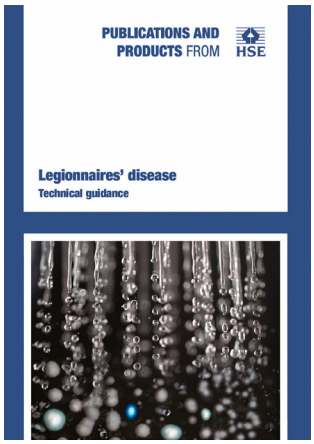
Legionnaires' disease

Technical guidance

Part 3: The control of Legionella bacteria in other risk systems



HSG274 Part 3
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This guidance is for dutyholders, which includes employers, those in control of premises and those with health and safety responsibilities for others, to help them comply with their legal duties. These duties include identifying and assessing the source of risk; preparing a scheme to prevent or control risk; implementing, managing and monitoring precautions; keeping records of precautions; and appointing a manager responsible for others.

This guidance gives practical advice on the legal requirements of the Health and Safety at Work etc Act 1974, the Control of Substances Hazardous to Health Regulations 2002 (as amended) concerning the risk from exposure to Legionella, and guidance on compliance with the relevant parts of the Management of Health and Safety at Work Regulations 1999.
Note that the second edition has been reviewed and updated in Part 1 only – The control of Legionella bacteria in evaporative cooling systems.

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Part 3 The control of Legionella bacteria in other risk systems

Note that the second edition has been reviewed and updated in Part 1 only.

Introduction

3.1 *Legionnaires' disease: The control of legionella bacteria in water systems. Approved Code of Practice and guidance on regulations* (L8) gives practical advice on the legal requirements of the relevant legislation concerning the risk from exposure to Legionella bacteria. This guidance is for dutyholders, including employers, those in control of premises and those with health and safety responsibilities for other people, to help them comply with their legal duties. It gives practical guidance on how to assess and control the risks of exposure to Legionella in risk systems, other than evaporative cooling systems or hot and cold water systems.

What are other risk systems?

3.2 In addition to evaporative cooling systems and hot and cold water systems there are other risk systems that may produce aerosols, thus posing a foreseeable risk of exposure to Legionella. This list is not exhaustive but examples of these types of systems include, but are not limited to:

- ultrasonic humidifiers/foggers;
- misting devices used for humidifying vegetables, meat and other food products;
- spray humidifiers;
- air washers, wet scrubbers, particle and trivial gas scrubbers;
- water softeners;
- emergency showers, eyebaths and face wash fountains;
- sprinkler and hose reel systems;
- spa pools;
- whirlpool baths;
- horticultural misting systems;
- vehicle washers including automatic washers for cars, buses, lorries and railway rolling stock;
- powered dental equipment;
- fountains and decorative water features including those on display for sale;
- non-disposable nebulisers used for respiratory therapy;
- industrial effluent treatment plants;
- irrigation systems;
- fire, dust and odour suppression systems;
- paint spray preparation equipment;
- tunnel pasteurisers and similar equipment.

3.3 Many of these systems operate at or above ambient temperature, or are prone to thermal gain during operation. This may be seasonal for some; for example, irrigation systems that operate outdoors, so may use water at temperatures that fall within the recognised temperature range for Legionella bacteria growth. All have the capacity to generate water droplets (aerosols) during operation and some, like powered dental equipment and respiratory therapy nebulisers, may dispense them directly into an individual's breathing zone.

3.4 The most significant, in terms of risk, are spa pools and the HSE/PHE guidance on managing spa pools, *Management of spa pools: Controlling the risks of infection*[42] should be followed. However, whirlpool baths (baths fitted with high velocity water jets and/or air injection but without water recirculation) are not considered a high risk if the water is immediately discharged after each use, subject to the source water supply being safe.

3.5 Any water system that has the right environmental conditions could potentially be a source for the growth of microorganisms, including Legionella bacteria. There is a reasonably foreseeable Legionella risk if the water system has a combination of the following factors:

- the presence of Legionella bacteria in the system water, either introduced via the water supply and/or via external contamination;
- conditions suitable for colonisation and multiplication of the bacteria, for example, the water temperature in all or some parts of the system may be between 20–45 °C;
- where water is stored or recirculated;
- deposits and materials that are a source of nutrients for the organism and support bacterial growth, such as contaminants from the surroundings or process including rust, sludge, scale, organic matter and biofilms;
- a means of creating and spreading breathable droplets (aerosols);
- the presence of susceptible people who may be exposed to those aerosols.

Risk identification and control

3.6 As with all foreseeable risk systems, there is a duty to carry out a risk assessment to decide whether further actions are needed and to maintain records of all maintenance carried out, together with monitoring results. These systems and any others found to present a risk need to be adequately controlled and will often require a combination of measures, such as regular maintenance, to ensure the system is kept clean, regular disinfection and ongoing monitoring where appropriate.

3.7 Most of these systems are likely to require a supply of mains water and will therefore be subject to the regulatory applications of the Water Supply (Water Fitting) Regulations 1999 and The Water Supply (Water Quality) Regulations 2001. To assess the risk properly, it is necessary to understand the system and its operation. The risk assessment should also consider:

- the source of the water with respect to the likelihood of Legionella contamination;
- the potential for microorganisms to grow;
- the potential for aerosol release;
- the likelihood and susceptibility of people being exposed to the aerosols.

3.8 If the findings show the risks from exposure to Legionella are insignificant and properly managed, no further action may be required. However, it is important to review the risk assessment regularly in case anything changes in the water system or its use.

3.9 If the assessment shows there are risks from exposure to Legionella:

- consider if the system can be replaced with a dry system. Where this not practicable, draw up and put in place a written scheme of measures to prevent or control the risks of exposure to the bacteria – the extent and complexity of the written scheme will be dictated by the level of risk;
- monitor any control measures and keep records of the results;
- record the significant findings of the risk assessment and keep appropriate records, with an indication of when to review the assessment and what to consider;
- review the assessment regularly to see whether circumstances that could alter the risk have changed;

- review the written scheme if the level of risk changes;
- ensure that those people involved in controlling the risks (including any contractors) are competent to do so and that their roles, responsibilities and reporting lines are clearly set down.

3.10 When carrying out the risk assessment, the dutyholder may need access to competent help and advice. Unless there is sufficient knowledge and expertise within your company, specialist help may be needed to carry out the Legionella risk assessment, and to devise and implement an effective written scheme and monitor its effectiveness.

3.11 A summary of the actions that should be taken for other risk systems is detailed in Appendix 6 and are in addition to the manufacturer's instructions. Further information is also available on the HSE website at www.hse.gov.uk/legionnaires/other-risk-systems.htm. Additionally, the Water Management Society publishes guidance on a number of other risk systems including industrial process systems, air scrubbers, vehicle washers, emergency showers, dental equipment and solar heating systems at www.wmsoc.org.uk.

Appendix 1 Legionella risk assessment

A1.1 It is a legal duty to identify and assess whether there is a risk posed by exposure to Legionella from operating the cooling system or any work associated with it.

A1.2 The risk assessment should consider all aspects of operation of the cooling system and be specific to the individual system under review. Site personnel who manage the systems should be consulted to determine current operational practice. The commissioning, decommissioning, periods of operation, maintenance, treatment and subsequent management of each individual aspect of the operation will require review and validation to ensure that site procedures are effective.

A1.3 The list below shows the most common key requirements when assessing the risk associated with a cooling system based on mechanical, operational, chemical and management aspects:

- details of the management personnel who play an active role in the risk management process, including names, job titles and contact information for:
  - the statutory dutyholder;
  - the appointed responsible person(s), including deputies;
  - service providers, eg risk assessors, water treatment suppliers, and cleaning and disinfection service providers;
- an assessment of the competence of those associated with risk management, including their training records;
- identification of roles and responsibilities, including employees, contractors and consultants;
- a check that you have considered removing the risk by 'substitution or elimination';
- the scope of the assessment, ie the details and entirety of the plant being assessed;
- details of the availability of an up-to-date schematic diagram, including all parts of the system where water may be used or stored;
- details of the design of the cooling system, including asset details and:
  - the location of any cooling towers, evaporative condensers and/or dry/wet cooling systems;
  - the type of cooling towers, evaporative condensers and/or dry/wet cooling systems;
  - the construction materials;
  - the pipework system;
  - details of any system modifications;
  - details on safe access relating to parts of the cooling system;
- assessment of the potential for the system to become contaminated with Legionella and other material, including consideration of:
  - the source and quality of the make-up water;
  - the likelihood for airborne contamination;
- details of any water pre-treatment processes such as filtration, softening, and particularly:
  - maintenance;
  - effectiveness;
  - monitoring;

- assessment of the potential for Legionella to grow in the system, including a review of:
  - normal plant operating characteristics and periods of intermittent use;
  - areas of low water flow or possible stagnation (eg deadlegs);
  - possible process contamination;
  - water temperatures that promote growth;
  - effectiveness of control measures, including chemical and physical water treatment measures, disinfection and cleaning regimes, and remedial work and maintenance;
- assessment of the risk of Legionella being released in an aerosol, including the potential for spray or splashes escaping from the system from the cooling tower, process or associated operations during normal or abnormal use;
- assessment of the risk of people being exposed to the aerosol due to the:
  - location of equipment;
  - numbers of people likely to be exposed;
  - likely susceptibility of exposed populations;
- a review of the Legionella control scheme, including:
  - management procedures for each stage of operation;
  - site records or log books, including system maintenance records; routine monitoring data; water treatment service reports; cleaning and disinfection records; Legionella and other microbial analysis results;
  - evidence of corrective actions being implemented (eg defect action / process);
  - evidence of proactive management and follow-up of previous assessment recommendations or identified remedial actions;
  - evidence of the competence of those involved in control and monitoring activities.

A1.4 The assessment should include recommendations for remedial actions for the control of Legionella where necessary and identify who will undertake such actions. The actions should be prioritised and a review date set for determining the completion of these tasks.

A1.5 Further detailed information is available in BS 8580 – 1 2019 *Water quality. Risk assessments for* Legionella *control. Code of practice* and the Water Management Society's *Guide to* Legionella *risk assessment for water services*.[43]

Appendix 2 Legionella written control scheme

A2.1 The risk from exposure will normally be controlled by measures which do not allow the proliferation of Legionella bacteria in the system. Once the risk is identified and assessed, a written control scheme should be prepared, implemented and properly managed.

A2.2 The scheme should specify the various control measures and how to use and carry out those measures. It should also describe the water treatment regimes and the correct operation of the water system plant. The scheme should be specific and relate to the cooling plant being operated on site (ie it should be tailored to the cooling plant covered by the risk assessment). Along with the information contained in this guidance, the following list summarises the information to include in a written control scheme:

- purpose;
- scope;
- risk assessment;
- notification of cooling towers;
- management structure:
  - dutyholder;
  - responsible person(s) and communication pathways;
  - training;
  - allocation of responsibilities;
- up-to-date schematic diagram showing layout of the cooling system(s);
- the correct and safe operation of the system;
- precautions in place to prevent or minimise the risk associated with cooling systems;
- analytical tests, other operational checks, inspections and calibrations to be carried out, including their frequency and any resulting corrective actions;
- remedial action to be taken should the scheme be shown not to be effective, including control scheme reviews and any modifications made;
- 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 system water;
- an incident plan which covers, for example:
  - very high microbial activity as estimated by dip slides or TVCs, count or repeat positive water analyses for Legionella spp;
  - an outbreak of legionellosis, suspected or confirmed as being centred at the site;
  - an outbreak of legionellosis, the exact source of which has yet to be confirmed, but which is believed to be centred in an area which includes the site.

Appendix 3 Action in the event of an outbreak of legionellosis

A3.1 In England and Wales, Legionnaires' disease is notifiable under the Health Protection (Notification) Regulations 2010[44] and in Scotland under the Public Health etc. (Scotland) Act 2008.[45] Under these Regulations, human diagnostic laboratories must notify the United Kingdom Health Security Agency (UKHSA), Public Health Wales (PHW) or Public Health Scotland (PHS) of any microbiologically confirmed cases of Legionnaires' disease (see 'Further sources of advice').

A3.2 An outbreak is defined as two or more cases where the onset of illness is closely linked in time (weeks rather than months) and where there is epidemiological evidence of a common source of infection, with or without microbiological evidence. An incident/outbreak control team should always be convened to investigate outbreaks. It is the responsibility of the Proper Officer to declare an outbreak. The Proper Officer, appointed by the local authority, is usually a consultant in Communicable Diseases Control (CCDC) in England and Wales, or the consultant in Public Health Medicine (CPHM) in Scotland. If there are suspected cases of the disease, medical practitioners must notify the Proper Officer in the relevant local authority.

A3.3 Local authorities will have jointly established incident plans to investigate major outbreaks of infectious diseases, including legionellosis, and it is the Proper Officer who activates these and invokes an outbreak committee, whose primary purpose is to protect public health and prevent further infection.

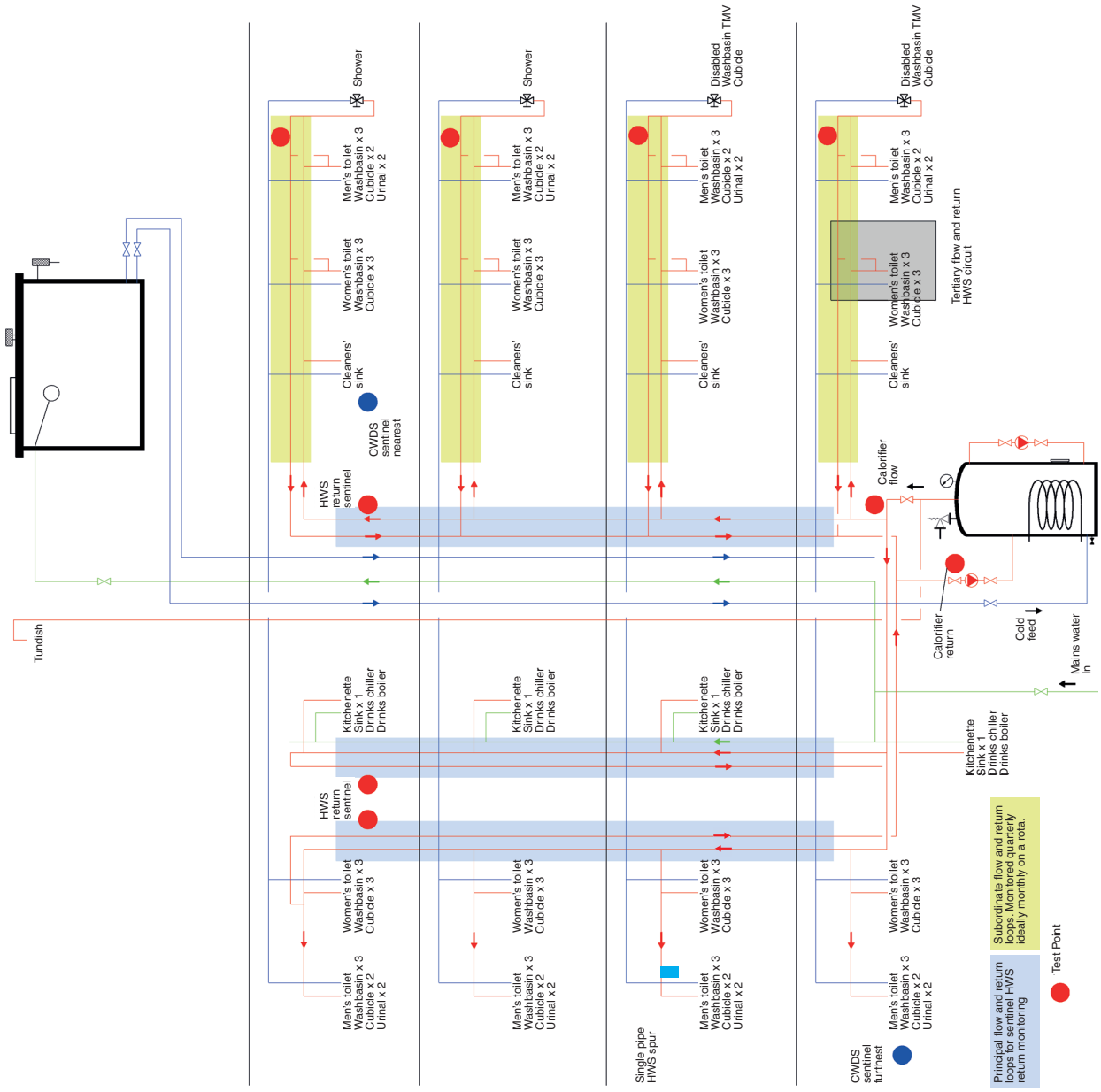
A3.4 HSE or local environmental health officers (EHOs) may be involved in the investigation of outbreaks, their aim being to pursue compliance with health and safety legislation. The local authority, Proper Officer or EHO acting on their behalf will make a visit, often with the relevant officer from the enforcing authority (ie HSE or the local authority). Any infringements of the relevant legislation may be subject to a formal investigation by the appropriate enforcing authority.

A3.5 There are published guidelines (by UKHSA, PHS and PHW) for the investigation and management of incidents, clusters and outbreaks of Legionnaires' disease in the community. These are:

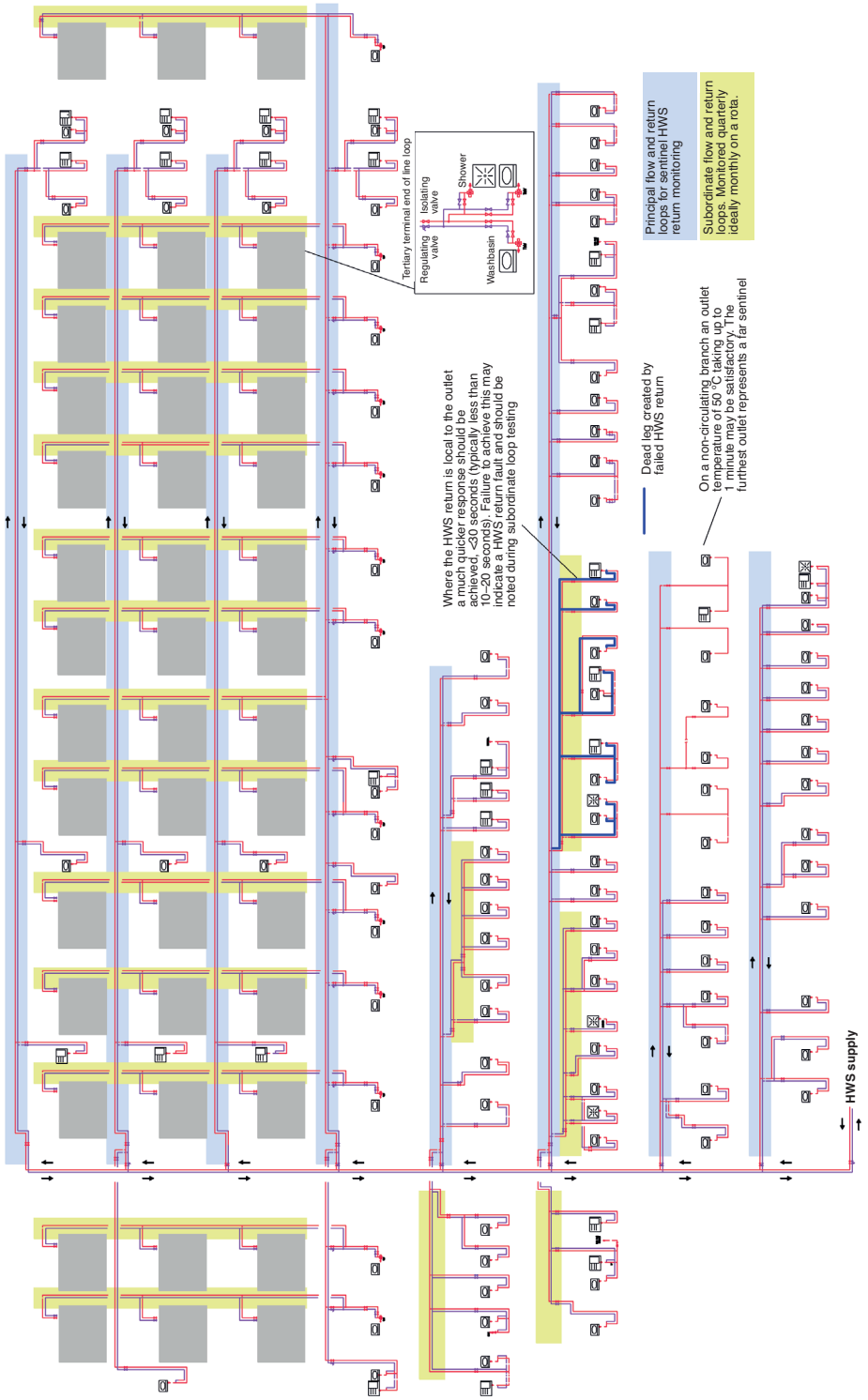
- for England, Guidance on investigating cases, clusters and outbreaks of Legionnaire's disease;[46]
- for Scotland, Guidelines on management of Legionella incidents, outbreaks and clusters in the community;[47] and
- for Wales, The communicable disease outbreak plan for Wales.[48]

A3.6 If a cooling water system has been implicated in an outbreak of Legionnaires' disease, emergency disinfection and cleaning of that system must take place as soon as possible, in accordance with the site incident plan.

Appendix 4 Example of sentinel points in a simple hot water system (HWS)



Appendix 5 Example of sentinel points in a complex hot water system (HWS)



Appendix 6 Checklist for recommended frequency of inspection for other risk systems

System/service	Task	Frequency
Ultrasonic humidifiers/ foggers and water misting systems	If the equipment is fitted with UV lights, check to ensure the effectiveness of the lamp (check to see if within working life) and clean filter	Six monthly or according to manufacturer's instructions
	Ensure automatic purge of residual water is functioning	As part of machinery shut down
	Clean and disinfect all wetted parts	As indicated by risk assessment
	Sampling for Legionella	As indicated by risk assessment
Spray humidifiers	Clean and disinfect spray humidifiers and make-up tanks, including all wetted surfaces, descaling as necessary	Six monthly
	Confirm the operation of non-chemical water treatment (if present)	Weekly
Air washers, wet scrubbers, particle and trivial gas scrubbers	Clean and disinfect air washers, wet scrubbers, particle and trivial gas scrubbers and water storage tanks	As indicated by risk assessment
	Apply, monitor, and record the results of the water treatment	As indicated by risk assessment
Water softeners	Clean and disinfect resin and brine tank – check with the manufacturer what chemicals can be used to disinfect resin bed	As recommended by manufacturer
Emergency showers, eyebaths and face-wash fountains	Flush through and purge to drain ensuring three to five times the volume of water in the stagnant zone is drawn off	As indicated by risk assessment, but at least every six months
	Inspect water storage tanks (where fitted	Monthly
	Clean and disinfect shower heads, nozzles, roses, 'Y' strainers, and water storage tanks (where fitted	Quarterly, or more frequently, as indicated by the risk assessment

System/service	Task	Frequency
Sprinkler and hose reel systems	When witnessing tests of sprinkler blow-down and hose reels ensure that there is minimum risk of exposure to aerosols	As directed
Spa pools	Detailed HSE/PHE guidance on the management of spa pools is available in *Management of spa pools: Controlling the risks of infection*	
Whirlpool baths	Clean, flush and disinfect air channels Remove, flush and clean jets	As indicated by risk assessment
Horticultural misting systems	Clean and disinfect distribution pipework, spray heads and make-up tanks including all wetted surfaces, descaling as necessary	Quarterly or as indicated by risk assessment
Dental equipment	Drain down, clean, flush and disinfect all system components, pipework and bottles	Twice daily (typically at the start and finish of each working day). Disinfectant contact time as recommended by the manufacturer
	Clean storage bottles, rinse with distilled or Reverse Osmosis (RO) water, drain, and leave inverted overnight	Daily
	Take microbiological measurements – refer to *Decontamination Health Technical Memorandum 01-05: Decontamination in primary care dental practices*[45]	As indicated by risk assessment
Vehicle wash systems	Check and clean filtration systems, collection tanks and interceptor tanks and check treatment system A biocide programme should be in place and should be monitored and controlled similar to the standards required in cooling towers Clean and disinfect system and ensure sludge tanks are emptied	As indicated by risk assessment
	Sample for Legionella	Initially to establish that control has been achieved and thereafter quarterly or as indicated by risk assessment

System/service	Task	Frequency
Fountains and water features	Clean and disinfect ponds, spray heads and make-up tanks including all wetted surfaces, descaling as necessary	As indicated by the risk assessment, and depending on condition
Industrial process water systems	Conduct a risk assessment of each system, preferably using an assessment team comprising members knowledgeable in Legionella management and control, as well as those familiar with the design and operation of the system. Devise a control scheme based on this risk assessment	Monitoring, inspection, and testing frequencies to be determined as indicated by the risk assessment

Glossary

acid A chemical that reduces the pH of water and reacts with alkali or base; it is commonly used for removing scale and other deposits from systems and sometimes it is used as a scale inhibitor.

adenosine triphosphate (ATP) A chemical in cells used as an energy source for metabolic purposes. Its concentration in water can be used to estimate microbial population density.

adiabatic cooler/condenser A term used to describe a heat rejection device that normally operates in dry mode but which can also operate using evaporative cooling to pre-cool the air stream with water. This increases the device's cooling capacity when ambient air temperatures are high, eg in the summer months.

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

air conditioning A form of air treatment whereby temperature, humidity, ventilation and air cleanliness are controlled within the limits determined by the requirements of the air-conditioned enclosure.

algae Simple organisms, similar to plants, that require light for growth. They are typically found in aquatic environments.

alkali A chemical that increases the pH of water and reacts with an acid.

alkalinity The concentration of alkali in water (measured by titration with standard acid solution).

antibodies Substances in the blood that destroy or neutralise toxins or components of bacteria generally known as antigens; they are formed as a result of the introduction into the body of the antigen to which they are antagonistic.

bacterium (plural bacteria) A microscopic, unicellular, prokaryotic organism, without a nuclear membrane.

balance pipes The pipes between adjoining duty towers and between duty and standby towers.

biocide A substance that kills microorganisms.

biofilm A community of microorganisms of different types growing together on a surface where they form a slime layer.

bleed A deliberate intermittent or continuous discharge of system water to drain that allows the admission of make-up water to the system, thereby controlling the concentration of dissolved or suspended solids in the water.

blow-down Another term for bleed.

bromine An element very similar to chlorine that is 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 levels.

chlorinate To add chlorine to water, usually in the form of a hypochlorite.

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

chlorine dioxide A compound used as a biocide.

cold water service Installation of plant, pipes and fitting in which cold water is stored, distributed and subsequently discharged.

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.

concentration factor Compares the level of dissolved solids in the cooling water with that dissolved in the make-up water (also known as cycles of concentration or concentration ratio). Usually determined by comparison of either the chloride or magnesium concentration.

conductivity The capacity of the ions in the water to carry electrical current. Conductivity measurement is used to estimate the total dissolved solids (TDS) in the water. The results are expressed as microsiemens/cm (µS/cm) and are temperature-dependent. TDS can be calculated by multiplying the conductivity level with a conversion factor of 0.7. Care should be taken not to confuse conductivity and TDS figures (see total dissolved solids).

conductivity controller A device that measures the electrical conductivity of water and helps control it to a pre-set value.

contact time The time a chemical is retained in the system.

cooling water system A heat exchange system comprising a heat rejection plant and interconnecting pipework for recirculating water (with associated pumps, valves and controls).

corrosion coupons In water circuits, these are small strips of various types of metal placed in racks that can easily be removed, weighed and/or inspected to enable the corrosion characteristics of the water to be assessed.

corrosion inhibitors Chemicals designed to prevent or slow down the waterside corrosion of metals.

culture The technique of detecting and enumerating bacteria by growing them on an artificial medium such as agar.

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

dip slide Coated plastic slide on which microorganisms can be grown, examined and quantified. They provide a broad indication of microbial growth only.

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

dispersant A chemical that loosens organic material adhering to surfaces. Dispersants are commonly used to loosen biofilm.

DPD No 1 An indicator used in the colorimetric determination of the concentration of oxidising biocides. DPD No 1 reacts to the presence of strong biocidal species, including free chlorine and total bromine (free and combined).

drift Water droplets and aerosols suspended in the air that discharges from a cooling tower or evaporative condenser. Note that the visible plume often seen above cooling towers under cool conditions is likely to be condensing water vapour (evaporated in the cooling process) rather than system water droplets/aerosol carried over.

drift eliminator Equipment containing a complex system of baffles designed to minimise the drift (see drift) discharging from a cooling tower or evaporative condenser.

evaporative cooling The process of evaporating part of a liquid to remove the latent heat from the main bulk of the liquid. In this way, the bulk of the liquid is cooled.

free chlorine The amount of chlorine available to act as a disinfectant in water. Note that disinfection properties are strongly affected by the pH of the water and decline rapidly in alkaline conditions.

half-life The time taken for the level of a treatment chemical to decrease to half its original value.

halogen A grouping of chemical elements that include bromine and chlorine.

heat exchanger A device for transferring heat between fluids that are not in direct contact with each other.

hypobromite ion (OBr^-) A form of bromine that is predominant at higher pH levels. While it has biocidal properties, it is less effective as a biocide than hypobromous acid.

hypobromous acid (HOBr) The form of bromine that is most effective as a biocide.

hypochlorite ion (OCl^-) A form of chlorine that is predominant at higher pH levels. While it has biocidal properties, it is less effective as a biocide than hypochlorous acid.

hypochlorous acid (HOCl) The form of chlorine that is most effective as a biocide.

incubation temperature The temperature at which dip slides or inoculated culture media should be held, for long enough for bacterial growth to become evident. The incubation temperature depends on the type of microorganism being tested in the water sample.

Langelier saturation index (LSI) A calculation used to assess the corrosiveness or scaling potential of water. It measures the tendency of water to deposit or dissolve calcium carbonate, helping to determine its balance. LSI values above zero suggest the water is scaling, while negative values indicate corrosion potential.

Legionella (plural Legionellae) A bacterium (or bacteria) of the genus *Legionella*.

Legionella pneumophila A species of bacterium that is the most common cause of Legionnaires' disease and Pontiac fever.

Legionnaires' disease A form of pneumonia caused by bacteria of the genus *Legionella*.

limit of detection The lowest amount of a substance that can be reliably detected by a specific scientific method or instrument.

make-up water Fresh water that is added to a recirculating water system to compensate for losses by evaporation, bleed, drift, windage and leakage.

mg/l (milligrams per litre) A measure of dissolved substances given as the number of parts there are in a million parts of solvent. It is numerically equivalent to ppm (parts per million) with respect to water.

microorganism An organism of microscopic size, including bacteria, fungi and viruses.

neonates Newborn children.

nutrient A food source for microorganisms.

pasteurisation Heat treatment to destroy microorganisms, usually at high temperature.

pH The logarithm of the reciprocal of the hydrogen ion concentration in water, expressed as a number between 0 and 14. The pH value indicates how acidic or alkaline the water is; values below 7 are increasingly acidic, 7 is neutral, and values higher than 7 are progressively alkaline. Acidity and alkalinity, however, are not proportional to pH (see acidity and alkalinity).

scale inhibitor Chemical added to water to inhibit scale formation.

scaling indices These are predictors for the scale-forming or corrosive properties of the water.

shot dose A single dose of a chemical, sometimes called a 'shock' or 'shot' dose. It can also describe routine high-concentration periodic dosing (such as with non-oxidising biocides or dispersants) to distinguish the dosing from maintaining a low concentration of chemical continuously.

total dissolved solids (TDS) The quantity of solids dissolved in the water, measured in mg/l. These solids will typically include calcium and magnesium (sodium in softened water), bicarbonate, chloride, sulphate and traces of other materials. TDS can be measured directly or determined indirectly from the conductivity reading (see conductivity).

total viable counts (TVCs) The total number of culturable bacteria (per volume or area) in a given sample.

turbidity The opacity of a liquid, eg cloudiness caused by a suspension of particles.

wholesome water Water supplied for such domestic purposes as cooking, drinking, food preparation or washing; or supplied to premises in which food is produced.

windage Water lost when wind forces an unusual flow pattern through the base of a cooling tower and blows droplets out of the tower.

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Further sources of advice

The Building Services Research and Information Association (BSRIA)
BSRIA Ltd, Old Bracknell Lane West, Bracknell, Berkshire, RG12 7AH, UK
https://www.bsria.com/uk/

United Kingdom Accreditation Service (UKAS)
UKAS, 2 Pine Trees Chertsey Lane, Staines-upon-Thames TW18 3HR
https://www.ukas.com/

UK Health Security Agency (UKHSA)
UKHSA, Nobel House, 17 Smith Square, London SW1P 3JR
https://www.gov.uk/government/organisations/uk-health-security-agency

Public Health Wales (PHW)
PHW, 2 Capital Quarter, Tyndall Street, Cardiff, CF10 4BZ
https://phw.nhs.wales/

Public Health Scotland (PHS)
PHS, 1 South Gyle Crescent, Edinburgh, EH12 9EB
https://www.publichealthscotland.scot/

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First edition

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Further information

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The Stationery Office publications are available from The Stationery Office, PO Box 29, Norwich NR3 1GN Tel: 0333 202 5070 Fax: 0333 202 5080. E-mail: customer.services@tso.co.uk Website: https://www.tso.co.uk. They are also available from bookshops.

Statutory Instruments can be viewed free of charge at https://www.legislation.gov.uk/ where you can also search for changes to legislation.

This document is available on the HSE website (Legionnaires' disease: Technical guidance)

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