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BSI Standards Publication

Water quality

Part 2: Risk assessments for *Pseudomonas aeruginosa* and other waterborne pathogens — Code of practice

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Contents

	Page
Foreword	iv
0 Introduction	1
0.1 General	1
0.2 Healthcare settings	2
0.3 Non-healthcare premises	2
1 Scope	3
2 Normative references	3
3 Terms and definitions	4
Section 1: General – risk assessment for all premises	10
4 General	10
5 Hazards and hazardous events for all premises	11
5.1 General	11
5.2 Health care	11
6 Preparations for risk assessment for all premises	11
6.1 Competence of the risk assessment team	11
6.2 Independence	12
7 Pre-assessment actions for all premises	12
7.1 General	12
7.2 Pre-communication	12
7.3 Appraisal of the WSP, supporting documentation and gap analysis	13
8 Site survey for all premises	17
8.1 General	17
8.2 Measurements	18
8.3 Risk assessment and rating systems	18
<i>Figure 1 — Example formats for risk scoring purposes</i>	21
9 Risk assessment for new projects and refurbishments for all premises	23
9.1 General	23
9.2 Competence and training for project risk assessments	25
10 Risk assessment reporting for all premises	25
10.1 General	25
10.2 Identified risks	25
10.3 Control measures	26
10.4 Report for all premises	27
11 Risk review and reassessment for all premises	27
11.1 General	27
11.2 Reviewing existing risk assessment report	28
Section 2: Healthcare	30
12 Pre-assessment actions for healthcare	31
12.1 General	31
12.2 Competence of assessors	32
12.3 Personal protective equipment (PPE)	33
12.4 Document review	33
13 Environmental and clinical surveillance	34
14 Site survey and additional factors to take into account over and above those in the <i>Legionella</i> risk assessment	37
14.1 General	37
14.2 Engineering control measures	37
<i>Figure 2 — Tap insert showing biofilm</i>	38

<i>Figure 3 — Debris on TMV protective strainer</i>	39
<i>Figure 4 — Example of poor design of washand basin</i>	40
<i>Figure 5 — Example of incorrectly fitted tap</i>	41
<i>Figure 6 — Example of poor siting of soap and towel dispensers</i>	42
<i>Figure 7 — Slime from an ultrasonic humidifier</i>	43
<i>Figure 8 — Scaled fountain</i>	43
14.3 Site survey	44
14.4 Risk assessment for infections from NTMs	45
14.5 Point of use (POU) filters	46
15 Risk assessment for new projects and refurbishments in healthcare	46
15.1 General	46
15.2 Assessments of new technology	47
16 Hydrotherapy pools	48
17 Drains as a source of waterborne infection	48
17.1 General	48
17.2 Amplification	48
17.3 Transmission	49
17.4 Clinical hygiene control measures	50
18 Risk reporting – healthcare specific measures	50
Section 3: Beauty, health spa and leisure premises with recreational water systems	52
19 Preparations for risk assessment	52
19.1 General	52
19.2 PA risk factors	52
<i>Figure 9 — An example of gross contamination of a pool deck level grille indicating unsatisfactory cleaning and maintenance</i>	53
19.3 Competence of assessors	53
20 Pre-assessment actions for leisure pools and associated equipment	54
21 Assessing risk	55
21.1 General	55
21.2 Site survey	56
21.3 NTM risk factors	56
22 Risk assessment for existing systems	56
22.1 General	56
22.2 Fish pedicures	58
23 Risk assessment of new projects which include pools	58
Section 4: Other premises and equipment	59
24 General	59
25 Process water risks	59
Annex A (informative) Waterborne microbial hazards and hazardous events in healthcare settings (see also BS 8680)	61
<i>Table A.1 — Waterborne microbial hazards within healthcare</i>	62
Annex B (informative) An example of risk assessment pre-survey preparation	67
<i>Table B.1 — Survey preparation</i>	68
Annex C (informative) Example of risk assessment for healthcare premises	70
Annex D (informative) Example of a risk assessment for an interactive water feature (IWF) within leisure premises	77
Bibliography	79

Summary of pages

This document comprises a front cover, an inside front cover, pages I to VI, pages 1 to 85, an inside back cover and a back cover.



Foreword

Publishing information

This part of [BS 8580](#) is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 January 2022. It was prepared by Subcommittee EH/3/4, *Microbiological methods*, under the authority of Technical Committee EH/3, *Water quality*. A list of organizations represented on these committees can be obtained on request to the committee manager.

Relationship with other publications

This standard is part of a series, [BS 8580](#), which includes the following parts:

[BS 8580-1](#), *Water quality – Risk assessments for Legionella control – Code of practice*

[BS 8580-2](#), *Water quality – Part 2: Risk assessments for Pseudomonas aeruginosa and other waterborne pathogens – Code of practice*

This British Standard is intended to be used in conjunction with [BS 8680](#).

Information about this document

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Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

This standard is intended for use in healthcare by Water Safety Groups (WSGs) including by, Authorising Engineer/Independent Advisers (see HTM 04-01 [1] and other relevant national health technical memoranda), Responsible Person(s), infection prevention and control professionals, microbiologists, contractors and service providers including, patient support services etc. It is also relevant to those providing specialist clinical services, for example, cardiology, dental, audiology, dialysis and aquatic therapy.

On non-healthcare sites, this British Standard is intended to be used by WSGs, Responsible Person(s) and all relevant advisors, contractors, service providers and suppliers.

Use of this document

As a code of practice, this British Standard takes the form of recommendations and guidance. It is not to be quoted as if it were a specification. Users are expected to ensure that claims of compliance are not misleading.

Users may substitute any of the recommendations in this British Standard with practices of equivalent or better outcome. Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

It has been assumed in the preparation of this part of [BS 8580](#) that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

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Contractual and legal considerations

In particular, attention is drawn to the following:

- WHO Guidelines for Drinking Water Quality [2];
- WHO Guidelines for safe recreational water environments [3];
- Health and Safety at Work etc. Act 1974 [4];
- Health and Social Care 2008 (Regulated Activities) Regulations 2014 [5].

0 Introduction

0.1 General

Pseudomonas aeruginosa (*PA*) is part of a large group of free-living bacteria that are ubiquitous in the environment including in natural water sources such as lakes and rivers. *PA* can survive and grow in constructed water systems and equipment in very low nutrient conditions including in deionized and distilled water [6], as well as in high nutrient environments such as sewage and the human gut. They can readily colonize water systems and associated equipment within buildings and develop significant biofilms close to and within outlets. Heavy biofilm growth of *PA* resulting in infections has been frequently associated with component parts such as aerators and flow straighteners within tap outlets.

PA can cause a range of infections from self-limiting skin infections in those using colonised swimming pools and hot tubs for example, to severe illness and death in highly susceptible patients in hospitals, particularly those with breaches in skin integrity, such as burns and intensive care patients, especially those who are immunocompromised [7].

Whilst many of the risk factors for *PA* growth and transmission are similar to those identified for *Legionella* (see BS 8580-1), there are many additional considerations which need to be taken into account when assessing risks from *PA*. These are covered within this British Standard.

Risk assessments for the microorganisms covered by this British Standard need to take into account not just the engineering factors which can lead to their growth and transmission (including those related to the design and engineering of water systems and associated equipment). They also need to include the way that water systems are used, the individual types of use, the susceptibility of users and those in the vicinity of the systems and equipment being used, as well as a range of other environmental factors and, where relevant, clinical factors. For this reason, a multidisciplinary risk assessment team approach is usually the most effective approach.

Risk assessments form the core of the development and implementation of a water safety plan (WSP) (see BS 8680) and need to be carried out in addition to the *Legionella* risk assessment where relevant (see BS 8580-1). *PA* risk assessments are particularly applicable in healthcare premises, including those providing primary care, nursing, and residential care, and especially in areas designated as augmented care and/or providing specialist services where there is exposure to water for treatment or diagnostic purposes. These include services such as audiology, cardiology, dental, aquatic therapy, decontamination departments and areas with specialist water containing equipment, for example, nebulizers.

Whilst risk assessments for *PA* need to be carried out routinely in healthcare and other settings where it is recognized there is a risk of *PA* infection, risk assessments for other waterborne opportunistic pathogens are usually only carried out when there is an identified risk for particular patient groups, e.g. from non-tuberculous mycobacteria (NTMs) in cystic fibrosis patients and/or where clinical and/or environmental surveillance indicates there is a need. Whilst this standard is primarily intended for assessment of the risk from *PA* infections, the risk assessment processes recommended can be also be applied to risk assessments for other waterborne opportunistic pathogens. These need to be adapted to take into account the relevant ecological niches, susceptibilities of those exposed and the clinical manifestations affecting the risk from individual hazard to be assessed.

This standard aims to assist both risk assessors and users, duty holders, owner/managers and WSG members to understand the microbial hazards (pathogens) associated with different systems, potential hazardous events and other factors which lead to their presence and to provide information and support to WSGs on how to prioritize actions and minimize the risks.

Use of this British Standard provides the information to aid the development of a holistic water safety plan (WSP). It is intended to be used with [BS 8680](#), which contains recommendations for the development of WSPs. This standard is also intended to be used in conjunction with completed and up to date *Legionella* risk assessments (see [BS 8580-1](#)).

0.2 Healthcare settings

PA is a major cause of hospital-acquired infections in augmented care patients; particularly in burns and cystic fibrosis (CF) patients and neonates. *PA* can cause infections in almost every part of the human anatomy where able to gain access, resulting in high levels of morbidity and mortality attributable to infection. Successful treatment is becoming increasingly difficult as *PA* is inherently resistant to many antimicrobial agents and can acquire antibiotic resistance genes, including for the production of carbapenamase [7], [8].

There are many potential routes of infection; *PA* can colonize human skin without causing infection but in healthcare settings, transmission of *PA* can occur directly from person to person and there is also evidence of indirect transmission from person to water system components and then onwards to other people.

Risk assessments for waterborne pathogens other than *PA* might be required when clinical surveillance, outbreaks and/or the Water Safety Group (WSG) identify a need. In most cases, the risk assessment process for *PA* within this standard can be used to inform the process of risk assessment for other opportunistic pathogens. The risk assessment process might need adapting to take account of the specific ecological niches which support the growth of the specific microorganism together with all the potential modes of exposure and transmission and the suitability and effectiveness of control measures.

Additional considerations need to be included when assessing resistant organisms, such as NTMs. NTMs are found in both natural and constructed water systems and equipment with evidence of transmission causing infection obtained from genetic fingerprinting of isolates from the lungs of patients implicating a variety of sources [9]. NTMs, both slow growing and fast-growing forms, are of increasing concern in healthcare settings where there are very vulnerable patients. Risk assessments need to take into account intrinsic resistance to biocides and heat tolerance particularly where measures applied to control *PA* are unlikely to successfully control NTM colonization and growth. Risk assessments for NTMs need to be carried out in areas intended for patients who are severely immunocompromised, such as transplant units, haematology-oncology units, cystic fibrosis units and other areas identified by the WSG as being at high risk.

0.3 Non-healthcare premises

PA risk assessments are applicable to other types of premises where there are systems and/or equipment which can pose a risk of *PA* infection for example: *PA* in water and colonized water systems and equipment in leisure and industrial setting can cause infections e.g. *PA* folliculitis, (an infection of the hair follicles) which is usually self-limiting, and also ear, eye, and urinary tract infections. Very rarely, infection in persons outside of healthcare settings can be life threatening, including to healthy individuals [10].

Whilst *PA* is the non-enteric pathogen of most concern in such settings, NTMs have also been associated with causing pneumonitis and respiratory infections associated with spa pool and hot tub use [11], [12], [13] and skin infections associated with whirlpool footbaths [14]. Risk assessments for NTMs might be indicated as a result of a case or cases associated with settings with hot tubs and items of equipment such as whirlpool footbaths including in nail and beauty salons. Water-based metal working fluids have also been associated with causing hypersensitivity pneumonitis in workers [15].

1 Scope

This British Standard gives recommendations and guidance on how to carry out risk assessments for *Pseudomonas aeruginosa* (*PA*) and other waterborne pathogens whose natural habitat is within constructed water systems and the aqueous environment (autochthonous) rather than those being present as a result of a contamination event. It includes those pathogens that can colonize and grow within water systems and the associated environment. It does not cover risk assessments for *Legionella* spp.; these are covered in [BS 8580-1](#), or risk assessments for enteric microorganisms derived from human or animal faecal contamination or sewage ingress.

This British Standard is especially applicable to all types of healthcare provision, including hospitals, care, nursing and residential homes, together with other settings such as educational, travel, leisure, commercial, industrial, where there are additional systems or equipment which could pose a risk from waterborne pathogens.

It is also applicable to spa baths, hot tubs, pools, and other equipment, including the use of large inflatable equipment in swimming pools. Premises where this standard can be used include the educational, travel, industrial, leisure and beauty sector, including health spas, nail bars and tattoo parlours, and other premises where water systems and associated equipment can pose a risk of infection from waterborne pathogens other than *Legionella* and those associated with gastrointestinal infections.

This British Standard covers risk assessment of distributed water systems and associated equipment, system components and fittings as well as above ground drainage systems. It takes account of all relevant environmental and clinical factors, aspects of human behaviour leading to contamination events, e.g. poor cleaning and storage techniques and all possible modes of transmission. It also takes into account risk factors within the associated environment, such as the potential for transmission from personnel, splashing and the contamination of outlets, sink traps and drains leading to conditions which can encourage the colonization and growth of waterborne pathogens and transfer of antibiotic resistance.

This British Standard also covers *PA* risk assessment reviews and reassessments where a previous assessment has been undertaken and risk factors identified.

For all sites, it is also of relevance to design engineers and architects, providers of fittings, outlets and components for water systems, manufacturers/wholesalers/contractors, installers and commissioners, risk assessors, regulatory bodies, building services engineers, water treatment consultants, travel, leisure and other relevant buildings owners and operators and those responsible for the safe management of water systems, especially within the leisure centres, schools, swimming pool operators, passenger vessel operators, etc.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document¹⁾. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[BS 8580-1](#), *Water quality – Risk assessments for Legionella control – Code of practice*

[BS 8680](#), *Water quality – Water safety plans – Code of practice*

¹⁾ Documents that are referred to solely in an informative manner are listed in the Bibliography.

3 Terms and definitions

For the purposes of this part of [BS 8580](#), the following terms and definitions apply.

3.1 aerosol

suspension in a gaseous medium of solid particles, liquid particles or solid and liquid particles having negligible falling velocity

NOTE An infectious aerosol is not visible to the human eye, can remain in suspension for a long period of time and transmission is by inhalation.

3.2 aspiration

liquid accidentally passing into the lungs when swallowing

NOTE This is commonly referred to as water “going down the wrong way”.

3.3 asset register

list of all items relevant to the risk of waterborne pathogens

NOTE 1 Asset register includes the pertinent information to allow waterborne pathogens, including PA, to be effectively used in the written scheme of control and in the risk assessment.

NOTE 2 Ideally, this will be made available to the risk assessor by the duty holder. This includes the physical components of the system and might also include other standalone items that could present a risk of waterborne infection. It also includes the schematic diagram, scheme of control and risk assessment.

3.4 augmented care

particular service designated as one where water quality needs to be of a higher microbiological standard than that provided by the supplier

NOTE 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 PA and other alert organisms (see HTM 04-01 [1] for specific examples of hospital areas that are likely to be designated as augmented care).

3.5 autochthonous microorganisms

microorganisms whose natural habitat is within water and the aqueous environment rather being present as a result of a contamination event leading to the ingress of enteric pathogens

3.6 biofilm

community of bacteria and other microorganisms and entrained debris, embedded in a protective layer at surfaces and interfaces in water systems

3.7 Caldicott Principles

processes a healthcare provider follows to protect any information that could identify a patient, such as their name and their records

3.8 carbapenems

group of antibiotics used for the treatment of severe or high-risk bacterial infections including those due to suspected multidrug-resistant bacterial infections

3.9 carbapenemases

enzymes produced by certain bacteria that inactivate carbapenem antibiotics

NOTE The genetic material coding for these enzymes can move between different Genera of bacteria (i.e. transfer between E. coli to Klebsiella for example).

3.10 Carbapenemase Producing Organisms (CPO)

bacteria that are able to produce carbapenemases, including carbapenemase-producing Enterobacteriaceae (CPEs)

3.11 Cephalosporins

group of antibiotics that are commonly used in both hospitals and in the community

3.12 competence

combination of training, skills, experience and knowledge that a person has and their ability to apply them to perform a task safely

NOTE Other factors, such as attitude and ability to carry out the task, can also affect someone's competence.

3.13 clones

genetically related isolates that are indistinguishable from each other by a variety of genetic tests or that are so similar that they are presumed to be derived from a common parent

[SOURCE: Tenover FC, Arbeit RD, Goering RV, Mickelsen PA, Murray BE, Persing DH, Swaminathan B. Interpreting chromosomal DNA restriction patterns produced by pulsed-field gel electrophoresis: criteria for bacterial strain [16]]

3.14 duty holder

employer(s) responsible for the effective management of health and safety

NOTE 1 The duty holder is the employer where the risk is from their undertaking to their staff or others, the self-employed person where the risk is from their undertaking to themselves or others, or the person in control of the premises where the risk is from systems in the building (e.g. a landlord who remains responsible for the maintenance of the systems). See ACoP L8, para. 28 [17].

NOTE 2 In most cases there will only be one duty holder, but in cases of shared accommodation there could be a shared duty. There might be some cases where the duty holder is a group such as a corporate body, Trust, etc. The duty holder cannot delegate this duty but can delegate managerial responsibility to the responsible person (also known as the competent person and the nominated responsible person) (see 3.28).

[SOURCE: BS 8580-1:2019, 3.11.1, modified – changed “individual(s)” to “employer”]

3.15 Extended Spectrum β -lactamases (ESBLs)

group of enzymes produced by certain bacteria that can destroy certain antibiotics such as cephalosporins making them ineffective (antibiotic resistance)

NOTE The ability to produce these enzymes can move between bacteria under certain conditions.

3.16 hazard

biological, chemical or physical agents or water conditions with potential to cause adverse health or safety-related effects

3.17 hazardous events

events which lead to water becoming unsafe for its intended purpose

NOTE This can be, for example, through the ingress of hazards into a system because of an absence of or failure in barriers, or an increase in hazards within a system to levels which could cause harm, e.g. the presence of nutrients leading to the growth of waterborne pathogens to an infectious dose, or an increase in chemicals at levels which are harmful to health, e.g. disinfection by-products, chemicals leaching from pipework or components.

3.18 risk

likelihood of a hazard causing harm, taking account of the probability, type and length of exposure and the severity of the consequences

NOTE In the context of this standard, amplification and dissemination of opportunistic waterborne pathogens, and exposure of susceptible individuals, are hazards and infection is the hazardous event.

3.18.1 inherent risk

risk associated with the system before any action has been taken to control it

NOTE In the context of a risk assessment for naturally occurring opportunistic pathogens in water there is an assumption that the system or components/fittings of the system have been or will be inoculated at some point.

3.18.2 residual risk

risk remaining after the application of control measures

3.19 interactive water feature (IWF)

recirculating water feature designed, installed or used for recreational use, in which there is direct water contact from the feature with the public, and when not in operation, all water drains freely so there is no ponding

3.20 medical access device

any device that is left in place within the body

NOTE These can either be short term or longer-term devices, such as urinary catheters, vascular access devices, e.g. cannulas. These devices can present an infection risk from opportunistic pathogens as they breach the natural barrier of the skin.

3.21 non-tuberculous mycobacteria (NTM)

mycobacterial species other than the *Mycobacterium tuberculosis* complex

NOTE They are commonly found in the environment in soil and water and can cause a range of infections in susceptible persons including lung, sinus, lymph node, joint, Central Nervous System (CNS), and catheter-related and disseminated infections. NTMs include both slow-growing and rapid-growing species. The most common species causing lung infection are the slow-growing *M. avium* complex (MAC; consisting of *M. avium*, *M. intracellulare* and *M. chimaera*), *M. kansasii*, *M. malmoense* and *M. xenopi*, and the rapid-growing *M. abscessus* (consisting of *M. a. abscessus*, *M. a. massiliense*, *M. a. bolletii* subspecies), *M. chelonae* and *M. fortuitum*.

[SOURCE: based on the British Thoracic Society guidelines for the management of non-tuberculous mycobacterial pulmonary disease (NTM-PD) [18]]

3.22 opportunistic infection

infection caused by organisms that are not normally considered to be true pathogens

NOTE These opportunistic pathogens include microorganisms found in water, soil and other environmental reservoirs. Infection is caused when these organisms are given the opportunity to breach normally protective barriers due to breaches of protective layers i.e. skin in burns patients, or in individuals with impaired defence mechanisms such as those with compromised immune systems.

3.23 opportunistic pathogens

microorganisms that are normal inhabitants of the natural aquatic environment and plumbed water systems and can cause infections in individuals with impaired local or general defence mechanisms, such as the elderly or the very young, patients with open wounds, burns, and those with compromised immune systems as a result of illness or treatment

[SOURCE: BS 8680:2020, 3.18]

3.24 pathogen

bacterium, virus or other microorganism that can cause disease in a person, animal or plant

[SOURCE: BS 8680:2020, 3.19]

3.25 risk assessment

overall process of risk identification, risk analysis and risk evaluation

NOTE Includes the identification of hazards and hazardous events.

[SOURCE: BS 8580-1:2019, 3.16.1]

3.26 risk assessment review

re-assessment of both the current risk assessment and scheme of control to verify they are valid and up to date

NOTE This could be, for example, checks and review of results to verify the ongoing effectiveness of controls, a review of applicable hazards and hazardous events, reassessment of the susceptibility of the population, risks/likelihood and consequence.

[SOURCE: BS 8680:2020, 3.24, term “risk assessment review” instead of “risk review”]

3.27 reassessment

process of reassessing a procedure or water system after the need is determined by review

NOTE This entails all the steps needed in an initial risk assessment.

3.28 responsible person (RP)

individual appointed with, and who has accepted, responsibility under the authority of the duty holder for ensuring that a business or organization’s responsibilities for water safety are met and that all individuals and organizations assigned to carry out tasks are competent to do so

NOTE 1 Also referred to as the nominated responsible person or the nominated competent person or accountable officer in healthcare premises.

NOTE 2 In a large undertaking there might be more than one responsible person, each responsible for a part of the undertaking.

NOTE 3 Core members of the water safety group (WSG) may take on the role of responsible persons.

[SOURCE: BS 8680:2020, 3.17]

3.29 schematic diagram

simple but accurate illustration of the configuration of the water system, including parts that are out of use, to be effectively used in the written scheme of control and in the risk assessment

NOTE 1 Schematic diagrams are required under the Approved Code of Practice (L8) for the management of risks from exposure to legionellae [17], so they need to be available for water systems and can be used in the context of managing risks from other opportunistic waterborne pathogens.

NOTE 2 An example of a computer-drawn and a hand-drawn schematic diagram are given in [BS 8580-1:2019](#), Annex G. These figures are monochrome, but colour might be useful for schematics of more complex systems.

3.30 scheme of control

procedures and checks intended to control the risk of opportunistic waterborne pathogens, including an up-to-date schematic diagram

NOTE The scheme can be in either hard copy or electronic format.

3.31 spray pad

play and water contact area designed to have no standing water

3.32 waterborne

any infection which is associated with exposure to water and/or the aqueous environment

3.33 water safety group (WSG)

multidisciplinary group of people formed to undertake the commissioning, development and ongoing implementation and management of the water safety plan (WSP) with the skills and responsibility for ensuring that the water is safe at the point of use for all uses and all users of water within buildings

NOTE 1 It also advises on the remedial actions required when water systems or outlets are found to be contaminated and the risk to susceptible persons is increased.

NOTE 2 The composition of the WSG and complexity of its role varies depending on the design, size and complexity of the systems and attached devices and risk assessments based on the types of hazard and the dose which can cause harm; the potential for hazardous events; and routes of exposure intended uses and users of the system or device. The WSG might also be known as the water management team.

[SOURCE: BS 8680:2020, 3.32]

3.34 water safety plan (WSP)

strategic plan, which defines and documents the arrangements that are required for the safe use and management of all water systems together with all associated systems and equipment within each building or estate to prevent harm arising from all forms of exposure

[SOURCE: BS 8680:2020, 3.33]

3.35 susceptible

individuals that have a breach in their natural protective barriers (i.e. skin integrity, mucosal layer issues) or impaired defence mechanisms against infection (such as being immunocompromised, elderly or very young)

3.36 thermostatic mixing tap (TMT)

tap incorporating a thermostatic mixing valve (TMV) which can be adjusted

3.37 thermostatic mixing valve (TMV)

valve, with one or more outlets, which mixes hot and cold water and automatically controls the mixed water to a selected temperature

[SOURCE: BS EN 1111:2017, 3.1]

3.38 vulnerability

describes the characteristics and circumstances that make a person susceptible to the damaging effects of a waterborne hazard

3.39 WRAS

formerly the Water Regulations Advisory Scheme, now Water Regs UK and a subsidiary of the Water Regulations Approval Scheme

NOTE 1 Companies are supported by UK statutory water undertakers which respectively advise on the interpretation of the Water Supply (Water Fittings) Regulations [19] and approve fittings and materials as suitable for contact with drinking water.

NOTE 2 There are a number of alternative test houses which will test and certify products to Water Regulation 4 and testing to [BS 6920](#).

Section 1: General – risk assessment for all premises

4 General

Risk assessments for *PA* should take account of all potential sources of infection including, for example, water used for consumption, both directly and indirectly (including as ice), as well as for personal hygiene, diagnosis and treatment of patients in healthcare settings, including decontamination and cleaning purposes and all other potential sources of exposure (see [BS 8680](#)). Assessors should check the asset register includes all relevant equipment, components and fittings associated with water storage and verify that appropriate risk assessments and maintenance, for example, are carried out. Assessors should be aware that infections can originate not just from water distribution systems and equipment which uses or stores water in buildings but also from the associated environment including above ground wastewater systems (drains). Contamination of the surrounding environment, equipment and patients, visitors and staff within the splash zone should also be taken into account.

NOTE 1 In investigations where surveillance implicates pathogens other than Legionella and PA, an environmental/public health microbiologist with expertise in the individual pathogen might also be required to support the WSG.

Those carrying out risk assessments should be familiar with relevant methods for detection and ecology of the target pathogen, the susceptible groups, relevant modes of exposure, virulence factors and the means of transmission and effective control. Specialist input should be sought by assessors where required, to verify the assessments take into account all relevant factors which can contribute to the risk, including from competent public health and/or clinical microbiologists with expertise in water microbiology, epidemiologists, infection prevention and control specialists, manufacturers, installers and suppliers, as necessary. Each risk should be analysed appropriately, considering its consequences and the likelihood of those consequences arising, to derive a measure of the severity and extent of harm that might occur and to set priorities for action.

Where there are common factors within the premises being assessed, while a proportion of these may be treated as a representative sample, the individual nature of each area should still be taken into account.

Where assessors identify a hazardous situation from the survey of the site, processes, visual inspection, measurements, records, or sample analysis results, they should record each situation and assess the risk arising from it.

The resulting risk assessment should take into account the inherent risk, the controls in place and how well these mitigate the risk. This combination should be evaluated to determine if the residual risk is as low as reasonably practicable (ALARP) and, if not, what additional control or mitigation measures are needed to achieve this. However, measures should still be monitored in case the risks change over time.

NOTE 2 Resources in an organization are finite, so an understanding of residual risk might help to ensure that the response is proportionate to the risk. It might also help the organization to understand the consequences if the controls fail and recognize the contribution of individual controls to overall risk mitigation.

NOTE 3 Examples of common risk factors for assessments within healthcare setting are included in [Table A.1](#).

5 Hazards and hazardous events for all premises

5.1 General

For premises which conform to HSE ACoP L8 [17] and associated guidance HSG 274 [20], [21], [22], for the management and assessment of *Legionella* risks in buildings (see BS 8580-1), many of the microbiological components of the WSP should already be in place as effective measures to control *Legionella* risks include many elements of good water system design, hygiene and maintenance. For PA and other relevant microbial waterborne hazards, assessors should verify all relevant hazards, hazardous events and risks are identified, characterized and effective management and monitoring programmes are developed within the WSP and implemented.

5.2 Health care

COMMENTARY ON 5.2

In practice, routine PA risk assessments will not be expected to include the potential for pathogens other than PA unless there are clinical indicators indicating a need, such as in areas with very susceptible patients, for example, haematology-oncology, transplant and cystic fibrosis units where the WSG might require risk assessments for NTMs as well as PA.

Risk assessors should check that there is adequate clinical surveillance in place and where there are exceedances over the expected levels of a potential waterborne pathogen for a particular area (ward, unit etc.) there are processes in place to investigate these with input from the WSG.

NOTE See Annex A for factors that increase the level of risk in healthcare settings.

6 Preparations for risk assessment for all premises

6.1 Competence of the risk assessment team

Where there is a risk of infection from waterborne pathogens, those carrying out the risk assessment should have the competencies needed to identify and assess all applicable systems and/or equipment which might pose a risk of infection and the measures needed to control the risk so it is as low as reasonably practicable (ALARP). The risk assessment should take into account the likelihood and consequence of waterborne hazards and hazardous events in the context of all potential modes of transmission, exposure (type, extent and frequency) and the susceptibility of those who might be exposed and the types of use which could present a risk.

Assessors, whether employed by the organization or external, should also have experience of the type of premises and/or equipment being assessed, as well as being familiar with and understanding the requirements of the relevant standards and guidance applicable to carrying out PA risk assessments and, where required by the RP/WSG or indicated by epidemiology or surveillance, risk assessments for other waterborne pathogens in addition to those required for *Legionella*,

NOTE 1 This can include ACoP L8 [17], HSG274, Parts 1–3 [20], [21], [22], BS 8680 and BS 8580-1.

Whilst assessors who are competent to carry out *Legionella* risk assessments will have an understanding of water system engineering, it should not be assumed they understand all factors leading to the ingress, growth and persistence of target organisms other than *legionellae*.

The RP/WSG should satisfy themselves that there are processes within the WSP to verify all those involved in the risk assessment process relevant to this standard have the information and competence (see 3.12) to verify the risk assessment is valid and sufficient.

NOTE 2 In addition to practical experience, attendance and the evidence of successful completion of recognized, accredited and externally assessed training courses can complement overall competence and might be considered by the RP/WSG within an overall assessment when selecting an external contractor.

NOTE 3 See [BS 8680](#) for more information on the WSP.

Further factors to take into account for those employing assessors should be the ability to work with different disciplines, communicate effectively and prepare and deliver reports on time (see also [BS 8580-1](#)).

6.2 Independence

The organization should be able to demonstrate those carrying out risk assessments for PA and other waterborne pathogens are impartial and independent. The WSP should include processes to verify there are no commercial, financial or other pressures to compromise impartiality of any members of the RP/WSG or anyone else contributing to the risk assessment, including the risk assessment team.

NOTE In many cases, risk assessments of this type are likely to be conducted by a multidisciplinary team including for example, RP/WSG members, health and safety professionals, infection control specialists and clinicians, maintenance and support staff, pool plant operators, engineers, specialist service providers etc. working within the organization for which the assessment is undertaken, together with, where needed, external contractors and/or service providers.

Care should be taken to verify that the assessment of risk and any resulting recommendations are not influenced by factors such as the potential unavailability of wards, pools and/or services, or vested interests of the contractor.

7 Pre-assessment actions for all premises

7.1 General

Wherever it is practicable to do so safely, arrangements should be made before the visit to verify all relevant parts of the system(s) and associated equipment can be assessed. Where access cannot be organized for all areas during the assessment visit, which would result in unavoidable omissions in the assessment, this should be communicated to the responsible person (RP) as soon as possible, indicating the effect any such omissions might have on the validity of the assessment and to determine whether the required information can be obtained by other means and what provisions need to be made to provide access on a subsequent occasion.

7.2 Pre-communication

Assessors should make contact with those responsible for the area to be assessed prior to carrying out the risk assessment to verify the scope of the assessment, confirm access and make arrangements for gathering all relevant background information, for example, WSPs, previous risk assessments, audits, relevant up-to-date logbooks, environmental and where appropriate, clinical surveillance data.

NOTE This includes arranging contact with those responsible for maintenance and day-to-day operations including microbiological, chemical (where relevant) monitoring and sampling, training, and competence records (see [Clause 12](#) for specific pre-assessment actions within healthcare settings).

It should be clear who is taking the lead in the risk assessment process and who should be involved in each step, i.e. who will be carrying out an assessment of exposure risks, the susceptibility of those exposed, engineering and physical water system design and operation, environmental services practices (e.g. cleaning and maintenance) and reviewing monitoring and surveillance data, and writing the report.

7.3 Appraisal of the WSP, supporting documentation and gap analysis

7.3.1 General

Assessors should review the WSP to verify that there are sufficient processes in place to minimize the risk associated with the individual hazard e.g. *PA*, NTMs etc.

The WSP should comply with [BS 8680](#) and include the governance arrangements in place (organization and accountability) for all water safety risks; a high-level gap analysis and appropriate actions to address any gaps identified; the processes in place to verify competence and effective risk assessments are carried out including for *Legionella* and *PA* and other relevant hazards and appropriate schemes of control and supporting programmes.

Assessors should verify the WSP defines or references the required processes so *Legionella* risk assessments are carried out in a competent and timely manner in accordance with [BS 8580-1](#) (see also [BS 8680](#)) and these can be used as the basis of the *PA* risk assessment. If the RP/WSG are satisfied that the *Legionella* risk assessments are up to date and valid, these should be used as a starting point and cross-referenced to avoid duplication.

If a WSP and/or *Legionella* risk assessment is not in place or up-to-date and signed off by the WSG/RP, or there are gaps identified in the WSP or previous risk assessments which have not been addressed, assessors should advise the identified RP.

7.3.2 The scope of the *PA* risk assessment

The scope of the *PA* risk assessment should clearly define the areas to be assessed, include a review of any existing risk assessments and a gap analysis to verify:

- a) the assessment reviews the governance, accountability, systems and equipment and activities covered by the *Legionella* risk assessment, to verify they are applicable to the effective management of risks from other waterborne infections;
- b) that the assessment takes account of all relevant microbial hazards (other than *Legionella*), all water uses and water systems and associated equipment, as well as potential hazardous events, all potential modes of exposure as well as the susceptibility of those who might be exposed. It is particularly important the assessment take account of specialized water uses that are to be accessed by different groups of users with different susceptibilities, for example, hydrotherapy pools. The effectiveness of existing controls and any actions that need to be taken to improve control for all relevant microbial hazards and users should also be assessed;
- c) the asset register includes all assets which could pose a risk of waterborne infection in addition to those identified in the *Legionella* risk assessment (see [\[17\]](#)), with input from those with practical experience and knowledge of the buildings, systems, equipment, activities and users;

NOTE 1 The asset register required for Legionella risk assessments is unlikely to include all systems and items of equipment, fittings and components which might pose a risk from PA.

- d) where assessments include a third-party assessor, the scope/agreement:
 - 1) should confirm who is responsible for production of a full asset register and gap analysis taking into account the schematic diagrams and findings from the *Legionella* risk assessment; (i.e. the client or the contractor) and
 - 2) should clearly define the areas to be assessed and the processes required for safe operation and routine maintenance (control measures) to minimize the risk from *PA*.

NOTE 2 For Legionella risk assessments see [BS 8580-1](#).

The scope of the *PA* risk assessment should include not just a physical assessment of assets but also how systems and equipment are used, where they are used, all potential modes of transmission and

who might be at risk. For example, assessors should determine an assessment of all potential sources of exposure to individuals, including the risk of cross-contamination from contact, splashing, person to person transmission as well as the impact of ineffective cleaning and flushing processes.

The WSP review should include:

- a) the processes for communication and reporting mechanisms, the structure between all members of the risk assessment team is agreed and clearly described, including for when matters of immediate concern are identified;
- b) the processes to verify the experience and competence of each assessor is appropriate for the system/ equipment etc. to be assessed and they understand the relevant risks applicable to each microbial hazard and where relevant, the environmental and/or clinical factors associated with the system which can contribute to the risk of infection;
- c) the processes for assessors to carry out effective pre-visit communication with all relevant parties to verify the validity of the risk assessment is not compromised during the site visit including:
 - 1) identifying who is responsible for authorizing and ensuring the assessor's safe access (see [7.1](#) and [7.2](#));
 - 2) access to all parts of the system or relevant equipment in "normal operation" and there is no planned treatment, repair or maintenance which would result in parts of the system or equipment not functioning etc.;
 - 3) arrangements are in place for where access is limited or not possible, for example where there are infection, radiation or patient-related reasons, so that information can still be obtained;
NOTE 3 In such situations, suitably trained staff could obtain the information on behalf of the assessor(s).
 - 4) any "permit to work" or access clearance necessary for access to all areas of the sites to be assessed will be available;
 - 5) site specific engineering personnel familiar with the site and the system(s) and equipment to be assessed will be available for escort where necessary for health and safety or security reasons, and to answer assessors' questions throughout the assessment visit as required;
 - 6) the relevant persons are identified to report matters of immediate concern during the risk assessment process;
 - 7) suitable PPE is available for areas that require access without certain controls (e.g. where there are risks to the assessor, for example, plant rooms, chemical stores, confined spaces, working at height, to preserve the integrity of infection control measures or where the assessor represents a risk to others;
 - 8) all relevant documentation such as records of previous risk assessments and inspections, monitoring results, training records, if not available before the visit are to be present on the day, and there are suitable conditions in place for safe keeping and GDPR (see [7.1](#));
 - 9) there are processes to continue the assessment if, on the day, there are unforeseen circumstances which result in areas/equipment, documentation or relevant staff not being available; and
- d) whenever reported information, such as records of previous inspections, is included, that this is recorded.

NOTE 4 Typically, the risk assessment process is a phased process where the water system engineering risk assessment is carried out first for Legionella risk assessment purposes (see BS 8580-1), followed by the environmental, clinical and operational practices which then feed into the exposure risk assessment for determination of overall PA risks.

7.3.3 Appraisal of the WSP

The appraisal of the WSP should review the processes in place for the risk assessment, safe operation and maintenance of all risk systems and associated equipment within the scope to verify:

- a) governance arrangements so the lines of responsibility, accountability and communication are in place and kept under review;
- b) there are processes for ensuring asset registers are kept up to date and contain all relevant systems, equipment and associated plant including equipment which might result in cross-contamination from wastewater as a result of backflow e.g. from macerators and other fittings and equipment;
- c) there is a description of the correct operation and maintenance of systems, plant and/or equipment with any precautions to be taken to minimize risk;
- d) there are details of any start-up and shutdown procedures, plant and equipment rotation, disinfection, temperature control and flushing requirements;
- e) there are processes for logging, risk assessments and management plans for any plant or equipment brought onto site by third parties which could pose a risk of infection;
- f) there is reference to, where appropriate general method statements, for example, standard operating procedures (SOPs)/risk assessment and method statements (RAMS) for tasks such as cleaning, disinfection, calibration, maintenance and monitoring operations;
- g) there are processes for any validation, monitoring, sampling and tests that are to be completed on the systems, along with the required frequency and the acceptable control parameter limits;
- h) there are details on who is responsible (including lines of communication) for ensuring defects or out-of-parameter results are appropriately addressed;
- i) there are processes for prioritization, identification, signing off and logging of corrective actions;
- j) previous risk assessment findings and actions taken are taken into account;
- k) there is appropriate surveillance and information for users and visitors to minimize the risk from waterborne infections;
- l) there are processes in place to verify WSG approval of the design, specification, installation, commissioning, handover, operation and maintenance of new systems and equipment; and
- m) in healthcare, there is suitable assignment and review of augmented care areas and high-risk patients.

Where it has been identified that up-to-date records are not being kept, or cannot be found, the assessor should recommend in the final assessment report that a system be put in place as a matter of priority.

7.3.4 Appraisal of training records and competence

Relevant training records of all personnel with an involvement in the management of risk from PA infections should be appraised.

NOTE 1 Records can also be checked to verify, as far as reasonably practicable, that staff are competent to take measurements and are using the correct reagents, standards and appropriately calibrated equipment.

Assessors should also verify there are processes within the WSP so that training and competence of all relevant personnel is reviewed on a regular basis, e.g. annually, or when there has been a change in relevant personnel.

If assessors take into account the training and/or competence of one or more of the parties to be inadequate, they should state this as part of the assessment report and include the need for training or refresher training as a priority in the recommendations of the assessment report.

NOTE 2 Common faults or shortfalls might include the following:

- a) no records or checks of competence (or for trainees/apprentices there is appropriate supervision in place);
- b) records are in place, but there is no indication of how competence was assessed;
- c) records in place, but refer to training rather than employees' ability to work safely and effectively;
- d) no checks on contractor, subcontractor or service provider competence; and
- e) no review to confirm continued and up-to-date competence and ongoing continuing education.

7.3.5 Appraisal of the maintenance, remedial actions and testing records of the water system

Assessors should appraise relevant records, including the *Legionella* risk assessment (see [BS 8580-1](#)), to review the relevance and effectiveness of the written scheme of control, and to check this is being adequately managed and logged, for example, there is a dated signature or electronic identification against each record, depending on whether the records are stored in hard copy or electronically.

NOTE 1 A review of the maintenance and monitoring records can help assessors derive information about the continued success of any control measures that are already in place.

Evidence should be sought to confirm that, for example, maintenance work and remedial actions have been prioritized appropriately and completed competently within a reasonable time, it is clear who carried out the work and that they were competent to do so.

Where remedial actions have not resulted in improved control of the identified risks, assessors should verify that there are processes for further escalation procedures to be invoked.

NOTE 2 With these procedures, risks would be eventually controlled and where appropriate, a "lessons learned exercise" or a new procedure is in place to prevent recurrence.

For example, the assessor can look at actions taken after adverse results have been found in the past to ensure that suitable corrective actions were taken in a timely manner (e.g. by vertical audit).

Assessors should check that where certificates raised by others after a task or action (e.g. calibration of testing equipment), they are supported by signed contemporaneous worksheets or their electronic equivalent.

Where there is a new or adapted control regime, there should be evidence of appropriate validation to verify the changes had the desired improvement in water quality and procedures are in place for appropriate monitoring, repeat sampling etc. to verify ongoing control. If the changes to the control regime did not improve water quality, assessors should verify that further escalation procedures were invoked to establish that risks would be eventually controlled and where appropriate, a "lessons learned exercise" or a new or improved control regime was put in place to prevent recurrence.

The scope and frequency of monitoring and sampling required can vary according to the systems/plant/equipment on each site, but assessors should check that all the control items or tests outlined within the recognized national guidance documents for each type of system have been taken into account.

If appropriate records are not being kept, or cannot be found, the assessor should recommend that a quality system for documentation and document control should be put in place as a matter of priority in the final assessment report (see BS EN ISO 9001 for example).

7.3.6 Appraisal of monitoring and inspection records (PA)

The assessor should appraise the records of monitoring, audits and inspections carried out on the systems being assessed.

NOTE 1 These might be found within the written scheme of control or separate documents, such as logbooks (hardcopy or electronic) or maintenance reports. It is reasonable to expect these records to be easily available for inspection.

The assessor should identify the control parameters that have been set within the written scheme of control (chemical and/or physical) and check whether these are appropriate and have been set correctly before deciding if the existing control measures are adequate.

Assessors should seek verification where required from the service provider or product manufacturer for equipment and products used and/or certain elements of the control regime.

NOTE 2 Assessors might not necessarily have sufficient knowledge of control equipment or experience to determine whether any specified control parameters are appropriate.

The assessor should review the relevance and success of the monitoring and inspection work, including any microbiological tests that have been carried out as these will indicate whether effective actions have been taken based on the results obtained.

The results of audits and inspections should be checked to see whether these indicate if the current scheme of control is sufficient.

To obtain an indication of what to expect during the survey, the assessor should take into account the following questions.

- a) Have tasks been completed competently and in a timely manner?
- b) Have tasks been completed at the correct frequency?
- c) Do the records indicate who carried out the task and when?

NOTE 3 Common faults found include:

- a) no records in place;
- b) records in place, but incomplete due to actions going unrecorded;
- c) actions not completed, for example, due to continued lack of access without escalation;
- d) inadequate or no escalation procedures;
- e) records are kept, but corrective actions have not been performed (or recorded as having been performed) following results which are out of specification;
- f) no preventative maintenance in place; and
- g) no, or inadequate, records of maintenance in place.

8 Site survey for all premises

8.1 General

Before the site visit, the pre-assessment actions identified in ([Clause 7](#)) should be carried out. As part of the risk assessment, a site survey should be conducted with reference to the existing WSP including the risk assessments, asset register, schematic diagrams and logbooks as these are essential for informing the PA risk assessment.

This would normally have been done already during the *Legionella* risk assessment, however assessors should satisfy themselves as to the completeness and accuracy of any information taken

from previous assessments or inspections and note where there are errors, omissions or they are out of date.

Assessors should not assume that these documents are accurate and should assess whether they need to inspect the water system to confirm the configuration, operation and management of microbial risks is as described (see [BS 8580-1:2019](#), Annex G for examples of schematic diagrams).

Assessors should decide whether they have sufficient available information to assess the risk successfully. If they conclude that it is insufficient, for example, because of the absence of as-fitted drawings or schematic diagrams, or any other critical information, they should decline to issue the assessment, or decide to issue it in draft or otherwise qualified format, identifying any omissions and the effect they might have on the validity of the assessment.

As part of the site survey, assessors should speak to management and staff to judge whether the effects of the management culture and work practices of the organization are adding to, or reducing, the risk.

Assessors should also review the operation and condition of each system and its components to assess whether they would support the proliferation and dissemination of *PA* by all potential modes of exposure. All parts of each system should be assessed, including any discrete plant, associated equipment, fitting or component and the existence and location of sentinel points. However, the greatest risk for *PA* growth is close to and within outlets therefore particular attention should be given to assessing the configuration, management and maintenance of outlets and any component parts, such as tap inserts, including those in the proximity of the outlet, for example, TMTs, TMVs, isolation valves, as well as any associated systems or equipment and the potential for cross-contamination from within drains.

Where practicable, the assessor should check that there are processes in place to verify that materials of construction of the water system and associated equipment have been tested for their tendency to support microbial growth as indicated. Any non-compliant materials or components should be identified within the risk assessment.

NOTE 1 The assessor can check that the processes are WRAS-approved.

NOTE 2 Attention is drawn to the Water Supply (Water Fittings) Regulations [19]. See [Annex A](#) for details of specific risks in healthcare settings.

8.2 Measurements

Where measurements of parameters, including temperature or biocide, are routinely taken on site, these should be checked for accuracy and reliability, that they are taken by competent personnel and the process validated. To verify readings, assessors might need to undertake measurements themselves or observe measurements being carried out by others. Where such measurements are undertaken, testing equipment should be regularly calibrated to verify accuracy [23].

Similarly, microbiological tests might be utilized, in which case the assessor should take into account whether the test is suitable and provides the results required for the purposes of the assessment and they are satisfied that samples are taken, identified, packed, transported, processed, analysed and interpreted correctly.

NOTE Guidance on sampling is given in BS EN ISO 19458 and for healthcare in HTM 04-01, Part C [24] (see also other relevant national guidance where applicable).

8.3 Risk assessment and rating systems

Assessing the likelihood of an adverse health effect being realized is subjective and is multifactorial, depending on the situation under assessment. Assessors should, therefore, use their own knowledge and experience (drawing on that from other members of the assessment team where appropriate) to

gauge the likelihood of harm occurring. Assessors should examine the various factors that contribute to risk and make an evaluation of the inherent (uncontrolled) risk (see 8.3). The residual risk should then be evaluated and a judgement made to determine whether any further control measures are required in order to reduce the residual risk further to achieve ALARP (i.e. the “risk gap”).

Risk rating systems, if used, should follow the general principles advocated in BS 8580-1, and cover the following:

- a) Contamination. An assessment of the known, likely, suspected or possible microbiological contamination of the water and surrounding environment.

NOTE 1 This may be a single event, intermittent or continuous low-level ingress.

- b) Amplification. An assessment of whether the conditions are likely to support the growth of microbial hazards. This might include environmental conditions such as temperature, water flow and turnover, nutrients including scale and corrosion products, materials of construction, areas where water is not replaced with fresh water, whether there have been, or are, failures in the application of effective control measures, including flushing, temperature and biocides.
- c) Transmission. An assessment of the mechanism(s) by which contaminated water could cause infection in those exposed. Such mechanisms might include formation of coarse droplets (e.g. splashing), formation of fine droplets (e.g. aerosols), direct contact (e.g. bathing), indirect contact (e.g. via the hands of others, items washed or rinsed in contaminated water, items splashed with contaminated water), food preparation, consumption or aspiration of water or ice either directly or indirectly.

NOTE 2 For transmission of infection by inhalation, aerosols need to be small enough to enter deep into the lungs (generally taken to be $<5\ \mu\text{m}$) and are not visible to the naked eye. They can remain suspended for long periods of time and are not visible but are produced whenever visible droplets are formed [25].

- d) Exposure. An assessment of the mode of transmission, duration, frequency and population size.
- e) Susceptibility of individuals exposed. An assessment of the nature and vulnerability of the exposed population, taking account of their susceptibility to infection and/or the presence of potential routes of ingress e.g. open wounds, burns, indwelling venous catheters etc.

The assessment should take into account both the likelihood of exposure to *PA* and its consequences. Evaluation of the factors a) to c), above, provide an indication of the likelihood of exposure, whereas d) and e) can influence both the likelihood and consequences of exposure, i.e. the risk that harm might occur taking account of the level of harm.

It might be possible to rate the likelihood of contamination, amplification and transmission of *PA* that could result in exposure by comparing the standard of the control measures that are being applied to that which is recommended in national guidance where applicable and available, e.g. HTM 04-01 [1] or equivalent national guidance or for pools, the Pool Water Treatment Advisory Group's (PWTAG) guidance documents. Where controls are being applied effectively, are appropriate for the susceptibility of those who are likely to be exposed and in line with current guidance, the likelihood of significant health consequence will probably be low. Conversely, where controls are not being applied or are not being applied appropriately or effectively, the likelihood of exposure will increase. In circumstances where national guidance does not exist, a multi-disciplinary assessment team should obtain a consensus judgement to assess the likelihood and consequences of exposure to *PA* and decide whether the risk could be reduced further.

The level of harm, i.e. the consequences of exposure, can range from insignificant to minor (e.g. self-limiting skin infection) through to critical (e.g. death) and is influenced by the individual susceptibilities of those who might be exposed and the frequency and extent of that exposure, which should also be taken into account.

Assessors should identify the risk gap and if more needs to be done to reduce this to ALARP, this should be reflected in the recommendations. If risks are ALARP, then no more needs to be done but the risks should be kept under review.

Risk ratings need to include operational considerations which will normally require consultation with others, such as members of clinical, infection control and prevention and cleaning teams. When assessing any policy, management arrangements and procedures, assessors should check actual practices, for example, by discussion with, and/or observation of, individuals carrying out their work or activities involving exposure to water or the aerosols derived from it.

Rating systems should be repeatable, so a single assessor would award the same score for a given situation and they should also be reproducible, i.e. different assessors would award same score.

NOTE 3 The simpler the system, the more likely this will be, e.g. traffic light-based rating systems or systems such as shown in [Figure 1](#).

When assigning a risk rating, the individual levels of risk associated with the water system, e.g. its components, maintenance and cleaning practices should be appropriately and clearly reflected within the final report.

NOTE 4 Where risks are common, for example, if the same risk is identified in several areas, it is acceptable to summarize that within the risk rating.

Non-microbiological risks, such as the risk to the organization's reputation and resulting public consequences in failing to manage healthcare-associated infections (HAIs), should also be considered when carrying out a risk assessment.

The overall risks applied should not simply be defined by the highest single element of risk identified nor should multiple identified risks of various significance be combined to report an average. For example, for a hospital with a ward/unit where patients are at extremely high risk of infection, e.g. haematology-oncology, assessors should not automatically designate the whole hospital as being at high risk for causing PA infections.

NOTE 5 Another example which is relevant to all types of premises is where the water system has been designed well to reduce risks, but inappropriate cleaning and/or maintenance practices might elevate the risk and undermine good system design.

NOTE 6 "Risk scoring systems" or "risk algorithms" have been used as an aid to the understanding of the relative risk(s) associated with the systems assessed, but they require care in their use as they can mask important issues or result in an overreaction if inappropriately applied.

For the implementation of a risk rating system to be of value, the repeatability of the rating system should be assured by clear guidance on its application in all circumstances where risk assessments are undertaken.

[Figure 1](#) gives example formats for risk scoring purposes, but whatever format is used, the results should be repeatable and reproducible.

Figure 1 — Example formats for risk scoring purposes

Severity	Insignificant No observed impact	Minor Discomfort/self contained/easily treated	Moderate	Major Potentially lethal to some	Catastrophic Lethal to many
Likelihood					
Almost certain					
Like /Probable					
Moderate/Possible					
Unlikely					
Rare					

	Risk Gap	Indicative timescales
	Intolerable risk gap between residual risk and ALARP	Take immediate action to reduce the risk
	Large risk gap between residual risk and ALARP	Take actions as soon as possible, time periods are typically within a few months.
	Significant risk gap between residual risk and ALARP	Take actions when operationally practicable, time periods often programmed to fit with shutdowns or planned maintenance.
	Minor risk gap between residual risk and ALARP	Take actions when other more significant risks have been completed.
	Generally operating to ALARP	No additional action required

Example 1**Risk Matrix**

Likelihood	Almost Certain					
	Likely		7			2
	Possible				3	
	Unlikely	6				1
	Rare		4		5	
		Insignificant	Minor	Moderate	Major	Critical

Impact**Example 2**

NOTE In this example, the risk category is arrived at by comparing the Impact and Likelihood of harm occurring. The numbers relate to the risks from outstanding actions in each risk category. No number means there are no outstanding actions in that category of risk.

For example, the number 2 above means there are two tasks outstanding which means that harm is Likely to occur and if it does, the impact will be Critical.