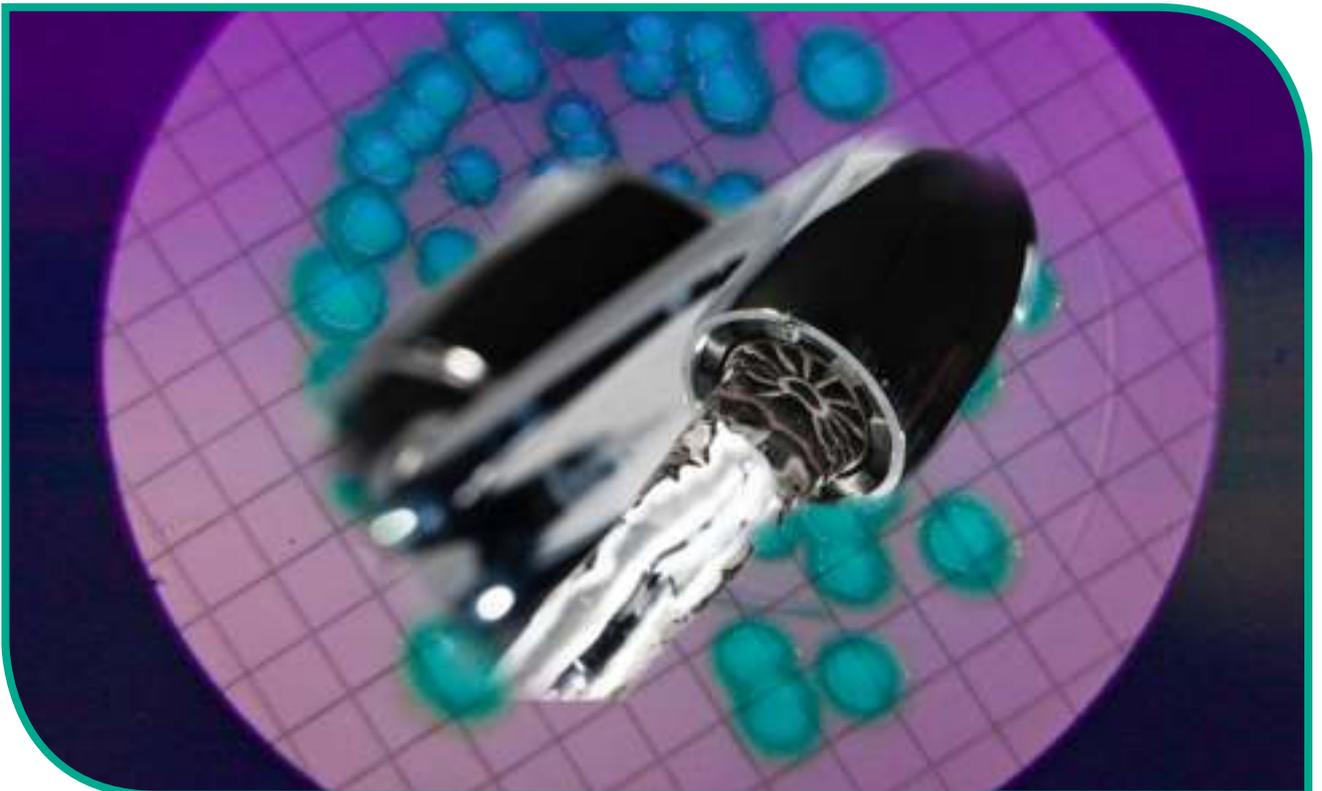




Department
of Health

Health Technical Memorandum 04-01: Safe water in healthcare premises

Part C: *Pseudomonas
aeruginosa* – advice for
augmented care units



Health Technical Memorandum
04-01: Safe water in healthcare
premises

Part C: *Pseudomonas
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Executive summary

Hospital water is a recognised potential source of *Pseudomonas aeruginosa* (hereafter '*P. aeruginosa*'), which is a microorganism that can act as an opportunistic pathogen and colonise and infect vulnerable patients. Several outbreaks of *P. aeruginosa* have been attributed to contaminated water systems in hospitals.

An addendum to Health Technical Memorandum (HTM) 04-01 published in 2013 advised on how to deal with the presence of *P. aeruginosa* in augmented care units.

HTM 04-01 Part C (2016) supersedes the 2013 addendum to HTM 04-01. The guidance is directed towards healthcare organisations providing patient care in augmented care settings, specifically aiming to inform estates and facilities departments and infection prevention and control (IPC) teams. As part of the 2016 revision of HTM 04-01, those sections of the addendum that introduced healthcare organisations to the concept of Water Safety Groups and Water Safety Plans are now a fundamental part of HTM 04-01 Parts A and B. The HSE has also incorporated WSGs and WSPs in its technical guidance HSG274 Part 2 (see the [References](#) section).

For the purposes of this document, the patient groups in augmented care settings include:

- a. those patients who are severely immunosuppressed because of disease or treatment: this will include transplant patients and similarly heavily-immunosuppressed patients during high-risk periods in their therapy;
- b. those cared for in units where organ support is necessary, for example critical care (adult paediatric and neonatal), renal, respiratory (may include cystic fibrosis units) and other intensive care situations;
- c. those patients who have extensive breaches in their dermal integrity and require contact with water as part of their continuing care, such as in those units caring for burns.

This document identifies methodologies to control and minimise the risks of morbidity and mortality due to *P. aeruginosa* associated with water outlets. It provides guidance on:

- considerations for water outlets and hot and cold water services in augmented care settings;
- protecting augmented care patients and ensuring a safe environment;
- methods of cleaning wash-hand basins and other good hygiene practices to minimise the risk of *P. aeruginosa* contamination.

Glossary and abbreviations

Alert organisms: Alert organisms are microorganisms that have the potential to cause harm and disease in individuals and which can cause an outbreak of infection in a hospital environment. An alert organism is identified by the microbiology laboratory and referred to the infection prevention and control (IPC) team for assessment of possible healthcare-associated acquisition and to identify any possible environmental/equipment sources.

Augmented care units/settings: There is no fixed definition of “augmented care”; individual providers may wish to designate a particular service as one where water quality must be of a higher microbiological standard than that provided by the supplier. While this document provides broad guidance, the water quality required will be dependent on both the type of patient and its intended use. Most care that is designated as augmented will be that where medical/nursing procedures render the patients susceptible to invasive disease from environmental and opportunistic pathogens such as *Pseudomonas aeruginosa* and other alert organisms. In broad terms, these patient groups will include:

- a. those patients who are severely immunosuppressed because of disease or treatment: this will include transplant patients and similar heavily immunosuppressed patients during high-risk periods in their therapy;
- b. those cared for in units where organ support is necessary, for example critical care (adult paediatric and neonatal), renal, respiratory (may include cystic fibrosis units) or other intensive care situations;
- c. those patients who have extensive breaches in their dermal integrity and require contact with water as part of their continuing care, such as in those units caring for burns.

Biofilm: A biofilm is a complex layer of microorganisms that have attached and grown on a surface. This form of growth provides a niche environment for a wide range of microorganisms to interact and where the secretion of exopolysaccharides by bacteria will form an extracellular matrix for both bacteria and other unicellular organisms such as amoebae and flagellates to remain in a protected state.

Dead-leg: A length of water system pipework leading to a fitting through which water only passes infrequently when there is draw off from the fitting, providing the potential for stagnation.

Flow straightener: A device inserted into the spout outlet of a tap to modify flow, take out turbulence and create an even stream of water.

Point-of-use filter: A filter with a maximal pore size of 0.2 µm applied at the outlet, which removes bacteria from the water flow.

Water outlet: (In this document) refers mainly to taps and showerheads, but other outlets, as indicated by risk assessments, may be considered important.

Water Safety Group (WSG): A multidisciplinary group formed to undertake the commissioning and development of the water safety plan (WSP). It also advises on the remedial action required when water systems or outlets are found to be contaminated and the risk to susceptible patients is increased.

Water safety plan (WSP): A risk-management approach to the safety of water that establishes good practices in local water distribution and supply. It will identify potential hazards, consider practical aspects, and detail appropriate control measures.

Water supply [to the hospital]: The water supplied can be via:

- the mains water supply from the local water undertaker (water company);
- a borehole;
- a combination of mains water and borehole supply;
- emergency water provision (bulk tankered water or bottled drinking water).

List of abbreviations

IPC: infection prevention and control

POU: point-of-use

TMV: thermostatic mixing valve

WSG: Water Safety Group

WSP: water safety plan

1.0 Introduction

1.1 Part C of HTM 04-01 (2016) focuses on specific additional measures that should be taken to control and minimise the risk of *P. aeruginosa*. It is aimed at those involved with patient safety and specifically aims to inform and advise healthcare estates and facilities and infection prevention and control (IPC) teams. Although its main focus is control of *P. aeruginosa*, the document may also have relevance to other waterborne pathogens such as *Stenotrophomonas maltophilia*, *Burkholderia cepacia* and atypical *mycobacteria*.

1.2 Part C should be read in conjunction with HTM 04-01 Parts A and B and HTM 04-01: Supplement – ‘Performance specification D 08: thermostatic mixing valves (healthcare premises)’ as the recommendations given in these documents for the control of *Legionella*, scalding risks, the testing of thermostatic mixing valves etc are also relevant.

1.3 Additional general requirements for the quality assurance of water systems including those within healthcare facilities should be followed (see the Health & Safety Executive’s Approved Code of Practice and guidance on regulations ‘Legionnaires’ disease: The control of *Legionella* bacteria in water systems (L8)’ and the NHS Premises Assurance Model).

An overview of *P. aeruginosa* is given in Chapter 5 of HTM 04-01 Part B. Guidance on:

- testing for *P. aeruginosa* is given in Appendix D of HTM 04-01 Part B.
- sampling for *P. aeruginosa* is given in Appendix E of HTM 04-01 Part B.
- the microbiological examination of *P. aeruginosa* test samples is given in Appendix F of HTM 04-01 Part B.

2.0 Hot and cold water services: overview

For comprehensive guidance on the design and installation of hot and cold water services, see HTM 04-01 Part A.

2.1 With the change in focus towards improving the patient environment and minimising the risk of healthcare-associated infections, there has been an increase in the provision of single-bed rooms with en-suite facilities. Additionally, to promote good hand hygiene, wash-hand basin provision has increased significantly in all clinical areas. However, in many situations this has led to infrequently used water outlets and low water throughput. Such outlets form a greater risk of contamination by *P. aeruginosa* than those that are used more frequently.

2.2 Water services have become more complex. Every effort should be made when planning, designing and installing new or modified systems to minimise and remove potential hazards (for example oversized water storage tanks, flexible hoses, stagnant water, poor temperature control, long branch pipes and dead-legs), as well as enabling access for monitoring and maintenance. Adapting existing systems to improve safety is almost always the more expensive solution.

2.3 In new and existing premises, therefore, it is essential that the needs of individual patient washing and bathing requirements are carefully considered. In new premises, the provision, correct siting and installation of showers and wash-hand basins, particularly

in accommodation where patients are unlikely to make use of them, requires assessment. For existing premises, and subject to a risk assessment, permanent removal of existing outlets and their associated pipework should be considered.

2.4 Tap design has evolved. In older installations, thermostatic control of water temperature was achieved by a separate thermostatic mixing valve (TMV) (commonly called a t-shaped TMV), typically located behind the sanitary assembly panel to which a wash-hand basin or other assembly was fitted, which then supplied water to the hot connection of a manual mixing tap or separate tap. Many new installations now include taps of a modern design with integral TMVs. They are usually manually controlled (on and off) and can be adjusted to further reduce outlet temperature to fully cold. For some applications, remote sensor-operated taps are available (many sensor taps also have the option of auto-flushing programmes and can be linked to the hospital's building management system). In some instances these developments have led to a more complicated internal tap design which may increase the need for additional routine maintenance (including decontamination) to mitigate the risk of contamination by *P. aeruginosa*.

2.5 There is some evidence that the more complex the design of the outlet assembly (for example, some sensor-operated taps), the more prone to *P. aeruginosa* colonisation the outlet may be (see Berthelot et al., 2006).

2.6 The choice and type of water outlets for the augmented care setting is therefore important (see also Table 2 in HTM 04-01 Part A). This choice should be based on a risk assessment of infection-control and scalding issues.

2.7 In intensive care and other critical care areas, where patients are unlikely to be able to use the wash-hand basins, the installation of non-TMV mixing taps may be the preferred control option following a risk assessment.

Note:

For clinical wash-hand basins, Health Building Note 00-10 Part C – ‘Sanitary assemblies’ (formerly Health Technical Memorandum 64) recommends integral thermostatically controlled water using either a single-lever tap or a sensor tap for most applications and settings. If risk assessment justifies a different tap assembly for clinical wash-hand basins in augmented care settings, then derogation from Health Building Note 00-10 Part C may be considered so long as it is approved by the Water Safety Group (WSG).

2.8 In accordance with Health Technical Memorandum 04-01 Part A, TMVs should be fitted where risk assessment has shown vulnerable patients are at risk of scalding. This should be considered when planning/ designing new builds or refurbishments. A TMV that is integral to the body of the tap/shower is preferred, as it is designed to always draw cold water through every time the outlet is used, thus helping to minimise the risk of stagnation (see also Table 2 in HTM 04-01 Part A).

Note:

Scalding risk assessments should form part of the water safety plan (WSP) before any decision is made on the method of scalding risk control (see also paragraphs 6.16–6.26 in HTM 04-01 Part B).

2.9 Owing to their high surface-area-to-volume ratio and location at the tap outlet, certain designs of flow straightener may present a greater surface area for colonisation and support the growth of organisms. Therefore, when selecting new taps, where possible flow straighteners should be avoided/ not included. Health Building Note 00-09 also advises against using aerators in outlets.

2.10 Sensors should be offset or positioned such as to reduce the risk of accidental contamination of the outlet and be positioned so that point-of-use (POU) filters can be used. Facilities for overriding the sensors will be necessary.

2.11 If retro-fitting new taps, it is important to ensure that they are easy to use and practical for the existing space.

2.12 Taps, components and fittings should be removable and easily dismantled for cleaning and disinfection. When replacing taps, also consider fitting:

- taps that are easy to use;
- taps to which a filter can be attached to the spout outlet. Note: Such taps can be used for supplying water for cleaning incubators and other clinical equipment.

3.0 Protecting augmented care patients

3.1 Management should ensure that all staff with responsibility for cleaning should be adequately trained and made aware of the importance of high standards of cleanliness (see also paragraphs 1.21–1.29 in HTM 04-01 Part A and paragraphs 6.29–6.30 in HTM 04-01 Part B). Refresher training should be given where a specific area does not maintain the expected standard of cleanliness. Visual monitoring of domestic staff should be undertaken by means of regular audits. The following paragraphs give examples of best practice advice aimed at protecting the susceptible patient and ensuring a safe environment:

- a. For direct contact with augmented care patients, water of a known satisfactory quality should be used, that is, either:
 - i. water where testing has shown absence of *P. aeruginosa*; or
 - ii. water supplied through a POU filter; or
 - iii. sterile water (for example, for skin contact for babies in neonatal intensive care units).
- b. Water outlets should be reviewed where there may be direct or non-direct contact with augmented care patients. This may also include reviewing the need for the outlets/showers and their potential removal.
- c. Use of single-use cleaning wipes should be considered for patient hygiene.
- d. Rigorous reinforcement of standard infection control practices should be implemented. This includes regular refresher training for relevant staff.
- e. The cleaning of clinical wash-hand basins and the taps should be undertaken in a way that does not allow cross-contamination from a bacterial source to the tap (see [paragraph 3.2](#)).
- f. The cleaning of patient contact equipment (for example, tap handles, incubators, humidifiers, nebulisers and respiratory equipment) should be reviewed. Options to minimise risk include the following measures:
 - i. use of single-use equipment;
 - ii. if locally reprocessed – even if used on the same patient – clean equipment with water of a known satisfactory quality (see (a) above);
 - iii. use of single-use detergent wipes for cleaning incubators. Manufacturers' instructions should be followed. If a disinfectant is used, it is important that it will not cause damage to the material of the incubator. Disinfectants should not be used to clean incubators while they are occupied.

- g. All other uses of water used in augmented care units should be considered and appropriate action/changes to operational procedures taken. Uses of water to be considered include:
 - i. drinking water fountains;
 - ii. bottled water dispensers;
 - iii. wet shaving of patients who have a central venous catheter inserted into the jugular vein;
 - iv. washing patients with in-dwelling devices.

Notes:

1. Tap water should not be used in neonatal units for the process of defrosting frozen breast milk.

2. Water features should not be installed in augmented care units.

3. Chilled water and ice-making machines should not be installed in augmented care units. Where ice is needed for treatment purposes, it should be made using water obtained through a microbiological POU filter or boiled water in sterile ice trays or ice bags.

- h. All patient equipment should be stored clean, dry and away from potential splashing with water.
- i. All preparation areas for aseptic procedures and drug preparation and any associated sterile equipment should not be located where they are at risk of splashing/contamination from water outlets.
- j. All taps that are used infrequently on augmented care units should be flushed regularly (at least daily in the morning for one minute). If the outlet is fitted with a POU filter, the filter should not be removed in order to flush the tap unless the manufacturer's instructions advise otherwise. A record should be kept of when they were flushed. Some taps can be programmed to flush automatically; such flushing may be recorded through the building management system (BMS).
- k. Thermostatic mixing valves (TMVs) and associated components should be serviced, including descaling and decontamination, at recommended intervals (see also Chapter 11 in HTM 04-01: Supplement – 'Performance specification D 08: thermostatic mixing valves (healthcare premises)').
- l. A TMV that is integral to the body of the tap/shower should be considered, as it will always draw cold water through every time the outlet is used, thus helping to minimise the risk of stagnation.
- m. Where taps are designed to be easily removed for maintenance purposes, they should be periodically removed for descaling and decontamination and/or placed in a washer-disinfector (subject to the tap manufacturer's instructions).
- n. It should be ensured that:
 - i. accurate records and drawings cover all the hot and cold water systems and that they are updated following any modification;
 - ii. all services are properly labelled, such that the individual services can be easily identified;
 - iii. staff who are engaged in the installation, removal and replacement of outlets and associated pipework and fittings are suitably trained to prevent contamination of the outlet and water system.

3.2 Clinical wash-hand basins are at particularly high-risk of contamination. It is therefore important to ensure the cleaning of these basins and the taps is undertaken in a way that does not allow cross-contamination from a bacterial source to the tap. In particular:

- a. During cleaning of basins and taps, there is a risk of contaminating tap outlets with microorganisms if the same cloth is used to clean the bowl of the basin or surrounding area before the tap.
- b. Waste-water drain outlets are particularly risky parts of the basin/system and are almost always contaminated (see Peleg and Hooper, 2010; Breathnach et al., 2012). Bacteria may be of patient origin, so it is possible that bacteria, including antibiotic-resistant organisms, could seed the outlet, become resident in any biofilm and have the potential to be transmitted to other patients.
- c. If POU filters are fitted to taps, the same cleaning regime applies to the wash-hand basin, but the filter itself should be cleaned according to the manufacturer's instructions. Care should be taken to avoid contaminating the external surface and outlet of the filter.

Best practice advice relating to all clinical wash-hand basins in healthcare facilities

3.3 Clinical wash-hand basins should be used solely for hand-washing. In particular, the following dos and don'ts should be noted:

- a. Do not dispose of body fluids at the clinical wash-hand basin. Use the slop hopper or sluice in the dirty utility area to dispose of body fluids.
- b. Do not wash any patient equipment in clinical wash-hand basins.

- c. Do not use clinical wash-hand basins for storing used equipment awaiting decontamination.
- d. Do not touch the spout outlet when washing hands.
- e. Taps should be cleaned before the rest of the clinical wash-hand basin. Care should be taken to avoid transferring contamination from wash-hand basin to wash-hand basin.
- f. Do not dispose of used environmental cleaning agents at clinical wash-hand basins.
- g. Make sure that reusable containers containing environmental cleaning agents are used in a manner that will protect them from contamination with *P. aeruginosa* (see Aumeran et al., 2007; Ehrenkranz et al., 1980; Sautter et al., 1984).
- h. Use non-fillable single-use bottles for antimicrobial hand-rub and soap.
- i. Consider the appropriate positioning of soap and antimicrobial hand-rub dispensers. The compounds in the products can be a source of nutrients to some microorganisms. Therefore, it is advisable to prevent soiling of the tap by drips from the dispensers or during the movement of hands from the dispensers to the basin when beginning hand-washing.
- j. Identify and report any problems or concerns relating to safety, maintenance and cleanliness of wash-hand basins to the WSG. Escalate unresolved issues to higher management and/or the IPC as appropriate.

Appendix A Example of a typical risk assessment to inform the WSP for augmented care units

Healthcare providers will assess risks identified for their units providing augmented care. The exemplar risk assessment form below is included for illustrative purposes.

Facility/ward/department: _____ Assessment completed by: _____

Date: _____ (Names/titles): _____

Brief description of activity, location or equipment: to determine the level of risk that *Pseudomonas aeruginosa* from the water use/supply poses to the patients in the unit

Description of the hazards	Persons affected by the work activity and how	Existing controls	Likelihood	Impact	Risk rating
<p>Infection/colonisation with <i>Pseudomonas aeruginosa</i> from contaminated water</p>	<p>Susceptible patients within augmented care units</p> <div data-bbox="555 949 875 1342" style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p>Note to reader: This is an example risk assessment. The control measures outlined are not exhaustive but are for illustrative purposes only. Each healthcare provider will have its own risks and will need to carry out a risk assessment based on these risks (see paragraphs 6.23–6.26 in HTM 04-01 Part B for examples of other risks and further guidance).</p> </div>	<p>USE OF WATER: For direct contact with patients, water of a known satisfactory quality is used:</p> <ul style="list-style-type: none"> • water where testing has shown absence of <i>P. aeruginosa</i>; or • water supplied through a point-of-use (POU) filter; or • sterile water (for skin contact for babies in neonatal intensive care units). <p>ENGINEERING ASSESSMENT OF WATER SYSTEMS:</p> <ul style="list-style-type: none"> • Correct installation and commissioning of water systems in in line with HTM 04-01 is adhered to • Schematic drawings are available for water systems. <p>FLUSHING:</p> <ul style="list-style-type: none"> • Flushing of water outlets is carried out and documented. <p>SAMPLING:</p> <ul style="list-style-type: none"> • Plans for the sampling and microbiological testing of water are in place 			<p>(See risk scoring matrix on next page)</p>

Risk scoring matrix

Risk scoring: Use the grid below to achieve an overall score for the risk by measuring across for the impact and down for the likelihood.						
		IMPACT				
		1	2	3	4	5
L I K E L I H O O D	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25
Key		Green Low		Amber Medium		Red High

The resulting **action plan** should include:

- Sources of information/persons consulted
- Further action if necessary to control the risk
- Person/s responsible for coordinating implementation of the action.
- Recommended timescales
- Date completed
- Revised risk rating

Appendix B Exemplar *P. aeruginosa* sample sheet

Hospital/site: St Lukes		Time sample taken: 07.00				
Building: East Wing		Date: 20 February 2016				
Faculty/department/ward: 12		Name of sampler (print): J. JONES				
Bacterial species: <i>P. aeruginosa</i>						
Note: The tap should not be cleaned or disinfected by heat or chemicals immediately before sampling						
Room No.	Room name	Outlet type	Outlet ID No.	Pre-flush sample	Post-flush sample	Sample's barcode (affix adjacent to sample details)
101	Neonatal ICU:					
	<input type="checkbox"/> WHB	<input type="checkbox"/> Mixer	<input type="checkbox"/> 001	Yes		
	<input type="checkbox"/> WHB	<input type="checkbox"/> Mixer	<input type="checkbox"/> 002	Yes	Yes	
102	Neonatal ICU clean utility:					
	<input type="checkbox"/> WHB	<input type="checkbox"/> Mixer	<input type="checkbox"/> 003	Yes		
	<input type="checkbox"/> Sink	<input type="checkbox"/> H/C lever-op	<input type="checkbox"/> 004	Yes		
Notes						
Refer to Appendix E in HTM 04-01 Part B (2016 edition) for detailed advice on obtaining samples correctly						

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