 60118-4 where applicable.

**4.96** Audio loop systems should be able to provide an interface with any public address or music system. In areas with televisions, they should be interfaced to provide TV sound into the local area loop system.

### Development planning

**4.97** It is essential to ensure that clinical, engineering and architectural aspects are developed simultaneously from project inception (see also HBN 00-01 – 'General design guidance for healthcare buildings'). This should ensure that systems are safely integrated in terms of location, distribution and future developments, and that security measures are designed in and service resilience is planned from the start.

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

**4.98** Everybody involved in construction work needs to take account of the CDM regulations. A summary of duties under the regulations can be found on [HSE's website](#).

## Whole life costs

**4.99** An important evaluation when considering a new installation or replacement of equipment is the overall cost impact or whole life cost of the choices being made. This will include:

- the benefit that different choices of equipment will bring to the healthcare service being provided and compatibility with other equipment (if appropriate);
- initial procurement and installation cost of each option;
- the annual cost in use including energy, maintenance, product-related supplies etc;
- the expected life of use before renewal or replacement;
- the cost of disposal.

**4.100** Evaluating these elements against a common rating can provide a useful assessment to support choice. The whole project team including users should have an input into the choice evaluation.

## Building information modelling (BIM)

**4.101** The use of BIM is an important factor in the design, procurement, construction and ongoing maintenance of buildings in line with current government policy and expectations.

**4.102** BIM is a process that results in the digital representation of a facility in 3D format. The resulting models support decision-making about a facility from the earliest conceptual stages, through design and construction and through its operational life.

**4.103** The outputs of BIM will link to the commissioning data, as-fitted drawings and manuals that are made available by the design team/contractor on completion of the scheme.

*Construction Operations Building information exchange (COBie)*

**4.104** COBie is a means of sharing mainly non-graphical information about a building or asset. It combines relational datasets to provide linked spreadsheets of information and is used as the standard means of reporting BIM data.

## Management of access to engineering services

**4.105** Healthcare organisations have the responsibility to ensure that all service installations are specified, designed, installed, commissioned and maintained (including future upgrade) with consideration for services modifications and dismantling during the life of the building.

**4.106** To satisfy these requirements, it is recommended that organisations:

- ensure that a project file is available for all new projects, alterations or extensions, regardless of the size of the project. The file should contain access to specifications, drawings, and maintenance information including access and safe disposal at the end of its useful life (in accordance with CDM requirements);
- ensure that adequate space is provided for installation and maintenance staff and appropriate access to services;
- adequately brief the designers, if alterations or new build is to take place, on the current and future maintenance policies;
- ensure that any new work, alterations or modifications do not restrict existing access to plant and equipment.

**4.107** The Control of Asbestos Regulations 2012 includes a duty to manage the risk from asbestos and to protect those who come into contact with asbestos unknowingly or accidentally. A risk register should include details of any asbestos-containing materials,

their condition and location, and when they were last inspected together with a management plan. The register should be made available to any design team, contractors, maintenance staff or personnel who needs to be aware.

## Commissioning, validation and handover of engineering installations

**4.108** It is important that, on completion of an installation and prior to handover, the performance of the installation is fully commissioned and validated.

**4.109** Benefit may be obtained by adopting a “soft landing” approach, which reflects the need for a smooth transition from the design and construction phase to the operational phase of a built asset (see the Cabinet Office’s (2013) ‘Government Soft Landings’).

**4.110** The final acceptable performance details should be recorded and – together with manufacturers’ operating and servicing details, test results, certificates, as-fitted drawings, manuals etc – made available to users and the maintenance organisation before the installation is handed over in accordance with CDM regulations.

**4.111** Once the installation is fully operational, its performance should again be tested, checked and/or witnessed by suitably qualified staff of AP status or higher, on behalf of the client and signed off by both client and contractor. This will validate that it is operating to the correct designed criteria at time of handover.

**4.112** Any risk management plans, operational procedures and contingency plans should be fully evaluated and tested with staff. Opportunities should also be taken as soon as practical during construction (before services are covered) and after physical completion of the facilities to familiarise and train staff in the use of all relevant equipment and services and

to practice any procedures to ensure staff members understand what is required of them.

See also the Royal Institute of British Architects (RIBA) (2013) ‘Plan of Work 2013’.

## Space requirements for engineering plant and services

**4.113** Building design should incorporate adequate space to enable the full range of engineering plant and services to be installed, maintained safely and kept operational.

**4.114** Space for plant and services should provide:

- an easy and safe means of access;
- secure accommodation protected from unauthorised access;
- adequate space around the plant and services to permit inspection, maintenance and replacement; and
- for the installation of further plant and services at a later date where this is anticipated to be required.

**4.115** Further information on the provision of space for plant is contained in BSRIA TN9/92 – ‘Space and weight allowances for building services plant’, and for building services distribution systems in BSRIA TN10/92 – ‘Space allowances for building services distribution systems’.

**4.116** In general terms:

- With the exception of drainage and some heating pipework, engineering services should not be brought from the ceiling void of the floor below. Service distribution to a particular area should be contained within the service spaces on that floor to avoid excessive disturbance to other areas.
- Plantrooms, particularly for air-conditioning and ventilation, should be

located as close as possible to the areas they serve, thus minimising the amount of space necessary to accommodate large-sized ductwork installations. Air handling units should not be installed within a plantroom containing plant that can produce any combustion gases.

- Care should be taken to ensure that noise and structure-borne vibration cannot be transmitted beyond the plantroom. Further guidance on acoustics and vibration can be found in HTM 08-01 – ‘Acoustics’.

## Sustainability and energy efficiency

**4.117** Engineering services should use renewable energy sources, wherever feasible. The energy consumption of engineering services should be further minimised through the use of low/zero carbon solutions and/or energy-saving devices. HTM 07-02 – ‘EnCode’ provides additional guidance.

**4.118** The following factors are an example of some of the issues that could be considered:

- Active use of local metering of services to provide ongoing feedback and minimise wastage.
- Use of natural lighting and ventilation, wherever feasible.
- Use of passive solar design, including the use of solar heating panels, the use of reflective glass and/or blinds to minimise solar gain, where appropriate, and locating heat-sensitive accommodation away from south-facing fascias.
- Use of energy-efficient equipment, including high-efficiency chillers and boilers (condensing where appropriate) and motors.
- Use of low-energy high-efficiency lighting (for example, LED lighting technology).
- Use of low-energy and variable-speed drives.

- Power factor and harmonic correction of major electrical plant.
- Use of presence detection, appropriate local switching, photocell and multi-circuit systems to control lighting.
- Use of a BMS system to provide automatic time-control switching (to shut down plant when not required) and performance monitoring (to ensure plant is operating at optimum levels).
- Implementation of heat recovery, particularly for ventilation systems.
- Use of ground/air/water source heat-pump technologies.
- Use of water-efficient taps, urinal controls, low-volume toilet cisterns and grey water (that is, rainwater harvesting or recycled water) to reduce water usage, having regard to the precautions necessary to mitigate infection control risks (see also HTM 07-04 – ‘Water management and water efficiency’).
- Use of combined heat and power (CHP) plant (including micro CHP plant) to reduce consumption of incoming electrical supplies as well as carbon emissions.
- Use of thermostatic controls to limit temperature increases and heat wastage.
- Increased pipe insulation to limit temperature losses.
- Use of improved building insulation.

**4.119** Account should be taken of the advisory report produced as part of the display energy certification (DEC) process. Further information is also provided in the following BSRIA guides:

- BG12/2011 – ‘Energy efficient pumping systems: a design guide’.
- TN6/2002 – ‘Water reclamation guidance: design and construction of systems using grey water’.

- BG2/2007 – ‘CHP for existing buildings: guidance on design and installation’.
- BG7/2009 – ‘Heat pumps: a guidance document for designers’.

**4.120** Consideration should be given to using the thermal properties of the building to enhance its energy efficiency. The main construction of a healthcare building (concrete, bricks etc) has the ability to absorb and release slowly the heat and cold temperatures to which it has been exposed. Where appropriate, the

movement of air in these areas can benefit the heating or cooling cycles at lower energy costs.

**4.121** Engineering plant and equipment should be suitable for being recycled, wherever practical. Ideally any disposal of plant and equipment should not require a special licence. Where a licence for disposal is necessary, these should be acquired as prescribed by law. Specific guidance can be found in HTM 07-01 – ‘Safe management of healthcare waste’ and HTM 07-05 – ‘The treatment, recovery, recycling and safe disposal of waste electrical and electronic equipment’.

## 5. Maintenance

### Introduction

**5.1** An agreed approach to maintenance should be considered as early as possible in the development of a facility. This should take into account the critical nature of the healthcare services to be supported, the staff and resources to be available for maintenance, and the range of engineering services to be supported.

**5.2** On completion of a new development or alteration, the design team/contractor should make available to maintenance personnel originals of commissioning data, as-fitted drawings, manuals and records of any changes implemented since commissioning. This is a requirement of the CDM regulations.

**5.3** A maintenance policy/asset management strategy should be in place which ensures that equipment is regularly inspected and maintained. This policy/strategy should outline the importance of the role and the benefits of maintaining buildings and equipment at optimum performance levels in order to support healthcare activities.

**5.4** Schedules of routine maintenance activities, suggested spares lists and operational information should be readily available. This should be achieved by the use of a computer maintenance management system to maintain plant databases, maintenance requirements and records.

**5.5** Care should be taken to ensure that access and management of electronic records is carried out in a secure and restricted manner

and that entries and adjustments are monitored by designated personnel.

**5.6** Monitoring of data from the critical engineering services enables faults to be rectified at an early date.

**5.7** It is also important to monitor completion of maintenance and to take action from missed activities or any observations made. Early response to loss of efficiency or performance can prevent unscheduled failure, further deterioration or the need for early replacement.

**5.8** Healthcare organisations should not allow a backlog of maintenance tasks or requirements to develop. For further details on the management of backlog, see DH's 'A risk-based methodology for establishing and managing backlog'.

**5.9** The actual frequency of any particular maintenance activity and the need for planned preventive maintenance of the engineering services should be determined and continually assessed throughout its operation. This is to avoid unnecessary routine maintenance while ensuring the services remain safe and available.

**5.10** Initial maintenance of equipment is particularly important to ensure warranties remain valid. Responsibility for this can be focused effectively by including the first 12 months' maintenance in the supply contract. If maintenance is to be provided by the supplier/installer, it will be advantageous to detail the costs in the initial tender invitations.

**5.11** The frequency of maintenance will depend on the relevant British/European standards, manufacturers' recommendations and the circumstances of application.

**5.12** Records, either by hard copy or data storage, should be completed for all maintenance actions.

### Maintenance personnel

**5.13** If staff are not suitably qualified, competent or available, organisations may need to arrange for the appointment of an approved/authorised contractor to provide a maintenance service and/or emergency breakdown support.

**5.14** A maintenance contractor may not be the equipment provider, services manufacturer or the installation contractor. Clear understanding needs to be established as to who is responsible for what, and what maintenance service will be provided.

**5.15** Management should be satisfied that the personnel responsible for the regular maintenance of the engineering services:

- understand the extent and nature of the healthcare to which the service relates;
- have a clear understanding and where necessary have undertaken the necessary training to ensure that their safety, and the safety of those around them, is a primary consideration. This should also apply to the outcome of their actions during maintenance operations;
- are aware of the organisation's policy with respect to entry to, or work in, confined spaces (see paragraphs 5.40–5.42);
- are competent to do the work and have had the necessary training;
- have a knowledge of the installed system;
- maintain a current awareness of the manufacturer's equipment, including computer hardware and software;

- have access to modern diagnostic equipment;
- have good technical support;
- are supported by an adequate supply of critical spares.

### Note

It is more important that critical spares are identified and held in stock rather than large supplies of general consumable spares, which may be available by just-in-time delivery. Procurement and spares management policies should be in place to ensure the correct spares are available at the relevant time.

**5.16** Records of service reports and attendance dates (both scheduled and achieved) should always be available.

### Tools

**5.17** Special tools to carry out the necessary basic level of breakdown, maintenance or overhaul should be made available and used. Spares and tools that may be required out of hours in an emergency must be available to staff, including contractors, carrying out the repairs.

**5.18** Instrumentation and tools that are classified as safety tools should always be available on site, and their position known to those who may need to use them.

### Instructions

**5.19** It is essential that practical training be given to all operational and maintenance staff to ensure that work routines, operational procedures (including permit-to-work systems), and correct application of the safety procedures and rules are implemented.

**5.20** Initially, and where appropriate, ongoing training should be given by the manufacturer to all technical staff as part of the contract

requirement, and should be based on the operating and maintenance manuals, which themselves should be supplied as part of the contract.

### Original and amended drawings

**5.21** As with test records, these drawings have contractual significance, being the original as-built form.

**5.22** They are legal documents showing the assembly and construction of a system, and healthcare organisations should ensure that complete and accurate drawings are handed over to them on completion of the work.

**5.23** These drawings, with dated amendments made during the construction phase up to final acceptance, should not be amended. Where subsequent changes are made, these should be entered on separate copy drawings and noted to indicate the date and reference as appropriate.

**5.24** Many drawings are now managed in a digital format. Care should be taken to ensure that any changes to information are managed/authorised in a way which is secure and maintains the history of change.

### Functional tests

**5.25** Functional tests are a practical demonstration of the operation of an item of equipment or plant. The commissioning functional test record sheet should be preserved for future reference. It will be the comparative reference for all future maintenance tests throughout the life of the item of equipment or plant.

**5.26** The frequency of such routine tests can depend on the use of the equipment as represented by the running hours or operations.

### Inspections prior to re-commissioning

**5.27** Before any engineering service equipment or plant is put back into service following a period of maintenance, a thorough inspection of

all operational controls, protection settings, alarms and indications should be carried out and the data entered in the asset record. This would normally be the responsibility of the person undertaking the work, the CP or the AP.

### Maintenance planning

**5.28** Irrespective of the scale of operation, maintenance programmes are essential to ensure that all the critical engineering service equipment is checked, inspected, tested, repaired or replaced at the appropriate time. This makes sound economic sense, as it enhances the operational lifespan of the equipment and maximises the potential for its availability for use.

**5.29** To ensure that an organised maintenance programme is carried out effectively, it should be supported by a reporting system of “defect and failure”. Classifications of urgency would allow for those defects requiring extensive plant isolation and shutdown to be slotted into the overall planned maintenance (PM) programme to minimise disruption.

#### Note

DH Estates and Facilities alerts can be accessed via the [central alerting system](#).

### Design of a planned maintenance (PM) programme

**5.30** The maintenance function will be made up of two key components:

- planned/routine maintenance, which is carried out to maintain the optimum performance of a service or equipment; and
- reactive maintenance/repair, being the response to unscheduled faults/failure and by its nature more expensive (one-off visits not planned).

**5.31** In most cases reactive tasks will be given priority over planned/routine tasks, but the

opportunity should be taken to review the feedback from such tasks to provide information that may adjust the routine maintenance plan. A balance which favours PM should be aimed for.

**5.32** However, any maintenance regime should not adopt a single approach to maintenance, that is, reactive, preventive or predictive. It should be a combination of all such methods and their correct mix is essential for the optimisation of the maintenance regime.

**5.33** The PM programme supplied by the manufacturer of specific equipment should be considered where it is available. If the manufacturer's programme cannot be obtained, a programme should be drawn up in consultation with the AP and the maintenance personnel with reference to industry standard guidance such as the Building & Engineering Services Association's (2014) 'SFG20 – standard maintenance specifications for building engineering services'.

**5.34** Although the manufacturer may carry out certain inspection and maintenance procedures under the terms of its warranty (see [paragraph 5.10](#)), these may not constitute a full PM programme. The user or their representative should therefore ensure that the complete PM programme is carried out during the warranty period.

**5.35** It is important that maintenance is planned so that any plant or equipment is out of service for as little time as possible. There may be some reluctance on the part of users to accept the intrusion of PM. By forward planning and some minor adjustment to timing, these difficulties may be minimised; however, failure to carry out the maintenance should not be considered an option as it will compromise safety and reliability.

**5.36** Where the correct functioning of important components is not necessarily verified by the periodic tests prescribed for the engineering service, those components should be regularly tested, and reference to testing them should be

included in the schedules of maintenance tasks. This applies, for example, to door interlocks that may only be required to perform their safety function when presented with an abnormal condition.

**5.37** Apart from those tasks, the maintenance programme should concentrate on verifying the condition of the critical engineering service and its components by means of testing and examination without dismantling. Parts that are working correctly should not be disturbed unnecessarily.

For further information, see CIBSE's Guide M – 'Maintenance engineering and management'.

### Access for maintenance

**5.38** Most, if not all, services may require modification or renewal during the useful life of a building. Accommodation should be planned for this to occur, taking into account weight, size and configuration of the item.

**5.39** It is important to plan ahead when such actions are being considered not only with regard to the equipment but also with regard to adjacent healthcare services, patients, visitors, staff etc who may be affected. Prior information and clear safety signs are essential in this regard.

### Working in confined spaces

**5.40** A confined-space permit-to-work procedure should be established and personnel trained in its use.

**5.41** The system should address the following points:

- assessment of the task to be undertaken;
- identification of the potential risks/hazards;
- fire precautions;
- ventilation;

- air quality testing, prior to entry and continuously during access requirements;
- provision for special tools and lighting (which may include the need for portable gas detection and explosion-rated electrical equipment/tools);
- working methods;
- implementation of the working methods;
- monitoring of compliance of the system;
- actions in case of emergency including rescue plans;
- any safety alerts or notices that have been issued;
- communication;
- first-aid.

**5.42** Further information is available from the following guidance notes from the HSE:

- INDG258 – ‘Confined spaces: a brief guide to working safely’; and
- INDG401 – ‘Working at height: a brief guide’.

### Review of the PM programme

**5.43** The PM programme, procedures and records should be reviewed at least once a year by the maintenance personnel in association with the nominated AP. To do this, it is necessary to keep systematic records of all work done so that judgement can be made in consultation with the manufacturer on what changes, if any, to the PM programme would be best.

**5.44** The review should aim to identify:

- any emerging defects;
- any changes required to the maintenance programme;
- any changes to maintenance procedure;
- any additional training required by personnel concerned with maintenance;
- whether records have been completed satisfactorily, signed and dated.

### Risk and/or priority maintenance

**5.45** In carrying out design, installation, operational and maintenance evaluation, a consistent method of assessment should be engaged to ensure that adequate information, consultation and appraisal is undertaken across the whole range of influences.

**5.46** Although some elements of a particular assessment may be complex (for example, patient criticality and resilience), it is important to keep the collective assessment as simple as possible.

**5.47** One method is to establish an evaluation matrix that allows information across two scales to be represented in an easily understood way that helps users come to a particular decision (see Figure 3). Both scales are graded from lowest to highest such that a combination of the assessments can be represented, mapping the likelihood of an event happening and the consequences of the effect.

Probability	Rating					
Certain	16	16	32	64	128	256
Likely	8	8	16	32	64	128
Possible	4	4	8	16	32	64
Unlikely	2	2	4	8	16	32
Rare	1	1	2	4	8	16
	Rating	1	2	4	8	16
Effect		Insignificant	Minor	Moderate	Major	Catastrophic

Figure 3 Evaluation matrix

**5.48** In a similar way, a cost/benefit matrix may be constructed or a risk/design measure assessment made.

**5.49** A more detailed example of applied risk assessment may be found in DH'S (2005) 'A risk-based methodology for establishing and managing backlog'.

**5.50** Completion of the risk assessment will aid a decision process and provide supporting evidence to evaluate and demonstrate the priorities within a complex engineering service network. This will also support response within the NHS PAM.

## 6. Training, information and communications

### General

**6.1** All personnel employed in the design, operation and maintenance of engineering services, including maintenance personnel and operators, should receive adequate, documented training. Personnel should not commence their duties until this training has been completed, competency has been validated and detailed operating instructions have been provided.

**6.2** As a minimum, training should include:

- the prime function for the operation and maintenance of the engineering service;
- the engineering principles behind the service design and the clinical function it serves;
- operational policies;
- safety provisions;
- first-aid (as appropriate);
- emergency procedures;
- use of respiratory equipment (as appropriate);
- use of personal protective equipment (as appropriate);
- actions in the event of a fire;
- problems and hazards that can arise from failing to follow the agreed operating, monitoring and maintenance procedures;
- the permit-to-work system and safety procedures in use (when appropriate);
- the danger of making unauthorised modifications, alterations or additions to

the critical engineering service, as well as the possible legal consequences;

- the procedure to be followed if it is suspected that the system is no longer operating correctly.

### Building occupiers

**6.3** The engineering services and their functions and operation should be explained to the building occupiers and equipment users (for example, theatre ventilation, medical gases and theatre lifts). This will assist in understanding the safe operation and capability of the particular system when changes are being considered.

### The required workforce

**6.4** A process needs to be developed which regularly checks that the workforce is competent and suitably trained to cover all aspects of the work required. The following issues may require consideration:

- **analysis of maintenance profile** (review of existing practice);
- **assessment of emergency repair experience** (to inform staff profile);
- **planned and first-line maintenance of equipment** (to determine essential skills);
- **recruitment and retention experience** (to understand the likely labour pool available);
- **skills gap** (determined by an analysis);
- **potential/ideal staff profile** (as if setting up a new structure);

- **possible training** (to meet the above if not available from in-house arrangements);
- review of professional qualifications and maintenance of continuing professional development.

**6.5** From this type of assessment, it should be possible to determine the service shortfalls relative to loss of staff for whom a natural replacement is not readily available, the skill shortages of existing staff and the skill shortage for equipment or systems installed.

**6.6** The resulting analysis may give rise to either a training need for existing staff or a need for a staff/structure review with possible training implications. It may also identify a service that may be more cost-effectively provided by an outsourced contract.

**6.7** While it is important to address the staff profile by trade or service, it may be useful for an organisation to link the outcome with other service profiles. This may indicate some common issues, economies of scale for training needs, useful feeder groups and a better general overview of the service, which can be used to inform a priority assessment.

## Improving the workforce profile

**6.8** Many of the traditional training routes no longer provide the level of opportunity relevant to the healthcare sector; at the same time, skills and competencies needed are becoming more and more specific to the healthcare sector.

**6.9** One challenge is to encourage more young people to enter the services sector of healthcare organisations under specific programmes such as the modern apprenticeship scheme where skills can be delivered to meet a specific need. Another is to develop a multi-skilled approach to service delivery. In each case, training and development will be an important factor in the solution.

**6.10** With an understanding of the existing workforce profile, a training plan may be established to meet the short-, medium- and

long-term requirements that are needed to satisfy the organisation's requirements.

**6.11** The cost of training and the cost of apprenticeships can be difficult to secure. When presented as part of an overall assessment with, at least, a medium-term plan, it can deliver cost-efficient provision of services meeting the future need of the organisation.

**6.12** Training and the quality of service are inter-linked. Taking full advantage of multi-skilling and flexible working practices will begin to deliver the cost and performance efficiencies required from the services.

**6.13** Opportunities should be taken of current government training schemes and courses provided by specialist training providers.

## Criteria for operation

**6.14** Maintenance staff should be trained in all maintenance procedures. The depth of training will depend on the level of required maintenance, but it should at least draw attention to any risks and safety hazards arising due to maintenance activities.

**6.15** Other personnel who monitor plant or who carry out routine plant maintenance should be trained in:

- understanding the visual displays;
- acknowledging and cancelling alarms;
- taking required actions following alarm messages;
- obtaining the best use of the system.

**6.16** Training (including refresher training) will need to be repeated periodically in order to cater for changes in staff or the systems.

**6.17** Records of the training provided should be kept up-to-date.

**6.18** On completion of training, employees should be assessed by an AP to ensure that the training programme has been understood and that they are competent to undertake the work required.

## 7. Supporting Health Technical Memoranda (HTMs)

**7.1** Within the overall HTM guidance structure, there are eight specialist subjects supported by this core document. The specialist subject areas are detailed below. The documents are available from the [UK government's website](#).

### Note

This HTM was prepared for publication in March 2014. Readers should ensure that they check the UK government's website (see link above) for the latest or new editions of all HTMs that post-date the publication of this document.

### Choice Framework for local Policy and Procedures 01: Decontamination

**7.2** Choice Framework for local Policy and Procedures (CFPP) is a suite of best practice guidance that is being piloted by DH within the subject area of decontamination.

**7.3** The CFPPs:

- allow choices to be made about how to control risk, which will inform the development of a local policy;
- take into account the constraints within which different organisations operate (for example, space and financial constraints).

**7.4** The CFPPs allow this to be achievable by having two levels of compliance:

- a. Essential Quality Requirements (EQR); and
- b. Best Practice (BP).

**7.5** EQRs are statements of attainment that are essential to the safe operation of a decontamination service.

**7.6** BP is a risk-assessment-and-control-based approach that allows people to make informed choices on how to achieve a more locally relevant outcome that at least mirrors the standards set by EQR.

**7.7** As a result, organisations will write their own local policies, which are based on appropriate risk-control measures developed for their own unique local facilities and services. In turn, quality regulators such as the CQC will treat this local policy as a reasonable interpretation of the CFPP guidance.

**7.8** The CFPP 01 series offers best practice guidance on the management and decontamination of surgical instruments, flexible endoscopes and linen.

**7.9** CFPP 01-01 Part A supersedes HTM 01-01 Part A (2006).

**7.10** CFPP 01-01 Parts B–E supersede HTMs 2010, 2031 and HBN 13 Supplement 1, and partially supersede HTM 2030. Only washer-

disinfectors used for processing surgical instruments (and not those used in laboratories or for endoscopes) are covered in CFPP 01-01.

### Choice Framework for local Policy and Procedures 01-01: Management and decontamination of surgical instruments (medical devices) used in acute care (replaces HTM 01-01 2006)

#### *Part A – the formulation of local policy and choices*

**7.11** Part A covers the policy, management approach and choices available in the formulation of a locally developed, risk-controlled operational environment. The technical concepts are based on European (EN), International (ISO) and British Standards (BS) used alongside policy and broad guidance. In addition to the prevention of transmission of conventional pathogens, precautionary policies in respect of human prion diseases including variant Creutzfeldt-Jakob disease (vCJD) are clearly stated. Advice is also given on surgical instrument management related to surgical care efficiencies and contingency against perioperative non-availability of instruments.

#### *Part B – Common elements*

**7.12** Part B covers common elements that apply to all methods of surgical instrument reprocessing such as:

- test equipment and materials;
- design and pre-purchase considerations;
- validation and verification.

#### *Part C – Steam sterilization*

**7.13** Part C covers standards and guidance on steam sterilization:

- design and pre-purchase considerations;
- validation and verification;
- steam plant;
- operational management.

**7.14** Appendix A to the document is a technical specification for use when purchasing porous load sterilizers. This appendix supersedes Model Engineering Specification (MES) C30 – ‘Sterilizers’.

#### *Part D – Washer-disinfectors*

**7.15** Part D covers standards and guidance on washer-disinfectors:

- design and pre-purchase considerations;
- validation and verification;
- water supply;
- operational management.

**7.16** Appendix A to the document is a technical specification for use when purchasing washer-disinfectors that process surgical instruments. This appendix supersedes Model Engineering Specification (MES) C14 – ‘Washer-disinfectors for surgical instruments’.

#### *Part E – Alternatives to steam for the sterilization of reusable medical devices*

**7.17** Part E covers low temperature (non-steam) sterilization processes (such as the use of vaporised hydrogen peroxide gas plasmas and ethylene oxide exposure).

### Choice Framework for local Policy and Procedures 01-04: Decontamination of linen for health and social care

#### *Management and provision*

**7.18** This document includes:

- a description of the overall structure of CFPP 01-04 guidance and the rationale behind the structure;
- DH policy on safe linen decontamination and processing.

Most importantly, it describes DH’s approach to laundry processes and their effectiveness against *Clostridium difficile*.

### *Social care*

**7.19** Social care settings range from large residential and nursing homes to small domiciliary care settings. Guidance and the ways of complying with that guidance therefore need to be in proportion to the infection risks associated with such settings (that is, the type of equipment and methods of linen processing will vary from setting to setting). This document gives an overview of these processes, outlines the EQR, explains how to move upwards towards BP, and gives guidance on how to categorise and segregate linen effectively depending on the type of social care setting.

### *Guidance for linen processors implementing BS EN 14065*

**7.20** Many NHS organisations outsource their linen processing to third-party organisations. Some of these third-party organisations adhere to the quality standards in BS EN 14065, which describes a management system for assuring the microbiological quality of processed linen through the control of biocontamination.

**7.21** This document gives guidance on ways of complying with CFPP 01-04, specifically for those organisations that have implemented or will be implementing BS EN 14065.

### *Engineering, equipment and validation*

**7.22** This document covers:

- the standards and regulatory framework relating to linen decontamination with which engineering staff should be familiar;
- roles of key personnel;
- design and pre-purchase considerations; and
- validation and verification of disinfection performance of washers, washer-extractors and continuous tunnel washers (CTWs).

## **Choice Framework for local Policy and Procedures 01-06: Decontamination of flexible endoscopes**

### *Policy and management*

**7.23** This document sets out DH's policy context and discusses the EQR and BP recommendations for an endoscope decontamination service. Transmissible spongiform encephalopathy (TSE) infectious agents are discussed and guidance given on management and handling of an endoscope after it has been used on a patient at increased risk of vCJD.

### *Design and installation*

**7.24** This document gives guidance on the design and fitting of endoscope reprocessing units. Example layouts are given for:

- a single-room decontamination facility for low throughput units;
- a large room with single-ended endoscope washer-disinfectors (EWDs);
- a two-room decontamination unit using double-ended EWDs;
- a high throughput reprocessing unit;
- a reprocessing unit supplying adjacent treatment rooms.

**7.25** Comprehensive guidance is given on the standards of water quality and water treatment needed for an endoscope reprocessing unit.

### *Operational management*

**7.26** This document gives guidance on operational responsibility together with advice on the procurement and operation of an EWD.

### *Validation and verification*

**7.27** The 'Validation and verification' document highlights the types of tests and maintenance procedures that are needed to ensure that decontamination has been achieved.

### Testing methods

**7.28** This document discusses the principles and methods that are used in the tests described in this CFPP and the tests detailed in BS EN ISO 15883-4.

### Health Technical Memorandum 01-05: Decontamination in primary care dental practices (2013 edition, supersedes the 2009 edition)

**7.29** The policy and guidance provided in this HTM are aimed at establishing a programme of continuous improvement in decontamination performance at a local level. The guidance suggests options to dental practices within which choices may be made and a simple progressive improvement programme established.

**7.30** This guidance is intended to support and advance good practice throughout primary care dentistry including that delivered by general dental practices, salaried dental services and where primary care is delivered in acute settings.

**7.31** This document is divided into three sections:

- Section 1: “Decontamination policy and foreword” outlines the policy and principles of decontamination in dental practices, and explains the EQR and BP requirements.
- Section 2: “Advice to dentists and practice staff” gives plain advice to dentists and practice staff on how to meet EQR and achieve BP; how to clean and sterilize instruments; and how to set up a decontamination area within the practice.
- Section 3: “Engineering, technology and standards” gives technical advice to engineering and technical staff, including Authorised Persons (Decontamination) and Competent Persons (Decontamination).

**7.32** The 2013 edition revised the criteria on storage times of reprocessed dental instruments. The rationale for this change is that dental instruments are used in contaminated body areas. Any environmental contamination that takes place would have a minimal impact on patient safety compared with contamination with another patient’s blood or body fluid, which would be a significant hazard to patients. Thus, the emphasis is on ensuring effective decontamination and preventing contamination with another patient’s blood and body fluid rather than on preventing environmental contamination of sterilized instruments.

**7.33** The 2013 edition was also updated to reflect the changes to the NHS infrastructure following the Health and Social Care Act 2012.

See also the [Infection Prevention Society’s dental audit tool](#), which has been developed to support implementation of the guidance.

## Health Technical Memorandum 02: Medical gases

### Health Technical Memorandum 02-01: Medical gas pipeline systems

#### *Part A – Design, installation, validation and verification*

**7.34** The purpose of this guidance is to provide comprehensive advice, but not all-inclusive, on design considerations applicable to healthcare premises. It outlines the “best practice” philosophy for systems where patient safety and well-being are of prime importance.

**7.35** Guidance in this part covers piped medical gases, medical and surgical air, and medical vacuum installations. It applies to all medical gas pipeline systems and anaesthetic gas scavenging disposal systems installed in healthcare premises. Specifically, it deals with the issues involved in the design, installation, and validation and verification (testing and commissioning) of a medical gas pipeline system.

*Part B – Operational management*

**7.36** The safe operation of a medical gas pipeline system relies on skilled staff who understand the system and who can liaise with clinical users to ensure continuing patient safety.

**7.37** This document lists key personnel involved in the operation, maintenance and use of the system. This will include nominated medical and nursing staff, risk managers/fire safety officers, pharmacy staff and the quality controller for the site, and competent personnel (who may be in-house staff or contractors). The document also includes relevant drawings and schedules of plant, terminal units, area valve service units (AVSUs), alarms etc.

## Health Technical Memorandum 03: Heating and ventilation systems

### Health Technical Memorandum 03-01: Specialised ventilation for healthcare premises (replaces Health Technical Memorandum 2025)

*Part A: Ventilation, design, installation, testing and validation*

**7.38** This document provides best practice guidance on the design and installation of ventilation systems and the close-control (air-conditioning) of “specialist” environments.

*Part B: Operational management and verification*

**7.39** This document sets out the necessary arrangements for managing healthcare ventilation and air-conditioning systems across the majority of premises.

## Health Technical Memorandum 04: Water systems

### Health Technical Memorandum 04-01: The control of Legionella, hygiene, “safe” hot water, cold water and drinking water systems

*Part A: Design, installation and testing*

**7.40** This document gives comprehensive advice and guidance to healthcare management, design engineers, estate managers and operations managers on the legal requirements, design applications, maintenance and operation of hot and cold water supply, storage and distribution systems in all types of healthcare premises. It is equally applicable to both new and existing sites.

**7.41** Interruptions in water supply can disrupt healthcare activities. The design of systems must ensure that sufficient reserve water storage is available to minimise the consequence of disruption, while at the same time ensuring an adequate turnover of water to prevent stagnation in storage vessels and distribution systems.

*Part B: Operational management*

**7.42** This document sets out the necessary arrangements for managing healthcare water systems across the majority of premises. Current legislation requires all parties involved to be aware of their individual and collective responsibilities for the provision of wholesome, safe hot and cold water supplies, storage and distribution in healthcare premises.

**7.43** The temperature control regimen is the preferred strategy for reducing the risk from *Legionella* and other waterborne organisms in water systems. This requires monitoring on a regular basis. Recommended test frequencies are listed in the document.

### Health Technical Memorandum 04-01: Addendum – *Pseudomonas aeruginosa* – advice for augmented care units

**7.44** The document is concerned with controlling/minimising the risk of morbidity and mortality due to *P. aeruginosa* associated with water outlets and provides guidance on:

- assessing the risk to patients when water systems become contaminated with *P. aeruginosa* or other opportunistic pathogens;
- remedial actions to take when a water system becomes contaminated with *P. aeruginosa*;
- protocols for sampling, testing and monitoring water for *P. aeruginosa*; and
- forming a Water Safety Group (WSG) and developing water safety plans (WSPs).

**7.45** The guidance is directed towards healthcare organisations providing patient care in augmented care settings. It is specifically aimed at Estates and Facilities departments and infection prevention and control (IPC) teams.

### Health Technical Memorandum 05: Firecode – fire safety in the NHS

#### Health Technical Memorandum 05-01: Managing healthcare fire safety (second edition published 2013)

**7.46** This document provides a framework for the implementation of DH's fire safety policy. It may be an appropriate method for meeting statutory duties under the Regulatory Reform (Fire Safety) Order 2005, which requires a managed risk approach to fire safety. The process of fire risk assessment, mitigation and review requires a robust system of management capable of identifying hazards, qualifying their impact, devising appropriate mitigation and continual monitoring.

#### Health Technical Memorandum 05-02: Guidance to support functional provisions for healthcare premises (2014 edition forthcoming)

**7.47** This document provides recommendations and guidance on the design of fire safety in healthcare premises. The functional approach is seen as enabling innovation in design while still providing an adequate degree of fire safety for patients, visitors and staff.

#### Health Technical Memorandum 05-03: Operational provisions

**7.48** This part of the suite brings together other fire safety guidance which is specific in application.

- Part A – 'General fire safety'
- Part B – 'Fire detection and alarm systems'
- Part C – 'Textiles and furnishing'
- Part D – 'Commercial enterprises on healthcare premises'
- Part E – 'Escape lifts in healthcare premises'
- Part F – 'Arson prevention in the NHS'
- Part G – 'Laboratories'
- Part H – 'Reducing false alarms in healthcare premises'
- Part J – 'Guidance on fire engineering of healthcare premises'
- Part K – 'Guidance on fire risk assessments in complex healthcare premises'
- Part L – 'NHS fire statistics 1994/95–2004/05'
- Part M – 'Guidance on the fire safety of atria in healthcare buildings'.

## Health Technical Memorandum 06: Electrical services

### Note

The HTM 06 series should be read in conjunction with the IEE Wiring Regulations BS7671 together with the Guidance Note 7 on Special Locations (Institute of Engineering and Technology (IET))

### Health Technical Memorandum 06-01: Electrical services supply and distribution

#### *Part A – Design considerations*

**7.49** This document covers electrical distribution assessment and design, which looks at the needs of patients and how the resilience/safety of the electrical system from source to patient can be provided. It covers high voltage and low voltage distribution networks together with standby systems including generators, uninterruptible power supplies, and isolated power supplies (also known as medical IT).

#### *Part B – Operational management*

**7.50** This document considers the operational management and maintenance requirements for hard-wired electrical systems and fixed power plant.

**7.51** The document is suitable for use with all forms of electrical maintenance work ranging from testing of plant, such as generators, to the periodic testing and inspection of the electrical network(s) and final circuits.

### Health Technical Memorandum 06-02: Electrical safety guidance for low voltage systems

**7.52** This HTM gives operational guidance on electrical safety requirements for low voltage systems (up to 1 kV) in healthcare premises including management, the professional and operational structure, safety procedures, testing, equipment and records.

**7.53** Guidance is intended to assist in meeting the requirements of the Electricity at Work Regulations 1989, which detail the precautions to be taken against risk of death or personal injury from electricity in work activities.

### Health Technical Memorandum 06-03: Electrical safety guidance for high voltage systems

**7.54** This HTM gives operational guidance on electrical safety requirements for high voltage systems (up to 11 kV) in healthcare premises including management, the professional and operational structure, safety procedures, testing, equipment and records.

**7.55** Guidance is intended to assist in meeting the requirements of the Electricity at Work Regulations 1989, which detail the precautions to be taken against risk of death or personal injury from electricity in work activities.

## Health Technical Memorandum 07: Environment and sustainability

### Health Technical Memorandum 07-01: Safe management of healthcare waste (2013 edition)

**7.56** This guidance is targeted at all waste producers involved in the management of healthcare waste. The purpose is to provide a framework for best practice in waste management in order to help NHS trusts and other waste producers. It aims to be a primary source of guidance covering those wastes produced directly from healthcare activities, taking into account changes in the legislation governing the management of waste, its storage, carriage, treatment and disposal, and health and safety.

**7.57** The 2013 edition supersedes all previous editions. The key areas of change include:

- updates to legislation, specifically for environmental permitting and transport/carriage regulations;

- a focus on the waste hierarchy through procurement practices, and the elimination, minimisation, recycling and recovery of waste;
- a drive to address the carbon impact related to waste through resource efficiency, transport impacts and disposal arrangements;
- the integration of new sector guides on GPs and dental practices as well as incorporating HTM 07-06 ('Disposal of pharmaceutical waste in community pharmacies') as a sector guide;
- a focus on practical advice and examples for classifying waste, in particular the infectious and offensive waste streams, including case studies to highlight best practice;
- a review of the terminology used for healthcare, clinical and non-clinical wastes.

### Health Technical Memorandum 07-02: EnCO<sub>2</sub>de – making energy work in healthcare

**7.58** The purpose of this document is to provide a primary source of guidance on managing energy use and carbon emissions in the healthcare sector. It aims to ensure that everyone involved in managing, procuring and using buildings and equipment gives due consideration to the implications of energy use and carbon emissions. It draws together best practice with the intention of putting energy at the heart of the health service.

### Health Technical Memorandum 07-03: Transport management and car-parking: best practice guidance for NHS trusts in England

**7.59** This document considers what measures trusts can adopt when developing travel plans and managing transport and car-parking, drawing on best practice to assist the NHS in a practical way. It aims to identify best practice in developing travel plans, give links to other

assessment tools, provide a matrix from which to estimate a base level of car-parking provision, point to external funding opportunities, and consider environmentally friendly transport options.

### Health Technical Memorandum 07-04: Water management and water efficiency – best practice advice for the healthcare sector

**7.60** This HTM's principal remit is to encourage the efficient management of water and to promote the economic and environmental benefits of doing so. Additionally, it examines water-management decisions in the context of:

- patient health and well-being;
- social and behavioural aspects; and
- available and appropriate technology.

**7.61** Methods for auditing facilities are outlined, with common areas of high water use discussed and technical solutions proposed. Guidance on establishing necessary social and behavioural aspects such as staff awareness, appropriate use of technology and a clear definition of responsibilities are also outlined.

### Health Technical Memorandum 07-05: The treatment, recovery, recycling and safe disposal of waste electrical and electronic equipment

**7.62** This guidance document explains the requirements of the WEEE Regulations and in particular how they will affect NHS trusts as users of non-household WEEE. It identifies the relevant stakeholders and their responsibilities.

### Health Technical Memorandum 07-07: Sustainable health and social care buildings – planning, design, construction and refurbishment

**7.63** This HTM addresses sustainable development within health and social care facilities by looking at the main issues that should be addressed throughout a building's life – highlighting key actions, commitments and responsibilities at every stage. It also explores

the reuse of existing buildings and provides advice on possibilities for sustainable refurbishment.

**7.64** The guidance in this document is based on the principle that unsustainable development has a detrimental impact on the health of our communities and consideration should be given to the social, environmental and economic context with every decision made.

**7.65** The key recommendations highlighted by this guidance document are to:

- set out a scheme's strategic sustainability objectives at a very early stage and the options explored (for example refurbishment versus new build);
- ensure that these objectives are addressed in the project budget and project brief;
- ensure that sustainability measures are assessed not only on a whole-life cost/ life-cycle cost basis but also from the perspective of other currencies (for example reduced carbon-dioxide emissions);
- ensure appropriate sustainability measures are embedded in the building's design;
- allocate key responsibilities at each stage;
- trace and evaluate progress towards achieving sustainability throughout the project's and building's life.

## Health Technical Memorandum 08: Specialist services

### Health Technical Memorandum 08-01: Acoustics

**7.66** This document outlines the principles and considerations associated with the control of noise generated by not only the various activities undertaken within healthcare premises but also the services which are required for these activities to be undertaken. The

document is concerned with reducing both the interior noise environment affecting the exterior noise environment and vice-versa.

**7.67** Noise from a certain activity within the premises should not appreciably intrude on activities taking place in adjacent areas. This may be avoided by either careful consideration of the positioning of rooms during design conception, or by provision of sufficient sound insulation.

**7.68** This document provides not only the considerations for use at the design stage, but also outlines the routine maintenance of noise control hardware or acoustic treatment and the monitoring and recording of noise levels. The responsibilities of all parties involved are defined, either by brief explanation or by use of reference to specific legislation, standards and/or codes of practice.

### Health Technical Memorandum 08-02: Lifts

**7.69** Healthcare buildings are dependent on lifts to provide an efficient, fast, comfortable, safe and reliable vertical transportation service for the movement of patients, staff, visitors, medical equipment and ancillary services items. Healthcare buildings may also be dependent on lifts to provide fire-fighting and evacuation facilities.

**7.70** This HTM gives comprehensive advice and guidance on the planning, design, installation, commissioning, testing, maintenance and operation of new lifts and escalators (vertical transportation) in healthcare buildings. It also provides supporting information that can be used in specifications for manufacturers, procurement contracts and the briefing of design teams.

**7.71** Although the guidance is applicable to new installations, it can be used for the upgrading and modernisation of existing installations.

### **Health Technical Memorandum 08-03: Bedhead services**

**7.72** Bed spaces and their environment have a significant impact upon patient experience and delivery of care. With patients able to choose their provider of healthcare service and the increased complexity of clinical techniques and procedures provided at bed spaces, it is now even more important to ensure that bedhead facilities are fit-for-purpose in all respects.

**7.73** This guidance covers the management policy for, operational management of, and design considerations for bedhead services. It applies to the range of engineering services and

equipment provided at in-patient areas and bed spaces within healthcare premises.

### **Health Technical Memorandum 08-06: Pathology laboratory gas systems**

**7.74** This document aims to provide best practice guidance on the design, installation and testing of pathology laboratory gas systems. It can be applied to fixed gas pipeline systems, discrete plant, compressed gas cylinders and gas generators in a laboratory environment. It also aims to improve system management by the introduction of defined PM tasks and a dedicated permit-to-work scheme.

# Appendix A: Exemplar emergency procedures and checklists

**A1** The following procedures and checklists have been prepared by trust estates and facilities management (EFM) personnel to meet the needs of their own organisations during failure of a service.

**A2** They are not intended to be appropriate or definitive for all sites, but they give an idea of

the types of format that may be used, and the different levels of technical content that may be appropriate on different sites.

**A3** Further procedures will be required within a healthcare organisation, and a regular review is important to ensure that directives, staff and equipment remain current.

## Procedure for electricity supply failure

Operational procedure reference no: .....

Hospital location: .....

Healthcare description (A&E, CCU, Ward 6 etc): .....

### Key areas of equipment likely to be

Lighting, medical equipment, fixed and/or mobile computers and associated equipment, other non-medical equipment (catering, waste disposal etc), communication systems (telephones, nurse call etc), heating and ventilation.

### Risk assessment

This procedure is linked to the overall hospital site procedure for failure of electricity supply and departmental risk assessment register. This document should be reviewed on a regular basis and especially if any alterations to equipment function, staff and responsibility take place.

### Aims

This emergency procedure is intended to highlight the key issues that may arise at departmental level in the event of electrical power failure. It is appreciated that this may be the result of a full site power failure, but it may also be the result of a local failure for which notification will be necessary. The main aim is to provide a structured approach to the safety of patients and staff and to minimise the risk associated with an electrical failure.

### Identification of failure

This may be indicated by the failure of key observable elements, for example lighting and computer displays, but may also be indicated by alarm signals from monitored supply panels on medical equipment, services and systems.

**Major supply failure**

In the event of an obvious full electrical failure, do not wait for the restoration of supplies by generator, but immediately take action.

Staff should safely complete or suspend any procedure being undertaken and prioritise their attention on the most critical equipment and/or patients. Local standby supplies and equipment-based systems should be checked. Where necessary, manual intervention should be started to ensure the safety of patients.

When supply is restored by generator, staff should ensure that all essential equipment is functioning correctly and, where necessary, transfer equipment or patients onto essential supplies.

On restoration of the normal supply, staff should check that all systems and equipment have reset to normal.

**Continued supply failure**

If full supply loss should continue for several minutes, immediately contact the hospital duty manager via the switchboard. The switchboard will also contact the duty engineer for attention.

Within the department, prioritise duties to ensure safety of patients and take preventative measures, where possible, to minimise the workload.

In the event that it is identified as a local failure, contact the duty manager to gain further staff support from other adjacent unaffected areas, or arrange to move the most critical patients to other departments.

**Partial supply failure**

If only part of the department's electrical systems fail, it is unlikely that standby systems will restore supplies in the immediate term. First, minimise the risk to patients and identify the extent of the failure. Contact the switchboard, who will alert the duty engineer and duty manager. Continue to monitor the situation and move critical equipment and/or patients to fully supported areas where possible.

**Awareness and training**

Electrical supply failure is one of the most wide-ranging impacts on the normal running of a department. It is likely that staff will be engaged in the regular testing of the standby systems, but further local awareness should be engaged to ensure that all staff are aware of the departmental issues and the effects of a longer-term and full failure. Where possible, this should be carried out at the workplace, but with minimum impact on patients. Senior managers should liaise with the estates engineer to arrange simulation and practical support.

Emergency procedures should be an essential part of new staff induction to the department to ensure all local issues are fully understood.

**Review procedure**

From incident experience and training evaluation, this procedure and any supporting information should be reviewed and amended as necessary to ensure the document remains up-to-date and definitive for the department.

This document was first issued on: ..... (Date)

**Amendments:** ..... (Brief details and date)

**Plan approved and accepted by:**

**Senior manager** .....

**Head of department:** .....

## Procedure for water contamination

**Operational procedure reference no:** .....

**Other relevant procedures:** Engineering scheme to provide piped fresh water supplies

### Scope

The following procedure is designed to instruct and advise on the operational requirements for dealing with contamination of the water supply. It is not considered a definitive guide as the particular circumstances of the incident will ultimately determine the course of action taken. It will attempt to highlight the responsibilities of estates staff, clinical staff and on-call administrators.

### Causes

Water may become contaminated in a number of ways, including:

- contamination of the incoming water supply to the hospital site;
- contamination due to substances inadvertently or maliciously added to the water storage systems;
- contamination caused by the corrosion or decay of materials in contact with the water supply, for example rusting metal and dead animals;
- cross-contamination of water supply due to the effect of a process carried out on site by staff or contractors where the safety devices are inadequate or non-existent, for example cross-contamination due to siphonage from drains and stagnant water;
- misoperation/failure of water treatment plant;
- migration between domestic hot and cold water services.

### Effects

The possible effects of contamination are varied, and will depend on the severity and degree of the contamination. However, further investigation should be carried out if:

- patient/staff complain about the taste of the drinking water;
- the water is discoloured;
- the water has a distinctive smell (this could be the result of chemicals (for example chlorine), acid, sewage or decaying matter);
- the water appears normal but people using it have become sick/infected.

### Investigation and response

The size of the affected area must first be ascertained. This will give some indication of the extent of the problem and may help to identify the source of the contamination.

The following actions may or may not require to be taken, depending on whether part of or the whole water system has been contaminated:

- inform the senior staff of affected departments to cease using the water;
- contact the local water authority. The contamination may have originated from the main water incoming supplies; there is likely to be an obligation not to contaminate the public water network;
- take samples as necessary to determine the nature of the contamination;
- once the extent has been determined, an assessment should be undertaken as to the nature of the contamination. The use of microbiology staff is recommended;

- isolate the affected area from the main supply to prevent further contamination;
- take samples at various points within the affected area(s) for future analysis;
- contact on-call or emergency administrative staff and advise them to arrange a supply of fresh water for areas requiring it;
- dependent on the nature of contamination, the cause may be obvious or easily located. If this is not possible, carry out a systematic investigation of water supply systems;
- if the cause of the contamination is located, isolate the contamination and carry out necessary works to resolve the situation;
- inform medical staff of the nature of the contamination and await advice on the clinical effect before restoring the water supply to the area;
- thoroughly flush all pipework (run taps, flush toilets, bidets etc) until further analysis shows no trace of contamination;
- when the water quality is restored and confirmed by medical or microbiology staff, allow normal use to continue.

**Further work**

- Study how the contamination has occurred and carry out preventative work if possible to avoid recurrence.
- Review the operational procedure for the incident and modify as necessary.
- Note the date and time of the incident, action taken and by whom, for future reference.

**Relevant drawing nos:** .....

**Additional information**

.....  
.....  
.....  
.....

Plan approved and accepted by:

**Board member:** .....

**Risk assessment**

This document is linked to risk assessment no ..... It should incorporate existing controls contained in the risk assessment and should be modified if any changes to the risk assessment are made.

## Procedure for piped medical gas failure

**Operational procedure reference no:** .....

**Hospital location:** .....

**Plant or system description:** .....

### Systems in use:

Oxygen ref ..... Nitrous oxide ref ..... Nitrous oxide/oxygen ref .....

Medical air ref ..... Waste anaesthetic gas scavenging ref ..... Medical vacuum ref.....

### Aims

The aim of this emergency procedure is to provide guidance and a structured approach to the management response in the case of a major failure in supply of piped medical gases, and to safeguard patients at risk from any such failure.

### Identification of the source and nature of failure

This will normally be indicated by an alarm actuation at one of the following locations:

- telephone exchange;
- porter's lodge;
- boiler room;
- main corridor;
- ward 1;
- ward 2;
- ward 3.

On actuation of the alarm, the hospital switchboard must be contacted with a description of the alarm legend. The switchboard operator will immediately contact the Duty Engineer or Duty Authorised Person (responsibility allocated in the medical gas pipeline system (MGPS) operational policy) for the initial response and investigation of the fault, and will follow switchboard procedures.

The situation will be assessed by the Duty Engineer and categorised accordingly as a minor or major failure of the system.

### Minor failure, not life-threatening

The Duty Engineer will contact the Authorised Person to have repairs carried out in accordance with Health Technical Memorandum 02-01, and inform the Duty Senior Manager of the cause and outcome of the situation. Permits-to-work will be issued in accordance with Health Technical Memorandum 02-01.

### Major failure of supply

If a major failure of supply has occurred, the following procedure is to be followed by the Duty Engineer, who will carry out the initial assessment and arrange for the following personnel to be contacted:

**Authorised Person Senior Manager Senior Pharmacist Senior Nurse Senior Medical Officer/Surgeon**

The situation will be re-assessed by the Senior Manager and a decision taken as to whether the major incident plan is also implemented and brought into operation, together with the procedures outlined in this document.

## Damage control

The cause and result of the damage to the system should be investigated by the Duty Engineer/Authorised Person.

Drawings and schematics should be readily available.

Steps should be taken to limit the amount of disruption, and a temporary supply should be secured by either valving or capping of damaged areas to enable emergency supply banks to cope during repairs. Failing this, sufficient portable cylinders should be provided at the point of use.

Following damage limitation, valve-off the damaged section where possible and ensure back-up supply banks are functioning.

Team members' attendance should be confirmed. They should assemble at a predetermined location where control will be handed from the Duty Engineer/Duty Estates Manager to the responsible Senior Manager.

The areas of responsibility for the various team members are outlined, but this list is by no means exhaustive and should be further developed in the light of knowledge as the incident develops.

## Areas of responsibility

### *Telephonist*

- First-line communications.
- Initial coordination of response.
- Assists with all communications and logs calls and responses.

### *Senior Manager*

- Coordination of all team members.
- Recovery strategy and repair coordination.
- Documentation.

### *Senior Pharmacist*

- Ordering and procurement of gases.
- Purity checks on reinstatement of supply.

### *Senior Medical Officer, Surgeon/Senior Nurse*

- Clinical prioritisation of supply requirements.
- Liaison with doctors and nursing staff.
- Movement of patients where necessary.
- Advice to other team members on clinical criteria.

### *Duty Engineer/Authorised Person*

- Initial response and coordination.
- Damage limitation and securing supply.
- Diagnosis and repair of failure.

- Provision of temporary supplies (pipeline).
- Testing and verification on reinstatement.
- Recommissioning and documentation.

*Designated Manager, Hotel Services*

- Provision of portering staff for moving and changing cylinders.
- Liaison with other team members for manpower requirements.
- Organisation of patient transport where needed.
- Organisation of transport for support services.
- Liaison with outside agencies and press.
- Communications.

**Debriefing**

Following return to normality, a team debriefing should be held to review the emergency procedure and update or correct any apparent weaknesses.

**Review procedure**

This procedure will be reviewed following any change in personnel, equipment, materials and environment or following any change. It will be reviewed at regular intervals not exceeding 12 months.

**Training and information**

All staff involved will receive adequate training and instruction to enable them to carry out these procedures with confidence during an emergency. This training will be recorded in the log attached, and updated on a regular basis.

**Amendments**

Plan approved and accepted by:

**Board member:** .....

**Risk assessment**

This document is linked to risk assessment no ..... It should incorporate existing controls contained in the risk assessment and should be modified if any changes to the risk assessment are made.

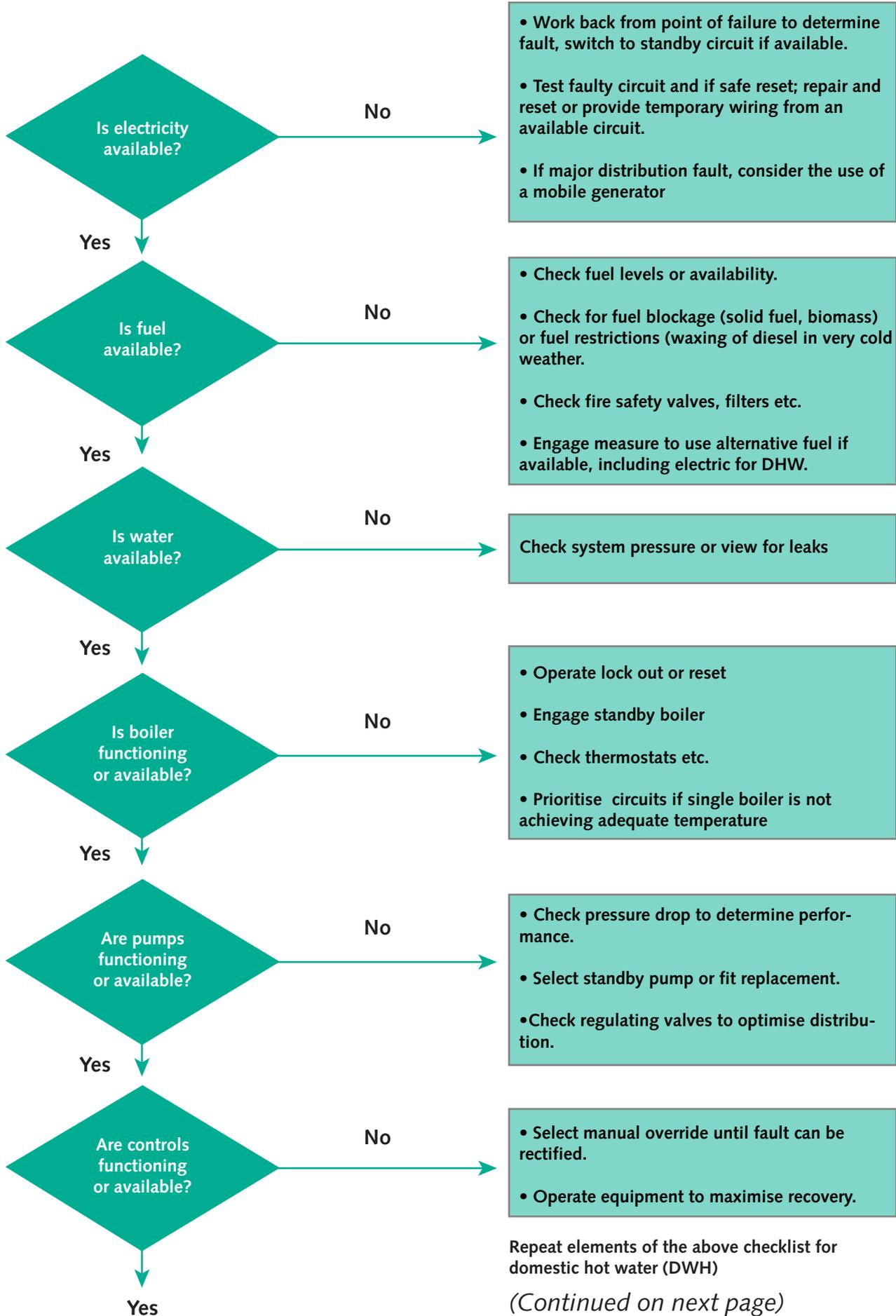
## Alternative form of a procedure in case of system failure

A4 For areas with complex services, for example a major boiler house or plantroom, an alternative way in which to express the actions to be taken by authorised and competent persons may be expressed in a checklist.

A5 The flowchart on the next page represents a simple indication of some issues that may arise, although a more detailed list may be appropriate for each specific area.

A6 It is important to make healthcare staff aware of the failure that has occurred and the measures to be taken to minimise the impact of heating or hot water failure. Where necessary, supplementary heaters may need to be deployed.

### Simple boilerhouse initial checklist



For major boiler houses providing steam and/or whole hospital heating and DHW, a more complex and site-specific list should be established.

Such sites should also consider:

- permanent standby boilers;
- alternative fuel capability;
- duty/standby pumps on all circuits;
- readily available (on-site) spares for essential equipment;
- a permanently available generator connection point; and
- access to a generator.

The boiler house should have an agreed flood risk assessment.

Ensure alarms are available, through BMS or other means, to indicate any major equipment failure including steam pressure loss, to engage an urgent prompt for attention.

### Sample assessment table

Operational checklist	Define ownership of the problem?	Will patient/Public/Staff safety/care be affected?	Will evacuation be required?	Risk of fire outbreak, or reduced fire-fighting ability?	Consider impact on electricity supply?	Consider impact on gas supply?	Consider impact on water supply?	Consider impact on drainage?	Consider impact on other services?	Increased risk of legionella?	Consider impact on site security?	Impact on fire alarms?	Will medical gases be affected?	Is there an impact on clinical waste?	Agree responsibility boundaries	Clinical department procedures?	Control of Infection Team involvement?	Do public relations need to be addressed?	Consider Service Level Agreements with purchasers?	Involve commercial services?	Record Trust personnel contact details?	Locate supply of specialist equipment?
Air-conditioning																						
Air pollution																						
Asbestos																						
Building management systems																						
Boilers																						
Clinical waste																						
Domestic hot water																						
Drainage																						
Electricity supply failure																						
Explosions																						
Extreme weather																						
Fire																						
Flooding																						
Gas																						
Heating																						
Incinerators																						
Infestation																						
Kitchens																						
Laboratory failures																						
Lifts																						
Medical engineering equipment																						
Operating theatres																						
Piped medical gases																						
Paging																						
Refrigerators																						

Operational checklist	Define ownership of the problem?	Will patient/Public/Staff safety/care be affected?	Will evacuation be required?	Risk of fire outbreak, or reduced fire-fighting ability?	Consider impact on electricity supply?	Consider impact on gas supply?	Consider impact on water supply?	Consider impact on drainage?	Consider impact on other services?	Increased risk of legionella?	Consider impact on site security?	Impact on fire alarms?	Will medical gases be affected?	Is there an impact on clinical waste?	Agree responsibility boundaries	Clinical department procedures?	Control of Infection Team involvement?	Do public relations need to be addressed?	Consider Service Level Agreements with purchasers?	Involve commercial services?	Record Trust personnel contact details?	Locate supply of specialist equipment?	
Sewage plant																							
Sterilization																							
Telephones																							
Transport incidents																							
Water contamination																							
Water supply																							
Water treatment																							

## Appendix B: Legal requirements

**B1** There are numerous legal duties that owners and occupiers of premises must adhere to. These are continually changing in the light of new evidence and experience. Reference should be made to these documents at the time of application.

### Health and safety

**B2** Current health and safety philosophy was developed following the Report of the Robens Committee 1972, which resulted in the Health and Safety at Work etc Act 1974.

**B3** The standards of health and safety in the UK are delivered through a flexible enabling system introduced in 1974 by the Health and Safety at Work etc Act 1974 and are typified by the Management of Health and Safety at Work Regulations 1999.

**B4** The Health and Safety at Work etc Act 1974 leaves employers freedom to decide how to control the risks that they identify – that is, to look at what the risks are and to take sensible measures to tackle them. The Act is part of criminal law, and enforcement is by the Health & Safety Executive (HSE). Successful prosecution can result in fines or imprisonment. However, most of the sanctions applied by HSE are in the form of improvement or prohibition notices.

**B5** On 6 April 2008 the Corporate Manslaughter and Corporate Homicide Act 2007 came into force throughout the UK. An organisation (which includes healthcare organisations) is guilty of an offence if the way in which its activities are managed or organised causes a person's death and amounts to a gross breach of a relevant duty of care owed by the organisation to the deceased.

### Regulations, Approved Codes of Practice, Standards and guidance

**B6** Regulations are law, approved by Parliament. These are usually made under the Health and Safety at Work etc Act following proposals from the HSE. Regulations identify certain risks and set out specific actions that must be taken.

**B7** Approved Codes of Practice give advice on how to comply with the law by offering practical examples of best practice. If employers follow the advice, they will be doing enough to comply with the law.

**B8** Approved Codes of Practice have a special legal status. If employers are prosecuted for a breach of health and safety law, and it is proved that they did not follow the relevant provisions of an Approved Code of Practice, they will need to show that they have complied with the law in some other way, or a court will find them at fault.

**B9** Standards (British or European), institutional guides and industry best practice play a large part in how things should be done. They have no direct legal status (unless specified by regulations). However, should there be an accident, the applied safety practices at the place of work would be examined against existing British or European Standards. It would be difficult to argue in favour of an organisation where safety was not to the described level.

**B10** Guidance is issued in some cases to indicate the best way to comply with regulations. But the guidance has no legal enforcement status.

## Other commonly cited legislation

**B11** There are numerous statutory and legal requirements that healthcare organisations and their supporting professionals, contractors, suppliers etc should comply with.

**B12** The list below is not intended to be exhaustive but is intended to demonstrate the wide range of issues that should be considered.

**B13** Legislation, regulations and other supporting documents are being updated over time and care should be taken to ensure that the most up-to-date publication is being consulted.

### General

[Health and Safety at Work Act](#)

[Factories Act](#)

[Building Regulations](#)

[Equality Act](#)

[Construction \(Design and Management\) Regulations](#)

[Electricity Act](#)

[Environmental Protection Act](#)

[Control of Pollution \(Amendment\) Act](#)

[Clean Air Act](#)

[Environment Act](#)

[Town and Country Planning Act](#)

[Control of Pollution Act](#)

[Water Industry Act](#)

[Water Resources Act](#)

[Noise & Statutory Nuisance Act](#)

[Climate Change Act](#)

[Food Safety Act](#)

[Medicines Act](#)

[Electricity Safety, Quality and Continuity Regulations](#)

[Corporate Manslaughter and Corporate Homicide Act](#)

### Health and Safety Regulation

[Management of Health and Safety at Work Regulations](#)

[Management of Health and Safety at Work and Fire Precautions \(Workplace\) \(Amendment\) Regulations](#)

[Workplace \(Health, Safety and Welfare\) Regulations](#)

[Provision and Use of Work Equipment Regulations](#)

[Manual Handling Operations Regulations](#)

[Personal Protective Equipment Regulations](#)

[Health and Safety \(Display Screen Equipment\) Regulations](#)

[Confined Spaces Regulations](#)

[Reporting of Injuries, Diseases and Dangerous Occurrences Regulations](#)

[Control of Substances Hazardous to Health \(COSHH\) Regulations](#)

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[Employers' Liability \(Compulsory Insurance\) Regulations](#)

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[Personal Protective Equipment Regulations](#)

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[Work at Height Regulations](#)

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