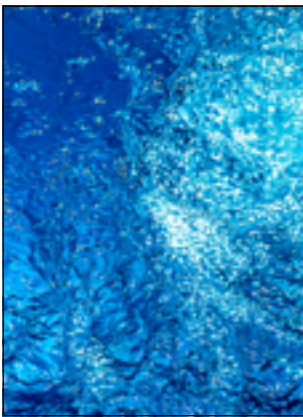


The control of legionella and other infectious agents in spa-pool systems



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Spa-pool systems are a recognised source of diseases caused by infectious agents including the organism that causes legionnaires' disease, primarily *Legionella pneumophila*. There have been a number of outbreaks linked to spa pools in leisure centres, hotels, holiday homes, on cruise ships and on display.

This guidance is primarily for those who manage or operate spa-pool systems and explains how to manage and control the risks from legionella and other infectious agents. It will also help service suppliers, designers, manufacturers, importers, suppliers and installers of spa-pool systems meet their legal responsibilities.

As well as guidance on operating and maintaining commercial-type systems, there is specific advice on domestic-type spa pools or hot tubs used as part of a business activity, for example in holiday park rental units, hotel bedrooms with a dedicated spa and systems on display or at exhibitions. The guide includes advice on effective ways to safely manage and control spa-pool systems through:

- design, commissioning, operation and maintenance;
- testing and monitoring spa-pool water quality;
- quality and frequency of inspections.

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This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

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Introduction

Scope and application

- 1 This guidance is aimed at dutyholders, including employers and those who manage and/or operate spa-pool systems, to help them comply with their legal duties under health and safety legislation. It also sets out the responsibilities of service suppliers and designers, manufacturers, importers, suppliers and installers of spa-pool systems, including contractors. There is practical guidance on how to assess and control the risks of exposure to legionella and other infectious agents to staff, users, and anyone else potentially exposed to the spa-pool water or aerosols from it.
- 2 There is guidance for maintenance staff, consultants, environmental health officers, cruise-ship operators, tour operators, rental companies, holiday lets and organisers of events where spa pools are used, hired or displayed.
- 3 Other water systems, including evaporative cooling systems, hot and cold water systems and other risk systems, also need to be managed under health and safety legislation. Further information is provided in HSE's *Legionnaires' disease: Technical guidance* (HSG274).¹

Background

- 4 A spa pool is a self-contained body of warm, agitated water designed for sitting or lying in and not for swimming or total body immersion. Spa pools contain water heated usually between 30–40 °C, which is filtered and chemically disinfected. They have air-jet circulation with or without air-induction bubbles and can be sited indoors or outdoors. Such systems have the ability to produce aerosols by means of air jets or similar devices. A spa pool is usually drained, cleaned or refilled after a number of bathers or a maximum period of time rather than after each bather.
- 5 Spa-pool systems are increasingly popular and can be found in a variety of sizes and settings ranging from sports complexes, health clubs, hotels and holiday complexes to cruise ships, private houses, and on display in showrooms or exhibitions. Spa pools have a much higher ratio of bathers to water volume than in swimming pools, so their water has a higher concentration of organic material from bathers.

6 There have been a number of outbreaks, including fatalities, linked to spa-pool systems in leisure centres, hotels, holiday homes, on cruise ships and on display. These systems pose a reasonably foreseeable risk as they have environmental conditions that could potentially allow and support growth and dispersion of legionella and other infectious agents where:

- water is stored or recirculated;
- water temperature in all or part of the system is between 20–45 °C;
- these systems can support microbial growth;
- water droplets are produced and dispersed as aerosols;
- there is the potential for exposure to any contaminated aerosols.

7 The organism that causes legionnaires' disease, primarily *Legionella pneumophila*, frequently grows in poorly designed and managed spa-pool systems. Other bacteria including other legionella species, *Pseudomonas aeruginosa* and environmental mycobacteria, are also commonly found in spa pools and can cause infection. These can be introduced into a spa pool from the wider environment or the water source itself, and *Pseudomonas aeruginosa* may also be introduced from the bathers themselves.

8 Spa pools are designed to contain water that is vigorously agitated, which leads to the formation of aerosols that can be inhaled. The water is usually maintained within the temperature range where legionellae and other infectious microorganisms can rapidly grow (20–45 °C) and the high organic content of spa-pool water makes it difficult to maintain effective disinfection. Spa-pool systems must therefore be managed carefully to ensure water quality does not encourage microbial growth and pose risks to users, people in the vicinity or passing near the spa pool.

Section 1: Legislative requirements

Health and safety law

9 This guidance provides specific information on the health and safety law that applies. General duties under the Health and Safety at Work etc Act 1974 (HSW Act)² extend to risks from legionella bacteria and other infectious agents which may arise from work activities, and dutyholders must ensure the health and safety of their employees or others who may be affected by their undertaking.

10 The Management of Health and Safety at Work Regulations 1999 (MHSWR)³ and the Control of Substances Hazardous to Health Regulations 2002 (COSHH)⁴ impose certain statutory duties on those who manage spa-pool systems.

11 The MHSWR provide a broad framework for controlling health and safety at work and these regulations require that dutyholders:

- assess the risks in their workplace;
- have access to competent help and advice to apply health and safety legislation;
- establish procedures for employees if there are situations presenting serious and imminent danger;
- cooperate and coordinate health and safety where two or more employers share a workplace.

12 More specifically, COSHH provides a framework of duties designed to assess, prevent or control the risks from hazardous substances, including chemicals and biological agents such as legionella and other infectious agents, and take suitable precautions. The essential elements are:

- risk assessment;
- prevent exposure or substitute with a less hazardous substance or process/method, where reasonably practicable;
- control exposure if prevention or substitution are not reasonably practicable;
- maintain, examine and test the control measures;
- provide information, instruction and training for their employees;
- provide health surveillance of employees, where appropriate.

13 The HSE publication *Legionnaires' disease: The control of legionella bacteria in water systems* (L8)⁵ contains the Approved Code of Practice (ACOP) and guidance on regulations. HSG274 *Legionnaires' disease: Technical guidance* gives further practical advice on the requirements of

the HSW Act, MHSWR and COSHH concerning the risk from exposure to legionella bacteria. The ACOP applies to employers and those in control of premises where there is a risk of exposure to legionella. It also:

- sets out the responsibilities of those supplying services such as water treatment, as well as those of manufacturers, importers, suppliers and installers;
- gives guidance on identifying, assessing and managing the risk in water systems, as well as record keeping.

14 Although only a court can give an authoritative interpretation of the law when considering the application of health and safety legislation, HSE and local authority (LA) inspectors expect employers to follow the guidance in the ACOP or be able to demonstrate compliance with the law in some other way. This document gives specific guidance, in the context of spa-pool systems, to help dutyholders comply with the health and safety legislation set out in the ACOP.

Enforcement

15 HSE and LAs enforce health and safety legislation. HSE is responsible for enforcement with respect to designers, manufacturers and installers and for spa pools in premises where HSE is the enforcing authority, eg factories as well as national and local government buildings. LAs are responsible for enforcement in hotels, retail outlets, and private sports and fitness clubs. The majority of spa pools in a business setting will be under the enforcement of LAs. Further guidance on enforcement allocation can be found at www.hse.gov.uk/lau/enforcement-allocation.htm.

Other relevant health and safety legislation

16 Other health and safety legislation the dutyholder may need to comply with includes:

- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR);
- Safety Representatives and Safety Committees Regulations 1977;
- Health and Safety (Consultation with Employees) Regulations 1996.

Reporting of Injuries, Diseases and Dangerous Occurrences 2013 (RIDDOR)

17 These regulations require employers and others to report to HSE accidents and some diseases arising out of or in connection with work. Cases of legionellosis are reportable under RIDDOR if a medical practitioner notifies the employer and the employee's current job involves working on water systems located in the workplace, which are likely to be a source of contamination. For more information see www.hse.gov.uk/riddor.

The Safety Representatives and Safety Committees Regulations 1977 and the Health and Safety (Consultation with Employees) Regulations 1996

18 These regulations⁶ require employers to consult trade union safety representatives, other employee representatives, or employees where there are no representatives, about health and safety matters. These include changes to work that may affect their health and safety at work, arrangements for getting competent help, information on the risks and controls, and planning of health and safety training.

Microbiological and other hazards

19 Water in spa pools should be free from irritant substances, chemicals and infectious microbiological agents at levels which may be harmful to health.

Microbiological hazards

20 These are generally introduced from bathers or external sources, ie the source water, atmosphere, and surface surrounds. The risk of microbial growth increases with the introduction of nutrients (for example mucus, saliva, perspiration, dead skin, suntan lotion, spray tans, cosmetics, shampoo and soap residues, urine and faecal matter, and hair). Poorly designed or poorly managed spa-pool systems can provide the conditions to create the risk of acquiring an infectious disease.

Legionella species

21 Legionellosis is a collective term for diseases caused by the legionella organism including the most serious legionnaires' disease, as well as the similar but less serious condition of Pontiac fever. There have been a number of outbreaks linked to spa pools, including those in leisure centres, hotels, holiday homes, cruise ships and those on display. Everyone is susceptible to infection but there is a heightened risk with:

- increasing age, particularly those over 45;
- smokers and heavy drinkers;
- those with existing respiratory diseases or certain illnesses and conditions such as cancer, diabetes, heart and kidney disease;
- those with an impaired immune system.

Coliforms and Escherichia coli

22 The presence of *E coli* in spa-pool water is an indication that faecal material has either entered the water from contaminated skin, or has been accidentally or deliberately introduced. Coliforms occur on vegetation and in soil as well as faeces, so their presence alone indicates external contamination. The presence of coliforms and/or *E coli* also confirms that the treatment has failed to control this contamination.

Pseudomonas aeruginosa

23 Numerous outbreaks of folliculitis caused by *P aeruginosa* are associated with spa pools and hot tubs. Folliculitis presents as a red rash caused by infection of the hair follicles, usually about 48 hours (range 8 hours–5 days) after immersion in pool water, and is related to the duration of immersion as well as the degree of contamination of the water. Children are generally more susceptible than adults.

Mycobacterium avium and Mycobacterium species

24 Respiratory disease has been associated with non-tuberculous mycobacteria, particularly *Mycobacterium avium*, in association with spa pools and hot tubs.

Other potential infections

25 Other infections such as amoebal, parasitic and other gastrointestinal infections, furunculosis (caused by *Staphylococcus aureus*) and *Molluscum contagiosum* (a viral skin infection producing papillomas) have also been associated with using spa pools.

Other hazards

26 The most immediate danger to users is from accidental drowning, resulting from slipping or tripping, or getting caught in fittings such as the outlets. This guidance is not intended to give detailed advice on non-microbiological hazards in the workplace, but the main hazards are summarised below and managers should be aware of these and manage the risks associated with them.

Chemical

27 COSHH covers substances that are hazardous to health, including chemicals and products containing chemicals. Risks associated with working with chemicals used in a spa pool, overdosing and disinfection byproducts and inadvertent mixing of incompatible chemicals must be managed. Further guidance is at www.hse.gov.uk/coshh/basics/substance.htm.

Temperature

28 Prolonged immersion in water above body temperature can lead to delayed shock. The warm temperature of spa pools could pose a risk of ill health to users who are pregnant, have cardiovascular problems, or are subject to fits. People taking medication for cardiovascular and nervous system conditions, and those with physical disabilities, should seek medical advice before using a spa pool. Shortening exposure time and using notices to warn users can help control the risk. While temperature mainly affects users, particularly young children, the high temperature and humidity around the spa pool could also affect people working for long periods close to it.

Electrical

29 Spa-pool systems should comply with the Electricity at Work Regulations 1989. More guidance on the risk of working with electrical equipment is available at www.hse.gov.uk/electricity/information/law.htm and further information on the standards covers wiring for electrical installations in swimming pools and spa pools can be found in BS 7671.⁷

Slips and trips

30 Water in and around the spa pool presents a slip hazard for users and those walking close to the equipment, and obstructions around the spa pool could present a trip hazard. There is a legal requirement to assess the risk from both hazards and guidance is available at www.hse.gov.uk/slips. Additional information on designing spa pools to minimise slip and trip hazards has been produced by the Swimming Pool and Allied Trades Association (SPATA): www.spata.co.uk.

Confined spaces

31 A confined space can be any space of an enclosed nature where there is a risk of death or serious injury from hazardous substances or dangerous conditions (eg lack of oxygen). The risk of working in a confined space, for example in and around the balance tank, must be assessed under the Management of Health and Safety at Work Regulations 1999. If the assessment identifies risks of serious injury associated with confined spaces from work in and around the spa-pool system, the Confined Spaces Regulations 1997 apply. Further guidance can be found at www.hse.gov.uk/confinedspace.

Manual handling

32 Take care to avoid injuries when handling the spa pool and any heavy and/or awkward loads such as chemical drums, as these can lead to cumulative damage that can be severe and debilitating. If manual handling is required, an assessment must be carried out in accordance with the Manual Handling Operations Regulations (www.hse.gov.uk/msd/manualhandling.htm).

Entrapment

33 There is a risk of suction entanglement and trapping hair or body parts in the spa-pool inlets, outlets and grilles. The risk should be assessed and appropriate control measures used to reduce it, for example by using design features and clearly displayed information to users.

Identifying and assessing the risk

34 Before any formal health and safety management system is implemented, the dutyholder is responsible for ensuring a risk assessment is carried out to identify the possible risks. The purpose of the assessment is to enable a decision on:

- the risk to health, ie whether the potential for harm to health from exposure is reasonably foreseeable, unless adequate precautionary measures are taken;
- the necessary measures to prevent, or adequately control, the risk from exposure to legionella and other infectious agents.

35 There are a number of factors that create a risk of someone acquiring an infectious disease from a spa pool:

- presence of infectious agents (eg legionellae) in the spa pool;
- suitable conditions for growth of the infectious agents, eg a temperature of 20–45 °C;
- a source of nutrients (eg organic matter from bathers and from the environment);
- a means of creating and spreading breathable droplets, eg the aerosol created by agitated water;
- presence of people who could be exposed to the infectious agents, eg users, those working on or near the vicinity of the spa pool, or passing near one.

36 If the dutyholder is competent and understands the risks associated with operating a spa pool, they may choose to do the risk assessment themselves. They may need access to competent help and advice, and if this is not available internally it may be sourced externally, ie from a consultant or person experienced in carrying out risk assessments. It is important that they are satisfied that any contractors employed are competent to carry out the tasks to the required standard.

37 The risk assessment enables the dutyholder to show that they have considered all the relevant factors, and the steps needed to prevent or control the risk. The Appendix provides information on the key requirements when assessing the risks associated with spa-pool systems and further information is also available in BS 8580 *Water quality. Risk assessments for Legionella control*.⁸ The assessment should consider:

- the source and quality of the supply water, eg from the mains supply or an alternative;
- description of the water system, its component parts and any associated equipment, including an up-to-date schematic diagram and the material used in its construction;
- possible sources of contamination of the supply and pool water, eg biofilms within the pipework, bathers, soil, grass, leaves for outdoor spa pools;
- the normal operating characteristics of the spa pool;

- unusual operating conditions, eg dosing pump breakdowns, dosing pipework blockages or power cuts;
- those working on or near the spa pool and susceptibility of users;
- clear allocation of management responsibilities;
- competence and training of key personnel;
- an evaluation of the microbiological and other risks associated with operation, eg infectious agents, slips and trips, manual handling, confined spaces etc;
- safe operating procedures and controls in place to manage and control the risk;
- monitoring, inspection and maintenance procedures;
- results of monitoring, inspection and any checks carried out;
- remedial action to be taken if the scheme and control measures are found to be ineffective;
- arrangements to review the assessment regularly and particularly when there is a reason to suspect it is no longer valid;
- arrangements to deal with accidents, incidents and emergencies.

38 The risk assessment should be linked to other relevant health and safety records, and specifically the written scheme of control.

39 In conducting the assessment, the dutyholder should appoint a competent person (known as the responsible person), to help them meet their health and safety duties and take day-to-day responsibility for controlling the risk identified from infectious agents in the spa pool, ie managing the control scheme. The appointed responsible person should have a clear understanding of their role and the overall health and safety management structure and policy in the organisation. If the necessary competence, knowledge and expertise are not available, the dutyholder may need to appoint someone externally. Further guidance is available in HSE's *Managing for health and safety at work* (HSG65).

40 It is important that the responsible person(s) have sufficient authority, competence and knowledge of the system to ensure all operational procedures are carried out in a timely and effective manner. Those appointed to implement the control measures should be suitably informed, instructed and trained, and their suitability must be assessed. They must be properly trained to ensure duties are carried out in a safe, technically competent manner, and receive regular refresher training. Records of all training, including initial and refresher training, must be kept.

Competence

41 Inadequate management, lack of training and poor communication can be contributory factors in outbreaks of diseases, including legionnaires' disease. It is important that everyone involved in the risk assessment and operation of the spa pool must be competent, trained and aware of their responsibilities. The dutyholder must ensure that suitable and sufficient information, instruction and training are provided. Competence will be a product of sufficient training, experience, knowledge and other personal qualities. Training,

including refresher training, is an essential element of an employee's capability to carry out work safely.

42 Employers must consult their employees or their safety representatives on the identified risks of exposure and the measures and actions taken to control the risks. Employees should be given an opportunity to comment on the assessment and control measures. Employers may wish to involve employees and/or safety representatives when carrying out or reviewing the assessment as a way to manage health and safety.

43 The risk assessment is a living document that must be reviewed regularly to ensure it remains up to date and specifically when there is reason to suspect it is no longer valid. An indication of when to review the assessment, and what to consider, should be recorded. This may result from, for example:

- changes to the spa pool, the way it is operated and used;
- changes to the treatment regime;
- changes to the building water system and any impact on the spa pool;
- availability of new information about the risks or control measures;
- the results of microbiological and/or chemical tests indicating control measures are not effective;
- changes to key personnel;
- a case of disease (eg legionnaires' disease) associated with the spa pool.

Controlling the risk

44 To control the risk, a course of action should be devised to manage the system by implementing effective control measures. A written scheme of control should be specific and tailored to the spa-pool system and any associated facilities, plant and equipment covered by the risk assessment (see the Appendix, checklist 2). This could be included in, or part of, the normal operating plan (NOP) which, together with the emergency action plan (EAP), constitutes the pool safety operating procedure (PSOP).

Information box 1 Pool safety operating procedure (PSOP)

Normal operating plan (NOP)

The NOP should set out the way the system operates on a daily basis and should include details of the layout, equipment, manner of use, user-group characteristics and any hazards or activity-related risks.

Emergency action plan (EAP)

The EAP should give specific instructions on the action to be taken, by all staff, in the event of any emergency.

How the plans can be kept

The plans can be kept as written documents or stored electronically, provided that employees have access to them and that they are available for inspection by the enforcing authority, if required.

45 The written scheme should specify:

- the spa pool and associated plant, ie up-to-date schematic diagram;
- the description of the correct and safe operation of the spa pool;
- the control methods and other precautions when operating the spa pool;
- the checks required to ensure the spa pool is operating safely and the frequency of such checks;
- remedial action required when monitoring shows that control measures are ineffective;
- information for users.

46 The following factors should also be considered:

- type, design, size, approximate water capacity and designed bather load of the spa pool;
- source and quality of water supply;
- type of dosing equipment, including the use of any automatic controls, timers, pumps, balance tank(s), air blowers etc;
- pipework and construction materials;
- type of filtration system;
- backwash schedule, if applicable;
- heat source and design temperature;
- chemical dosing equipment, including chemical separation, personal protective equipment (PPE), chemical storage arrangements;
- type of treatment to control microbiological activity, eg chlorine;
- a method used to control pH;
- cleaning regime – accessibility and ease of cleaning, what is cleaned, how and when;
- chemical and microbiological testing regime, including frequency, operating parameters, and actions when the results are outside parameters;
- susceptibility of users;

- intended use;
- water replacement frequency other than via backwashing;
- actions for repeated adverse monitoring results or contamination incidents and criteria for the closure and reopening of the spa pool.

47 Communication and management procedures are particularly important where several people are responsible for different aspects of the spa pool's operation. Responsibilities and lines of communication should be clearly defined, reviewed and documented to ensure they are effective, and documentary evidence made available for inclusion in internal and external audits. This also applies to external contractors who may be responsible for certain aspects of the control regime.

48 Arrangements should be in place to ensure staffing levels are appropriate while the spa pool is being operated and the responsible person(s) or an authorised deputy are contactable at all times when the spa pool is in use.

49 It is important to ensure that control measures are implemented effectively and this can be achieved by:

- ensuring the design bather load and recommended bather duration is not exceeded;
- encouraging showering before entering the pool;
- regular checks and observations at appropriate intervals;
- ensuring PPE is being used correctly;
- adequate supervision of staff to ensure defined procedures are understood and being followed;
- providing appropriate signage;
- taking prompt remedial action when required.

50 For precautions to remain effective, the condition and performance of the spa pool must be monitored and reviewed. The responsible person should oversee and manage this, although it is acceptable for competent consultants or contractors to provide assistance and advice. The review should include:

- checking the performance of the spa pool and its component parts;
- inspecting the accessible parts for damage and signs of contamination, eg biofilms, the condition of the jets/overflows/grilles etc;
- monitoring to ensure the treatment regime is controlling the growth of infectious agents;
- checking that any modifications are included in the review.

Record keeping

51 Where there are five or more employees, the law requires that the significant findings of the risk assessment must be recorded. If there are fewer than five employees there is no legal requirement to record anything.

52 Records must be kept when managing a spa-pool system and should include the following:

- names of those responsible for conducting the risk assessment, and managing and implementing control measures;
- significant findings of the risk assessment;
- written control scheme and details of its implementation (the normal operating plan or NOP – Information box 1);
- details of the state of operation of the spa-pool system, ie in use/not in use;
- results of any monitoring, inspection, test or check carried out on the spa pool, along with dates such as:
 - results of chemical and microbiological analysis of the spa-pool water;
 - water treatment chemical usage;
 - inspections, checks and records of maintenance on the water system, components and water treatment equipment to confirm correct and safe operation;
 - cleaning and disinfection procedures and associated reports and certificates;
- information on other hazards, eg chemical, slips and trips;
- training records of those who work on the spa pool.

53 Record of the risk assessment must be retained for the period it remains current and for at least two years afterwards, and records kept for monitoring, inspections, testing or checks, should be kept for at least five years.

54 Records, written or electronic, should contain accurate information about who did the work and when it was carried out. All records should be signed, verified or authenticated by a signature or other appropriate means.

Dealing with accidents, incidents and emergencies

55 The dutyholder must establish procedures to deal with situations involving serious and imminent danger where an employee, user or visitor is, or could be, exposed to a hazardous substance beyond that associated with normal day-to-day activity. This could be exposure to a chemical used to treat the water following a significant spillage, inappropriate mixing of chemicals or exposure to infectious agents from the spa pool.

56 The emergency procedures are often referred to as the emergency action plan (EAP), and form part of the pool safety operating procedure (PSOP) – see Information box 1.

57 The response to an emergency should be proportionate to the risk, for example a small chemical spillage may not require full evacuation of the whole premises but detecting certain levels of bacteria in the spa-pool water could require it to be closed down.

58 The emergency procedures should provide sufficient information to:

- mitigate the effects of the incident;
- limit the extent of any risks to health of the people working on or near and using the spa pool;
- restore the situation to normal as soon as possible;
- verify that remedial action has been effective;
- review factors which led to the incident and implement actions to prevent recurrence.

59 The EAP should include the following details:

- the identity of the relevant hazardous substances present, where they are stored and used, and the estimated amount in the workplace on an average day – this would be relevant for the water treatment chemicals;
- foreseeable types of accidents, incidents or emergencies that might occur with the hazardous substances on the premises including chemical and microbiological ones, eg spills or microbial growth in the spa-pool water;
- special arrangements to deal with the emergency situations not covered by general procedures;
- safety equipment and PPE required when dealing with an emergency;
- first-aid facilities sufficient to deal with an incident until the emergency services arrive, and location of the facilities;
- the role, responsibilities and authority of the people nominated to manage the accident, incident or emergency, eg person(s) responsible for shutting the spa pool down;
- procedures for employees to follow, such as clearing up and safely disposing of any hazardous substances or contaminated cleaning equipment;
- regular safety drills;
- special needs of all employees, visitors or spa pool users, eg procedures to ensure safe evacuation.

60 The EAP should be regularly reviewed and updated, specifically when circumstances change, for example where a new disinfectant is used. A record of procedures must be kept and be readily accessible. If appropriate, emergency procedures should be displayed in prominent positions in the workplace for employees or spa-pool users to read.

Responsibilities of designers, manufacturers, importers, suppliers and installers

61 Designers, manufacturers, importers, suppliers (including hirers) and installers must ensure the spa pool is designed, constructed, tested, installed and commissioned so that it will be safe and any risks to health are controlled when it's used. They must also provide adequate information for the user about the risks of the product. This should be updated if any new information about significant risks to health and

safety becomes available. Plumbing fittings and pipework etc must comply with the requirements of the Water Supply (Water Fittings) Regulations 1999⁹ and, in Scotland, the Water Supply (Water Fittings) (Scotland) Byelaws 2014.¹⁰

62 Suppliers of spa pools and services, including consultancy and water treatment services, should, so far as reasonably practicable, ensure that measures intended to control the risk of exposure to infectious agents are designed and implemented so that they are safe and any risks to health are controlled.

Information box 2 Relevant legislation

HSW Act, Sections 3 and 6

This places a duty on any person who designs, manufactures, imports or supplies articles or substances for use at work, to ensure that they are safe and without risks to health at work and that any information related to the article or substance is provided.

It also places general duties on employers and the self-employed to conduct their undertakings in such a way as to ensure, so far as is reasonably practicable, that people other than themselves or their employees are not exposed to risks to their health or safety. They should also provide adequate information regarding any aspects of their products or services that might affect their health and safety.

Consumer Protection Act (CPA) 1987¹¹

Consumers have the right to expect their purchased spa pool to:

- be of satisfactory quality, that a person would reasonably expect given the description, price and other relevant circumstances;
- be fit for purpose, ie it can be used for the purpose expected;
- match its description (verbal or written), and if the spa pool is chosen after seeing a sample it must match this.

It is a criminal offence for a trader to put a false description on goods.

General Product Safety Regulations 1994¹²

These regulations have replaced Section 10 of the CPA and apply to products supplied to consumers for their private use and to all those in the business supply chain who are established and supply consumer goods in the UK. Suppliers include 'producers' or 'distributors'.

Producers are required to:

- only place on the market safe products within the limits of their activities;
- provide relevant information to customers;
- take measures to keep themselves informed of the risks that products may present and take appropriate action, eg withdraw products from the market if necessary.

Distributors are required to act with due care to help ensure that products supplied by them are safe. A 'safe product' under the regulations presents either no risk or only minimum risk compatible with the product's use.

Health and safety law – holiday parks and lets

Holiday parks – privately owned units

63 The HSW Act does not apply to the private owners of spa pools and hot tubs installed in a holiday park unit where there is no financial gain and they are for the exclusive use of the owner, family and occasional guests. To ensure its safe use, the spa pool or hot tub should be used and maintained in accordance with the manufacturers' instructions.

Holiday parks – site owners' duties

64 Section 3 of the HSW Act imposes a duty on an employer (or self-employed person) to avoid exposing people who are not their employees to health and safety risks. So the site owner of the holiday park should:

- **for private owners** – liaise with the owner to ensure the safe use and maintenance of the hot tub and direct them to relevant information and guidance, including the manufacturers' instructions, on its safe use and the risks posed to both themselves and to others from legionella (see paragraph 75);
- **for the sale and rental of spa pools and hot tubs on site** – take reasonable steps to ensure the risk of exposure from infectious agents, including legionella, is understood, managed and controlled. This would be considered part of the site owner's business undertaking.

Section 2: Types and settings

65 This section is intended to provide definitions for the variety of spa-pool systems or spa-pool-like units and the various settings in which they may be installed and used. The type, design and intended use of the spa pool in relation to the setting in which it is being used should be considered as part of the risk assessment process. Further information on the factors that should be considered as part of the risk assessment process can be found in Section 1 Legislative requirements and the checklists in the Appendix.

Types of spa-pool systems

66 Common terms associated with spa pools are hot spa, hot tub, whirlpool spa and portable spa. Jacuzzi® is the registered trade name of a specific manufacturer and should not be mistaken for a generic name for spa pools.

67 There are other installations such as:

- compact spa-pool installations that have been designed often with air induction and a counter-current exercise unit;
- joined swimming pool and spa pool compartments to enable swimming in a confined area; or
- larger volume spa-pool installations with air induction, often in conjunction with a variety of water features.

68 Where domestic-type spa pools are used as a business activity, the bather load is restricted to a discrete group of users.

Bespoke spas

69 A bespoke spa pool is built in situ using standard, factory-built parts which may be modified or added to on site. Bather loads, water temperature and the size of the pool may vary greatly but usually they have a higher bather load and are in a commercial setting (defined below). These pools typically have either an overflow or deck-level spa with a separate filter and continuous chemical feeder system (see Figure 1 on page 26). The design includes a separate balance tank generally located in the plant room. The complexity of the design features, any associated equipment and the aerosol exposure must be considered during the risk assessment and will require enhanced levels of control and monitoring.

Hot tubs

70 A hot tub is a self-contained factory-built unit for indoor or outdoor use and is designed for sitting in. They are typically filled with treated water, maintained at a temperature above 30 °C, fitted with air jets and aerated (see Figure 2 on page 27). They are generally designed for a small number of discrete bathers where the water is not changed, drained or cleaned after every use. Hot tubs are not for swimming in and do not have a balance tank. These are likely to be small units but with regular daily usage and the above factors, along with the turnover of water, must be considered as part of the risk assessment.

Whirlpool baths

71 Whirlpool baths are designed for one or two bathers where the water is not treated, and are intended to be filled and emptied after each use. Whirlpool baths are usually fitted with water jets, which can be angled in use. In addition, there is usually an air track in the floor of the bath, powered by an air-blower system and/or air may be introduced to the water jets.

72 Whirlpool baths have the potential for similar problems to spa pools, such as the formation of biofilms within the pipework system associated with the air and/or water booster jets, and should be regularly disinfected. Such factors must be considered as part of the risk assessment process.

Natural spa pools

73 In these spa pools the water is untreated, but this in itself can pose potential health and safety implications. The water for natural spas should be shown to be of satisfactory microbiological quality before their construction. They must be managed to control the risk of exposure of bathers and others to infectious agents. This will usually require the natural spa pool to be managed in the same manner as any other commercial spa pool. Managers of natural spa pools should, therefore, follow the guidance on control measures provided in this guidance document, but alternative control strategies may also be used if proven to be effective.

Spa-pool settings

74 Spa-pool systems are fundamentally used in the following settings:

- domestic – privately owned;
- domestic – installed and used as part of a business activity;
- commercial – installed in a commercial establishment or public building.

Domestic-type spa pools – privately owned

75 Spa pools or hot tubs installed in domestic homes or privately-owned properties (for example, in a private holiday home) for which there is no financial gain, ie they are not available for rent or let and are for the exclusive use of the owner, family and occasional guests, and are not subject to the HSW Act. The operational use of such systems does not therefore fall within the scope of this guidance.

Domestic-type spa pools – used as a business activity

76 Domestic-type spa pools or hot tubs used as part of a business activity (eg in a holiday park rental unit or hotel bedroom(s) with their own dedicated spa, or as part of a rental agreement for a single family or group use) are subject to the general duties under the HSW Act. There is a legal requirement for these systems to be managed and controlled in proportion to the risk and the risk assessment should consider the type of pool and its use. Domestic-type spa pools are for use by a small, discrete group of people at any one time and are typically:

- of either a rigid or inflatable/foam-filled structure with freeboard and skimmer;
- systems where the water should be changed after each rental/week, whichever is the shorter;
- disinfected using bromine or chlorine through the use of an inline disinfectant feeder.

77 These spa pools are not suitable for medium or large-scale business use (ie large numbers of casual bathers and/or unrelated groups), or for commercial activity, as design features and systems for control are unlikely to be sufficient to cope with user demand.

78 Design bather load is a key characteristic and should be considered as part of the risk assessment to achieve effective control. There are circumstances in which a domestic-type hot tub would be unsuitable, and a commercial-type spa pool should be used. These include any settings where there is potential for a higher bather load and/or there is continuous bather use, for example party spas, entertainment spas, or similar – or where several accommodation units have shared access to a spa pool, eg at a holiday park or large hotel.

79 Where the use of a commercial-type spa pool is not possible or practicable (eg hot tubs used for cinema screenings), the risk assessment must consider the bather load and take into account the characteristics of the spa pool and the control measures required to effectively manage the risk in this setting. After each period of hire, the spa pool should be completely drained, cleaned, refilled, disinfected and drained again. When stored, the spa pool should be dry, including the insides of the pipework, as far as practicable.

80 There have been significant outbreaks associated with spa pools on display. Where a domestic-type pool is on display at a showroom or

exhibition, the design bather load would not apply to the risk assessment as the pool should be displayed empty of water and there would be no intended bather use. However, if it is filled, the risks posed to individuals who work with or pass in close proximity to the spa pool must be considered and must be treated and controlled.

Commercial-type spa pools

81 These are designed for higher bather loads and are subject to the general duties under the HSW Act. They are generally installed in a commercial establishment or public building. Typical commercial settings, where there is a higher number of users than for domestic-type spa pools and the number of bathers cannot be clearly anticipated or recorded, include hotels and holiday accommodation (where the pool is a shared facility), health clubs, beauty salons, sports centres and clubs, and swimming-pool complexes. Spa-pool systems for commercial use are generally characterised by the following:

- a deck-level overflow;
- greater numbers of users exposed for longer periods of time requiring increased levels of control and monitoring;
- a separate filter and continuous chemical feeder system;
- a balance tank and plant room.

Healthcare

82 Healthcare premises, residential or care homes can feature spa pools, including whirlpool baths, used for medical or therapeutic purposes. Special consideration should be given to patients or occupants in a healthcare setting (healthcare premises, residential or care homes), where they may be exposed to a spa-pool system and a potential source of waterborne infectious agents. This document should therefore be read in conjunction with HSE's HSG274 Part 2 *Special considerations for healthcare* and the Department of Health's specific guidance for healthcare premises: www.gov.uk/government/publications/hot-and-cold-water-supply-storage-and-distribution-systems-for-healthcare-premises.

83 A local risk assessment should consider the number and nature of any 'at risk' patients or residents, as there may be factors which increase their susceptibility to legionnaires' disease. Such factors include increasing age, those with existing respiratory diseases or certain illnesses such as cancer, diabetes, kidney disease, and those with impaired immune systems. The risk assessment should inform the overarching water safety plan, and it is important that the Water Safety Group has access to expert advice on any risks posed by spa pools and how to operate and maintain them safely.

Section 3: Design and commissioning

84 This section gives a description of the characteristics, design, construction and commissioning of spa pools. They are designed in different shapes, sizes and with different configurations of plant and equipment, and the setting in which they are intended to be used should be taken into account in the risk assessment. Spa pools, and any modifications made to them, should be designed with safe operation and maintenance in mind. In particular, all parts should be easily and safely accessible for all essential maintenance tasks and in a way that readily allows for cleaning and disinfection of all wet surfaces. Where spa pools with a higher bather load are sited indoors, consider the dehumidification/ventilation of the area around the spa pool.

Design

85 Spa-pool systems should be designed and constructed to be safe, and minimise risks to health and should comply with:

- Classification, Labelling and Packaging Regulations 2015;¹³
- Construction (Design and Management) Regulations 2015;¹⁴
- European Biocidal Products Regulation (EU) 528/2012;
- Water Supply (Water Fittings) Regulations 1999 and, for Scotland, the Water Supply (Water Fittings) (Scotland) Byelaws 2014;
- The Private Water Supplies Regulations 2009,¹⁵ in England, the Private Water Supplies (Wales) Regulations 2010;¹⁶ or the Private Water Supplies (Scotland) Regulations 2006;¹⁷
- BS EN 806 (Parts 1-5) Specifications for installations inside buildings conveying water for human consumption;¹⁸
- BS 8558 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.¹⁹

86 The design of the spa pool should take into account:

- location;
- design bather load;
- source water quality;
- drainage and water replacement;
- access for cleaning, operation and maintenance;
- balance tank (if appropriate);
- plant location;
- filtration;

- chemical treatment and storage areas;
- circulation rate and circulation hydraulics;
- turnover period;
- materials of construction;
- prevention of deadlegs.

Construction

87 Spa pools and associated pipework and equipment should be constructed from materials appropriate for their intended use. They should be supported to ensure minimal movement or flexing of the shell to prevent damage and facilitate effective drainage. Surfaces should be smooth and free from defects that would otherwise support microbial growth. All water fittings used in the construction of systems must comply with the requirements of Water Supply (Water Fittings) Regulations 1999 and, for Scotland, the Water Supply (Water Fittings) (Scotland) Byelaws 2014. All non-metallic materials used in the construction of the spa-pool system must comply with the appropriate parts of BS 6920.²⁰

88 The design of spa-pool shells normally conform to one of two designs:

- deck-level overflow system (see Figure 1) – maintains the water level at a constant height while the excess water flows to a balance tank to be replaced as the bathers leave the spa pool;
- freeboard and skimmer system (see Figure 2) – where the water level is below the top of the system to accommodate bather immersion.

Circulation

89 Spa pools and plant should be designed to achieve circulation and mixing of all the treated pool water with no stagnant areas and effective removal of water from the surface (where the bulk of the pollutants are). Spa pools should be designed with a surface draw-off of approximately 80% of the circulation volume. To maintain microbiological quality of the spa-pool water, the filter and pumps should be sized to provide a turnover of pool water that is suitable for the pool layout and operation at the limit of the anticipated bather load, which will typically be 6 minutes for commercial-type spa pools where bather load is high and 15 minutes for lower bather loads.

90 For deck-level overflow systems, surface water spills into perimeter channels forming part of the recirculation system, and is drawn from the balance tank and pumped through the filters and circulated back to the spa pool. All suction outlets should be duplicated and connected to more than one fitting, and the fittings should be of an anti-vortex design to reduce the risk of entrapment. Where suction pipes are run from a plant room, all suction valves should be left open while the pump is running to avoid deadlegs.

91 Figure 1 is an illustration showing a design for a deck-level overflow spa pool and its associated water system. It shows how the water is continuously circulated, filtered, chemically treated and heated before being returned to the spa pool via the inlets. Water within the spa pool should continually overflow into the deck channel, which then returns to the balance tank. There may also be a secondary circuit that draws water from the spa-pool footwell and reinjects it into the spa pool. The heater and chemical dosing units should be adequately interlocked to 'fail-safe' if the water stops circulating.

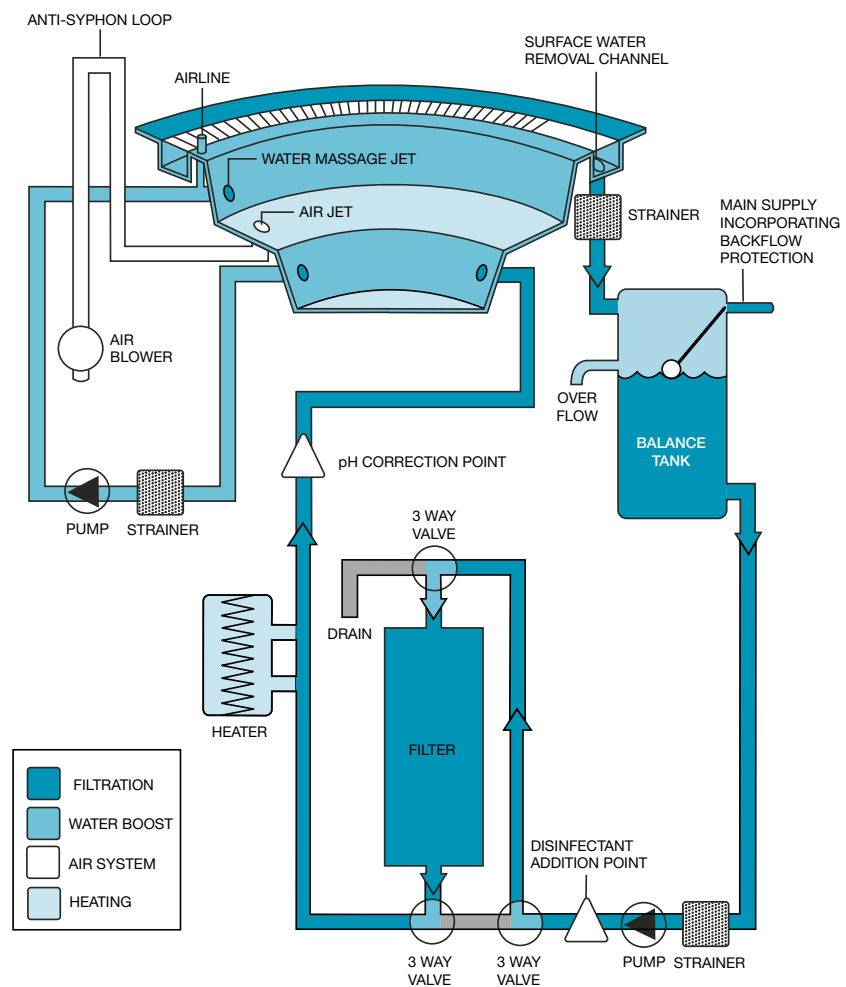


Figure 1 Design of a typical deck-level overflow spa pool and associated water system

92 Figure 2 illustrates a typical freeboard and skimmer system – it shows how the water is drawn directly from the spa pool via the surface level skimmer to the filter. Water within the spa pool should be continually pumped through the filter and returned to the pool tank. There may also be a secondary circuit that draws water from the spa-pool footwell and pumps it back into the spa pool.

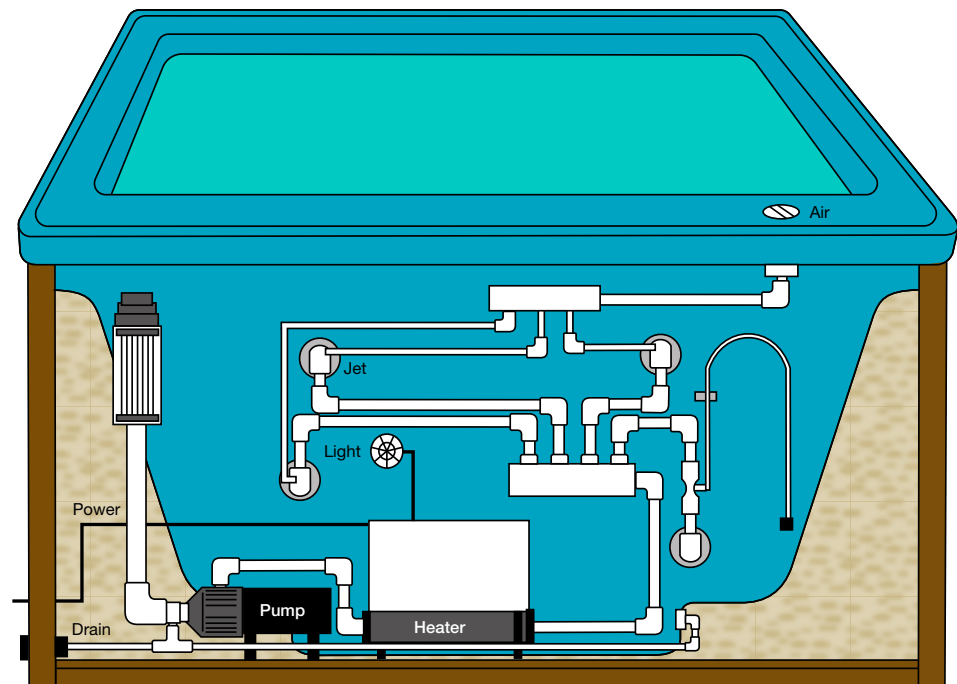


Figure 2 Design of a typical freeboard and skimmer spa pool and associated water system

Pipework

93 Pipework should be designed to be readily accessible and removable for inspection and cleaning, with minimum length of pipe runs to avoid deadlegs and reduce the surface area for microbial biofilm growth. As plastic pipework may readily support microbial growth, the materials chosen should minimise the risk. Flexible, internally-corrugated piping should not be used as it increases the surface area for growth and can create areas that are difficult to clean.

94 All non-metallic materials used in the construction of the spa pool should comply with the Water Regulations Advisory Scheme (WRAS) approval scheme which lists products that have been tested and comply with BS 6920.

Filtration

95 Filtration is necessary to ensure adequate water clarity can be maintained through the removal of suspended particulate matter/debris

in the water. Filtration is a means of entrapping particles mechanically and/or through absorption onto a filter medium. There are several types of system in common use and the choice of system type and size should reflect the anticipated type of use, circulation rate and bather load. Spa pools will typically only require one filtration system but multiple units and types in sequence may be appropriate, depending upon the local circumstances.

- **Sand filtration** – Sand filters are vessels containing 16/30 graded sand (or glass) as a filter medium through which a pressurised water supply is fed. They are recommended for use where bather load is anticipated to be high due to their size and reliability. The flow rate, in addition to the size and depth of the vessel and choice of medium, will affect the efficiency of the system. Higher filtration rates (such as 25–50 m³/m²/h) are suitable for lower bather loads and lower rates (such as 10–25 m³/m²/h) for higher bathing loads. The design and installation should allow for effective operational procedures such as checks on sand quality, regular backwashing and periodic media replacement. The system water volume should be based on the flow rate and time period recommended by the filter manufacturer to allow for backwashing.
- **Cartridge filters** – Cartridge filters are systems of tightly packed filter media such as fibreglass or paper in a demountable unit. They are small units and typically would only be used in domestic-type spa pools where the bather load and anticipated level of particulate matter was low. The design and installation should allow for removal of the cartridge for regular chemical cleaning, drying and periodic replacement.
- **Pre-coat filters** (including diatomaceous earth) – These filter vessels contain internal septum coated with a filter medium such as diatomaceous earth. The design and installation should allow for effective operational procedures such as backwashing and periodic media replacement.

96 Alternative types of filtration and filtration media exist and, where used, should be verified as suitable for the type of spa pool and the setting in which it is to be used.

Balance tank

97 Deck-level overflow systems should have a balance tank designed to take up the water displaced from bathers and should be:

- appropriately sized for the bather load;
- easily and safely accessible for inspection, cleaning and maintenance;
- constructed from materials which minimise the potential for microbial growth;
- smooth to facilitate inspection, cleaning and disinfection and free from defects that support microbial growth;
- easy to drain completely;
- designed to limit ingress of dirt and other potential nutrients but with a removable lid or inspection hatch to facilitate access while

maintaining the appropriate backflow protection with an air gap which is unrestricted;

- designed with sufficient water capacity when unoccupied for a filter backwash, where necessary.

Water treatment and control systems

98 Water treatment is essential to inhibit microbial growth in the spa-pool water and associated plant. The programme of treatment should be designed to control microbial growth, pH and include appropriate dosing control systems. The control system should be designed to be compatible with the proposed water treatment programme.

99 Where key risk factors are greater, such as high bather load, chemical dosage and control should be automated to ensure the correct treatment levels are consistently applied. Various automatic control systems are available incorporating redox, amperometric or photo ionisation detectors (PIDs), with pH control. Both amperometric and PID controllers are more specific for chlorine and bromine and are considered to provide better control than redox. Take care when considering the use of an automatic controller with trichloroisocyanuric acid (Trichlor) to ensure its suitability and compatibility with cyanuric acid.

100 Chemicals added to the spa-pool water as a solution are normally added by positive displacement metering pumps which can be adjusted to vary the volume of the chemical dosed. Dosing pumps should be designed to shut off if the circulation system fails, but automatic water quality monitors should remain in operation. Where chemicals are added, eg Trichlor, calcium hypochlorite or bromochlorodimethylhydantoin (BCDMH), they should be introduced using a sidestream dispenser.

101 Domestic-type systems used as part of a business activity are typically disinfected using bromine or chlorine through the use of an inline disinfectant feeder.

Heating

102 The typical operating temperature of spa pools is 30–40 °C. The heat exchanger should be sized to ensure that a rise in water temperature will not cause damage to the shell or any tiling but should be capable of heating the pool water within a suitable timeframe according to pool design. Specific details are given for tiled pools in BS 5385-4 *Wall and floor tiling. Design and installation of ceramic and mosaic tiling in specific conditions. Code of practice.*²¹

Booster jets

103 Booster jets are inlet fittings that blend air and water creating a high velocity turbulent mix. The booster jets and pipework should be designed to discourage biofilm formation and to facilitate inspection, cleaning and treatment programmes. This should include preventing areas where water might become stagnant in addition to enabling the

use of biodispersant compounds, eg chlorine dioxide, where circumstances require it for removing biofilm, slime, fouling etc.

Air-blower system

104 An air-blower system consists of a series of air holes or injector nozzles in the floor and seats which deliver air to these outlets and operated in a similar manner to booster jets. These can be difficult to disinfect and may support microbial growth, so the pipework should be designed to be demountable and accessible for inspection, cleaning and disinfection.

Spa-pool water make-up supply

105 The make-up water supply to the spa pool should comply with the Water Supply (Water Fittings) Regulations 1999 and, for Scotland, the Water Supply (Water Fittings) Byelaws 2014. The supply pipework should be sized to ensure the spa pool can be filled quickly after it is drained and cleaned.

Plant location

106 The pool plant and equipment should be located as near as possible to the spa pool with suction and delivery pipe runs and chemical dosing lines, where used, kept as short as practicable.

107 To ensure all routine and maintenance functions can be carried out adequately there should be sufficient space, easy access and a separate area close by for safe storage of chemicals. Further information on plant space and chemical storage can be found in the Chartered Institute of Building Services Engineers (CIBSE) Guide G Public Health and Plumbing Engineering,²² and *Swimming Pool Water: Treatment and Quality Standards for Pools and Spas* published by the Pool Water Treatment Advisory Group (PWTAG)²³ and the PWTAG website: www.pwtag.org.

Commissioning

108 Commissioning is an essential step in ensuring that spa-pool systems operate safely from the outset. They should be commissioned to ensure they operate correctly and safely in accordance with the design parameters. It is essential that the commissioning process is carried out by competent people in a logical and defined manner and in full compliance with the supplier's or installer's instructions. It should include both the spa pool and any associated pipework and water treatment plant, where relevant.

109 The responsibilities of the staff carrying out the commissioning process should be clearly defined, with adequate time and resources allocated to allow the integrated parts of the installation to be commissioned correctly. The precautions taken to prevent or control the risk of exposure to legionella and other infectious agents during normal operation also apply to the commissioning process. It is important to note that a spa-pool system may harbour residual water and microbial

contamination from pressure testing before leaving the manufacturer or supplier; this risk must be assessed and all components cleaned and disinfected as part of the commissioning process.

110 The spa pool should be fully tested to confirm its functional safety and fitness for its intended purpose before being brought into use, and the procedure and results should be fully documented. Commissioning should include:

- water disinfection to reduce microbial growth, typically with 50 mg/l chlorine for at least one hour, with the pH kept as near to 7.0 as possible during this period;
- evidence that safety standards have been met;
- a comprehensive functional water test to ensure the spa pool system operates correctly;
- chemical and bacteriological analysis of the water to ensure operating parameters are achievable and being maintained.

111 Once commissioned, the spa pool should be treated as if in normal use.

Section 4: Operation and maintenance

112 This section provides guidance on the operation, cleaning and disinfection of spa-pool systems. Water in spa pools should not contain significant levels of irritants or infectious microbiological agents, which generally come from the atmosphere, water source and surface surrounds or bathers.

113 The volume of water, operating temperature, location of the pool (eg outside) and bather loads all contribute significantly to risk, which means that disinfection, microbial control strategies and filtration are essential for maintaining standards in spa pools. As with any water system, routine maintenance is essential to ensure the system works as intended. Maintenance requirements should follow manufacturers' instructions, and additional guidance on maintaining water systems is provided in BS EN 806-5 Operation and maintenance.

114 An appropriate water treatment programme must be capable of controlling not only legionella and other microbial activity, but also pH. It should include appropriate measures, such as regular physical cleaning and shock disinfection, to maintain the system's cleanliness. As these aspects are often interrelated, failure to control one aspect will often lead to other problems and increase the microbial risk. The water treatment programme should be capable of delivering certain chemical and microbiological criteria (see Tables 3 and 4 in Section 5), which will depend on the nature of the water and the treatment system.

Bather load

115 Each type of spa pool is designed to contain a maximum number of bathers at any one time and this is an important determinant of satisfactory water quality during typical use of the spa pool. The risk assessment should consider the bather load to ensure satisfactory water quality and determine the operational actions. The number of bathers in the spa pool at any time should never exceed the number of seats or loungers provided in it.

116 The design bather load is the maximum number of bathers using the spa per hour (ie each hour is three periods of 15-minute bathing followed by a 5-minute rest period) and this should be stated and not exceeded. The design bather load should be approximately 10 times the capacity of water in the spa-pool system when measured in cubic metres, with a minimum of 250 litres per bather (for example a 5 m³ pool would have a design bather load of 50 bathers per hour).

Water replacement

117 In a commercial setting, as a minimum the total water volume should be replaced with fresh water when the bather load equals 100 x the water capacity measured in cubic metres since the last water replacement. Where a spa-pool area is incorporated within the swimming-pool water-treatment system, the dilution of pollutants is much greater and water replacement should be up to 30 litres per bather per day in accordance with the recognised standard for swimming pools. Where a stand-alone spa pool is situated adjacent to a swimming pool, the swimming-pool water may be used to fill the spa pool but the spa-pool water must be emptied to waste and not drained into the swimming pool.

118 Where a hot tub or spa pool is used as a business activity, the total water volume should be replaced each week, or after each group of users, if earlier.

119 It is expected that water will be completely drained and replaced in a typical spa-pool system. However, where this is not practicable, eg due to a large pool size, there should be additional control measures and enhanced monitoring to ensure that the physical, microbiological and chemical quality of the spa-pool water is maintained.

Water quality

120 Effective water treatment relies on filtration working in conjunction with chemical disinfection. Filtration that is working effectively and efficiently contributes to maintaining the cleanliness, clarity and safety of the water. Chemical disinfection is required to prevent microbial growth and reduce the risk of infection.

121 The spa-pool maintenance programme should ensure appropriate physical operation of the spa pool and provide a suitable chemical balance to achieve microbiological control. To ensure optimum water quality, the turnover time of the spa pool and the design bathing loads should not exceed recommended limits.

122 The turnover time is the time taken for the entire spa-pool water volume to pass through the filters and treatment plant and back to the spa pool. The maximum design water turnover time for lower bather loads is 15 minutes, and 6 minutes for commercial-type spa pools (where there are higher bather loads).

123 Backwashing is the process of reversing the flow of water through the filter to clean the filter media. Where sand filters are used, backwashing will be necessary. The frequency of backwashing should be informed by the risk assessment and manufacturers' instructions and it should not be done when the spa pool is in use. There should be sufficient capacity in the spa pool and balance tank for backwashing the filter efficiently and enough time must be factored into the process to enable the filter medium to settle before reopening the spa pool. For this reason, backwashing should be done after the

last user of the day, or before the site is closed overnight, but with the spa pool left running.

124 Sand filters should always be backwashed before the pressure rises above normal clean operating pressure by 0.35 bar. Precoat filters should be recharged according to manufacturers' instructions. Where cartridge filters are used, at least two sets should be retained to ensure there is one set in use while the other is being chemically cleaned and dried. Filters should be replaced as appropriate in accordance with risk assessment and manufacturers' instructions.

125 The frequency of inspection and monitoring of the spa-pool system will depend on the operating characteristics of the pool, its complexity, design bather load and setting, eg healthcare. The risk assessment should define the frequency of inspection and monitoring, depending on the type of use and user (particularly where there are adjustments made by the assessor to take account of local needs). Table 1 provides a checklist of operational actions and the typical recommended frequencies. Table 2 (page 38) provides guidance on the spa-pool inspection and recommended actions.

Table 1 Operational actions and typical frequencies

Operational actions	Typical frequencies	
	Commercial-type spa pools (high bather load)	Domestic-type spa pools and hot tubs
Check water clarity	Daily at opening and every two hours thereafter	At least twice daily depending on risk assessment and usage
Check if dosing system is working	Daily at opening	Daily
Check chemical reservoir level	Daily at opening	Daily where appropriate
Determine pH value, and residual disinfectant	Daily at opening and every two hours thereafter	At least twice daily depending on risk assessment and usage
Determine TDS	Daily	-
Clean the water-line	Daily – at end of the day/ user period with a fresh damp cloth using sodium bicarbonate (sodium hydrogen carbonate)	Check daily and clean as appropriate but as a minimum at water replacement
Clean overflow channels and skimmers	Daily – at end of the day/ user period	Check daily and clean as appropriate but as a minimum at water replacement
Clean spa-pool surround	Daily – at end of the day/ user period	Check daily and clean as appropriate but as a minimum at water replacement

Operational actions	Typical frequencies	
	Commercial-type spa pools (high bather load)	Domestic-type spa pools and hot tubs
Backwash filter	Daily – at the end of the day/user period	-
Replace cartridge filter with a cleaned cartridge	-	At water replacement
Inspect strainers and grilles	Daily	At water replacement
Record incidents	Daily	As appropriate
Check any automatic systems are operating correctly	Daily	Daily, where fitted
Drain spa pool, clean whole system including strainers and refill	Daily to weekly based on risk assessment	Between each group of users or at least weekly, whichever is shorter
Drain and clean balance tank	At least twice per year based on risk assessment and weekly visual checks	-
Inspect accessible pipework and jets and clean as necessary	Weekly	Weekly
Disinfect flexible hoses	Monthly	Monthly
Microbiological testing	Monthly for ACC, coliforms, <i>E coli</i> , <i>P aeruginosa</i> and quarterly for legionella	Monthly for ACC, coliforms, <i>E coli</i> , <i>P aeruginosa</i> and quarterly for legionella
Clean input air filter	Monthly	Monthly
Full chemical test dependent on water quality	Monthly or as determined by risk assessment	As determined by risk assessment
Disinfectant/pH controller – clean electrode and check calibration	Monthly or according to manufacturers' instructions	Monthly, where fitted, or according to manufacturers' instructions
Check effectiveness of filtration	Quarterly	-
Check, clean, disinfect and dry filter cartridge	-	Between each group of users or weekly, whichever is shorter
Clean and disinfect airlines	Quarterly	Weekly where appropriate
Check sand filter	Quarterly check and annual sand replacement	-

Dehumidification

126 Where spa pools with a higher bather load are sited indoors, consider the dehumidification/ventilation of the area around the spa pool. The level of evaporation from the surface of the spa pool is increased when the airblower/jets are operated and equipment should be in place to lower the humidity, for example:

- control timers to limit prolonged operation of the jets/airblower when the pool is not being used (limited to no more than 15 minutes' continuous operation);
- an air temperature of 1 degree C above the water temperature to a maximum of 30 °C and a maximum relative humidity of 60–70% is typically required. Ventilation should be set at a rate of 10–15 litres per second per square metre of wetted area;
- central plant incorporating heat recovery and/or heat pump dehumidification can be used to recirculate the air. However, recirculatory systems can operate under conditions that cause severe corrosion and loss of performance;
- using a cover when the spa pool is not in use;
- a wall-mounted dehumidifier can also be provided and can contribute to the space heating to reduce condensation.

User information

127 Risk assessments should identify the information to be provided for users, including good standards of hygiene, recommended bathing time, bather load and the appropriate procedures when using the spa pool. They are typically provided in a form of notice.

Information box 3 Example information for bathers

This is not an exhaustive list but, as an example, bathers should:

- use the toilet and shower before entering the spa pool;
- not wear sun tan lotions, spray tans or skin creams;
- not use the spa pool after a heavy meal or under the influence of alcohol or sedatives;
- keep their head above the water;
- not exceed 15 minutes' immersion at a time;
- not exceed the maximum number of bathers (one per seat);
- seek medical advice if pregnant, have health problems or immunosuppressed;
- supervise all children in and around the spa pool and not allow children under 4 years of age, or those unable to keep their head above the water level when sitting, in the spa pool.

Water treatment programmes

128 An appropriate water treatment programme must be capable of controlling microbial activity, pH and include appropriate measures, such as regular physical cleaning and disinfection. Where fitted, spa equipment should turn itself on automatically twice a day to ensure water treatment to all parts.

129 The pH, total alkalinity, total dissolved solids (TDS), temperature and calcium hardness of water are the main factors in determining the balance of the water. Balanced water is neither scale forming nor corrosive and may be measured using a number of indices (such as the Langelier Saturation Index or Ryznar Stability Index). Water balancing may not be required in spa pools with a higher bather load due to the frequency of water replacement and draining of the spa pool.

130 The most important factor in water balance is pH which should be maintained between pH 7.0–7.6. Depending on the nature of incoming mains water and the disinfectant used, the pH of the water may need to be adjusted by the use of chemical treatment to ensure the disinfectant remains effective (see Information box 4 Adjusting the pH).

Information box 4 Adjusting the pH

The nature of the incoming mains water supply tends to determine the pH adjustment required. Bromine products (eg 1-bromo-3-chloro-5,5-dimethylhydantoin) as well as some chlorine products (eg sodium dichloroisocyanurate dihydrate) tend to be relatively neutral when dissolved in spa-pool water and have little effect on the pH. Heating water drives off acidic carbon dioxide so the natural tendency is for the pH to rise in spa pools.

Products such as trichloroisocyanuric acid form an acidic solution (pH 3) in some but not all water supplies and an alkaline pH adjuster will be required to increase the pH to within the maximum range (pH 7.0–7.6), eg soda ash (sodium carbonate).

Sodium and calcium hypochlorite will result in an alkaline pH so an acid pH adjuster will be required. Acidic pH adjusters include sodium hydrogen sulphate (sodium bisulphate) and for commercial spas, hydrochloric acid.

131 The TDS are the measure of the concentration of dissolved materials present in the water from the water treatment chemicals and bathers. The TDS of the spa-pool water should be no more than 1000 mg/l higher than the incoming fill water, above which corrosion of the water distribution system may become more apparent. Planned regular water replacement will normally prevent such occurrences.

Cleaning and disinfection

132 The risk from exposure to legionella and other infectious agents should be controlled by maintaining the cleanliness of all parts of the system and the water within it to ensure the pool remains free from nutrient sources arising from contamination and corrosion. This may be achieved by routine inspection, cleaning and ongoing disinfection. Table 2 provides guidance on inspection and the recommended actions. The concentration of disinfectant used should be checked at the end of the disinfection period to ensure that it has been maintained for the duration of contact time.

133 In addition to the spa pool, balance tank and its associated components, cleaning should take account of other areas where contamination may occur, for example the ingress of dirt into the spa pool from the surrounding walkways. Cleaning products should be compatible with the materials used in the construction of the spa pool and with other chemicals used for treatment.

Table 2 Guidance on inspection and recommended actions

What to inspect	Purpose	Recommended action
Spa-pool waterline	Prevent ingress from surface contamination	Clean with a fresh, damp cloth using sodium bicarbonate (sodium hydrogen carbonate)
Overflow channels, skimmers, strainers and grilles, and the surrounding area	Prevent ingress from surfaces contamination	Clean with a concentration of 100 mg/l free chlorine
Balance tank, if any	Control microbial contamination	Drain and clean with particular attention to the waterline and the underside of the lid
Spa-pool covers	Control microbial contamination	Clean inside and out with a concentration of 100 mg/l free chlorine. Dry and store covers in a clean area when not in use. A cover lifter will keep the cover off the ground when not in use
Headrest	Control microbial contamination	Remove and clean
Jets and any accessible pipework	Control microbial contamination	Inspect and clean as necessary

What to inspect	Purpose	Recommended action
Water clarity	Check effectiveness of control measures	Review control strategies as cloudiness may indicate: <ul style="list-style-type: none"> ● the spa pool has been left unused ● failure of the circulation pump ● incorrect dosing of water treatment chemicals ● presence of undissolved chemicals ● incorrect filter cleansing procedures and/or ● algal/bacterial growth

Routine disinfection

134 A variety of disinfectants are used in spa-pool systems to control microbial growth (see Information box 5 Disinfectants). The quality of the incoming mains water supply should be taken into consideration before a disinfectant can be selected.

135 Various factors may influence the maintenance of disinfectant levels, for example bather numbers, temperatures, sunlight, turbulence, organic loading and/or aeration. At pH 7, free chlorine residual measured by DPD1 should be 3–5 mg/l, or total active bromine 4–6 mg/l. The effectiveness of the disinfectant is directly related to the pH of the water. Spa-pool water treatment chemicals should be continuously dosed and dosing of high-bather-load spa pools should be automatically controlled. Hand-dosing should only be used in emergencies such as plant failure or for shock treatment.

136 The process of disinfection using a chlorinating agent results in the formation of free and bound (combined) chlorine. Combined chlorine, which has slow and little disinfectant effect, is formed by the reaction of free chlorine with organic materials arising from bather pollution, eg urine and perspiration. The efficiency of the disinfection system to cope with the bather load is reflected by the concentration of combined chlorine. The ideal combined chlorine concentration is 0 mg/l, but a concentration of less than 1 mg/l is normally considered acceptable (although the combined chlorine should not exceed half of the free chlorine). Above this concentration, irritation to the mucous membranes of the eyes and throat may occur.

137 Disinfection using a brominated chemical results in combined bromine being formed as the predominant and effective disinfectant. Free and combined bromines are not usually differentiated between when monitoring the spa-pool water disinfectant concentration, since combined bromine is still an effective disinfectant and so the measurement is recorded as total active bromine (DPD1).

138 For spa pools that form an integral part of a leisure-pool system, where chlorinating disinfectants are used in conjunction with ozone, the residual disinfectant concentration required in the spa-pool water will be dependent on spa-pool design and attaining satisfactory microbiological results.

139 It is important to ensure that a satisfactory residual disinfectant concentration is achieved so that it does not permit microbial growth in the spa-pool water or the filter media.

Information box 5 Disinfectants	
Sodium hypochlorite	Sodium hypochlorite is usually supplied as a solution (10–15% available chlorine) which should be stored under cool conditions and used within its expiry date (a maximum of 3 months). Using sodium hypochlorite will raise the pH of the spa-pool water and requires subsequent pH reduction
Calcium hypochlorite	Calcium hypochlorite is supplied in powder, granular or tablet form, and must be dissolved in a suitable reservoir or feeder before being injected into the spa-pool water. In hard-water areas more frequent cleaning and backwashing of the filters may be required to minimise the occurrence of blockages in the filtration and distribution pipework due to the deposition of calcium salts. There are quick-dissolving granular calcium hypochlorites designed for shock dosing by hand. Using calcium hypochlorite will raise the pH of the spa-pool water and requires subsequent pH reduction

Information box 5 Disinfectants	
Chloroisocyanurates	<p>Chloroisocyanurates are commonly used in domestic-type spa pools and are available as slowly dissolving tablets (trichloroisocyanuric acid) or rapidly soluble granules (sodium dichloroisocyanurate dihydrate). Trichloroisocyanuric acid should be delivered via a dosing unit. Ensure that any automatic controller is compatible with cyanuric acid at concentrations in excess of 20 mg/l. Sodium dichloroisocyanurate dihydrate is only suitable for dosing directly into the spa-pool water and normally should only be applied in this way as an emergency measure. Using dichloroisocyanurates will usually have little or no effect on the pH of the spa-pool water, although this can depend on the source of the water. Using trichloroisocyanuric acid will tend to lower the pH</p> <p>The use of chloroisocyanurates results in the addition of cyanuric acid to the spa-pool water and its concentration should be maintained below 100 mg/l by dilution with fresh water. Cyanuric acid concentrations above this level can encourage algal growth and may prevent the release of free chlorine into the spa-pool water</p>
Solid bromine-based disinfectants	<p>Bromochlorodimethylhydantoin-1,bromo-3-chloro-5,5-dimethyl hydantoin (BCDMH) is a slow-dissolving tablet used in a soaker feeder, where a portion of the circulating water is bypassed through the brominator (feeder). BCDMH can also be used in a pre-filled granular feeder device, which may float (with or without additional minerals) or be plumbed into the circulation system. It must be added from a suitable dosing unit and ideally automatically injected before the filter</p> <p>Other formulations of brominated hydantoins are used which are more acidic and dissolve faster than pure BCDMH</p>

Information box 5 Disinfectants	
Silver stabilised hydrogen peroxide (SSHP)	<p>SSHP is a broad spectrum disinfectant usually supplied as a solution to be dosed or added to the spa-pool system. It comprises a solution of hydrogen peroxide, stabilised using proprietary ionic silver-based chemistry. The usual recommendation is a shock dose of the water to remove any existing biofilm or biofouling from the system, normally carried out at 100 ppm for a minimum of 12 hours. Higher concentrations may be required depending on the condition of the facility. The spa or hot tub can then be operated with a hydrogen peroxide residual of 50 ppm (30 ppm to 70 ppm hydrogen peroxide). No pH adjustment is required</p>
Ozone with residual disinfection	<p>Ozone may be used but it must be in conjunction with residual disinfection. The type of ozonisation used depends on the spa-pool installation. Where spa pools are installed as an integral part of a leisure-pool water treatment system, the treatment is sometimes combined with that of the main leisure pool. Ozone treatment would normally be followed by deozonisation before residual disinfection. Free chlorine residuals will still need to be maintained between 3–5 mg/l, bromine at 4–6 mg/l, and isocyanurates at 3–5 mg/l to ensure adequate disinfection</p> <p>Alternatively, trickle stream ozonisation is sometimes used where the ozone is not removed by a deozonisation bed prior to the addition of the residual disinfectant. The ozone should be at such a concentration to ensure that 0.01 ppm ozone is not exceeded in the atmosphere above the spa-pool water. The residual disinfectant may be any of those mentioned earlier in this table. The ozone generator should be checked daily to ensure it is operating correctly. The system must be maintained and cleaned as specified in the manufacturer's instructions</p> <p>Where ozone generation plant is installed, mechanical ventilation may be necessary to achieve 10 air changes per hour. Extract should be at low level and in accordance with HSE publication EH38 <i>Ozone: Health hazards and control measures</i>,²⁴ and CIBSE guide TM21 <i>Minimising pollution at air intakes</i>²⁵</p>

Information box 5 Disinfectants	
Ultraviolet light	Ultraviolet (UV) light only has a bactericidal action at the point of use and therefore additional disinfection is required (eg residual chlorine). BCDMH is not suitable for use in conjunction with UV as bromate will be formed. The system must be maintained and cleaned as specified in the manufacturer's instructions

Other disinfectants

140 There are other types of disinfectant available but it is important that the disinfectant used has been independently shown to be capable of providing satisfactory chemical and microbiological water quality.

Emergency disinfection

141 The EAP must take account of situations where the spa pool has become grossly contaminated. This may be identified by repeated failures of microbiological results or visual inspection. The EAP should include removing bulk contaminants by cleaning and super chlorination, and the use of a flocculent.

Chemical storage

142 Acids, alkalis and disinfectants should be stored appropriately in a secure, well-ventilated, dry storage area, preferably separate to the plant room, with each area having provision for heat and frost protection and marked with an appropriate warning sign. These should be bunded (the bund should be able to contain at least 110% of the maximum volume of liquid stored) and separated to contain any spillage of liquid chemicals and prevent any subsequent mixing of acids and alkalis, where highly toxic chlorine gas may be produced. Storage information is provided in the safety data sheets.

Section 5: Testing and monitoring water quality

143 The risk from exposure to legionella and other infectious agents should be prevented or controlled and the precautions taken monitored to ensure they remain effective. This section gives guidance on monitoring the water quality in spa-pool systems, routine sampling and testing for the presence of bacteria. These combined factors will help to give an indication of whether control is being achieved.

144 Spa-pool water should be routinely analysed to ensure the continued effectiveness and suitability of the treatment programme. The frequency and extent of any analysis will depend on the operating characteristics of the system and will typically include daily, monthly and/or quarterly actions to ensure that chemical dosage and system water quality are appropriate – see Table 1 Operational actions and typical frequencies (page 34).

145 The identification of changes in the water chemistry such as pH, disinfectant concentrations and water balance should allow for necessary corrective actions to be taken to the treatment programme or system operating conditions.

146 The microbiological monitoring programme should include the routine sampling and testing for the presence of bacteria to assess the effectiveness of the water treatment.

147 Testing of water quality, using chemical and microbiological monitoring, is an essential part of the spa-pool treatment regime and may be carried out by the operator where they are suitably trained to do so, or by an external service provider.

148 Testing and recording of the chemical and microbiological parameters associated with the spa pool should be carried out and appropriate actions taken according to the results (see Tables 3 and 4). The test results should be provided in the form of a report which will form part of the record-keeping requirements.

Chemical

149 The frequency and extent of the chemical testing should be determined by the risk assessment. Most testing can be done at poolside but some specialist tests will require laboratory analysis.

150 Testing of spa-pool water should capture normal variation of operating conditions, for example it should be carried out when the features are not

operating as spa-pool water chemistry alters during activation of the booster jets, and ideally should also be carried out just after maximum use to ensure the treatment regime is working appropriately.

Table 3 Chemical parameters and actions required

Test	Typical range	Recommended action
pH	7.0–7.6	None
	<7.0 or >7.6	Close spa pool and check the operation and calibration of acid/alkali dosing units Recheck pH once any faults have been rectified. If pH is still out of limits, the spa pool will need to be emptied and refilled with mains water to reach the typical pH range and additional treatment may need to be added to achieve this pH
Disinfectant	Chlorine 3–5 mg/l Bromine 4–6 mg/l	None
	Chlorine <1 mg/l or >10 mg/l Bromine <2 mg/l or >12 mg/l	Close the spa pool, apply corrective actions and retest
	Chlorine 1–2 or 6–10 mg/l Bromine 2–3 or 7–12 mg/l	Check dosing units are operating correctly High levels of disinfectant can be lowered by partial replacement of spa-pool water, once the underlying fault has been rectified Low levels of disinfectant can be increased by shock dosing of spa pool water, once the underlying fault has been rectified
Combined chlorine	0<1 mg/l	None
	>1 mg/l	Review control measures High levels can be lowered by partial replacement of spa-pool water, once the underlying fault has been rectified

Test	Typical range	Recommended action
Total dissolved solids (TDS)	No more than 1000 mg/l higher than the incoming fill water	None
	>1000 mg/l higher than the incoming fill water	Review control measures Spa pool will need to be emptied and refilled to lower concentration

151 Information obtained from regular monitoring can indicate whether:

- water replacement and backwashing are being done at sufficient frequency;
- disinfectant residuals are adequate;
- operation of the water treatment plant is effective for the bather load;
- there is overdosing of water treatment chemicals (indicated by high biocide levels);
- the filter remains effective;
- there is advanced warning of failure of filters, valves etc.

152 The test results should be recorded and should state the acceptable limits for parameters tested, together with any remedial action to be taken in the event of a test result being out of specification (both upper and lower limits).

Microbiological monitoring

153 The frequency and extent of the microbiological sampling strategy should be determined by the risk assessment but at least monthly for ACC, coliforms, *E coli* and *P aeruginosa* and quarterly for legionella. Sampling should be done when the spa pool is in use, preferably when heavily loaded or immediately afterwards, and sampling for legionella should be carried out in accordance with BS 7592²⁶ (Information box 6 Microbiological sampling procedure). The laboratory performing the tests should be accredited by the United Kingdom Accreditation Service (UKAS) to EN ISO 17025 *General requirements for the competence of testing and calibration laboratories*.²⁷ Additional microbiological sampling should also be taken:

- when a spa pool is first used or recommissioned;
- after a report of ill health following spa-pool use;
- where there is doubt about the effectiveness of the control regime;
- where there has been a contamination incident;
- where alterations are made to the treatment or maintenance regimes.

154 Reports of illness associated with use of a spa pool should be discussed with the local environmental health officer (EHO), who will

liaise with local public health services, as necessary. In the event of an outbreak, where there are two or more cases of illness associated with a spa pool, additional microbiological samples will be taken by the appropriate agency, following discussion between the EHO and local public health service Health Protection Team, or Health Board.

155 Sampling frequency can be altered, depending on the risk assessment, including previous adverse results or any adverse health effects reported by the bathers. Spa pools situated outdoors will have additional demands placed on the disinfection and filtration systems from environmental contamination by dust, debris etc, so it is important that these factors are taken into account when determining a monitoring schedule.

Information box 6 Microbiological sampling procedure

Sample bottles for microbiological testing should be either individually wrapped or the outer surface disinfected by wiping with, for example, an alcohol swab and allowing the bottle to dry before use. Plastic (not glass) sampling bottles can be supplied by the testing laboratory for this purpose – they must be sterile and contain a validated neutralising agent for the disinfectant.

The testing laboratory must be informed of the disinfectant used before the sample is taken, to ensure that the appropriate validated neutraliser is supplied. If an appropriate neutraliser is not available then the sample must be tested as soon as possible as the testing laboratory will need to take into account the time delay before testing is carried out when interpreting results.

For routine monitoring, a sample bottle of 500 ml should be used and, for legionella, a sample bottle of a size specified by the laboratory. Microbiological sample bottles should not be rinsed with the water to be tested as this will remove the neutraliser. To take the sample:

- remove the stopper or cap first with one gloved hand, making sure that nothing touches the inside of the bottle or cap;
- when the bottle is being plunged into the water, keep the long axis approximately horizontal but with the neck pointing slightly upwards to avoid loss of the neutralising agent;
- immerse the bottle about 200–400 mm below the pool surface and then tilted upwards to allow it to fill;
- when removed from the water, replace the cap immediately and invert the bottle repeatedly to disperse the neutraliser;
- send to the laboratory without delay to enable analysis ideally within 24 hours of sampling but no longer than 48 hours.

In transit, any samples should be protected from light and placed in insulated containers maintained at the following approximate temperatures for the duration of the journey:

- samples for legionella testing – ambient temperature;
- samples for non-legionella testing – 2–8 °C (use freezer or ice packs but do not let the sample container come in direct contact with the freezer packs).

A record should be made of the pH value and the disinfectant residuals determined at the time of sampling.

156 Regular microbiological testing should be carried out by a laboratory with the required tests within its scope of accreditation and recorded together with any remedial actions and follow-up samples after an adverse result.

Microbiological tests

157 The monitoring programme should include the routine monthly sampling and testing for the presence of bacteria and should include an ACC (or total viable or total colony count), coliforms, *E coli*, and *P aeruginosa*, in addition to quarterly tests for legionella.

158 The ACC will give an indication of the overall microbiological quality of the spa pool and whether microbiological control is being achieved. This should be carried out in accordance with BS EN ISO 6222²⁸ with incubation at 37 °C for 24 hours.

159 The presence of *E coli* and/or coliforms is an indication of the presence of serious contamination and a failure in the water treatment system to remove the contamination.

160 The presence of *P aeruginosa* is an indication of water treatment failure with likely colonisation of and biofilm formation on the spa-pool filter and within other parts of the system.

161 Where health problems associated with the use of the spa pool are identified, it may be necessary to test the water for other relevant organisms, based on epidemiological evidence. First seek advice from the local Health Protection Team.

Recommended actions based on the microbiological results

162 The dutyholder should cease operation of, and close the spa pool immediately where, following a routine microbiological test, there is evidence of gross contamination if there is:

- >10 cfu *E coli* per 100 ml in combination with
 - >10 cfu ACC per ml **and/or**
 - >10 cfu *P aeruginosa* per 100 ml;
- >50 cfu *P aeruginosa* per 100 ml:
- >1000 cfu *legionella spp* per litre;
- other chemical or physical evidence that the spa-pool disinfection system is not operating correctly.

163 If the microbiological results are unsatisfactory but do not indicate immediate closure as above, a review of the records should be carried out and the sampling and microbiological tests repeated immediately. Repeat failures could indicate significant microbiological contamination problems that may require more focused monitoring. This may include water samples or swabs from suspect components such as the balance tank or the overflow channels (see Table 4).

164 If the results are still unsatisfactory after the repeat samples and investigation, immediate remedial action is required that may necessitate the spa pool being closed.

Table 4 Microbiological results and appropriate actions

Microbiological result	Action
Aerobic colony count (or total viable count)	
Aerobic or total colony count at 37 °C >10 cfu/ml	If the colony count is >10 cfu/ml and is the only unsatisfactory microbiological result, and residual disinfectant and pH values are within recommended ranges, the water should be resampled and retested
Aerobic or total colony count at 37 °C >100 cfu/ml	<ul style="list-style-type: none"> ● Check treatment system and manual testing results records immediately ● Implement any remedial action as required ● Resample and retest
Coliforms and <i>E coli</i>	
Coliforms and <i>E coli</i> present >1 cfu/100 ml	Occasional positive samples may occur if the spa pool has been sampled immediately after a contamination event before the disinfection system had time to be effective. A repeat sample should be taken whenever coliforms have been detected

Microbiological result	Action
Coliforms ≤ 10 cfu/100 ml	A coliform count of up to 10 cfu/100 ml is acceptable provided that the residual disinfectant and pH values are within recommended ranges, there are no <i>E coli</i> present and the aerobic colony count is < 10 ml
Coliforms present on repeat test or if > 10 cfu/100 ml at any time	<ul style="list-style-type: none"> ● Indicates that disinfectant regime is ineffective ● Close spa pool ● Shock dose the spa pool with 50 mg/l free chlorine circulating for 1 hour or equivalent ● Drain, clean and disinfect ● Review control measures and risk assessment ● Carry out remedial actions identified ● Refill, disinfect and adjust pH to recommended range; and retest next day and 2-4 weeks later

Pseudomonas aeruginosa

<i>P aeruginosa</i> present 10–50 cfu/100 ml with or without raised coliform, <i>E coli</i> or colony count	<ul style="list-style-type: none"> ● Take a repeat sample for testing ● Scrub walls of balance tank, if any, and cleanse the filter ● Chlorinate to 10 mg/l free chlorine, circulate and flush ● If repeat sample contains <i>P aeruginosa</i> the filtration and disinfection processes should be examined to determine where the organism has been multiplying
<i>P aeruginosa</i> present > 50 cfu/100 ml with or without raised coliform, <i>E coli</i> or colony count	<ul style="list-style-type: none"> ● Close spa pool ● Shock dose the spa pool and balance tank, if any, with 50 mg/l free chlorine circulating for 1 hour or equivalent and flush through ● Drain, clean and disinfect ● Review control measures and risk assessment ● Carry out remedial actions identified ● Refill, disinfect and adjust pH to recommended range; retest next day and 2–4 weeks later

Legionella

< 100 cfu/l	Under control but maintain control measures
> 100 cfu/l and up to 1000 cfu/l	<ul style="list-style-type: none"> ● Resample and keep under review ● Review control measures and risk assessment ● Carry out remedial actions identified as necessary

Microbiological result	Action
>1000 cfu/l	<ul style="list-style-type: none"> ● Immediate closure of pool and exclude public from pool area ● Shut down spa pool ● Shock dose the spa pool with 50 mg/l free chlorine circulating for 1 hour or equivalent ● Drain, clean and disinfect ● Review control measures and risk assessment ● Carry out remedial actions identified ● Refill and retest next day and 2–4 weeks later

165 Alternative techniques for determining microbial activity may be used as long as they are suitably validated and accredited. It is important that the data from such tests can be properly interpreted, so that appropriate action levels can be set to enable informed decisions on the control measures needed. This may be achieved by running the tests in parallel with traditional culture-based methods for a period.

Appendix: Spa-pool checklists

It is a legal duty to carry out an assessment to identify and assess whether there is a risk posed by exposure to legionella and other infectious agents from the spa-pool system or any work associated with it. Once the risk is identified and assessed, a written control scheme should be prepared, implemented and properly managed. The following checklists will help to ensure the appropriate arrangements are in place to manage and control any risk of infection from the spa-pool system. This will include a physical inspection of the system, and an examination of the management procedures and appropriate records.

In addition to the spa-pool system, the dutyholder will also need to assess whether there are any other sources of risk and ensure appropriate control measures are put in place.

Checklist 1 Risk assessment

- 1 Clear allocation of management responsibilities including name, job titles and contact information for:
 - dutyholder;
 - responsible person and nominated deputies;
 - service providers.
- 2 Clear identification of roles and responsibilities including employees and contractors.
- 3 Competence, training and instruction of key personnel, employees and contractors including training records.
- 4 Check to confirm that consideration was given to preventing the risk by elimination or substitution before implementing control measures.
- 5 Description of the spa-pool system (including make, model, year of manufacture, and type), component parts and associated equipment including an up-to-date schematic diagram to include:
 - system plant, eg filters, strainers, pumps, non-return valves;
 - standby equipment, eg spare pumps;
 - associated pipework and piping routes;
 - associated storage/balance tanks;
 - chemical dosing/injection points;
 - water supply;
 - parts that may be temporarily out of use.

6 Evaluation of the risk which should include the potential for microbial growth, other health and safety issues (eg chemicals, working in confined spaces, electrical safety, ease of access to parts of the system etc) and compliance with the water safety elements of the water fittings regulations.

7 Assessing the potential for the system to become contaminated with micro-organisms (including legionella) and other material, including considering:

- the source and quality of the make-up water;
- the likelihood for airborne contamination;
- the effectiveness of the biocide treatment.

8 Arrangements to review the risk assessment regularly and particularly when there is reason to suspect it is no longer valid.

Checklist 2 Written control scheme

1 Purpose.

2 Scope.

3 Risk assessment.

4 Management structure.

5 Instructions for correct and safe operation of the system.

6 Safe operating procedures for the spa-pool system including appropriate control measures.

7 Precautions in place to prevent or minimise risks associated with the system.

8 Effectiveness of control measures including chemical and physical water treatment, disinfection and cleaning regimes and remedial work and maintenance.

9 Monitoring, inspection and maintenance procedures.

10 Results of monitoring, inspection and any checks carried out.

11 Tests, checks and inspections to be carried out, their frequency and resulting corrective actions.

12 Remedial action to be taken in the event that the scheme and control measures are found to be not effective.

13 Health and safety information, including details on storage, handling, use, and disposal of any disinfectant used in both the treatment of the system and testing of the water.

14 Emergency plan to deal with situations involving serious or imminent danger.

15 Audit of contractors upon completion of any contracted work (eg plumbing work or biocide installation).

Glossary

Acid A chemical which lowers pH value (increases the acidity) when added to pool water

Acidity A measure of the acid content of water

Active bromine This is readily available for killing bacteria and algae. It includes free bromine and some bromamines

Aerobic colony count (ACC) The total number of culturable bacteria (per volume or area) in a given sample (does not include legionella)

Aerosol A suspension in a gaseous medium of solid particles, liquid particles or solid and liquid particles having negligible falling velocity. In the context of this document, it is a suspension of particles which may contain legionella with a typical droplet size of <5 µm that can be inhaled deep into the lungs

Air blower Mechanical device for inducing air into ducting in the spa

Air induction A system whereby air is induced into ducting and released into the water through small orifices or where it is induced from the side of the spa into hydrotherapy jets

Algae simple organisms similar to plants that require light for growth, typically found in aquatic environments

Algicide A chemical compound which destroys algal growth

Alkali A chemical which raises the pH value (reduces the acidity) in pool water – also called a base

Alkalinity A measure of the alkaline content of water

Amperometric An electronic device for measuring the current produced in water due to the presence of oxidising agents such as bromine, chlorine or ozone

Automatic controller An electronic system to maintain correct disinfectant and/or pH value. A chart recorder may be incorporated to give a permanent and continuous record of these parameters. Manual back-up is required

Backwash The process of reversing the flow of water through the filter to clean the filter media and discharge the waste to drain

Balance tank A tank fitted in circulation system of overflow spas to balance water displaced by bathers and to provide additional water volume in heavy-use situations, to maintain a constant level in a commercial-type spa

BCDMH Abbreviation for the dry organic compound 1-bromo-3-chloro-5, 5-dimethylhydantoin-bromine-based spa and pool water disinfectant.

Biocide A substance that kills microorganisms

Biofilm A community of microorganisms of different types growing together on a surface so that they form a slime layer

Booster jets For pumping water at high pressure, normally sized for maximum performance through hydrotherapy jets and also to provide high-pressure jets of water within the body of the spa for body massage

Brominator A dispensing device for dosing bromine into a spa or pool recirculating system

Bromine An element very similar to chlorine used as a biocide and sometimes as a disinfectant. The main practical difference between bromine and chlorine when used as a biocide is that bromine remains effective at higher pH values

Cartridge filter A replaceable filter used in domestic-type spa pools and constructed from pleated paper or wound fibres, through which water is passed for filtration

Chlorination The process of treating pool or spa water with chlorine. Chlorine can be added to pool and spa water in a variety of commercially available forms as gas, solutions or solids (granules or tablets)

Chlorine An element used as a biocide and for disinfection (see **bromine, combined chlorine** and **free chlorine**)

Chlorine residual The amount of chlorine remaining in the spa-pool water after satisfying the chlorine demand. The chlorine residual can be expressed as free chlorine residual, combined chlorine residual or total chlorine residual

Combined bromine Bromine which has reacted with nitrogen to form bromamines

Combined chlorine The amount of chlorine that has reacted with nitrogenous or organic materials to form chlorine compounds. If the materials are nitrogenous then the compounds formed are chloramines

Coliform A bacterium belonging to the enterobacteriaceae

Deadleg A length of water system pipework leading to a fitting through which water only passes when there is draw off from the fitting, thereby providing the potential for stagnation

Deck-level overflow system A system with perimeter overflow channels for the removal of surface water forming a part of the recirculation system which are typically used in commercial-type spa pools

Decks and surrounds Areas surrounding spas, which are specifically constructed and installed for use by bathers

Diatomaceous earth (DE) filter A filter using diatomaceous earth as a filtering medium

Disinfection The reduction of the number of microorganisms to safe levels by either chemical or non-chemical means (eg biocides, heat or radiation)

DPD1 A chemical reagent used to measure the bromine, chlorine and ozone residuals in the water

Filter A device that separates particulate matter from water by circulation through a porous medium

Filtration rate The rate of filtration of water in a given time, ie cubic metres per square metre of effective filter area per hour (or gallons per square foot of effective filter area per hour)

Flocculent A chemical used to aggregate particles suspended in water, for example contaminants, to aid their removal by filtration

Free chlorine Chlorine dissolved in water to form hypochlorous acid and Hypochlorite ion

Hypochlorite Inorganic chlorine compounds used for pool-water disinfection. Commercially available forms are sodium hypochlorite solution, calcium hypochlorite granules and tablets (lithium hypochlorite is not permitted)

Langelier saturation index This is applied to pool water to assess whether it has corrosive or scale-forming tendencies. The equation used to calculate the index takes into account the pH, alkalinity, calcium hardness, total dissolved solids and temperature of the water

Oxidising biocide A chemical agent which kills microorganisms by oxidising organic matter, eg cell material, enzymes or proteins

Ozone A tri-atomic form of oxygen with powerful oxidising properties, used as a water disinfectant and purifying agent in conjunction with another residual disinfectant

Parts per million (ppm) A ratio for expressing chemical concentration. In water, parts per million has the same numerical value as milligrams/litre (mg/l)

pH A logarithmic scale of units, 0–14, which measures the balance between acidic and alkaline (basic) compounds in water. Values below 7 are increasingly acidic, 7 is neutral, and values higher than 7 are progressively alkaline. However, acidity and alkalinity are not proportional to pH (see acidity and alkalinity)

Ryznar stability index This is used to assess the scale-forming tendency of water by using pH and calcium carbonate saturation to correlate to a database of scale-thickness measurements observed in municipal water systems

Scale Hard deposits, which can block pool pipework and form on pool water surfaces. Generally caused by the precipitation of calcium and magnesium carbonate from hard water

Shock dose A term usually applied to the process of adding a higher than normal dose of disinfectant, sometimes called 'shot' dose or super chlorination, to pool water to control microbial growth or destroy bather impurities

Skimmer A device designed to remove surface water, forming part of the recirculation system

Super chlorination see **shock dose**

Total alkalinity The quantitative analysis of the mix of bicarbonates, carbonates and hydroxides in water. While too high total alkalinity causes pH to resist adjustment, too low total alkalinity makes it difficult to maintain

Total chlorine The total sum of the free and combined chlorine in the water

Total dissolved solids (TDS) The quantity of soluble material in water expressed as mg/l. These solids will typically include calcium and magnesium (sodium in softened water), bicarbonate, chloride, sulphate and traces of other materials. High levels cause turbidity

Total viable counts see **aerobic colony count**

Turnover time The period of time required to circulate a volume of water equal to the total volume of water in the system. In spas this is usually expressed in minutes

Water displacement The volume of water displaced by each bather entering the spa. The water displacement is approximately 0.06 m³ (13 gallons) per bather

References

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- 7** *BS 7671 Requirements for Electrical Installations. IET Wiring Regulations* British Standards Institution
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18 BS EN 806 (Parts 1–5) *Specifications for installations inside buildings conveying water for human consumption* British Standards Institution

19 BS 8558 *Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages* British Standards Institution

20 BS 6920 *Suitability of non-metallic materials and products for use in contact with water intended for human consumption with regard to their effect on the quality of the water* British Standards Institution

21 BS 5385-4 *Wall and floor tiling. Design and installation of ceramic and mosaic tiling in specific conditions. Code of practice*
British Standards Institution

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23 *Swimming Pool Water: Treatment and quality standards for pools and spas* Pool Water Treatment Advisory Group (PWTAG) www.pwtag.org

24 *Ozone: Health hazards and control measures* Environmental Hygiene Guidance Note EH38 HSE 2014 www.hse.gov.uk/pubns/eh38.htm

25 *Minimising pollution at air intakes* TM21 CIBSE 1999 www.cibse.org

26 BS 7592 *Sampling for Legionella bacteria in water systems. Code of practice* British Standards Institution

27 EN ISO 17025 *General requirements for the competence of testing and calibration laboratories* British Standards Institution

28 BS EN ISO 6222 *Water quality. Enumeration of culturable micro-organisms. Colony count by inoculation in a nutrient agar culture medium*
British Standards Institution

Sources of information

Manufacturers should provide detailed advice and instructions on the management of their spa pool. General advice on this can also be obtained from:

- Pool Water Treatment Advisory Group (PWTAG) pwtag.org
- Swimming Pool and Allied Trades Association (SPATA) www.spata.co.uk
- British and Irish Spa and Hot Tub Association (BISHTA) www.bishta.co.uk
- Chartered Institute for the Management of Sport and Physical Activity (CIMSPA) www.cimspa.co.uk

SPATA publish detailed guidance on constructing and installing commercial-type spa pools, and BISHTA publish guidance on domestic-type, self-contained spa pools.

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Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

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