NHS National Services Scotland

Water Safety Guidance

Scottish Health Technical Memorandum

Part B - Operational Management

SHTM 04-01 part B

Draft 2.09 - March 2026.

Contents

Executive Summary

Scottish Health Technical Memorandum (SHTM) 04-01 “Water safety guidance” is published in seven parts:

- part A: Design, installation, and commissioning
- part B: Operational management
- part C: Microbiological testing
- part D: Disinfection of domestic water systems
- part E: Alternative materials and filtration
- part F: Chloramination of water supplies
- part G: Operational procedures and Exemplar Water Safety Plan.

The documents give comprehensive advice and guidance on the legal requirements, design implications, maintenance, and operation of safe water systems in healthcare premises. The use of these premises is very intense, the occupancy level high and the patients may be particularly susceptible to waterborne infection risks. Their condition may also require close control of the clinical and built environment.

This 2026 SHTM suite draws together developments and updates from the previous guidance, including recommendations for the safe management of water systems, via the integration of the principle of Water Safety Groups (WSGs) and Water Safety Plans (WSPs) and how to manage and minimise the risks to health from various aspects, ranging from clinical risks, microbial and chemical contamination, changes to the water system, resilience of the water supply and so on. It also introduces a stronger emphasis on staff competencies and the implementation of water hygiene awareness training.

There has been increasing evidence that the interaction of water supply and above ground drainage can each give rise to problems where the design and/ or operation is poorly configured. Therefore, a brief section on above ground drainage design has been included in this version.

Information regarding the mechanisms for compliance with the Scottish Water Byelaws are also discussed.

This 2026 version of SHTM 04-01 supersedes all previous versions of SHTM 04-01 “Water Safety for Healthcare Premises”.

Language used in technical guidance

In SHTMs verbs such as “must”, “should” and “may” are used to convey notions of obligation, recommendation or permission. The choice of modal verb will reflect the level of obligation needed to be compliant.

The following describes the implications and use of these modal verbs in SHTMs (readers should note that these meanings may differ from those of industry standards and legal documents):

A. “Must” is used when indicating compliance with the law

B. “Should” is used to indicate a recommendation (not mandatory/ obligatory), for example among several possibilities or methods, one is recommended as being particularly suitable - without excluding other possibilities or methods

C. “May” is used for permission, for example to indicate a course of action permissible within the limits of the SHTM

D. “Shall”, in the obligatory sense of the word, is never used in current SHTMs

Typical usage examples

A. “All water fittings used in the construction of systems referred to in this SHTM must comply with the requirements of the Water Supply (Water Fittings) (Scotland) Byelaws 2014.” [obligation]

B. “Waterborne bacteria should be considered during the design, construction, installation, commissioning and maintenance of the hot and cold water systems and above ground drainage system in the healthcare-built environment,” [recommendation]

C. “There are also other waterborne bacteria acknowledged to be in the water systems that may require further supplementary management practices to control)” [permission]

Project derogations from the Technical Guidance

Healthcare facilities built for the NHS are expected to support the provision of high-quality healthcare and ensure the NHS Constitution right to a clean, safe and secure environment. It is therefore critical that they are designed and constructed in accordance with appropriate technical standards and guidance. This applies to all new and refurbishment projects, regardless of procurement model.

Note 1: The healthcare organisation, and their project teams, should ensure that they have a fully documented list of technical standards and guidance that are applicable to the specific project.

It is recommended that the starting point for all projects should be one of full adherence to the SHTM guidance or better if that can be demonstrated. While it is recognised that derogations may be required in some cases, these must all be risk-assessed and documented in order that they may be considered within a structured derogation review and approval process. In all instances derogations must not compromise the health and safety or operational resilience of the healthcare facility. Healthcare organisations should ensure that any derogations do not impact on their legal or statutory obligations.

Derogations must be properly authorised by the project's senior responsible officer and informed and supported by appropriate technical advice including that of the WSG, irrespective of a project's internal or external approval processes.

A schedule of derogations should be created for any project, including details of approvals, risk assessment and identified mitigations.

Note 2: This guidance does not alter the healthcare organisations legal or statutory obligations.

NHS Scotland Sustainable Development Policy Drivers

Responding to the global climate emergency is one of the Scottish Government's highest priorities. Sustainable development, the concept that the needs of the present must be met "without compromising the ability of future generations to meet their own needs" is integral to the Scottish Government's overall purpose. The Scottish Government's National Performance Framework (NPF) shares the same aims as the United Nations' Sustainable Development Goals. It highlights the need for a 'whole system approach' to successfully deliver the NPF's national outcomes for Health and recognises the important role that NHS Scotland has in helping to achieve this.

Over recent years the current and future impact of climate change has been well documented, with risks to human health and to health and social care delivery highlighted within Scotland's summary report of the UK Climate Risk Independent Assessment*. NHS Scotland is committed to the delivery of a high quality, environmentally and socially sustainable health service that is resilient to the locked-in impacts of climate change. Director Letter (DL) (2021) 38 'A Policy for NHS Scotland on the Climate Emergency and Sustainable Development' provides the framework for this aim to become a reality, and to maximise NHS Scotland's contribution to mitigating and limiting the effect of the global climate emergency.

* NHS Scotland Climate Change Risk Assessments and Adaptation Plans: A Summary Report on the National Services Scotland (NSS) website.

Who should read this guidance?

This document is aimed at specifiers, designers, suppliers, installers, commissioners, WSGs, estates and facilities managers and operations, and Infection Prevention and Control Teams (IPCTs). Elements of the document will also be relevant to managers concerned with the day-to-day management of healthcare facilities and senior healthcare management. Infection prevention specialists who are involved with monitoring water quality and managing infections and outbreaks potentially linked to water supplies will also find it helpful to be familiar with this guidance.

Main changes since the 2014 suite

- This 2026 edition of SHTM 04-01 provides comprehensive guidance on measures to control waterborne pathogens.
- This edition has been updated to align with the Health and Safety Executive's (HSE's) revised Approved Code of Practice (ACOP) for Legionella (L8) and its associated Health and Safety Guidance (HSG) 274 guidance documents.
- A new chapter on above ground drainage has been added to SHTM 04-01 Part A.
- New guidance has been included in SHTM 04-01 Part A on the hygienic storing and installation of fittings and components and on the competency of installers/ plumbers working on healthcare water systems. The guidance also outlines that any person working on water distribution systems or cleaning water outlets needs to have completed a water hygiene awareness training course.
- Information is discussed in relation to compliance with the Scottish Water Byelaws in SHTM 04-01 Part A.
- SHTM 04-01 Part A and Part E now outlines requests for pipework manufacturers data sheets regarding the product limitations.
- Part B of the SHTM 04-01 now includes updated guidance on the remit and aims of the WSG.
- SHTM 04-01 Part B now includes information on Nontuberculous mycobacteria (NTM).
- Guidance on sampling techniques for, testing for, and the microbiological examination of *Pseudomonas aeruginosa* samples - originally in the Health Technical Memorandum (HTM) 04- 01 Addendum - is now included in SHTM Part C to complement the Total Viable Count (TVC) guidance.
- Whilst SHTM 04-01 Part G provides updated guidance on the WSP and in addition to the 2014 sample templates includes several more.

While some guidance on other water- service applications is included, it is not intended to cover them fully. For example:

- process waters used for laundries, see HTM 01-04 - ‘Decontamination of linen in health and social care’
- endoscopy units, see HTM 01-06 - ‘Decontamination of flexible endoscopes’
- primary care dental premises, see HTM 01-05 Decontamination in primary care dental facilities
- renal units, see Health Building Note (HBN) 07-01 and HBN 07-02, the Renal Association's guidelines and ISO 13959 and 11663
- sterile services departments (SSDs), see Scottish Health Planning Note (SHPN) 13 - Part 1 Decontamination Facilities: Central Decontamination Unit
- hydrotherapy pools, see the Pool Water Treatment Advisory Group’s (PWTAG's) ‘Swimming pool water: treatment and quality standards for pools and spas’
- spa pools, the control of legionella and other infectious agents in spa-pool systems HSG282
- birthing pools, see HBN 21 - ‘Maternity’ and PWTAG’s ‘Swimming pool water: treatment and quality standards for pools and spas’

Acknowledgements

NHS Scotland Assure would like to thank the principal contributors for their efforts in the production of this updated version of Scottish Health Technical Memorandum (SHTM) 04-01 Part B, these include NHS England, NHS Wales and Department of Health Northern Ireland. The SHTM suite (Parts A to G) have been updated collectively from the four nations and will be adopted across the UK NHS as unified documents. For each nation, the publication will reflect the standards for that nation.

NHS Scotland Assure would like to thank the National Water Services Advisory Group (NWSAG), Scottish Engineering and Technology Advisory Group (SETAG) and colleagues from Antimicrobial Resistance and Healthcare Associated Infection Scotland (ARHAI) for their contributions and efforts to the production of the SHTM suite revision.

NHS Scotland Assure would also like to thank those who took the time to comment and send feedback during the scoping and technical engagement phases of this document.

NHS Scotland Assure acknowledge contributions from those individuals and organisations involved in the development and publication of previous versions of the SHTM 04-01 suite.

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1. Introduction

The needs of the building occupants

1.1. The development, construction, installation, commissioning, and maintenance of hot and cold-water supply systems are vital for patient and public safety which must remain as a primary focus throughout. Healthcare premises are dependent upon water to maintain hygiene and a safe and a comfortable environment for patients and staff, and for treatment and diagnostic purposes.

1.2. Interruptions in water supply can disrupt healthcare activities. The design of systems should 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. Water safety must be the primary aim.

1.3. This Scottish Health Technical Memorandum (SHTM) gives comprehensive advice and guidance to healthcare management, design engineers, estate managers, operations managers, contractors and the supply chain 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.

Aims of this guidance

1.4. The current review and update of SHTM 04-01 is intended to move users of the document towards a holistic management of water systems via Water Safety Groups (WSGs), Water Safety Plans (WSPs) and other initiatives. This is especially important when we consider the additional risks of delayed handovers and poor installation techniques.

1.5. Outbreaks and pseudo-outbreaks of waterborne infections, including those caused by Nontuberculous mycobacteria (NTM), have been associated with water in distribution systems, wastewater systems and associated equipment. Patients at increased risk of NTM infections (see at-risk patient groups) need spaces which are designed, managed and operated to prevent exposure as much as possible, taking into account all possible modes of transmission including ingestion, inhalation, aspiration and contact (both direct and indirect).

1.6. It has been written to promote good practice for those responsible for the design, specification, installation, commissioning, operation, and maintenance of water services in healthcare premises, by:

- highlighting the need for robust governance and management
- outlining the remit of the WSG and how this relates to the provision of safe water in healthcare premises
- outlining key criteria and system arrangements to help stop the ingress, colonisation and growth of opportunistic microbial waterborne pathogens and the ingress of chemical contaminants
- identifying temperature regimes for sanitary outlets to maintain water hygiene
- ensuring the safe delivery of hot water
- outlining how the correct selection of system components and correct use by occupants can help preserve the quality and hygiene of water supplies
- providing a point of reference to legislation, standards and other guidance pertaining to water systems
- providing a basic overview of possible potential waterborne pathogens
- giving an overview of some of the different water systems (including components) and their safe installation, commissioning and operation and maintenance
- providing typical system layouts and individual component location
- providing information on thermostatic mixing valve (TMV) configurations, appropriate usage, and maintenance requirements
- identifying key commissioning, testing and maintenance requirements for referral by designers, installers, operators, and management

Waterborne pathogens

1.7. This guidance provides measures to control waterborne pathogens. Legionella colonisation and growth, in the main, is associated with poor engineering configuration, operation and maintenance, with limited evidence of patient- to-patient or patient-to-outlet transfer. However, *Pseudomonas aeruginosa* can colonise skin of healthy individuals without causing infection. *Pseudomonas aeruginosa* may be transferred from person-to-person, person to and from outlets and from splash contamination of the surrounding environment from both patients and staff. Suspected *Pseudomonas aeruginosa* waterborne infections require clinical surveillance and additional investigations to determine the source and interventions as agreed by the WSG with input from infection control specialists, microbiologists and estates. Whilst temperature control is the traditional strategy to minimise the risk from Legionella, managing the risk from *Pseudomonas aeruginosa* requires a multifactorial approach that will require temperature and other strategies. There

are also other waterborne bacteria acknowledged to be in water systems that may require further or supplementary management practices to control.

1.8. As with all control measures, temperatures should be monitored at regular intervals to verify effective control.

1.9. Because of the complexity of hot and cold water distribution systems and the difficulty of maintaining a temperature control regime in some healthcare facilities, this guidance suggests that additional chemical, physical and other water control methods that have been shown to be capable of controlling microbial colonisation and growth may also be considered.

1.10. NTM (also known as environmental mycobacteria) are a group of bacteria found in soil, water, dust, as well as within constructed water systems and associated equipment such as those installed within healthcare premises. NTM are not contaminants but part of the natural background microbial population entering the incoming supply and can colonise and grow within biofilms attached to water system infrastructure where conditions allow. They are responsible for opportunistic infections that affect both immunocompromised and immunocompetent patients, immunocompromised patients are the most susceptible. *Pseudomonas aeruginosa* is a gram-negative organism which is ever-present in the environment being most commonly found in soil and water but can also be part of the normal gut flora and selected out by antibiotics which are not active against it. It is often termed an opportunistic pathogen, thus, there can be infection from a patient's own flora as well as from environmental sources. Legionella are also opportunistic pathogens of humans and normally inhabit warm, moist or aquatic environments. Their predilection for warm water means that they are capable of colonising artificial water systems and equipment containing water. Legionnaires' disease is not contagious from person to person but is of environmental origin and usually contracted by inhaling the organism in an aerosol produced from water containing the organism. Aspiration of water (where water droplets are drawn into the lungs whilst breathing) containing Legionella can also cause infection.

1.11. All waterborne bacteria should be considered during the design, construction, installation, commissioning and maintenance of the hot and cold-water system and above ground drainage system in the healthcare-built environment.

1.12. Healthcare water and drainage systems are often large and potentially complex which if not designed and managed adequately can lead to growth of organisms.

1.13. The management of the water system, including minimising the risk of NTM, should be part of the organisations WSP. The WSP should be developed by the multidisciplinary WSG. The WSG should meet regularly to review the WSP as well as water quality and potential issues. Designers should also inform the water management strategy from the early stages of concept design through to completion, which should include a designer's risk assessment and commissioning brief.

1.14. This guidance suite has included information from the relevant British Standards (BS) and Health and Safety Executive (HSE) documentation regarding the management of water systems in relation to Legionella, pseudomonas aeruginosa and the current (at the time of writing) information on other waterborne bacteria. It is noted that research is ongoing with respect to the identification and risk reduction techniques for NTM, together with development of a specific British Standard specifically on NTM. It is acknowledged that, at the time of writing, there is limited information available for NTM in healthcare water systems, regarding bacterial survival temperature ranges, material selection and disinfection resistance.

At risk patient groups

1.15. The non-exhaustive list below is intended to be used by key clinical colleagues and the Healthcare Organisations WSGs, to assess the specific patient risk groups who occupy spaces with the healthcare buildings and who may require additional control measures. The findings from these reviews must be documented along with any changes that will need to be made to the WSPs and other initiatives. The completion of these additional control measures should be reported at each Healthcare Organisations WSG meeting.

1.16. Potential “at risk” patient groups:

- lung transplant patients
- cystic fibrosis patients
- haematology/ oncology patients undergoing chemotherapy where neutropenia is expected
- solid organ transplantation after intensive treatment
- allogenic stem cell transplantation
- any patient with a long line (such as central venous catheter) in situ

2. Policy and regulatory overview: water safety and the healthcare estate

Introduction

2.1. NHS Scotland has a corporate responsibility to account for the stewardship of its publicly funded assets. This includes the provision, management and operation of an efficient, safe estate that supports clinical services and strategy.

2.2. This corporate responsibility is carried by all accountable officers, directors with responsibility for estates and facilities and their equivalents, chairs, Chief Executive Officers (CEOs) and non-executive NHS board members. Together they have a responsibility to enact the principles set out in this document, provide leadership, and work together to implement the necessary changes to provide a safe, efficient high-quality healthcare estate.

2.3. To achieve this, quality and fitness-for- purpose of the healthcare estate is vital. Scottish Health Technical Memorandum (SHTM) 04-01 seeks to set out the quality of, and standards for, water safety in the healthcare estate.

2.4. A healthcare organisation's Water Safety Group (WSG) is pivotal in ensuring that decisions affecting the safety and integrity of the water systems and associated equipment do not go ahead without being agreed by them. This includes consultations relating to decisions on the procurement, design, installation and commissioning of water services, equipment, and associated treatment processes.

2.5. The quality and fitness-for-purpose of the estate are assessed against a set of legal requirements and governance standards. Adhering to the guidelines outlined in this SHTM will be considered as evidence towards compliance and governance standards.

Compliance of the healthcare estate

2.6. Principles related to the safety of healthcare estates and facilities are enshrined in Patient Rights Scotland) Act 2011(11) and The Charter of Patient Rights and Responsibilities (Health and cleanliness standards. There will be an expectation that the NHS facilities are clean, safe, suitable and fit for purpose, this includes water safety.

Note 3: There are numerous other statutory and legal requirements that NHS Scotland organisations, supporting professionals, contractors and suppliers must comply with. These are covered in the respective Health Building Notes (HBNs), Health Technical Memoranda, (HTMs), Scottish Health Planning Notes (SHPNs), SHTMs, Scottish Health Facilities Notes (SHFNs), Statutory Compliance Audit and Risk Tool (SCART), Health and Safety Executive (HSE) requirements and the Property and Asset Management Strategy (PAMS).

2.7. In the UK, water safety falls within the requirements of the Health and Safety at Work etc. Act 1974. This Act also places duties on design teams, suppliers, and installers to ensure that articles or substances for use at work are safe and without risks to health and that any information related to the article or substance is provided. The Management of Health and Safety at Work Regulations 1999 provide a broad framework for controlling health and safety at work. The Control of Substances Hazardous to Health (COSHH) 2002 provide a framework of actions designed to assess, prevent, or control the risk from bacteria like Legionella and take suitable precautions.

2.8. The HSE's (2013) Approved Code of Practice (ACOP) 'Legionnaires' disease: The control of legionella bacteria in water systems (L8)' and (2024) Technical Guidance Health and Safety Guidance (HSG) 274 'Part 2: The control of legionella bacteria in hot and cold water systems' contain practical guidance on how to manage and control the risks in water systems. Much of this information is also relevant to other pathogens, although additional measures will be required.

2.9. The HSE has published complementary technical guidance in HSG274, which is split into three specific areas:

- part 1 - evaporative cooling systems
- part 2 - hot and cold-water systems
- part 3 - other risk systems

2.10. In addition, under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR), there is a duty for employers to report any cases of legionellosis in an employee who has worked on hot and cold-water systems that are likely to be contaminated with Legionella. Cases of legionellosis are reportable under RIDDOR if:

A. a doctor notifies the employer

B. the employee's current job involves work on or near cooling systems that are located in the workplace and use water; or work on water-service systems located in the workplace which are likely to be a source of contamination.

Healthcare associated infections should also be reported to Antimicrobial Resistance and Healthcare Associated Infection (ARHAI) in line with the National Infection Prevention and Control Manual (NIPCM) Chapter 3.

2.11. Regarding enforcement responsibilities, the HSE will take the lead regarding incidents involving Legionella. See the 'Memorandum of understanding Between HSE and Healthcare Improvement Scotland and the Working Arrangements Protocol between the HSE, Local Authorities in Scotland and Social Care and Social Work Improvements Scotland (Care Inspectorate)

Water regulations

2.12. As well as complying with the recommendations outlined in this document, the design and installation of the hot and cold-water services, new or extended, in any healthcare premises should also comply with:

- the Water Supply (Water Fittings) (Scotland) Byelaws
- the Drinking Water Quality Regulator (DWQR) Guidance
- recommendations of the water suppliers in the Water Regulations Advisory Scheme's (WRAS)/ WaterRegs UK
- any other requirements of the local water undertaker

The Water Supply (Water Fitting) (Scotland) Byelaws

2.13. These Byelaws set legal requirements for the design, installation, operation and maintenance of plumbing systems, water fittings and water-using appliances. They have a specific purpose to prevent misuse, waste, undue consumption, or erroneous measurement of water and, most importantly, to prevent contamination of drinking water.

2.14. These Byelaws apply in all types of premises supplied, or to be supplied, with water from a water undertaker. They apply from the point where water enters the property's underground pipe, to where the water is used in plumbing systems, water fittings and water using appliances. However, they do not apply in premises that have no provision of water from the public mains supply.

The Public Water Supplies (Scotland) Regulations 2014 (as amended 2017)

2.15. These Regulations cover the quality of water supplied by water undertakers for public distribution which is intended for domestic purposes; these purposes include drinking, cooking, food preparation, washing and sanitation. Water supplied meeting these quality requirements is referred to as wholesome water.

The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 (as amended 2017)

2.16. These Regulations cover private sources of water intended for human consumption including drinking, cooking, food preparation or other domestic purposes, such as boreholes and wells. Water meeting these quality requirements is referred to as wholesome water. These Regulations also place duties for monitoring and control of the quality of public water supplies where these are then further distributed to other users on separate premises by the water company's bill payer (this arrangement is often referred to as onward).

3. Introduction to SHTM 04-01

3.1. This edition of Scottish Health Technical Memorandum (SHTM) 04-01 - Water safety guidance' supersedes SHTM 04-01 Water safety for healthcare premises 2014.

3.2. This guidance has been revised to take account of Health and Safety Executive's (HSE's) Approved Code of Practice (ACOP) and guidance on regulations 'Legionnaires' disease: The control of legionella bacteria in water systems (L8)' and its complementary technical guidance Health and Safety Guidance (HSG) 274.

3.3. This SHTM gives comprehensive advice and guidance to healthcare management, design engineers, Water Safety Groups (WSGs), estates 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.

3.4. The document comprises seven parts. This part (Part B) outlines the principles involved in the operational management of the hot and cold water supply, storage and distribution systems in healthcare premises.

General

3.5. Current statutory legislation requires both "management" and "staff" to be aware of their individual and collective responsibility for the provision of wholesome, safe hot and cold-water supplies, and storage and distribution systems in healthcare premises.

3.6. Healthcare premises are dependent upon water to maintain hygiene and a safe/ comfortable environment for patients and staff, and for clinical and surgical care.

3.7. The safe development, specification, construction, installation, commissioning and maintenance of hot and cold-water supply systems and associated systems and equipment are vital for public health.

3.8. Interruptions in water supply can increase the risk of microbial ingress especially if these result in depressurisation of the supply pipework. The design of systems should 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.

3.9. Whilst handwashing is a traditional and important measure to control the spread of microorganisms in healthcare premises, the increase in the use of antimicrobial hand-rubs resulted in a significant reduction in the use of wash hand basins which should be taken into account in calculations of water usage. Under-use of taps encourages colonisation and growth with *Pseudomonas aeruginosa*, Legionella and other waterborne organisms. The design team should be aware of this and, accordingly, consider how local infection policies regarding hand hygiene and the use of antimicrobial hand-rubs might impact on the frequency of use of wash hand basins and the volume of water being distributed (see also SHTM 04-01 Part B on the extent of utilisation). The placement of clinical wash-hand basins (CWHB) should be agreed by the WSG and informed by a multidisciplinary approach, to mitigate the risk of spray/ splashing that may lead to transmission of water/ waste waterborne organisms and hazards associated with over-provision. Please refer to the National Infection Prevention and Control Manual (NIPCM) Chapter 4 for details on the wash hand basin, also see SHTM 64, the WSG should agree the details of the wash hand station arrangement, including (but not limited to) the soap dispenser and hand towel locations.

Areas this SHTM does not cover

3.10. Although many of this SHTM's recommendations will be applicable, it does not set out to cover water supply for fire-fighting services nor water supply for industrial or other specialist purposes, other than to indicate precautions that should be taken when these are used in association with domestic water services. The point at which a domestic activity becomes an industrial process has not been defined, and the applicability will need to be considered in each case by the Healthcare Organisations WSG.

3.11. This SHTM does not cover wet cooling systems such as cooling towers. Guidance on these systems is given in HSE's ACOP and guidance 'Legionnaires' disease: The control of legionella bacteria in water systems (L8)' and HSG274 technical guidance Part 1.

4. Governance and management responsibility

Note 4: Governance is concerned with how an organisation directs, manages, and monitors its activities to ensure compliance with statutory and legislative requirements while ensuring the safety of patients, visitors and staff is not compromised.

To help achieve this, healthcare organisations need to ensure that robust 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.

4.1. This guidance should be applied to all healthcare premises, however small, where there is a duty of care under the Health and Safety at Work etc. Act 1974.

4.2. To ensure governance with regard to water safety, the duty holder will:

- identify and assess sources of risk
- if appropriate, prepare a written scheme for preventing or controlling the risk
- implement, manage, and monitor precautions
- keep records of the precautions
- appoint a competent person (CP) with sufficient authority and knowledge of the installation to help take the measures needed to comply with the law

4.3. To implement the above legal duties in a healthcare organisation, the duty holder should ensure that a suitable Water Safety Policy has been created and that they appoint a Water Safety Group (WSG) to undertake the commissioning, development, implementation, and review of a Water Safety Plans (WSPs). The aim of the WSG is to ensure the safety of all water used by patients/ residents, staff, and visitors, and to minimise the risk of infection associated with waterborne pathogens. Short life working groups may be created as appropriate when specific items requiring more focus are identified. This could include the creation of a Project Water Safety Group (PWSG) for any larger projects, or an Incident Management Team (IMT) should there be an identification of pathogenic bacteria in the water system and/ or a patient. The responsibility for the appointment of the members of a short life working group should be defined in the organisations policy and should ensure all stakeholder groups are represented.

4.4. The WSG should demonstrate that any person on whom the statutory duty falls has fully appreciated the requirement to provide the healthcare building with an adequate supply of hot and cold water of suitable quality. Though compliance with this guidance may be delegated to staff or undertaken by contractors, accountability cannot be delegated. The WSG should ensure that appropriate expertise and competence is available to ensure the delivery of safe water for all uses throughout the organisation. This group should have clearly identified lines of accountability up to the Chief Executive Officer (CEO) and NHS board.

4.5. The WSG and, where established, the PWSG should include persons who are fully conversant with the design principles and requirements of water systems and should be fully briefed in respect of the cause and effect all waterborne hazards.

4.6. The WSP is a holistic approach to manage water for all uses (including diagnostic and treatment purposes) so that it is safe for all users including those most at risk of waterborne infections as a consequence of their illness or treatment, such as hydrotherapy pools, renal dialysis equipment and heater cooler units.

4.7. All regular tests and checks set out in the WSP should be carried out even if they cause minor disruption to healthcare services, and comprehensive records should be maintained in accordance with the healthcare organisation's management policy.

4.8. Risk assessments form an integral component of the WSP and is a legal requirement to identify potential hazards (which may be microbial, chemical, or physical) in the system, risks of infection to patients, staff and visitors, and other indicators of water quality (for example, taste, odour, flavour, and appearance if intended for drinking). See typical examples in section 8 of issues to consider in the water system risk assessment. Additional risk assessments to consider scalding (used to inform the need for thermostatic mixing valves (TMVs)/ thermostatic mixing taps (TMTs)) or clinical assessments (used to inform where additional control measures would be required based on the patient risks) should be completed and the findings integrated into the final plan.

4.9. The risk assessment should be carried out by a CP(s). If the provision of risk assessments is contracted to an external organisation, it is recommended that those engaged to carry out any risk assessments associated with water safety should be able to demonstrate to the WSG their experience and competence in assessing specific risks from microbiological, chemical, and physical hazards on the specific healthcare population. They should also be able to give advice on how to manage the systems/ equipment to minimise the risks and so on. It is the responsibility of the WSG to determine the method of demonstrating this competence. Core requirements including accredited training, evidence of competence being assessed and personal examples of recent water safety risk assessments in the healthcare sector presented orally and/or by interview should be considered options. Detailed knowledge and expertise requirements of the risk assessor(s) are provided in the World Health Organization's (WHO) (2011) 'Water safety in buildings'.

4.10. The risk assessor(s) should be given access to competent assistance from the client. This may be in the form of:

- engineering and building expertise
- as-fitted drawings and schematic diagrams
- clinical expertise
- knowledge of building occupancy and use including vulnerability of patient groups
- bespoke equipment plus policies, procedures, and any protocols (for example cleaning of wash-hand basins and disposal of clinical effluent and so on)

4.11. In addition, access should be made available to all required areas (and associated systems and equipment) unless deemed inaccessible by legislation (for example areas that contain asbestos).

4.12. For water system risk assessments, contractors should be able to demonstrate a full understanding of, and work to, current guidance. In addition to guidance provided above, the documents below should also be referenced in relation to the specification, procedures, and general requirements for completing robust and fit-for-purpose water safety risk assessments:

- the Health and Safety Executive's (HSE's) (2013) Approved Code of Practice (ACOP) L8
- Health and Safety Guidance (HSG) 274 Part 1 (2024) - 'The control of legionella bacteria in evaporative cooling systems'
- HSG274 Part 2 (2024) - 'The control of Legionella bacteria in hot and cold water systems'
- HSG274 Part 3 (2024) - 'The control of legionella bacteria in other risk systems'
- British Standard (BS) 8580-1 (2019) - 'Water quality: Risk assessments for Legionella control – Code of Practice'

- BS 8580-2 (2022) - 'Water quality: Risk assessments for *Pseudomonas aeruginosa* and other waterborne pathogens - Code of Practice'
- Building Services Research and Information Association (BSRIA's) (1999) FMS 4/99 - 'Guidance and the standard specification for water services risk assessment'
- BSRIA's (2015) BG 57/2015 - 'Legionnaires' disease - risk assessment'

4.13. Management procedures should ensure that compliance is continuing and not notional. The prime purpose of the assessment is to be able to demonstrate that the WSG is aware of all the relevant factors that may pose a risk of waterborne infection, that effective corrective or preventive action has been implemented, and that monitoring is in place to ensure the plans are effective in controlling the risk.

4.14. Healthcare organisations should be aware of the legal duty to notify the water undertaker when it is proposed to carry out works on any systems conveying water from the public water supply (see the Water Supply (Water Fittings) (Scotland) Byelaws 2014)).

Note 5: Water undertakers can carry out a fittings inspection to ensure that work has been properly carried out and that the public water supply remains protected for work carried out. Consideration should be given to the use of a plumber from the Water Safe scheme as they have a duty to ensure that their works are in accordance with the Water Byelaws.

5. Statutory requirements

5.1. It is the responsibility of the duty holder to ensure that their premises comply with all statutes.

5.2. Duty holders have an overriding general duty of care under the Health and Safety at Work etc. Act 1974. Therefore, they should ensure the water supply, storage and distribution services are installed and operated within the terms of the following legislation.

Health & Safety at Work etc. Act 1974

5.3. Employers have a general duty under the Health and Safety at Work etc. Act 1974 to ensure, so far as is reasonably practicable, the health, safety and welfare of patients, visitors and staff and the public who may be affected by workplace activities.

5.4. These duties are legally enforceable, and the Health and Safety Executive (HSE) has successfully prosecuted employers including health organisations under this statute. It falls upon owners and occupiers of premises to ensure that there is a management regime for the proper design, installation and maintenance of plant, equipment, and systems. Failure to have a proper system of working and adequate control measures can also be an offence even if an outbreak of, for example, Legionnaires' disease or other such incident has not occurred.

The Management of Health & Safety at Work Regulations 1999

5.5. These regulations provide a broad framework for controlling health and safety at work. They require every employer to make a suitable and sufficient assessment of all risks to health and safety of employees and the public caused by work activities and require employers to have access to competent help in applying the provisions of health and safety law. In addition to Legionella and other waterborne pathogens, other risks from a hot and cold-water distribution system include deterioration of water quality, scalding at hot water outlets and danger due to pipe bursts at excessive pressures.

Control of Substances Hazardous to Health (COSHH) regulations

5.6. These regulations provide a framework of actions designed to control the risk from a range of harmful substances including waterborne pathogens such as Legionella and the chemicals that may be used to control the growth of microorganisms in water supplies. Employers have a duty to assess the risks from exposure to these substances to ensure that they are adequately controlled.

Public Health (Infectious Diseases) Regulations 1988

5.7. The Public Health (Notification of Infectious Diseases) Scottish Regulations 1988 require that a properly appointed officer shall inform the Chief Medical Officer for Scotland, as the case may be, of any serious outbreak of any disease that to his/ her knowledge has occurred in the district.

Note 6: Appendix 2.3 of HSE's Legionella technical guidance Health and Safety Guidance (HSG) 274 Part 2 (2013) contains further advice and guidance on communication and cooperation with the consultant in communicable disease control (CCDC), and on arrangements for support of the CCDC and for this person to have access to provider units including healthcare organisations.

The Public Water Supplies (Scotland) Regulations 2014 (as amended 2017)

5.8. The Public Water Supplies (Scotland) Regulations 2014 (as amended 2017) apply to water supplied by a water undertaker to any premises that are used for domestic purposes such as drinking, cooking, personal hygiene, washing or food production.

Note 7: Two additional sources of advice on drinking water quality are:

- the Director of Public Health
- World Health Organization's (WHO's) 'Guidelines for drinking water quality'

The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 (as amended 2017)

5.9. These regulations cover private sources of water such as boreholes and wells intended for human consumption including drinking, cooking, food preparation or other domestic purposes. These regulations also place duties for monitoring and control of the quality of public water supplies where these are then further distributed to separate premises by the bill payer other than the water undertaker or licensed water supplier (often referred to as onward distribution).

Food Safety Act 1990

5.10. The Food Safety Act 1990 covers water used for food preparation or food manufacture and also includes water used for drinking. The Food Hygiene (Scotland) Regulations 2006 (and amendments) are also relevant.

The Health and Safety Executive's (4th edition) Approved Code of Practice L8 2013

5.11. The HSE's (2013) Approved Code of Practice (ACOP) L8 (4th edition) came into effect on 7 November 2013 and is supported by the technical guidance (HSG274 Parts 1–3). It replaced the earlier publication entitled 'Legionnaires' disease: The control of Legionella bacteria in water systems - ACOP and guidance' (L8 3rd edition). The onus is on the duty holder to demonstrate that procedures in place are as good as, or better than, those required by L8.

5.12. The ACOP L8 has a special legal status. If a person or organisation is prosecuted for a breach of health and safety law and it is proved that they did not follow the provisions of the Code, they will need to show that they have complied with the law in some other equally effective way, or a court will find them at fault. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

5.13. Compliance with HSG274 will satisfy the ACOP L8.

5.14. The health service, with responsibility for the wider aspects of public health and the operation of healthcare premises, is expected to be particularly vigilant.

5.15. The incidence of healthcare-associated waterborne illness including Legionnaires' disease is relatively low, but cases and outbreaks are considered avoidable. Management, operators, and contractors should be aware that incidents or outbreaks cause widespread concern, especially if associated with healthcare premises. Investigation of these outbreaks has shown that they are generally related to poor training, flaws in system design and/or installation, poor commissioning and risk assessments, defects, and breakdowns. However, by far the greatest contributors to outbreaks of Legionnaires' disease are poor or inappropriate maintenance and control procedures and ineffective communication and systems management.

5.16. These regulations set legal requirements for the design, installation, operation and maintenance of plumbing systems, water fittings and water-using appliances. They have a specific purpose to prevent misuse, waste, undue consumption, or erroneous measurement of water and, most importantly, to prevent contamination of drinking water. These regulations are enforced by the local water undertaker, to where the water is used in plumbing systems, water fittings and water- using appliances. However, they do not apply in premises that have no provision of water from the public mains supply.

5.17. These regulations are set out - along with the Department for Environment, Food and Rural Affairs' (Defra) guidance on the regulations and the water industry's recommendations for fulfilling these provisions - on the WaterRegsUK guidance website.

6. Legionella overview

Source of bacteria

6.1. Legionella bacteria are ubiquitous in both the natural and constructed aquatic environment and are widespread in natural freshwater including rivers, lakes, streams, and ponds and may also be found in damp soil.

6.2. Airborne dispersal may occur when aerosols or droplet nuclei are created. There is a strong likelihood of low concentrations of Legionella existing in all open water systems including those of building services; therefore, the main emphasis should be on preventing Legionella from multiplying in water systems in healthcare premises.

Ecology

6.3. The following factors have been found to influence the colonisation and growth of Legionella:

- water temperature between 20°C and 45°C will promote growth
- areas of poor flow, stagnation, or inappropriate components
- biofilms play an important role in harbouring and providing favourable conditions in which Legionella can grow. Biofilms in water systems are heterogeneous and will consist of bacteria, fungi, algae, protozoa, debris, and corrosion products. Nutrients can be provided to the biofilm from the incoming water, particularly where there is increased turbidity and from scale, sediment, corrosion products, trapped organic and inorganic molecules supplied by the flowing water and a range of surface materials
- Legionella are unable to grow in sterile water as they require other microorganisms for growth. Legionella have also been shown to proliferate rapidly in association with some waterborne protozoa including amoebae
- water fittings, pipework and materials used in the construction of water systems can encourage the growth of waterborne pathogens. Water quality can deteriorate within the system and in components such as terminal fittings, particularly when utilisation is low. Pipework downstream of thermostatic mixing valves (TMVs) may pose a particular problem as the lower temperature can encourage the growth of waterborne pathogens

Epidemiology

6.4. Legionnaires' disease is often described as an atypical acute pneumonia of rapid onset often with gastrointestinal symptoms, which can confuse the diagnosis. Legionnaires' disease is predominantly caused by inhalation of L. pneumophila serogroup 1, which is the most common cause of Legionnaires' disease accounting for around 85% of cases within the EU (see the European Centre for Disease Prevention and Control's (ECDC) website).

However, other non-pneumophila species have also been shown to cause disease in hospitals. Pontiac fever is a self-limiting form of legionellosis which usually requires no treatment.

6.5. The risk of healthcare-associated legionellosis depends on a number of factors such as:

- the presence of Legionella in sufficient numbers
- conditions suitable for multiplication of the organisms (temperatures between 20°C and 45°C)
- source of nutrients (for example scale, sludge, rust, protozoa, and other available organic carbon, bacteria, and biofilms)
- a means of creating and disseminating aerosols (a typical droplet size of <5 µm can be inhaled deep into the lungs) that contain viable Legionella (potential sources, for example, include showers and spray taps and most other water draw-offs that can create an aerosol)
- the presence of people who may have compromised immune or respiratory systems or have other risk factors that increase their susceptibility to Legionella infection

6.6. Many of these factors listed above are found in buildings, however with appropriate mitigation measures these can be controlled to minimise risk.

Control measures

6.7. A temperature control regime is the traditional means of controlling Legionella in hot and cold-water services. Hot and cold-water systems should be maintained to keep cold water at a temperature below 20°C, and to keep hot water stored at 60°C and distributed so that it reaches the outlets at a minimum of 55°C within one minute. Owing to the complexity of hot and cold-water systems found in healthcare facilities and the difficulty of maintaining a temperature control regime at all times, in all areas, chemical and other water treatments that have been shown to be capable of controlling microbial colonisation and growth may need to be considered as an additional control measure.

6.8. Validation of treatment systems is important to ensure that the design and operation of a new or modified system is effective. Ongoing verification by operational monitoring is essential to ensure the control measures remain effective. The monitoring of treatment programmes should demonstrate they are working within legislation and established guidelines giving due regard to the findings of the risk assessment and are effective in controlling the target waterborne pathogens. The frequency of monitoring and test procedures will vary according to the method selected and the level of risk posed by the water systems.

6.9. The use of biocides requires meticulous monitoring, and their use can influence water quality including taste and odour. Where biocides are used, documented risk assessments (which have been agreed with the Water Safety Group (WSG)) should identify at-risk patient groups (and/ or equipment) to ensure there are no unforeseen consequences for patients (for example, patients in neonatal units and renal units).

6.10. Additional Health and Safety control measures may be required, this can include but is not limited to the use of gas monitors to identify the escape of gases. Where these are required, a visual and audible alarm should be installed outside the plant area to warn that it is not safe to enter the area without additional safety measures being in place.

Route of Infection

6.11. The principal route of infection for Legionnaires' disease is through inhalation of the bacteria into the lungs via aerosols. The risk rises with increasing numbers of inhaled bacteria. Aspiration of contaminated drinking water into the airways has also been described as a mode of transmission of Legionnaires' disease. Aspiration can be a significant source of legionellosis in certain vulnerable patients including those using nasogastric tubes, stroke patients, those taking sedatives and narcotics, and those with motor neurone disease. Consumption of ice made from contaminated water has been linked to some nosocomial cases of Legionnaires' disease.

Aerosol generation

6.12. Contaminated water presents a risk when dispersed into the air as an aerosol with smaller aerosols (<5 µm diameter) remaining airborne for longer, penetrating deeply into the lungs (alveoli). However, larger droplets can evaporate and still contain several organisms. Amoebic vacuoles, typically 3 µm, may contain many Legionella and potentially provide an infectious dose.

6.13. Water services can generate aerosols from the process of water splashing on to wash-hand basins, sinks, and baths, in shower cubicles and when flushing toilets. Equipment that uses or is cleaned by water should be assessed for its potential to produce aerosols both in normal and abnormal (for example during maintenance) operating conditions.

Number of infectious bacteria

6.14. The number of organisms required to cause infection has not been reliably determined and is likely to vary from person-to-person.

6.15. Two factors determine the number of bacteria deeply inhaled:

- the concentration of bacteria in the air is determined both by the concentration of bacteria in the water and by the amount of contaminated water dispersed into a given air volume. The concentration of live bacteria in the air reduces rapidly with distance from the source; however, this depends on the humidity and temperature
- the duration of exposure to the contaminated air:
    - exposure in a shower is usually limited to a few minutes, while exposure in a bath is much longer
    - the risk increases with the number of Legionella in the air, the respiratory rate of the individual and the length of time the person is exposed. The chances of Legionella infections occurring increase with the number and susceptibility of people exposed.

Susceptibility of individuals

6.16. While previously healthy people may develop Legionnaires' disease, there are several factors that increase susceptibility:

- increasing age, particularly over the age of 50 (children are rarely infected)
- existing respiratory disease that makes the lungs more vulnerable to infection
- illnesses and conditions such as cancer, diabetes, kidney disease or alcoholism, which weaken the natural defences
- smoking, because of the probability of impaired lung function
- patients who are immunocompromised as a result of illness or treatment (for example, those on immunosuppressant drugs that inhibit the body's natural defences against infection)

7. Pseudomonas aeruginosa and other waterborne pathogens: overview

Ecology

7.1. *Pseudomonas aeruginosa* is a Gram-negative bacterium, commonly found in wet or moist environments. It is commonly associated with disease in humans with the potential to cause infections in almost any organ or tissue, especially in patients compromised by underlying disease, age, or immune deficiency. As a pathogen the significance of pseudomonas aeruginosa is exacerbated by its resistance to antibiotics, virulence factors and its ability to adapt to a wide range of environments and nutrients.

7.2. *Pseudomonas aeruginosa* thrives in relatively nutrient-poor environments such as water systems at a range of different temperatures and can exist as planktonic cells in water or as biofilms where mixed populations of bacteria are bound to surfaces. Biofilms can become detached to contaminate the water phase or flow.

Transmission

7.3. *Pseudomonas aeruginosa* is an opportunistic pathogen that can colonise and cause infection in patients who are immunocompromised or whose defences have been breached (for example, via a surgical site, tracheostomy or indwelling medical device such as a vascular catheter). In most cases, colonisation will precede infection. Some colonised patients will remain well but can act as sources for colonisation and infection of other patients. As a microorganism that is often found in water, the more frequent the direct or indirect contact between a susceptible patient and contaminated water, and the greater the microbial contamination of the water, then the higher the potential risk for patient colonisation or infection.

7.4. Contaminated water in a healthcare setting can transmit *Pseudomonas aeruginosa* to patients through the following ways:

- direct contact with the water through ingesting; bathing; contact with mucous membranes or surgical site; or through splashing from water outlets or basin (where the flow from the outlet causes splashback from the surface)
- indirect contact via healthcare workers' hands following washing hands in contaminated water, from medical devices/ equipment or surfaces contaminated with water or from contaminated equipment such as reusable washbowls or refillable spray cleaning bottles
- inhalation of aerosols from respiratory equipment, devices that produce an aerosol or open suctioning of wound irrigations

Source

7.5. It is generally accepted in the case of Legionella that the source of bacteria in hot and cold-water systems is the incoming water supply and that it becomes a problem where there is a failure of the recommended control measures (for example, maintenance of temperatures or water treatment regimes). In contrast to Legionella, the origin of *Pseudomonas aeruginosa* is less certain and its presence is particularly evident within the last two metres of system pipework before the point of discharge.

7.6. Devices fitted to, or close to, the tap outlet (for example mixing valves, solenoids, or outlet fittings) may exacerbate the problem by providing the conditions and nutrients that support microbial growth (for example, appropriate temperatures, a high surface-area-to-volume ratio, or a high surface area for oxygenation of water and leaching of nutrients from materials such as ethylene propylene diene monomer (EPDM)). The source, therefore, could be:

- the incoming water supply from the water provider
- the water supply within the building (both from the storage and distribution system), usually within biofilms
- the wastewater system (see Breathnach et al. 2012)
- via external retrograde contamination from:
    - clinical areas due to the discarding of patient secretions or where medical equipment may have been washed in the wash-hand basin
    - outlet users where hands may have been contaminated by *Pseudomonas aeruginosa*
    - poor hygiene or processes during cleaning, resulting in contamination from the drain or surrounding environment to the outlet fitting
    - splashback from contaminated drains
    - contaminated cloths/ mops and so on

7.7. Given this variety, the challenge for the Water Safety Group (WSG) is to risk-assess operational practices in an attempt to minimise contamination from any of these sources.

Non-tuberculous mycobacteria

7.8. Nontuberculous mycobacteria (NTM) are acid-fast gram-positive, non-motile, non-spore-forming bacteria with characteristic lipid-rich cell walls which help to protect them from adverse environmental factors, including the common control measures such as heat and biocides as used to control Legionella and *Pseudomonas aeruginosa* growth in water systems. NTMs can survive at relatively high temperatures; however, their heat tolerance is dependent on the species. NTM can grow also in low nutrients and low oxygen conditions and can multiply within both protozoa and biofilms. They are also able to survive in water dosed with biocide at levels above those used for shock treatment during the commissioning of new systems and/or associated equipment. NTM can be categorised as either rapid-growing (visible in up to seven days to appear on culture media in the laboratory) or slow-growing (which can take several weeks). Both types can pose a risk of life-threatening HCAIs in high-risk patient groups, especially those who are immunocompromised and more susceptible to infection as a result of illness or treatment. NTMs have been associated with healthcare outbreaks worldwide, they are ubiquitous in nature and are known to colonise hospital water systems. These outbreaks usually involve bacteraemias sternal wound infections, plastic-surgery wound infections or post-injection abscesses. More than 200 species of NTM have been identified to date. Of these approximately 50% are associated with causing infection in humans, from self-limiting cutaneous infections to life threatening widespread disseminated disease in lung transplant patients. There are several gaps in current knowledge with respect to:

- all of the pathways and risk factors leading to infection from NTM
- the dose and length of exposure needed to cause infection by all potential infectious NTM
- all the potential routes of transmission for each pathogenic NTM
- the time between exposure and infection
- the safe target level for each of the potentially pathogenic NTM species in water systems and associated equipment, to ensure no harm to highly susceptible patients
- the long-term effective control methods for preventing NTM colonisation and growth in water systems

7.9. Mycobacterial infections in patients undergoing dialysis treatment have also been reported. Other infections have been attributed to the transmission of Mycobacterium chimaera from contaminated heater cooler units used in theatre during cardiothoracic surgery and M abscessus in Cystic Fibrosis patients. They have also been isolated in potable water, taps and showers, and have been associated with causing infections through other colonised medical equipment, including dialysis machines, bronchoscopes, ice machines and contaminated surgical solutions.

Stenotrophomonas

7.10. There are at least 14 species of Stenotrophomonas; the most important waterborne pathogen is Stenotrophomonas maltophilia. This is an opportunistic environmental pathogen that causes healthcare-associated infections and is found in aqueous habitats including water sources. S. maltophilia is an organism with various molecular mechanisms for colonisation and infection and can be recovered most notably from the respiratory tract of cystic fibrosis patients with *Pseudomonas aeruginosa*. Its habits within the healthcare environment are very similar to *Pseudomonas aeruginosa*; however, it is more heat-sensitive and will not grow above 40°C. Good temperature management should reduce the risk of colonisation. It has been associated with the colonisation of taps/ tap water, sinks/ sink traps, showers and spray taps, hydrotherapy pools, icemakers, disinfectant solutions, haemodialysers, nebuliser chambers, humidifier reservoirs, bronchoscopes, and ventilator circuits. S. maltophilia isolated from tap water has been shown to be responsible for the colonisation/ infection of five neonates in a neonatal intensive-care unit. Where clinical results indicate water may be a vector in the transmission of Stenotrophomonas spp., then water sampling should be carried out as per *Pseudomonas aeruginosa*.

Note 8: Other emerging pathogens of concern in healthcare (see National Infection Prevention and Control Manual (NIPCM) Chapter 4, section 4.1.9). Other organisms may have particular pathogenicity in certain circumstances. Specialist microbiological advice should be sought until their management and control within healthcare can be documented more fully.

Management of control

7.11. Management of water systems to reduce the risk of waterborne pathogens is vital to patient safety. It requires surveillance and maintenance of control measures including temperature control, usage, cleaning, and disinfection measures as identified within the risk assessment and Water Safety Plan (WSP) for both hot and cold-water systems.

7.12. To prevent the growth of waterborne pathogens, controls are necessary to manage the water system before and after the outlet.

7.13. The WSG should ensure that estates and facilities staff have up-to-date accurate records and drawings/ diagrams showing the layout and operational manuals of the whole water system. Estates and facilities staff should have received adequate water hygiene training and be fully aware of the extent of their responsibilities to prevent microbial contamination of plumbing components (see Scottish Health Technical Memorandum (SHTM) 04-01 Part A). For further guidance see Health and Safety Guidance (HSG) 274 Parts 1, 2 and 3.

7.14. The WSG should also ensure that infection prevention and control (IPC) and clinical teams have received adequate water hygiene training and that there is compliance with national evidence-based guidelines for preventing healthcare-associated infections. Best practice advice relating to clinical wash-hand basins (CWHBs) should be followed to minimise the risk of contamination of surfaces, outlets and drains due to waterborne pathogens.

7.15. IPC teams and WSGs should continue to monitor clinical isolates of waterborne pathogens including the presence of Pseudomonas aeruginosa in risk-assessed augmented care units as an alert organism and be aware of possible outbreaks or clusters of infection with this microorganism. Refer to the list of alert organisms in NIPCM appendix 13.

8. Operational management

Introduction

8.1. Healthcare organisations have an explicit duty under the Health and Safety at Work Act etc. 1974 to assess and manage the risks posed by water systems on their premises. These Organisations should make use of Water Safety Plans (WSPs) and risk assessments to consider how patients, staff and visitors are at risk from their environment and from others. Ensuring these elements are in place will assist the organisation to fulfil its duties in relation to the provision of safe water systems. A programme of audit should be in place to ensure that key policies and practices are being implemented appropriately. This will inform the organisation's assurance framework.

8.2. Each healthcare organisation, through its Water Safety Group (WSG), WSP and any short life working groups, should be able to demonstrate that they have suitable governance, competence, and accountability arrangements in place to deliver safe water in healthcare premises.

The Water Safety Group

8.3. The WSG is a multidisciplinary group formed to oversee the commissioning, development, implementation, and review of the WSP. The aim of the WSG is to ensure the safety of all water used by patients/ residents, staff, and visitors, to minimise the risk of infection associated with waterborne pathogens. The WSG should also consider a remit towards other engineering disciplines such as, above ground drainage systems, closed loop systems, roof drainage, with an agreed scope and set of Terms of Reference (ToR). It provides a forum in which people with a range of competencies can be brought together to share responsibility and take collective ownership for ensuring it identifies water-related hazards, assesses risks, identifies, and monitors control measures and develops incident protocols.

Note 9: Where estates and facilities provider services are part of a contract (including Public Finance Initiative (PFI)/ Public Private Partnership (PPP), it is essential that these providers participate fully in all those aspects of estate and facilities management that can affect patients. This includes responding to specific requests from the infection prevention and control (IPC) team and WSG, which may be in addition to relevant guidance and documentation.

8.4. The WSG should have clearly identified lines of accountability up to the duty holder. The roles, responsibility, and accountability of the WSG should be defined by a set ToR. WSG meetings will take place at least quarterly with formal minutes taken and actions recorded.

An acceptable quorum should be identified that ensures meetings take place with the necessary stakeholders and that decisions are taken with the agreed mix of competencies. The meetings should have in place an agreed set of agenda themes. If any stakeholder is not in attendance of a WSG meeting the Chair shall request a reason from the individual which shall be recorded. The meeting minutes should be drafted and circulated with 10 working days.

8.5. The group should ensure there is appropriate expertise available to ensure all elements of the WSP are fully implemented. This will require assurance from installers, maintainers, and users with regard to the safety of all water used by patients/ residents, staff, and visitors, to minimise the risk of infection associated with waterborne pathogens. The WSG may typically comprise personnel who:

- are familiar with all water systems and associated equipment in the building(s) and the factors that may increase risk of infection from Legionella, *Pseudomonas aeruginosa* and other waterborne pathogens (that is, the materials and components, the types of use and modes of exposure, together with the susceptibility to infection of those likely to be exposed)
- have knowledge of the particular vulnerabilities of the at-risk population within the facility; as part of its wider remit, the WSG should include representatives from areas where water may be used in therapies, medical treatments, or decontamination processes where exposure to aerosols may take place
- undertake regular (at least once every 3 years) training/ Continued Professional Development (CPD) on water related topics such as, water hygiene, system cleanliness, engineering principles. Each Healthcare Organisation to review list of recommended learning, level of training required and create policies and records to evidence completion. The level of individual competence should be decided and agreed by the WSG

8.6. This would normally involve representation from estates (operations and projects), infection control, medical microbiology, nursing, augmented care, housekeeping/ support services, an Authorising Engineer/ independent adviser, medical technical officers, specialist users of water (such as renal units and departments offering aquatic therapy), and sterile services departments (SSDs). See Figure 8.1 for an example structure and see also the Note 9.

8.7. Emerging technologies and new innovations in water system installations can introduce an element of risk due to the uncertainty associated with products that are not yet established. The risks associated with unknowns around product reliability, longevity, performance and maintenance should all be considered and balanced against the potential benefits of the new innovation.

8.8. The WSG should discuss, review and document decisions regarding the introduction of emerging technologies and innovations. A multidisciplinary risk assessment considering all potential patient groups should be conducted and reviewed by the WSG. Whenever possible, experiences from early adopters of the technologies in other healthcare organisations should be sought. An initial pilot programme can also provide confidence and assurance on the suitability of the product in advance of wider implementation. If the WSG approve the innovation, comparisons with similar products and systems should be made. It is important that access for maintenance, availability of spares, compatibility with other system components and where relevant, The Water Supply (Water Fittings) (Scotland) byelaws approval is considered.

8.9. Where large or complex projects are being undertaken by the Healthcare Organisation a Project Water Safety Group (PWSG) could be established. The PWSG is a multi-disciplinary team reporting the main WSG. The aim of the PWSG is to ensure the safety of all future water used by patients/ residents, staff, and visitors of a new build/ refurbishment project and to minimise the risk of infection associated with waterborne pathogens. A defined ToR will be created by the Healthcare Organisations WSG for the PWSG to work under. The WSG and project team should maintain project oversight and maintain governance processes and policies. This will include defining milestones for a risk assessment review and undertaking a lesson learnt exercise at the end of each project.

8.10. This ToR will define the roles, responsibility, and accountability of the PWSG and will define the frequency of the meetings of this group, with formal minutes taken and actions recorded. All members of the PWSG should undertake regular (at least once every 3 years) training/ CPD on water related topics such as, water hygiene, system cleanliness, engineering principles. The main WSG will review the list of recommended learning, level of training required and create policies and records to evidence completion. The level of individual competence should be decided and agreed by the main WSG.

8.11. An acceptable quorum for the PWSG should be identified that ensures meetings take place with the necessary stakeholders and that decisions are taken with the agreed mix of competencies. The meetings should have in place an agreed set of agenda themes. The meeting minutes should be drafted and circulated with 10 working days.

8.12. The healthcare organisation when preparing a project design brief should detail the potential uses and quality of water required for the facility and ensure appropriate risk assessments are carried out by the multidisciplinary PWSG first. By doing this detail, this will identify any measures needed for the patient groups. The risk assessments also should include for any connecting equipment and their requirements. Input to the risk assessments should be by members of the multidisciplinary WSG and selected others where appropriate. Refer to the National Infection Prevention and Control Manual (NIPCM) for further information on patient risk factors.

8.13. A project WSP (refer to British Standard (BS) 8680) should be created and should include definitions on the processes and communications pathways. This includes details when the systems can be wetted and the processes to be followed if issues are found with the water systems.

Designated Person

8.14. The Designated Person (Water) provides the essential senior management link between the Healthcare Organisation and its professional support, which also provides independence of the audit-reporting process. The Designated Person will chair or maintain close liaison with the WSG to provide an informed position at NHS board level and by:

- making appointments in writing for the Authorising Engineer (AE) (Water) and the Legionella Risk Assessor
- making appointments in writing for Responsible Person (RP) and Deputy Responsible Person (DRP) (Water) and Authorised Persons (AP) (Water)
- ensuring through the WSG that water for hygiene is safe
- making appropriate WSG membership appointments

Infection Prevention and Control Team

8.15. The Infection Control Manager, the IPC Doctor and the Consultant Microbiologist are nominated by management to advise on infection control policy and to input as part of the WSG. The Infection Prevention and Control Team (IPCT) should be consulted in relation to projects where changes to the water system are being proposed. All members of the team who provide support as part of the WSG or any sub-groups will possess sound professional knowledge of Legionella and other water borne pathogens along with general water safety issues and have completed appropriate training.

The policy should be acceptable to the IPCT, and they should agree any amendment to that policy. Within the design, build and operational function of the facilities there will be competing priorities from the various WSG members. IPC teams should have an understanding of the engineering water systems and the estates teams of associated microbiological risks.

Responsible Person (RP) (Water)

8.16. The WSG will be lead and may be chaired by the RP (Water) appointed by the Designated Person who will possess sound professional knowledge of Legionella and water safety issues and appropriate training. The appointment should be in writing by management to devise and manage the necessary procedures to ensure that the quality of water in healthcare premises is maintained. The RP (Water) should have sufficient authority to ensure that all operational procedures are carried out in an effective and timely manner and be required to liaise closely with other professionals in various disciplines. In addition, the RP (Water) should possess a thorough knowledge of the control of Legionella and other water borne pathogens.

Note 10: Healthcare Organisations may consider that there are advantages in having the WSG chaired by Designated Person with executive responsibilities and the ability to exchange information to and from board level while ensuring that all disciplines (such as beyond estates functions) fulfil their particular responsibilities (such as flushing and cleaning procedures).

8.17. The role of RP (Water), as part of the WSG, as described above involves:

- advising on the potential areas of water-related risks and identifying where systems do not adhere to this guidance;
- liaising with the water authority (See Scottish Health Technical Memorandum (SHTM) 04-01 Part A) and environmental health departments and advising on the continuing procedures necessary to ensure acceptable water quality
- monitoring the implementation and efficacy of those procedures
- approving and identifying any changes to those procedures
- ensuring equipment that is to be permanently connected to the water supply is properly installed
- ensuring adequate operating and maintenance instructions exist and adequate records are kept

8.18. Implementation of an effective maintenance policy must incorporate the preparation of fully detailed operating and maintenance documentation and the introduction of a WSP. The RP (Water) should appoint a deputy to whom delegated responsibilities may be given. The deputy should act for the RP (Water) as delegated and directed.

8.19. The RP (Water) should also be fully conversant with the design principles and requirements of water systems and should be fully briefed in respect of the cause and effect of water-borne organisms, for example Legionella pneumophila. The role can extend to the operation and maintenance of associated plant. It is recognised that the RP (Water) cannot be an expert on all matters and must be supported by specialists in specific subjects such

as water treatment and microbiology, but they must undertake responsibility for calling upon and coordinating the activities of such specialists. Roles and responsibilities may vary across Healthcare Organisations depending on operational structures.

The RP (Water) should be aware that manufacturers, importers, suppliers, installers, and service providers have specific responsibilities that are set out in the Health and Safety Executive's (HSE's) Approved Code of Practice (ACOP) L8.

Authorised Person (Water)

8.20. The AP (Water) has the key operational responsibility for the service; they should be qualified and sufficiently experienced and skilled for the purpose. They will be nominated by the Healthcare Organisation and assessed by the AE (Water) to determine if they are able to demonstrate:

- their application through familiarisation with the asset types and system(s) in their area of responsibility and attendance at appropriate professional courses to underpin this knowledge
- a level of experience that allows them to understand the engineering systems and where people may be placed at risk
- evidence of knowledge and skills

8.21. The AP (Water) will be appointed in writing as the single person with sole responsibility for the maintenance and monitoring for a defined water system(s). No work will be carried out on the agreed water systems as identified by the WSG without the knowledge and written consent of the AP, consideration should be given to issuing Permits to Work where higher risks are identified. This could include where works include breaking into an active water system, where a confined space risk is identified or where high-risk patients are located. An important element of the AP's role is the maintenance of records, quality of service and maintenance of system safety (integrity) together with responsibility for ensuring that delegated projects comply with the Healthcare Organisations policies and procedures.

8.22. The AP (Water) will be responsible for establishing and maintaining the register of Competent Person (CP) (Water) and for evidencing competence of these people who may be employees of the Healthcare Organisation or appointed contractors. Regular health screening along with checks on the cleanliness of tools for the CPs should be completed and recorded.

8.23. Larger Healthcare Organisations will require more than one AP (Water), and each Healthcare Organisation should assess the number that they need based on the size of the estate, the complexity of the water systems installed, the patient cohort and the number of other AP appointments held by staff members.

8.24. Administration duties, such as record keeping, should be assigned to specific APs (Water), and recorded in the operational policies. The AP (Water) will be responsible for providing an update on operational maintenance and monitoring compliance in advance of each WSG meeting.

Competent Person (Water)

8.25. The CP (Water) provides skilled installation and/ or maintenance and/ or monitoring of the specialist service. Within each Healthcare Organisation they can have many different job titles and can be contractor staff. They will be appointed or authorised to work via a Permit to Work (if a contractor and this is deemed appropriate), or understanding instructions (if they are directly employed staff) by the AP (Water). They will demonstrate a sound trade background and specific skill in the specialist service, working under the direction of the AP (Water) in accordance with operating procedures, policies, and standards of the service. Irrespective of whether they are directly employed staff or contractors, evidence of competence for the tasks they are performing are required before they can carry out unsupervised works on water systems.

Maintenance Technician (Multi skilled/ Plumbers)

A Maintenance Technician, sometimes described as a multi-skilled technician or a plumber, is directly employed by the Healthcare Organisation and has sufficient technical knowledge and the experience necessary to carry out maintenance and routine testing of the water, storage, and distribution system. Typically, they will perform the more invasive types of maintenance on water systems such as the installation of new pipework or fittings, carrying out servicing of thermostatic mixing valves (TMVs)/ thermostatic mixing taps (TMTs) and undertaking disinfections. They will be appointed by, and work under the direction of, the AP (Water) in accordance with operating procedures, policies, and standards of the service. Where necessary they shall have separate sets of tools for working on “clean” and “dirty” systems.

Tradesperson (Maintenance Assistant)

A Tradesperson, sometimes referred to as a Maintenance Assistant, is directly employed by the Healthcare Organisation and has sufficient technical knowledge and the experience necessary to carry out monitoring and routine testing of the water, storage, and distribution system. They will be appointed by, and work under the direction of, the AP (Water) in accordance with operating procedures, policies, and standards of the service. Where necessary they shall have separate sets of tools for working on “clean” and “dirty” systems.

Contractor

A Contractor is the person or organisation designated by management to be responsible for the supply, installation, validation, and verification of hot and cold-water services, and for conducting installation checks and tests. In relation to the control of Legionella and other waterborne bacteria, it is essential to ensure that potential contractors have suitable qualifications (for example companies who are members of the Legionella Control Association and individuals who have City and Guilds accredited training courses and evidence of competence can be demonstrated). Where necessary they shall have separate sets of tools for working on “clean” (such as domestic water) and “dirty” (such as above ground drainage) systems. The Healthcare Organisations AP should undertake site walk rounds to have assurance the works are being undertaken in a hygienic as well as compliant manner.

Authorising Engineer (Water)

8.26. An AE (Water) acts as an independent professional advisor to the Healthcare Organisation, appointed by the organisation with a brief to provide services in accordance with SHTM 00 guidance:

- the AE (Water) acts as an assessor, making recommendations for the appointment of APs
- monitoring the performance of the service
- attending quarterly WSG meetings to provide independent input
- reviewing policies and procedures with the RP
- and providing an annual audit to the Healthcare Organisations Designated Person

Water System Risk Assessor

8.27. The Risk Assessor acts as an independent professional advisor to the Healthcare Organisation, appointed by the Healthcare Organisation with a brief to provide services in accordance with BS 8580-1 and/ or BS 8580-2. The Risk Assessor shall:

- have demonstrable competence and proven knowledge of waterborne pathogens relevant to NHS healthcare water systems
- their company should be Legionella Control Association (LCA)/ United Kingdom Accreditation Service (UKAS), or equivalent, accredited
- be provided with NHS Policies, Procedural documents, any existing Legionella Risk Assessments, and a current List of the Healthcare Organisations owned and leased sites
- provide a Risk Assessment, on an agreed format, for each individual Water System in each building
- use the formal criteria highlighted in the Healthcare Organisation Risk Assessment Policy and NHS Scotland National Risk Matrix to develop and determine specific (using Impact/ Consequence and Likelihood definitions within the 5 x 5 Risk Matrix scoring system) risks. Highlight assumptions, prove calculations and individual responses to identified risks in each level (Risk Prioritised Action Plan)
- factors to be considered in each Risk Assessment:
    - contamination
    - amplification
    - transmission
    - exposure
    - host susceptibility
    - operational history
    - new and emerging technologies
    - drinking water quality
- provide an Executive Summary Report in prioritised risk level order, applicable to all Risk Assessments being undertaken on Healthcare Organisation owned and leased sites, premises/ building blocks, plant, and water systems
- identify operational safety issues
- identify any Water Systems that cannot be fully assessed and highlight the reasons why not
- identify any aspects of the Risk Assessment that require further specialist knowledge or equipment (including Personal Protective Equipment (PPE), access, restrictions, permit to access/ work, and the need for a competent escort who is familiar with the system(s)) in order to complete the assessment or avoid putting themselves or others at risk during the assessment

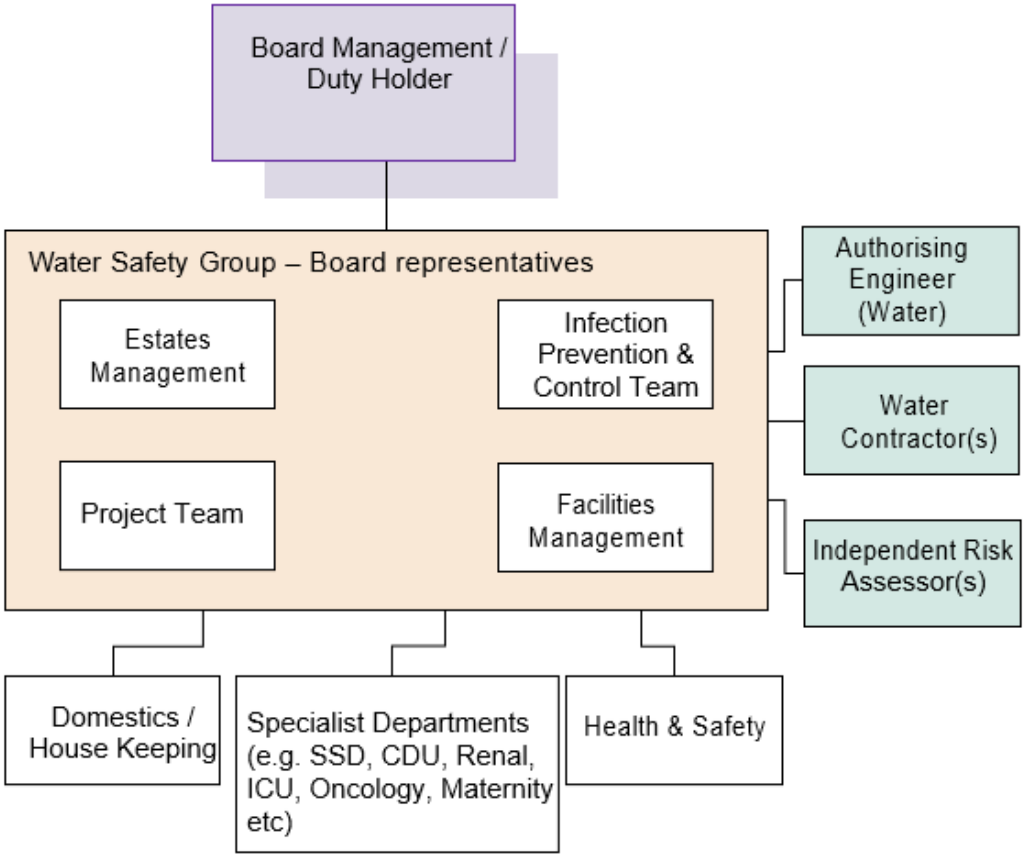
- identify whether a Schematic Drawing has to be prepared or redrawn as part of the assessment and its coverage
- ensure that Risk Assessment(s) will be made available to the WSG

8.28. This can be summarised as follows:

- provision of a descriptive plan of the extent, condition, and design of installations
- assessment of risk arising from bacterial contamination and scalding
- preparation of Risk Assessment Score Matrix
- identification of faults with comments, recommendations, and priorities for remediation
- provision of management systems and Planned Preventive Maintenance (PPM) task analysis
- provision of domestic hot and cold-water services condition and temperature analysis
- provision of a schedule of dead-legs and infrequently used facilities
- provision of survey, inventory and assessment of TMVs and outlets
- provision of a condition report for cold water storage tanks and calorifiers

8.29. As required, restricted security access to parts of the water systems will be implemented that are proportionate to the potential security implications.

Figure 8.1 - Various stakeholders represented as part of a typical Water Safety



Remit of the WSG

8.30. The following is a typical list of tasks assigned to the WSG:

- to work with and support the IPC team
- to ensure effective ownership of water quality management for all uses
- to determine the particular vulnerabilities of the at-risk population
- to review clinical and environmental monitoring data
- to be responsible for communication on water-related issues
- to oversee adequate supervision, training, and competency of all staff
- to ensure the WSP is kept under review especially in light of additions to the estate or new risks identified
- to ensure new builds, refurbishments, modifications, and equipment are designed, installed, commissioned, and maintained to the required water standards
- to determine whether there is a need for any risk assessment reviews to be commissioned and agree acceptable timescales for completion
- to review the risk assessment actions identified and ensure an action plan is in place, with agreed deadlines, to ensure any health risks pertaining to water quality and safety are addressed
- to ensure maintenance and monitoring tasks indicated by the risk assessments have been allocated and accepted
- to ensure agreed maintenance and monitoring procedures are in place and that staff undertaking them have been suitably trained and can evidence competence
- to agree and review remedial measures and actions linked to findings of non-compliance from the maintenance and monitoring, and ensure an action plan is in place, with agreed deadlines, to ensure any health risks pertaining to water quality and safety are addressed
- to determine best use of available resources

8.31. Detailed minutes of the group meetings should be recorded, distributed promptly along with action logs, and retained in accordance with the management policy to demonstrate good management, appropriate and timely actions, and good governance.

8.32. The WSG should always act in an appropriate and timely manner. Individual responsibilities should not be restricted by the need to hold formal meetings.

8.33. Episodes of colonisation or infection of patients that could be related to the water system should be referred by the IPC team to the WSG for any additional action to be determined.

8.34. The WSG, or a sub-group of, should review any proposed or existing developments associated with the water supply and distribution system to ensure that they:

- minimise the risk to patients/service-users, especially those treated in augmented care settings
- are compliant with all extant legislation and guidance and follow the Healthcare Organisations policy

8.35. All systems and equipment that use water to which patients, staff and visitors could be exposed should be approved by the WSG. When buying equipment, assurance should be sought from the manufacturer regarding safety for patients and service-users.

8.36. The WSG will need to ensure that decisions affecting the safety and integrity of the water system do not proceed without its agreement.

8.37. There will be competing priorities for project teams, WSGs and senior management to reduce the carbon footprint of the NHS estates as well as minimizing waterborne infection risks, these priorities may not be complimentary, but both should be considered.

Water safety plans

8.38. To assist with understanding and mitigating risks associated with waterborne hazards in distribution and supply systems and associated equipment, healthcare organisations should develop a WSP, which details the management approach to the safety of water and establishes good practices in local water usage, distribution, and supply (see Figure 8.2). It will identify potential water-related hazards, consider practical aspects and detail appropriate control measures. The content of a WSP will depend on the size and complexity of the healthcare organisation's water system. The plan will include governance arrangements related to the management of water safety. See paragraph 8.46 for a list of elements that the WSP should incorporate whilst further details can be found in BS 8680:2020 "Water Quality - water safety plans - Code of Practice".

8.39. Those organisations with existing robust water management policies for waterborne hazards will already have in place much of the integral requirements for developing a WSP.

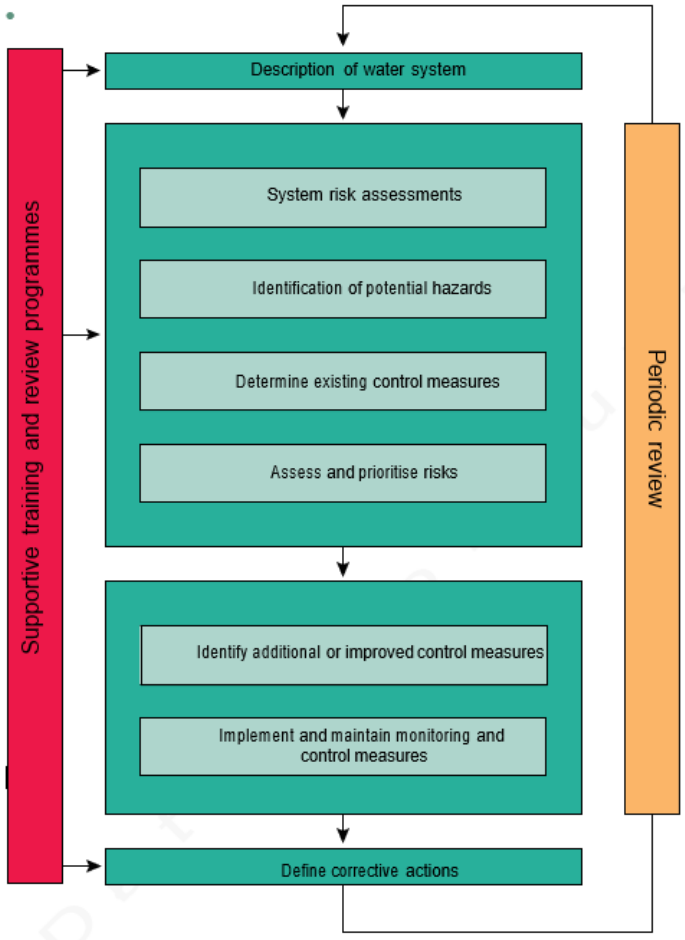
8.40. The WSP is a living document. It should be kept under continual review to ensure the adequate assessment and control of the risks from a wide range of waterborne pathogens. It should be a standing agenda item at WSG meetings.

8.41. The first step in the development of a WSP is to gain a comprehensive understanding of the water system, including the range of potential hazards, hazardous events and risks that may arise during storage, delivery, and use of water. It may require an understanding of the quality and management of the water as provided and how that water is used. Fundamental to this and any subsequent investigation or review is the provision and availability of accurate records. Schematic diagrams are essential for assisting understanding of how entire water systems operate; however, more advanced drawings (as built) are often needed in complex buildings. The WSP should also be cross-referenced to the healthcare organisation's security management strategy and business continuity plan.

8.42. WSPs include the need to:

- assess the risks that may be posed to patients (including those with particular susceptibility), staff and visitors
- put into place management systems to ensure the risks are adequately controlled
- ensure all persons with responsibility for works on and/ or management of the water system shall be subject to competency checks

Figure 8.2 - Documentation of management procedures (adapted from Figure 4.1 in World Health Organization's (WHO's) 'Water safety in buildings') The picture identifies the management procedures for WSPs and controlling risks



8.43. With respect to physical, chemical, and microbiological hazards, the WSP should incorporate, reference and point the readers to:

- the current Healthcare Organisation policy with respect to water safety
- information on the properties, water systems and assets under the control of the Healthcare Organisation and those that can expose Healthcare Organisation patients, staff, and visitors to risk but that are managed by 3rd parties
- management structure/ organogram and full details on the roles and responsibilities of all those named positions (including 3rd parties)
- the whereabouts of the TOR for the WSG and any subsequent water related groups
- the whereabouts of clinical risk assessments to identify those settings where patients are at significant risk from waterborne pathogens
- the whereabouts of specific risk assessments detailing how the patient will be protected from splash and aerosol contamination from equipment, outlets and drains and the additional measures to be taken (for example, avoiding exposure to water, only using sterile water or installing effective splash screens)
- the whereabouts of the engineering scald and bacterial risk assessments for all water systems (including those undertaken on 3rd party properties)
- information on the current action lists from the risk assessments undertaken showing progress to completion of the items identified
- information on the operational monitoring and maintenance (control measures) for all water systems (including mobile facilities) and the record-keeping methodology, including the water sampling plans for the microbiological testing of water
- the whereabouts of the agreed methods for each of the monitoring and maintenance tasks (Risk Assessment and Method Statement (RAMS)/ Standard Operating Procedures (SOPs))
- information on the typical remedial actions to be taken to remedy any out of specification findings from the monitoring and maintenance tasks undertaken or from out of specification microbiological tests
- information on the evidence of the appropriate design, installation, commissioning and maintenance of all components and equipment
- the whereabouts of the audit plan (covering both internal and external audits) and the reports and actions identified during these audits along with how the audit actions are being closed down and any subsequent changes in practice that may be required to prevent future occurrences
- the whereabouts of defined training requirements and registers for all staff involved in water safety and information on the competence assessment process employed
- the whereabouts of the pertinent surveillance monitoring which may indicate water system links to the patient infection

- the whereabouts of information on how the Healthcare Organisation will manage any water related incidents identified as having a potential link to the Healthcare Organisations systems

Risk assessments

8.44. The risk assessments that inform the WSP should identify potential hazards caused by waterborne pathogens, chemicals, temperature (scalding) and events that may arise during supply, storage, delivery, maintenance, and use of water in healthcare facilities.

8.45. Once potential hazards and hazardous events have been identified, the severity of risk needs to be assessed so that priorities for risk management can be established. The risk assessment needs to consider the likelihood and severity of hazards and hazardous events in the context of exposure (type, extent, and frequency) and the vulnerability of those exposed. Although many hazards may threaten water quality, not all will represent a high risk. The aim should be to distinguish between high and low risks so that attention can be focused on mitigating risks that are more likely to cause harm (see BS 8580-1 for guidance on Legionella risk assessments and BS 8580-2 for guidance on *Pseudomonas aeruginosa* and other waterborne pathogens). Other factors to consider may include the following:

- governance and accountability
- the susceptibility of all who may be exposed to water (including ice) used for diagnosis and treatment
- scalding risk and the appropriate installation of TMVs
- failure to maintain necessary hot and cold system supply temperatures
- clinical practice where water may come into contact with patients and their invasive devices
- the appropriate cleaning of the environment and equipment
- the disposal of blood, body fluids and patients' wash-water
- the maintenance and cleaning of wash- hand basins and associated taps, specialist baths and other water outlets
- suitable sizing, siting and installation of wash- hand basins including the appropriate positioning of soap and antimicrobial hand-rub dispensers
- change in use (for example, clinical area changed to office accommodation or vice-versa) due to refurbishment or operational necessity
- other devices that increase/ decrease the temperature of water (for example, ice-making machines, water chillers) which may not be appropriate where patients are at particular risk such as in augmented care settings
- engineering assessment of water systems, including appropriate design, installation, commissioning, maintenance and verification of the effectiveness of control measures
- infrequently used outlets

- previous risk assessment, current control measures and documentation
- policies and procedures
- the unnecessary use of flexible hoses and any containing inappropriate lining materials
- sampling, monitoring and testing programmes that needs to be put in place
- backflow protection
- safe access to equipment
- prevention of unauthorised access to equipment

The skills and competency to assess these risks will most likely, require input from more than one specialism.

8.46. Situations will arise where venous catheter sites and surgical wounds may become contaminated from water outlets such as showers and spray taps. Similarly, the practice of soaking leg ulcers or syringing ears may require consideration of the microbiological quality of water used and will require local assessment.

8.47. The likelihood of hazardous events is influenced by the size and complexity of the water system and can be exacerbated by poor or overcomplicated design, construction, commissioning, operation, and maintenance.

Staff training and competence

8.48. The WSG should implement a programme of staff training to ensure that those appointed to devise strategies, carry out control measures and undertake associated monitoring are appropriately informed, instructed and trained. They should also be assessed as to their competency. It is essential that they have an overall appreciation of the practices affecting water hygiene and safety, and that they can interpret the available guidance and perform their tasks in a safe and technically competent manner.

8.49. The WSG should review the competence of staff on a regular basis, and refresher training should be given; records of training attendance need to be maintained. Although training is an essential element of ensuring competence, it should be viewed within the context of experience, knowledge and other personal qualities that are needed to work safely. Competence is dependent on specific needs of individual installations and the nature of risks involved. It is recommended that each CP has their competence verified, at least annually, for each task they are deemed competent to carry out.

Water hygiene training

8.50. Individuals to whom tasks have been allocated (supervisors and managers as well as operatives) need to have received adequate training in respect of water hygiene and microbiological control appropriate to the task they are responsible for conducting. The training and competence assessment should be clearly defined and should include those responsible for simple housekeeping tasks such as outlet flushing and the cleaning of wash-hand basins, through to maintenance staff and up to individuals who define strategy and develop procedures.

8.51. It is important that any person whether a direct employee of the NHS or a contractor working on water distribution systems or cleaning water outlets should have completed a water hygiene awareness training course so that they can gain an understanding of the need for good hygiene practices when working with water distribution systems and water outlets, and of how they can prevent contamination of the water supply and/or outlets. The training should be agreed by the WSG.

Note 11: Water Hygiene Training: As part of helping to ensure the delivery of safe wholesome water at all outlets and preventing contamination, which may lead to healthcare-associated infections, it is recommended that healthcare organisations implement a water hygiene training scheme.

Consideration should also be given to integrating a health screening element into the training to help ensure those undergoing the training are not carriers of any waterborne diseases on the date of training and are aware of their responsibilities towards the water supply. Those responsible to maintain, clean and clinical use of outlets should be made aware of the hygiene risks they impose when developing symptoms of certain infectious diseases, such as infective jaundice, gastroenteritis, persistent diarrhoea or prolonged unexplained fevers, and should report this to their line managers.

It is important that individuals are aware of their duty to protect the health of patients, staff, and visitors and that they are responsible for ensuring they inform their line manager if they come into contact with any disease that has the potential to cause harm.

The course should encompass the following topics (not exhaustive):

- organisational governance arrangements in relation to water hygiene and safety
- familiarisation with local policies/ procedures in relation to the management and provision of water hygiene and safety
- information on prominent waterborne pathogens and their consequences
- the ways in which water distribution systems, water outlets, components and any associated equipment can become contaminated
- the responsibilities of individuals to prevent the contamination of the water distribution system and water outlets and assisting in ensuring control measures in place are effective
- how the safety of water can be maintained by good hygiene practices
- when not to work with water intended for domestic purposes
- system design
- components/ accessories (taps and TMVs)
- disinfection and cleaning equipment/ materials
- how to store and handle pipes
- organisation-specific control measures
- the impact of getting it wrong
- role of persons being trained
- personal hygiene along with dealing with clothing, footwear, cleaning equipment/ materials, tools and storage when considering water hygiene (as applicable to each role)

Management of water safety risks and issues

8.52. Identified water safety risks and issues should be assessed, prioritised, and included on a risk register for discussion and management by the WSG and advice given on when these should be escalated to senior management/ NHS board level. Consideration should also be given to the potential and known threats from unauthorised access to the water supply for malicious purposes.

8.53. When the risks have been identified, an action plan needs to be developed with defined responsibilities and agreed timescales to minimise these risks. The action plan should include:

- appropriate remedial actions, monitoring details and schedules for validation that show the remedial actions are effective and subject to ongoing verification (completion dates should be defined)
- any training and competency issues required to ensure compliance with this guidance

Advice on exposure of augmented care patients to *Pseudomonas aeruginosa* is covered in SHTM 04-01 Part C.

Project documentation

8.54. The AP (Water)/ Estates teams will require engagement for new works/ refurbishment works regarding connections to their existing water supplies and reviewing RAMS/ method statements and reviewing the contractors Construction Stage Water Safety Plan (CPWSP) flushing regime.

8.55. The contractor should also formally invite the Healthcare Organisations stakeholders including the APs for site walk rounds during construction so that they can become familiar with the project.

Safe hot water temperature

8.56. See SHTM 04-01 Part A for guidance on safe water temperatures and delivery devices. See also HSE's 'Managing the risks from hot water and surfaces.'

8.57. To reduce the risk of scalding, thermostatic mixing devices are required for specific hot water outlets (see SHTM 04-01 Part A). A scalding risk assessment is necessary to establish the need and type of device to be installed. Thermostatic mixing devices should only be installed where a risk assessment indicates their need.

8.58. As with any safety device, routine checks will be essential to ensure continued satisfactory operation (see Health Technical Memorandum (HTM) 04-01Supplement – 'Performance specification D 08: thermostatic mixing valves (healthcare premises)'). Such devices, however, should not be a substitute for caution. For example, when performing assisted bathing, it is often necessary to set the delivery temperature to a higher level than normally considered safe to allow for the cooling effect of large baths that are required.

8.59. Before lowering or assisting patients into the bath, the water temperature must be checked with a thermometer to ensure that it has fallen to a safe value.

Utilisation

8.60. One of the critical factors affecting the quality of water within hot and cold water distribution systems is the extent of utilisation.

8.61. Where stagnation occurs or utilisation is low, cold water temperature can increase significantly and approach the range that is conducive to the growth of a variety of waterborne pathogens such as Legionella. When not used, hot water will rapidly cool to temperatures that are conducive to the growth of pathogens. It is essential that hot water return pipework is circulating correctly and consideration should be given to any long radial lengths of hot water pipework, especially when these are not frequently used. Where hot and cold water is mixed, further opportunities arise for deterioration in water quality.

8.62. TMVs should not be installed in series with mixing taps (thermostatic or manual).

8.63. The WSG needs to ensure that there is good liaison between the estates officers/ maintenance providers and clinicians to ensure that the water services are sufficiently used.

8.64. Health and Safety Guidance (HSG) 274 Part 2 recommends that generally, for infrequently used outlets, flushing is carried out once a week but that in healthcare facilities the risk assessment, as agreed by the WSG, may indicate a higher frequency, and water draw-off should form part of the daily cleaning process. The procedure for such practice should be fully documented and covered by written instructions. For example, where flushing of a few little used outlets is required then twice weekly flushing may be adequate. Where flushing of an unused ward is required, then daily flushing may be more appropriate.

8.65. Consideration should be given to removing infrequently used showers, taps and any associated equipment that uses water. If removed, any redundant supply pipework should be cut back as far as possible to a common supply (such as to the recirculating pipework or the pipework supplying a more frequently used upstream fitting) but preferably by removing the feeding ‘T’ piece.

8.66. Prior to the removal of outlets, a competent designer should check that the proposed alterations will not affect the operation of the remaining water services and drainage systems. The designer should ensure that system velocities, volume flow rates and pressure characteristics remain within recommended design parameters. This requirement is particularly important in situations where multiple outlets are removed from a single location. The current trend towards water free augmented care areas for example is likely to result in a significant deviation from the original system design and commissioning data.

8.67. Monitoring of water usage on a building-by-building basis can indicate when usage falls and the risk increases. Reductions in normal usage patterns should be investigated and remedial measures introduced following investigations by the WSG.

Note 12: Regular flushing applies to all infrequently used outlets. The use of portable temperature monitoring devices may assist in identifying where additional flushing is necessary. Flushing does not mimic actual use and should be regarded as a temporary measure, particularly in the context of unoccupied or infrequently used areas. If flushing activity is found to be the only source of water movement, the outlet should be removed.

Temporary closure of wards/ departments

8.68. During the temporary closure of wards or departments, a flushing regime should be instigated to maintain system hygiene. Flushing should be continued until stable temperatures are achieved. Advice and guidance is also provided in BSI's PD855468.

8.69. Alternatively, when this is impracticable, or should the temporary closure become permanent, the WSG should risk assess if it should be left charged with water and disconnected from the rest of the system, ensuring there are no dead-legs. Before reconnecting, the system should be thoroughly flushed, recommissioned and disinfected. Further, new tap cartridges and strainers may be required, these should be changed in-line with the manufacturer's recommendations.

Leak detection/ water conservation

8.70. It is essential to regularly check systems and all components for signs of leakage; for example, a tap left dripping can waste in excess of 14,000 L of water each year. Particular attention should be given to WCs as leakage appears as a dribble at the back of the pan, which often goes undetected.

8.71. Consumption should be monitored; if it increases for no apparent reason; this may indicate a leak. Wet or soggy patches of ground may identify underground leaks, for example areas of greenery that are more lush than their surroundings.

8.72. Where water conservation measures are to be considered, a risk assessment should be undertaken to ensure there is no detrimental impact that may cause stagnation or low water usage in the existing water or drainage systems.

Water treatment undertaken by the local water undertaker

8.73. Local water undertakers use different types of water treatment, which may include the use of chloramine, and add additional compounds such as fluoride. It is recommended that regular contact is maintained with the local water undertaker to keep up to date with changes that may affect water quality or other operational changes affecting the premises.

Energy management

8.74. Efforts should be taken to minimise energy consumption without compromising water safety management. An effective maintenance plan will also contribute to this.

Maintenance practice

8.75. Healthcare organisations should ensure that all personnel that work on water systems can demonstrate competence and have been inducted in local procedures, which should include safe water hygiene practices.

8.76. There are legal, operational, and economic reasons for introducing good maintenance practice. There is a legal requirement under the Water Supply (Water Fittings) (Scotland) Byelaws 2014 to maintain water fittings to comply with the regulations. It sets a requirement to protect and preserve water quality for the safety of patients, staff, and visitors. Complying with the law is generally given the highest priority and is the minimum requirement that must be satisfied.

Note 13: BS EN 806-5 and complementary guidance in BS 8558 covers the operation and maintenance of water systems, in which a number of aspects are covered:

- operation
- interruptions to operation and disconnection
- resumption of supply
- damage and faults (change in water quality, insufficient water supply, noise emission)
- alterations, extensions, and refurbishment
- accessibility of installation components
- maintenance

8.77. Regulations require notification to the water undertaker of any proposed changes and additions to the water supply system in the premises. Before making any changes, a risk assessment should be carried out and audited by an independent assessor. Further details can be found on the WaterRegsUK website.

8.78. Maintenance is required to achieve optimum economic life and maintain maximum operational efficiency of the plant.

8.79. There should be a risk assessment, which includes consideration of the designer's risk assessment, to decide the appropriate type of maintenance for example scheduled, corrective or condition- based, for the different items of plant. The following should be considered:

- would a breakdown of a particular service during working, or outside normal, hours pose a risk to patient safety and wellbeing?
- how long can a breakdown of particular plant be tolerated?
- what cost can be justified to avoid breakdown of particular plant such as standby pumps, dosing pumps and so on?
- the availability of suitable spares.

8.80. If response to failure is critical for certain items of plant, the maintenance organisation will require a planned strategy of calling out skilled staff to achieve an agreed response time and to minimise the interval between breakdown and the diagnosis and repair of the plant.

8.81. The approach for healthcare premises should be based on that PPM as any failure in the water services would be seriously detrimental to the provision of healthcare. The PPM programme and any subsequent amendments should be agreed by the WSG.

Maintenance responsibility

8.82. A maintenance manager should be given responsibility for implementation of an operational maintenance strategy which will be prioritised based on risk. These responsibilities will include:

- the provision of adequately trained and supervised labour
- clear definitions of the equipment and services to be maintained, together with the procedures to be carried out on them
- monitoring of the quality of the work carried out to ensure that it is consistently acceptable
- the identification of appropriate resources and the implementation of financial control procedures

Note 14: The maintenance manager should ensure that risk assessments have been carried out for all maintenance activities and be particularly aware of any specific risks associated with hot and cold-water installations (for example, hazards associated with gaining access to cisterns, the discharge of large volumes of hot water to enable the inspection of calorifiers and hot water storage vessels, and the possibility that these may have become colonised by *Legionella*).

Contract maintenance

8.83. The increasing complexity of building services equipment has resulted in a growing reliance on contractors for the provision of maintenance services. The decision to use either a contractor or in-house staff should be taken in the light of local circumstances.

8.84. Contracts between contractors and healthcare organisations should clearly define the responsibilities of both parties. See Chapter 2 of Health Building Note (HBN) 00-08 - '(Estatecode) Part B: Supplementary information for Part A' for further guidance. Building Services Research and Information Association (BSRIA's) BG3: 'Maintenance for building services' also provides advice on aspects to be considered when obtaining contract maintenance.

8.85. All staff who work on or with water systems should have the necessary qualifications, regulatory knowledge, competence, and experience needed to complete safely and effectively their specific tasks. Each individual should have a full understanding of their role and the impact of their actions on patient care.

8.86. Only installers with the appropriate qualifications, regulatory knowledge and competence should be used to install and maintain water installations. There are seven Approved Contractors' Schemes (APHC, Aplus, CIPHE, Snipef, Taps, WaterMark and WIAPS) authorised through the Water Supply (Water Fittings) (Scotland) Byelaws 2014 In addition to plumbing installers, four schemes (Aplus, Taps, WaterMark and WIAPS) operate sector memberships for specialist areas of work covering external water services (below-ground pipe etc.), catering equipment and point-of-use (POU) (chilled-water) equipment. If installing water coolers, consider using contractors who are members of the Water Dispenser and Hydration Association (WHA).

8.87. The WaterSafe register holds details from all seven Approved Contractors' Schemes for businesses that have registered plumbing installers.

8.88. A recognised benefit to using an Approved Contractor (including sector installers) is they can carry out some work without the need to provide advanced notification to the water undertaker, and their work will be certified upon completion. A "work completed" certificate issued by a WaterSafe recognised plumber provides a defence for property owners who are challenged by a water undertaker enforcing the Water Supply (Water Fittings) (Scotland) Byelaws 2014 or during legal proceedings. It is also recommended that the individual who carries out the works holds a current Energy and Utility Skills Register (EUSR) Water Hygiene card at the time of the works.

Maintenance brief

8.89. The maintenance manager requires a brief that is in line with all the requirements of the WSP and approved by the WSG. This will include (among others):

- the scope of work
- budgeting - overall and single item limits
- level of reliability
- response time required to correct faults
- criteria for quality of service, works and equipment
- reporting procedure
- accountability and responsibility
- energy-saving policy
- health and safety policy
- environmental and sustainability factors

8.90. The above requirements are necessary regardless of whether the work is carried out by contractors or in-house staff.

Performance monitoring

8.91. This involves the regular inspection of systems and records, which should be in such detail as to enable the WSG to form an opinion regarding compliance with the agreed criteria.

8.92. If a contractor is commissioned to carry out maintenance but in-house expertise is not available to monitor their performance, it may be necessary to seek advice from an independent professional adviser (this may be available from a neighbouring healthcare organisation). Using another maintenance contractor in a monitoring role could lead to a conflict of interest.

8.93. Performance monitoring should establish that:

- the required level of service is met
- all the required plant is being maintained
- system performance is being maintained (that is, by the implementation of microbial sampling and temperature/ biocide-level- monitoring regimes)
- maintenance is being carried out to the agreed standard
- correct replacement parts are being used
- the agreed spares stocks are being held on site
- records are being correctly maintained
- the agreed standards, number of staff, and number of visits are being achieved

- plant is being operated to achieve optimum energy usage
- health and safety requirements are being complied with
- only agreed subcontractors with the appropriate knowledge and competence are being employed
- the client and typical users of the building are satisfied
- invoices accurately reflect the work carried out, including materials expended
- breakdowns do not occur too often
- adequate consideration is being given to the potential environmental impact of contractors' actions, for example disposal of lubricants, chemicals, worn parts and so on that cannot be recycled

Monitoring systems

8.94. Where monitoring systems are provided to assist in the management of hot and cold-water systems, they should be subject to a routine maintenance and calibration. Systems should be in place to ensure that all set alarms are responded to in a timely manner.

Emergency action

8.95. Contingency plans should be available in the event of the following:

- a power or energy interruption or a plant failure resulting in the temperature control strategy, or the delivery of effective control measures not being maintained as designed
- a water supply failure that could last beyond the period for the designed storage capacity

Note 15: The WSG should ensure that plans are in place for the supply and distribution of alternative safe water for drinking to vulnerable patients and those unable to collect supplies from distribution points within the healthcare facility. This will include the use of sterile water if appropriate.

- monitoring and sampling results that indicate patient safety may be compromised unless remedial action is undertaken with immediate effect
- emergency action in the event of a case or an outbreak of a healthcare- associated waterborne infection
- tampering/ sabotage of the water supply could impact on patient and staff safety

Note 16: water suppliers should liaise with healthcare authorities to develop emergency plans to maintain supplies for domestic purposes to healthcare premises. Guidance on temporary supplies is provided in BS 8551.

These plans may include:

- adequate storage cistern capacity and distribution arrangements within the healthcare facility to provide minimum volumes of water at the outset of a major incident to maintain hygiene and health for an initial period until other temporary arrangements can be introduced
- the provision of connection points to existing storage cisterns at suitable locations for delivery of emergency supplies of water, for example from tankers (with suitable locations to park the tanker and procedures to disinfect emergency fill pipes)
- plans for the supply and distribution of alternative safe water for drinking to vulnerable patients and those unable to collect supplies from distribution points within the healthcare facility

Data management and record-keeping

8.96. Given the amount of data that must be managed to facilitate the effective management of large and complex water systems, it is recommended that electronic data management tools be utilised to facilitate the intelligent use of data for the WSG to easily monitor trends and analyse chemical and microbiological parameters.

8.97. It is essential to have comprehensive operational manuals for all items of plant that include requirements for servicing, maintenance tasks and frequencies of inspection.

8.98. This information should be kept together with all commissioning data.

8.99. Documentation should also be drawn up as part of the health and safety file for the healthcare facility.

8.100. As a minimum, the following items should be recorded:

- the names and positions of those responsible for conducting risk assessments, and managing and implementing the WSP
- the significant findings of risk assessments
- details of the procedures including sufficient detail to identify that the work was completed correctly and when the work was carried out
- results of any monitoring inspection, test or checks carried out

8.101. Records should be kept for at least five years unless they are required to be kept longer by the organisation's data management policy.

As-fitted drawings

8.102. The availability of accurate as-fitted drawings is essential for the safe operation of hot and cold-water service systems and to inform the risk assessment. The drawings will be necessary to perform the temperature control checks on the systems and will assist in identifying any potential problems with poor hot water circulation and cold-water dead-legs where flow to infrequently used outlets can be low. Such information should identify all key components in the installations, for example water meters, cisterns, filtration equipment (where fitted), calorifiers, and the location of isolating valves in the systems. Drawings should be kept up to date and amended when any changes are made to the system.

Schematic drawings

8.103. Separate schematic drawings should be prepared and displayed such that all plant items, control valves etc. can be identified. A schematic diagram is an important tool to inform the risk assessment process. These are not formal technical drawings and are intended to be easy-to-read without specialised training or experience. While providing only an indication of the size and scale, they allow someone unfamiliar with the layout of a system to understand the positions and connections of the relevant components quickly. For further information, refer to BS 8580-1 2019 Annex G (informative) Schematic diagrams. Drawings should be kept up to date and amended when any changes are made to the system.

Note 17: All drawings should be available to each person working on the systems and while conducting risk assessments.

8.104. In addition to drawings, there should be comprehensive schedules of outlets, lists of sentinel taps (outlets), other outlets to be tested (frequency as per the WSP) and other components in the system.

Asset register

8.105. The WSG should ensure that an accurate record of all assets relating to the hot and cold-water distribution systems is set up and regularly maintained. They should also ensure that records of all maintenance, inspection and testing activities are kept up-to-date and properly stored.

8.106. The asset register should be designed to provide the following information:

- an inventory of plant and water-associated equipment
- a basis for identifying plant details
- a basis for recording the maintenance requirements
- a basis for recording and accessing information associated with maintenance
- a basis for accounting to establish depreciation and the provision needed for plant replacement
- information for insurance purposes

8.107. When completing records, it is essential that there is an audit trail in place indicating the individual concerned and dates/ times where appropriate.

8.108. Further information on the monitoring of performance and effectiveness in carrying out maintenance tasks can be found in CIBSE's Guide M - 'Maintenance engineering and management'

9. Description of systems, operational considerations, and requirements

Source of supply

9.1. See Scottish Health Technical Memorandum (SHTM) 04-01 Part A for comprehensive guidance and information on sources of water supply.

9.2. If supplies are taken from local boreholes or wells and so on, the water should be tested to comply with the requirements of the Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017 (as amended 2017) The results of all analyses should be kept and recorded. Private supplies should be registered with the local authority.

Temperature control regime

9.3. A temperature control regime is the traditional strategy to control Legionella and other waterborne pathogens. This will require monitoring on a regular basis. Frequencies are listed in Table 9.1.

Note 18: The flow temperature of hot water out of the calorifier should be a minimum of 60°C. It should be a minimum of 55°C on flow and returns to all outlets and at the start of the hot water return. It should be a minimum of 50°C at the final connection to the calorifier.

9.4. Whereas many of the checks will, of necessity, require the use of separate thermometric equipment, some of the temperature checks can be carried out by continuous monitoring such as sensors and reporting systems (optionally linked to a building management system (BMS). For instance, where circulating loops are installed the access to the pipework may be difficult and so sensors may reduce the associated risks with frequently gaining access to these locations whilst at the same time providing more data on system performance. Where a BMS is used, it will be essential to ensure that regular calibration and physical tests are performed in accordance with the manufacturer's instructions. The designer as part of their designer's risk assessment should have noted maintenance/ calibration requirements, cost, possible time out of service and so on.

9.5. Advances in technology has resulted in an increased utilisation of remote monitoring systems across healthcare premises. When utilised appropriately, it can provide a greater understanding of the effectiveness of inherent water management control measures.

9.6. Remote monitoring offers real time reporting and enables system operators the facility to monitor temperature trends and to conduct timely reactive measures in response to system alarm conditions. Remote monitoring systems can identify infrequently used outlets and will also highlight hand hygiene practices and cleaning activities. Remote monitoring systems can also be used to validate that flushing has been undertaken and inform whether flushing activities need addressed to increase water throughput. By removing the need for individuals to access the clinical environment, the risk of contamination from operatives, clothing and equipment will be reduced.

9.7. The Water Safety Group (WSG) and project team should identify what remote monitoring should be considered to allow for performance monitoring. The WSG should also identify the scale of the monitoring systems and the impact this will have on the flushing regimes. When introducing monitoring systems, consideration should be given to how alerts are raised, operating set points and parameters, and system specific training needs. The decision process for selecting remote monitoring should be determined on a site-by-site basis and should consider advantages and disadvantages of the systems. The decision should be made by the WSG supported by specific representation from finance, cyber security, and information technology stakeholders.

9.8. The deployment of remote monitoring may be a recommendation that arises from a Legionella risk assessment, operational concerns, duty holder intervention, or availability of monitoring resource. The reduced risk of contamination, the economic factors associated with staff resource and water savings, and the facility to trigger and react immediately to real time alarms are likely to be the most important considerations in healthcare premises.

9.9. It is important that healthcare organisations consider potential radio wave interference, particularly in high-risk clinical environments. It is also recommended that for cloud-based systems, data protection measures, and the wider security challenges associated with adopting cloud-based technologies are considered.

Biocide regimes

Note 19: Biocidal treatment may adversely affect the lifecycle of the installation. For further information on biocidal treatment, see Chapter 6 of SHTM 04-01 Part A. For ongoing checks, see Health and Safety Guidance (HSG) 274 Part 2.

9.10. In addition to maintaining a temperature control regime, there may be occasions where additional biocidal treatment is required for the effective control of Legionella and other waterborne pathogens. However, the selection of a suitable treatment is complex and depends on a number of parameters. Moreover, the chosen biocide needs to be properly managed. This is particularly the case with cold water services compared with hot water services (HWSs) where, with the benefit of circulation, water is returned to the calorifier/

water heater and is then reheated. However, it should be taken into consideration that effective concentrations of some biocides are difficult to achieve in hot water systems due to gassing off. For water intended for consumption, the biocide concentrations must not exceed prescribed concentrations for drinking water.

9.11. The WSG should be actively involved in the decision-making process and should involve consultation with the water undertaker to ensure the suitability of biocidal products for their intended application. See SHTM 04-01 Part D for further information.

Metal contamination

9.12. See SHTM 04-01 Part A.

Water softening

9.13. See SHTM 04-01 Part A.

Filtration

9.14. See SHTM 04-01 Part A for guidance on point-of-entry filtration.

9.15. See SHTM 04-01 Part E Alternative Materials and Filtration.

Metering

9.16. Metered data should be logged and recorded by an automatic metering system (see also water efficiency'). Where water meters are installed in below-ground meter chambers, the chambers should be kept clean of debris and water; this will enable quick and accurate reading of the meters.

9.17. Meters should be periodically checked to ensure that they are operating and providing accurate readings.

9.18. Meters, other than the water undertaker's meter, should be removed at such intervals as recommended by the manufacturer for cleaning and renewal of worn parts and should be tested for accuracy and disinfected prior to replacement.

9.19. Meters should ideally provide a pulse output that can be monitored by a BMS, but if not should be read on a regular basis (monthly) and consumption monitored. Data from the meter should be reviewed over time for anomalies (typically low or high consumption rates). Graphical methods may be beneficial. Where it is desirable to connect to the water undertaker's meter, its authorisation must be gained in advance.

9.20. Consumption should be checked against the utility bill and any discrepancies investigated.

Water storage

9.21. For general information on water storage, see Chapter 10 in SHTM 04-01 Part A.

9.22. The Water Supply (Water Fittings) (Scotland) Byelaws 2014 and relevant parts of British Standard (BS) EN 806 and BS 8558 specify minimum standards for cold water storage cisterns to ensure that the stored water is retained at a wholesome standard suitable for domestic use. It is necessary to minimise stagnation and stratification of the stored water. A nominal 12 hours' total on-site storage capacity is recommended. The quantity of the water stored should be carefully assessed in relation to the daily requirement so that a reasonable rate of turnover is achieved. The storage capacity should be reduced where it is known or established that it is excessive and where it is practicable to do so. Automatic self-adjusting tank volumes controlled by the BMS should be considered, therefore allowing the nominal 12hr storage for that day regardless of the water consumption.

9.23. All cold-water storage cisterns should be examined at least annually, or more frequently if the risk assessment dictates, paying particular attention to the presence of foreign objects, biological material, and corrosion. Where issues with cleanliness, scale or internal contamination are noted then the cisterns should be cleaned, and, if required, any remedial work carried out. Before the cisterns and system are put back into use, they should be disinfected in accordance with the procedure detailed in BS 8558 and PD855468. Where consideration is being given to the removal of a storage cistern, a full assessment of the downstream system is needed to ensure any consequential impacts are properly understood. These may include, but not be limited to, changes in pressure for pipes or equipment and any backflow prevention protection the cistern may have been providing.

9.24. The cleanliness of the plant/ tank rooms should be included in the Water Safety Plan (WSP) and should highlight the importance that dirt/ dust/ other contamination should not accumulate on or around the tanks. Staff who enter the plant rooms to work or carry out cleaning and disinfections should have been trained as per the WSG training plan, so they understand contamination risks.

9.25. Any chemicals or biocidal products used in the cleaning or maintenance of cisterns should be flushed from the cistern before it is put back into use.

9.26. Cistern insulation should be checked to ensure that it is adequately positioned and in good condition.

9.27. Float-operated valves should be checked to ensure they are securely fixed and set to achieve a correct water level in accordance with the Water Supply (Water Fittings) (Scotland) Byelaws 2014. Refer to SHTM 04-01 Part A for further guidance.

9.28. Overflow/ warning pipes, incorporating suitable rodent screens, should be checked to ensure that they maintain a steady fall (which ensures they will drain freely) and are clear and correctly routed to give an obvious visual alarm of an overflow condition. A weatherproof label fixed adjacent to the warning pipe identifying the tank and its location, together with the person/ department to be contacted in the event of a discharge, will contribute to a quick and accurate defect report which could then be acted upon, so minimising water wastage When connected to drain, they should comply with BS EN 1717. See SHTM 04-01 Part A for further guidance.

Pressurisation/ supply pumps

9.29. Where two or more pumps are installed for pressurising systems, automatic control should be provided to prevent stagnation. The automatic control should also ensure all pumps are brought into operation at a regular frequency as determined by the risk assessment. The controls should have a soft start which can prevent pressure surge should sections of pipe have been drained during a power outage.

9.30. The maintenance carried out on this type of equipment should be in accordance with the manufacturer's recommendations.

Cold water distribution system

9.31. The design and installation of the cold-water distribution system should comply with the Water Supply (Water Fittings) (Scotland) Byelaws 2014 and relevant parts of BS EN 806-2 and BS 8558 (see Chapter 9 of SHTM 04-01 Part A for further information).

9.32. The control of water temperature in the cold-water service will essentially rely on a design/ installation that routes cold water pipework away from heat gains, good insulation, and water turnover. Maintaining regular movement of cold water in sections prone to stagnation and guarding against excessive heat gain are effective control measures for Legionella and other waterborne pathogens. Special attention should be given to the maintenance and monitoring of these systems.

Note 20:

- For the control of Legionella and other waterborne pathogens, 20°C is the quoted upper value above which multiplication of Legionella in particular begins to take place. It should be noted that during extremes of weather, environmental factors can influence the incoming water temperatures, particularly where water is provided from surface-water sources.
- Where automatic flushing of urinals is used, their careful location and connection to the water system can be effectively used to assist in water turnover. When used, devices having a duty cycle should be set to flush as deemed necessary by the WSG. Information from water quality programs could be used to determine appropriate periods. Note that automatic flushing devices should not be located in accommodation used by patients who may become distressed by the noise.

9.33. Schematic diagrams and as-built drawings of the system with numbered and labelled valves reduce confusion and save time in trying to identify appropriate isolating valves and other system components.

9.34. Checks and actions should be carried out to show that:

- the system components show no sign of leakage or corrosion or limescale
- the system insulation is in good condition
- the system filters have been changed and/ or cleaned in accordance with manufacturers' recommendations. Regularly check and clean strainers
- all isolating valves have periodically been worked through their full range of travel
- every water outlet complies with the backflow protection requirements of the Water Supply (Water Fittings) (Scotland) Byelaws 2014
- Type BA backflow protection devices (Reduced Pressure Zone valves (RPZ)) have been checked on a regular basis, at least yearly. Refer to WaterRegsUK for further guidance.

Drinking water

9.35. If separate drinking water supplies are provided, reference should be made to SHTM 04-01 Part A, and subject to a risk assessment consideration should be given to their removal.

Note 21:

- Current guidance does not draw a distinction between drinking and general cold-water services, and separate systems are no longer recommended. The installation of separate drinking water supplies has been standard policy. But in many cases where such systems have been installed, the quality of drinking water (particularly at infrequently used draw-offs, for example washrooms) has generally been inferior to that of the general cold-water supply.
- Softeners using salt-regenerated ion- exchange resins increase the sodium content of the water during softening, and this may be undesirable for children and infants (including the making up of babies' bottles) and anyone on strict salt-restricted diets.
- Where drinking water is supplied from a tank then that water tank should be microbiologically tested at least twice per year. There is a contradiction between the guidance given in HSG 274 Part 2, where temperatures should be taken remote from the ball valve and in BS 7592 which does not recommend opening the tank to undertake sampling. It is therefore up to each Healthcare Organisation to determine, in this instance, how they evidence that their system has not adversely changed the water supplied from the water undertaker and that it remains wholesome.

Hot water storage and distribution

9.36. HWSs should be designed and installed in accordance with the Water Supply (Water Fittings) (Scotland) Byelaws 2014 and relevant parts of BS EN 806-2 and BS 8558. The hot water system may be of either the vented or the unvented type (see SHTM 04-01 Part A for further information).

9.37. To control possible colonisation by waterborne pathogens including Legionella, it is essential to maintain the temperature within the hot water circulating system. To some extent, if properly maintained, the calorifier/water heater will provide a form of barrier to microbial growth. The minimum flow temperature of water leaving the calorifier/water heater should be 60°C, with an anti-stratification / shunt pump installed to circulate hot water from the top to the bottom of a calorifier to ensure that temperature at the bottom is as close to that at the top as possible.

9.38. The minimum water temperature at the connection of the return to the calorifier/water heater should be 50°C. To achieve the required circulating temperatures, it will be necessary to maintain the balance of flows to individual pipe branches and draw-off points. This may be achieved by temperature activated, automatic balancing valves or by commissioning sets.

9.39. Calorifiers should be subjected to regular procedures that include the following:

- inspection, cleaning, and maintenance at least annually, or as indicated by the rate of fouling
- quarterly drain flushing to minimise the accumulation of sludge. This may be extended to annual draining if, during inspection, it is found that there is little accumulation of debris
- whenever dismantled for statutory inspection, or every year in the case of indirect calorifiers, calorifiers should be thoroughly cleaned to remove sludge, loose debris, and scale
- whenever a calorifier is taken out of service, it should be refilled, drained, refilled again and the entire contents brought up to, and held at, the nominal operating temperature of 60°C for at least an hour the calorifier should remain isolated until the procedure is completed.
- when bringing calorifiers back online, it is important that service valves are opened slowly to avoid any disturbance of sediment debris. Calorifiers that are to be taken out of service for more than a few days should be drained and should not be refilled until ready to return to service. The drain valve should be left open while the calorifier is out of use
- where it is known or established that gross over-capacity exists in a calorifier, and where it is practicable to do so, it should be replaced by a calorifier or Plate Heat Exchanger of the appropriate size. This can be reviewed and informed by the use of historic data

Note 22: Full-flow (spherical/ ball-type) isolating valves should be specified to avoid clogging. The drain from the gully should be of sufficient size to take the flow from the calorifier drain.

9.40. Hot water circulating pumps should be of adequate performance to ensure a minimum available temperature at draw-off points of 55°C. It is undesirable to have standby pumps owing to stagnation risks. If, however, an existing installation includes a standby pump and it is impracticable to remove it from service, it should be automatically controlled so that each is regularly brought into operation, the control system should automatically change over operation every 3 hours.

9.41. It is not permissible to shut down the pumped circulation. To do so will lead to the loss of the required system temperatures, unless part of a planned maintenance programme.

9.42. Electrical trace-heating is not recommended except for very small systems and those existing systems that would be difficult to rectify. Where it has been retained, it should be checked routinely (at least monthly) to ensure that it maintains the water temperature above 55℃. Care should be taken to ensure there are no cool spots. Consideration should be given to monitoring the temperatures by means of a BMS.

Note 23: Dead-leg lengths should be as short as practicable; that is, the trace-heating should be taken up to the draw-off or mixing device. The continuity of the trace-heating should be monitored to avoid localised failure.

Instantaneous water heaters

9.43. These devices usually serve one draw-off only and are either electrically or gas-heated. In essence:

- the flow rate is limited and is dependent on the heater's hot waterpower rating
- where restricted rates of delivery are acceptable, the heater can deliver continuous hot water without requiring time to reheat
- they are susceptible to scale formation in hard water areas where they will probably require frequent maintenance
- this form of hot water heating should only be considered for smaller premises or where it is not economically viable to run hot water distribution to a remote outlet
- they should be monitored to ensure they operate above 55°C (see Table 9.1)

Pressure and expansion vessels

9.44. Pressure and expansion vessels should be subject to routine inspection and maintenance as recommended by the manufacturer. Where practicable, these should be flushed through with wholesome water and purged to drain. If replaceable, bladders or diaphragms should be changed according to the manufacturer's guidelines or as indicated by the risk assessment. The Health and Safety Executive (HSE) state that Vessels with a 'flow through' design should provide less opportunity for water to stagnate and become contaminated.

9.45. To minimise the risk of microbial growth, expansion vessels should be installed:

- in cool areas on cold flowing pipes
- mounted as close to the incoming water supply as possible
- mounted vertically on pipework to minimise any trapping of debris
- with an isolation and drain valve to aid flushing and sampling
- to minimise the volume retained within them
- designed to stimulate flow within the vessel

9.46. In existing installations where pressure vessels are not flow through design then an “Anti-Legionella” valve could be retrofitted. These “Anti Legionella” valves are advertised as being able to convert standard single connection expansion vessels into a 'flow through' type by separating the inlet and outlet water supplies, so that the water content of the vessels is continually renewed. A documented risk assessment should be produced to appraise the potential options and determine which course of action should be taken.

Safe hot water delivery devices

9.47. Thermostatic mixing devices should only be installed where a risk assessment indicates their need.

9.48. It is essential to check the temperature settings and operation of water mixing devices regularly (see manufacturers’ instructions and Chapter 11 in Health Technical Memorandum (HTM) 04-01: supplement - ‘Performance specification D 08: thermostatic mixing valves (healthcare premises)’). Other maintenance, where required, should be strictly in accordance with the manufacturer’s instructions. Local water quality will influence the maintenance frequency for any installation.

9.49. All pipework supplying existing thermostatic mixing taps (TMTs) should be inspected to ensure that there is no preceding thermostatic mixing valve (TMV) supplying water to the hot port of the tap.

Note 24:

- In existing installations, it may be necessary to install inline strainers.
- When bathing, or assisting patients, healthcare staff must always check the water temperature with a thermometer.

Showers and Spray Heads

9.50. Disinfection of showerheads and angle- valve strainers has only a short-lived effect on microbial colonisation and growth. Manual cleaning to remove scale and other deposits or replacement of disposable showers should be carried out as based on the risk assessment. Traditionally this has been a quarterly task, but the water quality and evidence base will influence the risk assessor’s decision of the actual frequency implemented. Regular flushing of showers reduces microbial growth, but counts can significantly increase if regular flushing should cease. The most effective management of showers will be achieved by the removal of unnecessary ones and the regular use of others. Where showers are removed, it is important to cut back and remove all associated pipework.

9.51. It is important to note the distinction between self-purging and self-draining showers.

- self-purging showers can be an effective Legionella control procedure, while self-draining showers can support the proliferation of Legionella. Self-purging will release water direct to drain, via a dedicated drain, when the shower flow control is switched to on
- self-draining will release the water when the shower flow control is switched to off (with the blended waterpipe section of pipe then laying empty)

Note 25: Adjustable showerheads (variable spray type) are not recommended in healthcare facilities. See SHTM 04-01 Part A.

Point-of-use filtration

9.52. Point-of-use (POU) filtration should be considered and agreed by the WSG only as an interim safeguard where control measures have been ineffective, prior to and during engineering remedial works or plumbing refurbishments and maintenance works, and where additional protection is required for vulnerable patients. Continuous long-term use of POU filters is not recommended, except where there is no effective alternative. The WSG should review their use and ensure an action plan is created and enacted to make certain they are changed at the intervals specified by the manufacturer.

9.53. The use of filtered water using a sterilising-grade POU filter has been shown to reduce the incidence of Nontuberculous mycobacteria (NTM) infections. Where outlets are considered to be safe for these patients (for example, when progressing through their recovery pathway), these outlets should be removable for effective disinfection and be fitted with sterilising-grade POU filters (see POU filters).

9.54. Where POU filters are installed as a temporary measure while appropriate remedial work is carried out, they should be changed in accordance with the manufacturers' recommendations, (such as 1 to 3 months). Once removed for whatever reason, a replacement filter should be fitted. Suitable retaining clips, or similar, should be installed to prevent unauthorised removal of the POU filter. When changing filters, it is recommended that sampling of water quality takes place at outlets identified as sentinel points before refitting a replacement filter. It is essential to ensure that - where filters are to be used - they are constructed of the appropriate materials (see SHTM 04-01 Part A).

9.55. Where POU filters are to be used, the backflow protection requirements need to be maintained in accordance with the Water Supply (Water Fittings) (Scotland) Byelaws 2014. This may require additional backflow protection or modification of the system. In addition, sufficient activity space should be maintained to enable the outlet to be used without contaminating the filter.

9.56. Where filters are in place, follow manufacturers' instructions for cleaning, or they should be wiped clean as part of the basin/sink cleaning protocol as agreed by the WSG.

9.57. Where POU filters are no longer required, the outlet connection should be flushed, cleaned, and disinfected to remove any accumulated biofilm.

Removal of redundant pipework and services

9.58. In existing systems or during refurbishments, water systems should be inspected to identify redundant pipework (often referred to as blind ends) or services. In such cases, pipework should be cut back to the connection point including replacing the branch T with a straight coupling to ensure all redundant pipework is removed and to eliminate any opportunity for stagnation to occur.

Cleaning and disinfection

9.59. At some stage during the occupancy and use of a building, it is possible that the hot and cold-water systems could become contaminated with waterborne pathogens. Should this be the case, the WSG may wish to consider cleaning and disinfection of part of, or the entire system. Advice may be found in HSG274 Part 2, SHTM 04-01 Part D and BSI's PD855468. See also SHTM 04-01 Part A for guidance on the impact of treated water on materials and components.

Note 26: Whenever disinfection is planned, liaison with specialist departments (such as renal units and neonatal units) should take place.

Summary checklist for hot and cold system water systems

9.60. A summary checklist for hot and cold water systems is shown on the following pages (adapted from HSG274 Part 2), this should include those installed within Mobile Facilities. For every operation that is undertaken, a method statement needs to be prepared and followed to ensure the stages are completed safely and effectively.

9.61. In Table 9.1 the suggested minimum frequencies of inspecting and monitoring the hot and cold water systems will depend on their complexity and the susceptibility of those likely to use the water and are for guidance only. The risk assessment should define the frequency of inspection and monitoring depending on the type of use and user and particularly where there are adjustments made by the assessor to take account of local needs. The water quality and evidence base will influence the risk assessor's decision. The table is not an exhaustive list and the types and frequency of testing of other pieces of equipment will be determined based on the risks identified and the control measures that can be applied.

HSG 274 Part 3 contains examples of other systems that may be installed and some of the pre-planned maintenance that should be undertaken. The WSG should assess the appropriateness of the proposed pre-planned maintenance regime for all assets installed on their water systems.

Table 9.1 - Checklist for hot and cold-water systems (adapted from HSG274 Part 2)

Service	Action to take	Frequency
Calorifiers	Inspect calorifier internally by removing the inspection hatch or using a borescope, and clean by draining the vessel. The frequency of inspection and cleaning should be subject to the findings and be increased or decreased based on conditions recorded.	Annually, or as indicated by the rate of fouling.
Calorifiers	Where there is no inspection hatch, purge any debris in the base of the calorifier to a suitable drain. Collect the initial flush from the base of hot water heaters to inspect clarity, quantity of debris and temperature.	Annually, but may be more frequent as indicated by the Risk assessment or result of inspection findings.
Calorifiers	Check calorifier flow temperatures (thermostat settings should modulate as close to 60°C as practicable without going below 60°C). Check calorifier return temperatures (not below 50°C).	Monthly
Hot water services	For non-circulating systems: take temperatures at sentinel points (nearest outlet, furthest outlet, and long branches to outlets) to confirm they are at a minimum of 55°C within one minute.	Monthly
Hot water services	For circulating systems: take temperatures at return legs of principal loops (sentinel points) to confirm they are at a minimum of 55°C. Temperature measurements may be taken on the surface of metallic pipework.	Monthly

Service	Action to take	Frequency
Hot water services	For circulating systems: take temperatures at return legs of subordinate loops; temperature measurements can be taken on the surface of pipes, but where this is not practicable, the temperature of water from the last outlet on each loop may be measured, and this should be greater than 55°C within one minute of running. If the temperature rise is slow, it should be confirmed that the outlet is on a long leg and not that the flow and return has failed in that local area.	Quarterly (ideally on a rolling monthly rota).
Hot water services	All HWS systems: take temperatures at a representative selection of other points (intermediate outlets of single pipe systems and tertiary loops in circulating systems) to confirm they are at a minimum of 55°C to create a temperature profile of the whole system.	Representative selection of other outlets (ideally on a rolling monthly rota) to ensure all outlets are tested annually.
POU water heaters (no greater than 15 litres)	Check water temperatures to confirm the heater operates at 55°C, or check the installation has a high turnover.	Monthly-six monthly as indicated by the risk assessment.
Combination water heaters	Inspect the integral cold water header tanks as part of the cold-water storage tank inspection regime; carry out remedial work and clean, descale and disinfect as necessary. If evidence shows that the unit regularly overflows hot water into the integral cold water header tank, instigate a temperature-monitoring regime to determine the frequency, and take precautionary measures as determined by the findings of this monitoring regime.	Annually
Combination water heaters	Check water temperatures at an outlet to confirm the heater operates at 55°C.	Monthly

Service	Action to take	Frequency
Cold water storage cisterns	Inspect cold water storage cisterns and carry out remedial work and clean, descale and disinfect as necessary. Where cisterns contain filtered water, a review of the condition of glass traps and High Efficiency Particulate Absorbing filter (HEPA) filters should be included in the inspection.	Annually
Cold water storage cisterns	Check the cistern's water temperature remote from the ball valve and the incoming mains temperature. Record the maximum temperatures of the stored and supply water recorded by fixed maximum/ minimum thermometers where fitted.	6 monthly (summer and winter) or as indicated by the temperature profiling.
Cold water services	Check temperatures at sentinel taps (typically those nearest to and furthest from the cold cistern and mains but will also include other key locations on long branches to zones or floor levels). These outlets should be below 20°C within two minutes of running the cold tap/ mixer tap. To identify any local heat gain, which might not be apparent after one minute, observe the thermometer reading during flushing.	Monthly
Cold water services	Take temperatures at a representative selection of other points to confirm they are below 20°C to create a temperature profile of the whole system. Peak temperatures or any temperatures that are slow to fall should be an indicator of a localised problem.	Representative selection of other outlets (ideally on a rolling monthly rota) to ensure all outlets are tested annually.
Cold water services	Check thermal insulation to ensure it is intact and consider weatherproofing where components are exposed to the outdoor environment.	Annually

Service	Action to take	Frequency
Cold water services	Undertake an assessment of the actual turnover time of the tank under normal operation. Where it is noted that too much water is being stored, steps should be taken to improve turnover by reducing the stored volume or by removing the tank entirely.	Annually
Showers and spray taps	Dismantle, clean, descale and disinfect removable parts, heads, inserts and hoses (where fitted), or replace as per healthcare organisations policy.	Quarterly or as indicated by the rate of fouling or other risk factors, such as areas with high-risk patients.
POU filters	Record the service start date and lifespan or end date and replace filters as recommended by the manufacturer (bacterial- retention filters should be used primarily as a temporary control measure while a permanent solution is developed, although long-term use of such filters may be needed in some healthcare applications). Flow rates should be monitored as reductions may indicate significant fouling before the planned replacement date has been reached.	According to manufacturer's guidelines.
Base exchange softeners	Visually check the salt levels and top up salt, if required. Undertake a hardness check to confirm operation of the softener.	Weekly, but depends on the size of the vessel and the rate of salt consumption.
Base exchange softeners	Service and disinfect.	Annually, or according to manufacturer's guidelines.

Service	Action to take	Frequency
Multiple-use filters	Backwash and regenerate as specified by the manufacturer.	According to manufacturer's guidelines or as indicated by the risk assessment/ WSG, it may be necessary to use disinfection tablets in the backflush water to prevent biofilm build up.
Infrequently used outlets	Consideration should be given to removing infrequently used showers, taps and any associated equipment that uses water. If removed, any redundant supply pipework should be cut back as far as possible to a common supply (for example to the recirculating pipework or the pipework supplying a more frequently used upstream fitting) but preferably by removing the feeding 'T'. Infrequently used equipment within a water system (such as not used for a period equal to or greater than three days) should be included on the flushing regime. Flush the outlets until the temperature at the outlet stabilises and is comparable to supply water and purge to drain, sustain and log this procedure once started.	Twice weekly, or as indicated by the risk assessment/ WSG.
TMVs/ TMTs	Inspect, clean, descale and disinfect any strainers or filters associated with TMVs/ TMTs and carry-out "in service testing as per HTM 04-01 D08 including a "fail safe" test.	6 monthly or on a frequency defined by the risk assessment, WSG or taking account of any manufacturer's recommendations

Service	Action to take	Frequency
Inline strainers	Inspect, clean, descale and disinfect any strainers not associated with TMVs/ TMTs.	Annually or on a frequency defined by the risk assessment, taking account of any manufacturer's recommendations.
Pressurisation and expansion vessels	Where practical, flush through and purge to drain.	Where these are non-flow through treat as an infrequently used outlet.
Pressurisation and expansion vessels	Where removable, any bladders or diaphragms should be changed according to the manufacturer's guidelines.	As indicated by the risk assessment or WSG or taking account of any manufacturer's recommendations.
Biocidal treatment systems	Check the dosing and control system operation including alarms.	Daily after initial installation moving to weekly at a maximum.
Biocidal treatment systems	Measure the treatment parameters to establish the required values are being achieved at representative outlets including sentinel outlets.	Daily after initial installation moving to weekly at a maximum.
Biocidal treatment systems	Validation and calibration of the automatic monitoring system.	On a frequency defined by the risk assessment or taking account of any manufacturer's recommendations.

Service	Action to take	Frequency
Water Sampling	Collect planned water samples as per the Healthcare Organisations water sampling plan. The plan should be developed and agreed by the WSG based on the assets installed at each site and the patient risks.	As indicated by the risk assessment or WSG or taking account of any manufacturer's recommendations. Refer to SHTM 04-01 Part C for sampling guidance.

10. Other operational considerations

10.1. The Water Safety Group (WSG) needs to identify other waterborne hazards (the list below is not exhaustive but provides examples).

10.2. Waterborne pathogens including Legionella may colonise other areas where droplets of contaminated water of a size suitable for deep inhalation are generated. Such aerosol-generating plant and equipment should not be installed next to patient accommodation or air inlets. Some patients may be particularly susceptible to infection (see also Health and Safety Guidance (HSG) 274 Part 3).

Vending, chilled water and ice making machines

10.3. See Scottish Health Technical Memorandum (SHTM) 04-01 Part A for guidance on installation of this equipment.

10.4. Where equipment is hand-filled, there should be clear instructions on the water used; it should be hygienically collected and decanted into the equipment from a clean vessel.

10.5. Chilled water drinking fountains should only be installed with agreement by the WSG and appropriately risk assessed. These units normally include a reservoir to assist in the cooling cycle; if machines are turned off, water quality can deteriorate. Where carbon filters and/ or Ultraviolet (UV) are fitted, these should be maintained as per the manufacturer's instructions. Additional cleaning to ensure adequate hygiene of nozzles etc. should be put in place as recommended by the WSG. Maintenance records should be kept, and it may be easier for the management of servicing and maintenance of these units to be completed centrally by the estates and facilities team rather than by individual departments.

10.6. Ice machines should not be placed in augmented care units. For all areas, in the first instance, alternatives to ice should be sought. Where ice is needed for treatment purposes, it should be made using water obtained through a microbiological Point-of-use (POU) filter or boiled water in sterile ice bags.

Portable/ room humidifiers

10.7. Designs should not include the use of "portable" or "room" self-contained humidifiers (having a water supply that is sprayed/atomised into the room space). In clinical/patient areas the decision to use this type of humidifier should rest with the WSG and consideration should be given to the use of distilled water. See also Safety Notice NHSE SN (96)06 - 'Evaporative type cooling fan'.

Non-wholesome water storage

10.8. Non-wholesome water is sometimes stored for emergency use (for example for fire- fighting purposes). These systems should have an appropriate backflow prevention device in accordance with the Water Supply (Water Fittings) (Scotland) Byelaws 2014. They should be considered by the risk assessment and the WSG.

Deluge showers

10.9. Deluge showers (sometimes called emergency showers) are intended for use in an emergency where a staff member or a patient/ visitor has suffered external chemical contamination. Similarly, there may be other special outlets used for personal emergencies, for example eyebaths. These should not be installed on the end of lines. They should be dismantled, descaled, and disinfected regularly in accordance with the risk assessment, and should be flushed twice weekly.

Trolley wash procedures

10.10. High-pressure hoses will generate aerosols and have been associated with causing cases and outbreaks of Legionnaires' disease. The contamination of the aerosol can be reduced if the water supply is taken from a wholesome water system via a suitable air gap giving fluid category 5 protection - typically an air gap of Type AA or AB, which requires a break tank and booster pump to provide adequate pressure to the washing equipment. Procedures should be put in place to flush to drain before use, and to disinfect them if they have been out of use for a prolonged period.

Lawn sprinklers and garden (or similar) hoses

10.11. In certain conditions, lawn sprinklers may retain stagnant water in the pipework / hose supplying the sprinkler head; they may also produce an aerosol spray. The pipework may be installed underground or via a flexible hose over ground. In either case it is very unlikely that they can be completely drained down after use or when not required; at certain times in the year the retained water may be at temperatures suitable for the colonisation by, and multiplication of, Legionella and *Pseudomonas aeruginosa*. There is evidence linking cases of Legionnaires' disease with permanently installed systems that use underground supply plumbing. Irrigation systems and hoses for these purposes should be supplied via backflow prevention devices giving fluid category 5 protection - typically an air gap of Type AA or AB, which requires a break tank and booster pump to provide adequate pressure to the irrigation nozzle or hose outlet. A risk assessment should be undertaken prior to use to minimise the risk by implementing suitable control measures.

10.12. Hoses used for filling of remote equipment or mobile units should be of materials suitable for use with wholesome water systems and should be drained, capped between uses and kept in cool conditions. They should be disinfected (by immersing in hypochlorite) before use.

Vehicle-washing plant

10.13. Vehicle washing is carried out either using a hand-held pressure spray or by a frame wash that consists of a bay containing a rectangular pipework frame fitted with several high-pressure sprays. In the latter case, this equipment should be flushed regularly. Pressure washers and frame washers should be supplied via backflow prevention devices giving fluid category 5 protection – typically an air gap of Type AA or AB, which requires a break tank and booster pump to provide adequate pressure to the outlets. See the Water Management Society's 'Managing the risk of legionnaires' disease in vehicle-washing systems W046-5'.

10.14. Permanent hard-standing areas for vehicle-washing purposes should have an even surface to avoid ponding and have a slope or dish to a suitable drain.

Decorative internal water feature

10.15. Internal ornamental water features (for example a water cascade in the main entrance hall) are susceptible to airborne contamination and should not be installed.

External water features

10.16. Ornamental fountains have been implicated in cases of legionellosis. External water features should not be situated under trees where fallen leaves or bird droppings may contaminate the water. Exposure to high winds should be avoided as they can disperse spray beyond the immediate confines of the basin/ pond. The apex of the water column/jet should not exceed the distance to the nearest edge of the basin/pond for the same reason. An overflow/ outlet to a suitable drain should be provided for easy emptying and cleaning. Where possible, a permanently installed freshwater supply pipe with topping-up device should be provided. Their provision should be subject to a risk assessment and approval by the WSG, and appropriate action is required to minimise the risk. Any top-up supply from a wholesome water supply should be supplied via backflow prevention devices giving fluid category 5 protection – typically an air gap of Type AA or AB.

10.17. A documented risk assessment should be undertaken prior to use to minimise the risk by implementing suitable control measures.

Wet fire and automatic sprinkler systems

10.18. Wet fire protection systems have been implicated in outbreaks of legionellosis. All hose reels, sprinkler systems and wet risers should be isolated from the potable water supply by a method permitted by the Water Supply (Water Fittings) (Scotland) Byelaws 2014. Many fire authorities are not in favour of local firefighting, preferring early professional intervention. It may, therefore, be possible to remove hose reels, thus avoiding their hazards. (Any redundant pipework should be cut back to the connection point including replacing the branch 'T' with a straight coupling.)

10.19. Fire-fighting systems should be included within risk assessments. See FPA Technical Briefing Note - 'Legionella and firefighting systems' 2004 and RC63: Recommendations for minimising the impact of legionella in firefighting systems 2015 for further guidance.

Patient contact equipment (for example respiratory nebulisers, humidifiers)

10.20. Patient contact equipment (such as respiratory nebulisers and humidifiers) should be used, drained, cleaned, rinsed, and dried strictly in accordance with the manufacturer's recommendations and agreed by the WSG. They should always be allowed to dry thoroughly before use.

Heater cooler units used in cardiac surgery

10.21. Heater coolers units (HCUs) are used in cardiopulmonary bypass operations and for extracorporeal membrane oxygenation or extracorporeal life support, and their function is to regulate the temperature of the blood perfusing the patient using water in the HCU tanks to indirectly raise or lower the patient's body temperature. There have been a number of outbreaks and fatalities due to the presence of Mycobacterium chimaera in the HCUs that has resulted in endocarditis, surgical site infection and disseminated infection possibly via the aerosol route. HCUs should be operated and decontaminated according to the manufacturer's instructions, and their use should be subject to a documented risk assessment that should be approved by the WSG.

Flowers and plants

10.22. Consideration should be given to providing specific facilities for regularly disposing of wastewater and compost outside in-patient accommodation. This should not be provided in dirty utilities.

Buried pipelines

10.23. Pipelines made of plastics are susceptible to ingress of hydrocarbons such as fuels and oils. These chemicals can permeate through plastic pipes if they are nearby and contaminate the water supply, and it may take days, weeks or even months before a noticeable taste can be detected in the water supply. Whenever spills are reported, an assessment of services within the area should be undertaken.

10.24. Where there is a risk of hydrocarbon contamination of the supply, barrier pipe can be used instead. This is a double-layer plastic pipe with a barrier layer (usually aluminium) in between.

Other risk systems

10.25. Further guidance on other risk systems is given in Appendix 3.1 of HSG274 Part 3.

Abbreviations

ACOP: Approved Code of Practice

AE: Authorising Engineer

AP: Authorised Person

ARHAI: Antimicrobial Resistance and Healthcare Associated Infection

BMS: Building Management System

BS: British Standard

BSRIA: Building Services Research and Information Association

CCDC: Consultant in Communicable Disease Control

CEO: Chief Executive Officer

COSHH: Control of Substances Hazardous to Health [Regulations]

CP: Competent Person

CPD: Continued Professional Development

CPWSP: Construction Stage Water Safety Plan

CWHB: Clinical Wash-hand Basins

Defra: Department for Environment, Food and Rural Affairs

DL: Director Letter

DRP: Deputy Responsible Person

DWQR: Drinking Water Quality Regulator

ECDC: European Centre for Disease Prevention and Control

EPDM: Ethylene propylene diene monomer

EUSR: Energy and Utility Skills Register

HCU: Heater Cooler Units

HEPA: High Efficiency Particulate Absorbing filter

HBN: Health Building Note

HSE: Health & Safety Executive

HSG: Health and Safety Guidance

HTM: Health Technical Memorandum

HWS: Hot Water Services

IMT: Incident Management Team

IPC: Infection Prevention and Control

IPCT: Infection Prevention and Control Team

LCA: Legionella Control Association

NIPCM: National Infection Prevention and Control Manual

NPF: National Performance Framework

NSS: National Services Scotland

NTM: Nontuberculous Mycobacteria

NWSAG: National Water Services Advisory Group

PAMS: Property and Asset Management Strategy

PFI: Private Finance Initiative

POU: Point-of-use

PPE: Personal Protective Equipment

PPM: Pre Planned Maintenance

PPP: Public Private Partnership

PWSG: Project Water Safety Group

PWTAG: Pool Water Treatment Advisory Group

RAMS: Risk Assessment and Method Statement

RIDDOR: Reporting of Injuries, Diseases and Dangerous Occurrences Regulations

RP: Responsible Person

RPZ: Reduced Pressure Zone valve

SCART: Statutory Compliance Audit Risk Tool

SETAG: Scottish Engineering and Technology Advisory Group

SHFN: Scottish Health Facilities Note

SHPN: Scottish Health Planning Note

SHTM: Scottish Health Technical Memorandum

SOP:	Standard Operating Procedures
SSD:	Sterile Services Department
TMV:	Thermostatic Mixing Valve
TMT:	Thermostatic Mixing Tap
ToR:	Terms of Reference
TVC:	Total Viable Count
UKAS:	United Kingdom Accreditation Service
UV:	Ultraviolet
WHA:	Water Dispenser and Hydration Association
WHO:	World Health Organization
WRAS:	Water Regulations Advisory Scheme
WSG:	Water Safety Group
WSP:	Water Safety Plan

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