



Scottish Health Technical Memorandum 2040

(Part 1 of 6)

Overview and management responsibilities

The control of legionellae in healthcare premises - a code of practice

IMPORTANT NOTE LEGIONELLA

SHTM 2040 and the HSC Approved Code of Practice and Guidance (L8) 2000

HSC's Approved Code of Practice came into effect on 8 January 2001. At this time i.e. December 2001 the UK Health Department's Guidance HTM 2040 (SHTM 2040 in Scotland) has not been aligned with the ACOP. Work is ongoing but it is unlikely that HTM 2040 and SHTM 2040 will be updated until late 2002 and launched on a UK basis.

L8 takes cognisance of 'hospitals' but requires considerable interpretation for practical application. The revised UK Health Department Guidance will undertake to address this issue.

In the meantime this version of SHTM 2040 must be read as subordinate to the new ACOP.

Disclaimer

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IMPORTANT NOTE: See front cover for status of SHTM 2040. SHTM 2040 must be read in conjunction with and as subordinate to HSC ACOP L8.



1. Introduction

General

- 1.1 The guidance contained in this part is applicable to new and existing sites, and is for use at various stages during the inception, design, upgrading, refurbishment, extension and maintenance of a building.
- 1.2 The approach should be to remove all potential sources of seeding, growth and spread of legionellae. Where this ideal cannot be achieved in existing situations, steps should be taken to control and prevent legionellae by sound operational management.
- 1.3 The control of legionellae is a continuing responsibility. The effectiveness of precautionary measures should be continually monitored, and a continuing programme to ensure awareness should be devised. Although knowledge of legionellosis has improved markedly in recent years there is a continuing misunderstanding about the method of dissemination. Many people are under the impression that cooling towers are the only source of legionellae in building service systems. All water systems are capable of colonisation by legionellae, and taps are just as capable of generating an aerosol as showers or, indeed, cooling towers.
- 1.4 The biggest risk is complacency leading to the deterioration of water hygiene to the extent that an outbreak of the disease occurs.
- 1.5 The general manager/chief executive has the responsibility of ensuring that designated staff are appointed.
- 1.6 This SHTM does not include advice on water supplies for clinical equipment such as dialysers, nebulisers and respiratory humidifiers or for water services for pharmacy and dental departments. Users of clinical humidifiers and nebulisers are reminded that sterile water, not tap water, should be used and that they should be emptied and cleaned thoroughly following each period of use. All equipment with water reservoirs should be stored dry. Water for any other purpose should meet any identifiable local requirements, but users must recognise that any water system may provide a suitable environment for legionellae and other water-borne organisms.
- 1.7 SHTM 2027; *Hot and cold water supply, storage and mains services* should be consulted for guidance on the general design and operation of water systems in healthcare premises.

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Application to premises

- 1.8 Precautions to prevent outbreaks of legionnaires' disease are required even in those premises which have to date not been infected. The guidance should be used for all sites where there is in-patient or out-patient accommodation, for example hospitals, clinics, health centres and Blood Transfusion Service premises.

Priorities

- 1.9 Premises designed since 1988 should be in compliance with SHTM 2040; The control of legionellae in healthcare premises – a code of practice, with reference to SHHD/DGMs (1988)50; (1989)35; 1989(77); 1990(51) and 1991(15).
- 1.10 All existing premises should be regularly reviewed to identify where they do not meet the advice of this SHTM. A realistic programme should be prepared to eradicate any shortfall. Priority should be given to patient areas, although the exact priority will depend on local circumstances.

NOTE: Reference must be made to Health and Safety Commission, 'Legionnaires' disease, The control of legionella bacteria in water system – Approved Code of Practice and Guidance' issued 2000.



2. Statutory obligations

Health and Safety at Work

- 2.1 Employers have a general duty, under the Health and Safety at Work etc Act 1974, to ensure, so far as is reasonably practicable the health, safety and welfare of their patients, employees and visitors. These duties are legally enforceable, and the Health and Safety Executive (HSE) have successfully prosecuted occupiers of premises under this statute for outbreaks of legionnaires' disease. It falls upon both the owners and occupiers of premises to ensure that there is a management regimen for the proper design, installation and maintenance of plant, equipment and systems. Failure to have a proper system of work and adequate control measures can also be an offence even though an outbreak has not occurred.

Control of Substances Hazardous to Health (COSHH) Regulations

- 2.2 Also relevant are the Control of Substances Hazardous to Health (COSHH) Regulations 1999 which came into force in 1999. In the context of hot and cold water supply, storage and mains services, these regulations apply to micro-organisms, including legionellae, which could create a health hazard. These regulations also apply to the chemicals which may be used to control the growth of organisms in water supply.

Reporting requirements under health and safety legislation

- 2.3 The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 came into force on April 1996. These place a responsibility on employers to report cases of work related disease to the HSE. The list of reportable diseases includes a number of infections which could be related to work within health services and includes legionellosis.

The Public Health (Infectious Diseases) Regulations 1975 requires that a properly appointed officer shall inform the Chief Medical Officer of any serious outbreak of the disease which to his knowledge has occurred. Reference should also be made to Public Health (Notification of Infectious Diseases) Scotland Regulations (1988) and amendment regulations 1989.



NOTE: Further advice is given in the Scottish Infection Manual: 'Guidance on Core Standards for the control of infection in Hospitals, health care premises and at the community interface' issued by the Public Health Policy Unit Room 401, St. Andrews House, Scottish Executive Health Department, Edinburgh EH1 3DG.

Water Supply Regulations

- 2.4 The Water Supply (Water Quality) (Scotland) Regulations 1990 (as amended) apply to water stored and distributed within any hospital which is used for drinking and any domestic purpose.
- 2.5 The Private Water Supplies (Scotland) Regulations 1992 (Statutory Instrument No. 2790) cover private water supplies (Boreholes and Wells).

NOTE: Legionellosis is a notifiable disease: 'The European Community Directive Relating to the Quality of Water Intended for Human Consumption'; Council Directive 80/778/EEC.

Food Safety Act

- 2.6 The Food Safety Act 1990 covers for water used for food preparation or food manufacture, and also includes water used for drinking.

NOTE: Reference should also be made to Food Safety (General Food Hygiene) Regulations 1995; and Food Safety (Temperature Control) Regulations 1995.

Approved Code of Practice

- 2.7 The Health and Safety Commission have published 'Legionnaires disease, The control of legionella bacteria in water systems – Approved Code of Practice and Guidance 2000'. This single publication replaces the 1995 ACOP and the technical guidance HSG 70. This has allowed information to be consolidated, with the aim of making it easier to read and understand the duties under the law.
- 2.8 The health service, with responsibility for the wider aspects of public health and the operation of NHS premises, is expected to be particularly vigilant. The courts will expect a higher standard of care from public bodies, given the resources available to them and the greater risks to the occupants of these premises. Though the number of outbreaks of legionnaires' disease is relatively small, outbreaks are considered to be avoidable. Management must also acknowledge that incidents or outbreaks cause widespread

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concern especially if associated with healthcare premises. Investigation of these outbreaks has shown that they are generally related to a breakdown in management systems. Design flaws and defects have also been implicated as the cause of some outbreaks.

- 2.9 Hence, managers need to satisfy themselves, by monitoring, that the procedures are being implemented. It is not sufficient merely to devise procedures.
- 2.10 It is a widely held misconception that wet cooling towers are the only source of the disease, and that a building without such a tower presents no risk. All water systems are liable to colonisation by legionellae.
- 2.11 The prohibition of wet cooling towers is not envisaged; in some instances, they provide the only practicable solution. The relevant statutory requirement is to assess risk and the measurements to prevent (or where it is not reasonably practicable to prevent, to minimise) the risk from exposure to legionellae.
- 2.12 The Notification of Cooling Towers and Evaporative Condensers Regulations 1992 requires the registration of cooling towers and evaporative condensers to the local authority.

NOTE: Directors of environmental health are required to maintain a register of cooling towers and whirlpool spas in association with the Health and Safety Executive.

3. Management responsibility

Management accountability

- 3.1 The chief executive or general manager has overall responsibility for all aspects of the quality of water supplies within his/her organisation.
- 3.2 The procedures instituted should be such as to demonstrate that any person on whom the statutory duty falls has fully appreciated the actual and potential risks of legionellae. Though compliance with this guidance may be delegated to staff, or undertaken by contract, accountability cannot be delegated.
- 3.3 Regular assessments should be made at least annually, using this guidance, to establish the extent of risk. Shortfalls should be clearly recorded and the proposed control measures, with timescales, developed. A review should be undertaken whenever there is a substantial change in physical environmental conditions.
- 3.4 The objective must be to institute management procedures to ensure that compliance is continuing and not notional. The prime purpose of the assessment is to be able to demonstrate that management has identified all the relevant factors, has instituted corrective or preventative action, and is monitoring that the plans are being implemented.
- 3.5 This guidance should be applied to all healthcare premises, however small, where there is a duty of care under the Health and Safety at Work etc Act 1974. Smaller premises, such as clinics, present a risk in the same way as a major hospital. Intermittently used areas, for example premises not used over the weekend, may present ideal environments for the growth of legionellae.

NOTE: Reference should be made to Part 6 of this SHTM 'Supplementary guidance applicable to intermittently used healthcare premises'.

Role of infection control team

- 3.6 The infection control team (legionella) should be nominated in writing by the chief executive or general manager for advising on and monitoring infection control policy for legionnaires' disease. The infection control team (legionella) should be involved in the production of the policy and management procedures for the control of legionellae. Similarly, the team has a key role in formulating the plans for its implementation.

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- 3.7 Additionally, the policy should be acceptable to the control of infection team and any amendment to that policy must be agreed by the team.

Nominated person

- 3.8 A nominated person (legionella), possessing adequate professional knowledge and with appropriate training, should be nominated in writing by the general manager or chief executive to devise and manage the necessary procedures for the prevention of legionnaires' disease. The persons will be required to liaise closely with other professionals in various disciplines. In addition, the person should possess a thorough knowledge of the control of legionellae and would ideally be a Chartered Engineer.

NOTE: Training courses on minimising the risk of legionellae in water systems are available from The Property and Environment Forum Executive.

- 3.9 This person's role, in association with the infection control team and maintenance staff, involves:
- advising on the potential areas of risks and identifying where systems do not comply with this guidance;
 - advising on the necessary continuing procedures for the prevention of legionellae;
 - monitoring the implementation and efficacy of those procedures;
 - approving and identifying any changes of those procedures;
 - maintaining adequate records.

- 3.10 Implementation of an effective maintenance policy must incorporate the creation of fully detailed operating and maintenance documentation and the introduction of a logbook system. The "nominated person" should appoint a deputy to whom delegated responsibilities may be given. The deputy should act for the nominated person on all occasions when the nominated person is unavailable.

- 3.11 The nominated person should be fully conversant with the design principles and requirements of water systems and should be fully briefed in respect of the causes and effects of contamination with legionella. The appointment of an engineer as the nominated person is appropriate in that the responsibility can extend to the operation and maintenance of the associated plant. It is

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recognised that the nominated person cannot be a specialist on all matters and must be supported by specialists in specific subjects such as water treatment and microbiology, but he/she must undertake responsibility for calling upon and co-ordinating the activities of such specialists.

Hazard assessment

- 3.12 Legionellae, which causes legionellosis, are naturally widespread in water systems. It is exceptional for a water supply, either public or private, to be entirely free from aquatic organisms, and for this reason it is important that appropriate measures are taken to guard against conditions which may encourage microbial multiplication. Provided water is derived from the public mains and its quality is preserved in the storage and distribution system by correct design, installation and maintenance, it can be regarded as being microbiologically acceptable for use without further treatment. Strict adherence to the guidance in this SHTM will not eradicate legionellae, but there will be reduction in the risk of an outbreak.
- 3.13 The number of organisms which cause infection has not been reliably determined and is likely to vary from person to person. However, all patients are at risk, and those who are immuno-compromised can be particularly susceptible.
- 3.14 Particularly susceptible patients will be those found in departments concerned with:
- head/neck cancer;
 - bone marrow transplant;
 - renal dialysis;
 - leukaemia;
 - organ transplant;
 - AIDS.
- 3.15 Outbreaks have been linked to the inhalation of infected aerosols. Most people recognise that showers and wet cooling towers generate aerosols. Less well known is that a 'fog' of aerosols is generated when a bath or basin is filled. Aerosols can be generated from any water outlet, and no water outlet can be considered free from potential risk. Hence baths, spa baths and hydrotherapy pools also represent hazards. If the water is contaminated, the possibility of the organism being entrained in the aerosol increases.
- 3.16 These aerosols are buoyant and can remain suspended in the air for a relatively long time. Any air movement will distribute them over quite large distances. Recently it has been shown that the organism can survive even after the "wet" layer of the aerosol has dried.

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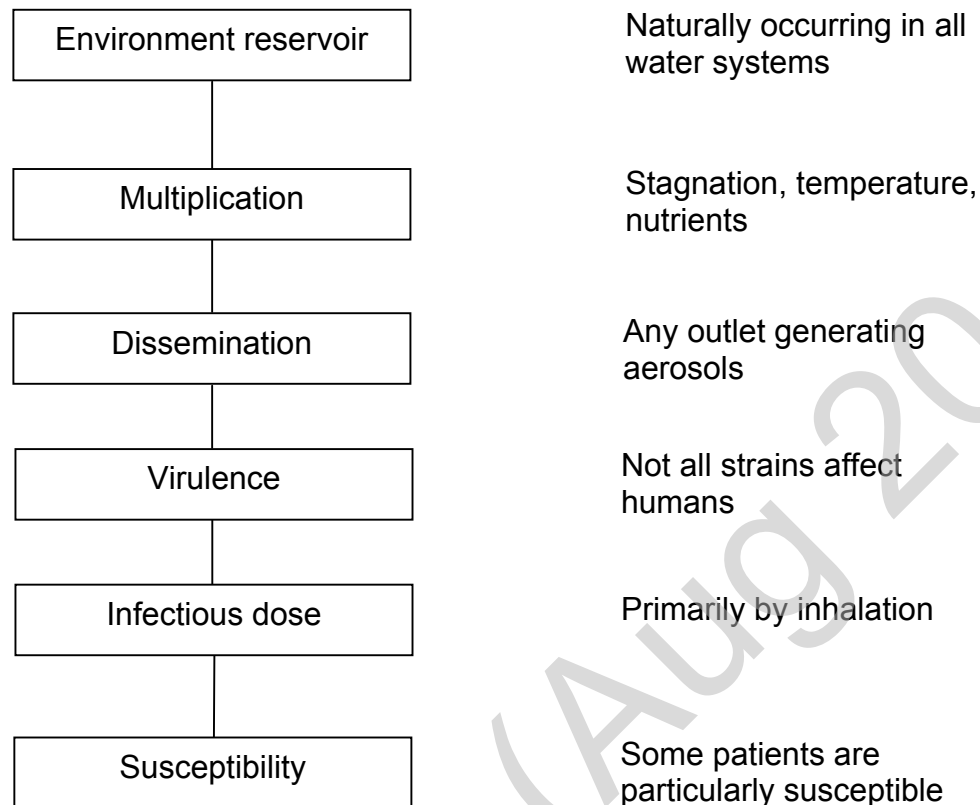
- 3.17 For certain immuno-compromised patients there may be other routes of infection. However, since these represent minimal risk, the SHTM does not deal with these aspects.

Prevention

- 3.18 It has been suggested that the following “chain of causation” must exist for legionellosis to be acquired:

- a. an environmental reservoir;
- b. opportunity for multiplication;
- c. a mechanism for dissemination;
- d. virulence to the human host;
- e. inoculation of an infectious dose;
- f. host susceptibility.

(See Figure 1, Chain of causation.)

Figure 1: Chain of Causation

- 3.19 Employing this hypothesis, the key preventative measures that may be applied are those which break the chain of causation. Strict procedures for water supply hygiene and disinfection are essential and particular attention should be paid to outlets.

NOTE: Refer to EPM(92)3 and SHPN2.

- 3.20 Simple precautions to achieve this objective are:
- removing all taps and outlets and associated pipework which are not needed, due to disuse or under-use;
 - ensuring that the hot water from the calorifier is at or above 60°C and that it does not fall below 50°C in the circulation pipework;
 - keeping the length of the pipework carrying blended water at 24-45°C to the minimum (never more than 2 m);
 - reducing the length of dead-legs or spurs from the main hot water circulation system to the minimum (maximum 5 m);
 - avoiding water stagnation;

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- f. introducing an appropriate level of maintenance and ensuring correct and safe operation;
 - g. maintaining the cleanliness of water systems;
 - h. using adequate water treatment in wet cooling towers;
 - i. keeping storage cisterns clean and sealed from extraneous matter and insulating where necessary to maintain temperatures below 20°C;
 - j. reducing the amount of water stored (24 hours maximum).
- 3.21 Where systems are known to be of uncertain quality or where consistent problems have been identified, a regimen of additional water treatment systems may be appropriate.

Monitoring and record keeping

- 3.22 Based on this guidance and the results of the risk assessment, a written operational plan should be devised. This should clearly identify who has overall accountability for the premises, and who is responsible for devising and carrying out the procedures. The record should include the systems, plant and equipment which pose a potential threat, and a detailed schedule of the preventative maintenance procedures. Finally, provision should be made in the plan for evaluation of the efficacy of the measures.

Water supply and distribution

- 3.23 It is exceptional for a water supply, either public or private, to be entirely free from aquatic organisms, and consequently it is important that appropriate measures are taken to guard against conditions that may encourage microbial multiplication. Legionellae, like other opportunist pathogens including *Aeromonas hydrophila* and *Pseudomonas aeruginosa*, are common in the environment and as such can seed treated water systems during construction.
- 3.24 Micro-organisms can also be introduced during refurbishment, repair, alteration or during routine inspection and sampling.
- 3.25 Hospital sites are generally large and often contain complex storage reservoirs and distribution systems similar to those operated by the water authorities. The water authorities or a specialist consultant can assist with the design, specification, tendering and commissioning of such water systems.
- 3.26 Wherever possible, publicly supplied mains water should not be mixed with private supplies. Each should be separately identified. Where mixing does occur it must be protected by a Type A air gap.

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Water treatment regimen

- 3.27 The regimen of water treatment chosen should be agreed by the infection control doctor (legionellae) and the nominated person (legionellae). The regimen should be of proven efficacy, and substances and products to be used in contact with potable water supplies must be listed in the current edition of the Water Bylaws Scheme's (WBS) Water Fittings and Materials Directory (WFMD).

NOTE: Reference should be made to SHTN 2. The WRc, byelaws scheme is not in itself sufficient. For new materials CCM committee or WRc Medenham (J Fawells Dept.) approval on toxicity levels is required.

- 3.28 Chemical conditioning systems which are used in conjunction with potable water systems should be selected very carefully. Addition of any substance must not cause a breach of any requirement in the Water Supply (Water Quality) (Scotland) Regulations, and any system for introducing a substance must be listed in the current edition of the WFMD.
- 3.29 Consideration should be given as to whether or not the process kills only the organisms flowing through the equipment (leaving no residual disinfecting agent in the water) or whether agents are released into the water circuits.
- 3.30 Further care should be taken to ensure that adequate filtration and/or reverse osmosis is used to provide a pure water supply free of contaminants for water serving clinical processes, for example dialysis equipment.

Air conditioning

- 3.31 Air-conditioning and ventilation systems have been shown to provide a route for distributing contaminated air throughout a building. Particular attention should be paid to the humidification process. Ductwork should be examined for evidence of "ponding", that is, places where water has collected.

NOTE: Refer to SHTM 2025; *Ventilation in Healthcare Premises*.

Design and build contracts

- 3.32 An outbreak of legionnaires' disease has been associated with healthcare premises built under the "design and build" type of contract, under which the client retains no clerk of works on-site and there is no "commissioning" period on completion of the work. It is essential to ensure that, immediately before occupation, the measures outlined in this SHTM have been taken for disinfection and maintenance of temperatures. A nominated person (legionellae) should be appointed immediately before handover. (Adequate

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documentation, including “as-fitted” drawings, should be available at the time of handover.)

NOTE: Refer to SHTN No. 1, PCD.

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4. Epidemiology

General

- 4.1 Although legionnaires' disease was first recognised in July 1976, when an outbreak occurred among delegates attending an American Legion Convention in Philadelphia, the cause of the outbreak was not identified until January 1977 when the Center for Disease Control in Atlanta reported the isolation of the aetiological agent which they named *Legionella pneumophila*. Diagnostic tests were developed which revealed earlier outbreaks of the disease and sporadic cases dating back to the 1940s. Thus the infection was not new, but had escaped recognition.
- 4.2 Legionnaires' disease is an illness characterised mainly by pneumophila. Typically it begins quite abruptly with high fever, chills, headaches and muscle pain. A dry cough soon develops, and most patients suffer difficulty with breathing. About one-third of patients also develop diarrhoea or vomiting and about half become confused or delirious. The case fatality rate is similar to that of most other types of pneumonia.
- 4.3 *L. pneumophila* can also cause a short febrile (feverish) illness without pneumonia known as Pontiac fever. Since *L. pneumophila* was originally isolated, several other species of legionella capable of causing pneumonia have been described in the UK and elsewhere. The 1988 outbreak of non-pneumonic legionellosis at Lochgoilhead in Scotland, now referred to as Lochgoilhead fever, was attributed to the species *L. micdadei*. Legionellosis is the generic term used to cover legionnaires' disease, Pontiac fever and Lochgoilhead fever.
- 4.4 To date, at least 37 different species of legionellae are recognised. The species most commonly associated with disease outbreaks is *L. pneumophila*. Fourteen different serogroups of *L. pneumophila* have been described, *L. pneumophila* serogroup 1 being most commonly associated with cases of legionnaires' disease in the UK.
- 4.5 There are various sources of the organism and various routes of transmission to humans. Domestic hot water services in large buildings have been shown to be the most common source, but evaporative cooling towers serving the air-conditioning plant in these types of establishment have also been implicated. A poorly maintained whirlpool spa has also been shown to be a source, as have individual wall-mounted humidifiers and nebulisers using tap water.



- 4.6 In all these instances, the infection is considered to have been acquired by inhalation of small water droplets carrying the bacteria. Aerosols containing such droplets may be generated by running taps or showers and during the normal operation of cooling towers and evaporative condensers. Survival of the bacterium in an aerosol is enhanced if the ambient relative humidity is greater than 65% and if it is sheltered from direct sunlight. Viable bacteria contained within aerosols may travel great distances.
- 4.7 The incubation period (the time between exposure to the organism and the development of first symptoms) may range from 2-10 days. There is no record of person-to-person spread of infection. The bacterium is not highly virulent, but may infect individuals who are susceptible. In most outbreaks fewer than 5% of people exposed to the source of infection have contracted legionnaires' disease, although in some hospital units such as renal and oncology wards, greater attack rates have been reported.

Risk of infection

- 4.8 The principle route of infection is through inhalation of the bacteria into the lungs. The risk increases with increasing numbers of inhaled bacteria. Other infection routes may include ingestion and external wounds.

Source of bacteria

- 4.9 The bacterium is ubiquitous, surviving and multiplying in water. It is widespread in natural fresh water including rivers, lakes, streams and ponds and may also be found in wet soil. Airborne dispersal may occur when water droplets are created. There is a strong likelihood of very low concentrations of the bacteria existing in all open water systems including those of building services. There is also a risk where earthworks are taking place near to open windows or intakes to air-conditioning/ventilation systems.
- 4.10 The risk is related to the number and types of bacteria in the water at the point of use.

Aerosol generation

- 4.11 Contaminated water presents a risk when it is dispersed into the air as an aerosol. This risk increases with reduced droplet size for two reasons. First the smaller the droplet, the longer it remains airborne. Second, small droplets (5 microns diameter or less) penetrate deeply into the lung and cannot easily be expelled. However, larger droplets can evaporate and become smaller ones, still containing the initial number of organisms. Aerosols are produced merely by water streams breaking up after striking a surface or by a bubble bursting on the water surface.

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- 4.12 In both a cooling tower and an evaporative condenser, water is distributed over large areas of wetted surfaces to create intimate contact between air and water, increasing the opportunity for the formation of aerosols. Water services are also capable of generating aerosols from the impact of tap water hitting wash-basins, sinks and baths, and from showers.
- 4.13 In whirlpools and spas the refreshing agitation of the water is achieved by the combination of air jets and pulsating water flow. Splashing of water and bursting of the air bubbles as they break through the water surface creates an aerosol immediately above the water surface.
- 4.14 The risk increase with the number of “infected” droplets in the aerosol generated, especially if the size of the droplet in the aerosol is within the range 2 to 5 microns in diameter.

Number of inhaled bacteria

- 4.15 Two factors determine the number of bacteria deeply inhaled:
- a. the concentration of bacteria in the air:
 - (i) this is determined both by the concentration of bacteria in the water and by the amount of contaminated water dispersed into a given air volume. The concentration of live bacteria in the air falls rapidly with distance from the source. Where a cooling tower and the fresh-air inlet to a building are both at roof level, it may be possible for contamination from the tower to reach the air inlet and hence enter the building;
 - (ii) the quantity entering will depend primarily on the separation distance between the tower and the fresh-air inlet. Increasing this distance of separation and locating the air inlet upwind (prevailing wind) of the tower help to reduce the likelihood of water droplets containing legionellae from entering the building;
 - b. the duration of exposure to the contaminated air;
 - (i) exposure in a shower is usually limited to few minutes, while exposure in a spa is usually longer. Exposure to airborne legionellae distributed in a building from a contaminated cooling water system may take place whenever the tower is operating, which may be most of the day during the summer;
 - (ii) the risk increases with the number of legionellae in the air and with the respiratory rate of the individual, and the length of time the person is exposed. The chances of legionella infections occurring increase with the number and susceptibility of people exposed.

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Susceptibility of individuals

- 4.16 While previously healthy people may develop legionnaires' disease, there are a number of factors which increase susceptibility:
- a) increasing age, particularly above 50 years (children are rarely infected);
 - b) sex: males are three times more likely to be infected than females;
 - c) existing respiratory disease which makes the lungs more vulnerable to infection;
 - d) illnesses, such as cancer, diabetes, kidney disease or alcoholism, which weaken the natural defences;
 - e) smoking, particularly heavy cigarette smoking, because of the probability of impaired lung function;
 - f) patients on renal dialysis, or on immuno-suppressant drugs which inhibit the body's natural defences against infection.

5. Ecology

5.1 The following conditions have been found to influence the colonisation and growth rate of legionella:

- a. water temperatures in the range 20–45°C favour growth. It is uncommon to find proliferation below 20°C, and the organisms do not survive long above 60°C. The optimum laboratory temperature for the growth of the organism is 37°C, that is, body temperature. Organisms may, however, remain dormant in cool water, multiplying only when the temperature reaches a suitable level;

NOTE: The death curve is logarithmic with time for a given temperature.

- b. the presence of sediment, sludge, scale and organic material provides a good nutrient source for legionellae. Evidence suggests that the presence of iron oxide (rust) also favours the growth of the organism;
- c. legionellae have been shown to colonise certain types of water fitting, pipework and material used in the construction of water systems. The presence of such materials and of large quantities of sediment may provide nutrients for legionellae and can make eradication difficult;
- d. other commonly encountered organisms in water systems such as algae, amoebae and other bacteria may serve as an additional nutrient source for legionellae. Algal slime may provide a stable habitat for multiplication and survival. Legionellae have been shown to proliferate rapidly in association with some water-borne amoebae;
- e. exposure to direct sunlight may inhibit the growth of legionellae while stimulating the growth of algae and the formation of slimes;
- f. biofilms are thought to play an important role in harbouring and providing favourable conditions in which legionellae can grow;

NOTE: A biofilm is a slime which develops on surfaces in contact with water.

- g. stagnant water encourages colonisation.

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Appendix: Management checklist

Legionellosis risk assessment

1. Appoint infection control doctor (legionella) and nominated person (legionella).

NOTE: A logbook recording the action taken on this checklist is recommended.

2. Produce record of drawings and schematics for all water systems. The drawings/schematic should show:

NOTE: Existing drawings should be checked for accuracy.

- a. layout and arrangement of all calorifiers and pumps;
- b. layout and arrangement of all cisterns, humidifiers and cooling towers;
- c. all other water systems, such as hydrotherapy pools, which may present a legionellosis hazard;
- d. dead-legs and blind ends, with lengths and diameter indicated;
- e. operation and check points for cross-referencing with operational instructions and temperature records.

There should also be adequate documentation which details the engineering design intent and maintenance and operation procedures.

3. Identify work needed to be carried out for compliance with this SHTM and HSC(L8)2000. This will require:
 - a. tracing all water pipework;
 - b. measuring the time taken to achieve recommended temperatures at hot and cold water outlets;
 - c. measuring temperatures at all cisterns, calorifiers, humidifiers and cooling towers, and at other strategic points to check compliance;
 - d. checking layout and arrangement of cisterns, calorifiers, pumps, humidifiers, cooling towers and other water systems which may present a legionellosis hazard;
 - e. identifying little-used outlets and associated pipework which could be removed.

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4. Develop schemes for risk minimisation and control in order of priority, having considered cost, risk and difficulty.
5. List all buildings in priority order of non-compliance and potential risk.
6. Devise an agreed management programme for the minimisation of risks identified in (5) above. This should be an action plan identifying resources and time-scales.
7. Manage the programme described in (6) above and identify compliance failures for remedial action.
8. Review the programme at yearly intervals to record progress in implementing the programme. All changes to the water systems and functional content should be recorded and evaluated.

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References

NOTE:

Where there is a requirement to address a listed reference, care should be taken to ensure that all amendments following the date of issue are included.

Publication ID	Title	Publisher	Date	Notes
Acts and Regulations				
	The Building (Scotland) Act	HMSO	1959	
	Clean Air Act	HMSO	1993	
	Consumer Protection Act	HMSO	1987	
	Electricity Act	HMSO	1989	
	The Food Safety Act	HMSO	1990	
	Registered Establishments (Scotland) Act	HMSO	1998	
	The Water (Scotland) Act	HMSO	1980	
	Health and Safety at Work etc Act	HMSO	1974	
SI 346	The Active Implantable Medical Devices Regulations	HMSO	1992	
SI 2179 & 187	The Building Standards (Scotland) Regulations	HMSO	1990	
	The Building Standards (Scotland) Regulations: Technical Standards Guidance	HMSO	1998	
SI 1460	Chemicals (Hazard Information and Packaging for Supply) Regulations (CHIP2)	HMSO	1997	
SI 3140	Construction (Design and Management) Regulations	HMSO	1994	
SI 437	Control of Substances Hazardous to Health Regulations (COSHH)	HMSO	1999	
SI 635	Electricity at Work Regulations	HMSO	1989	
SI 1057	Electricity Supply Regulations	HMSO	1988 (amd 1990)	
SI 3080	Electromagnetic Compatibility (Amendment) Regulations	HMSO	1994	
SI 2372	Electromagnetic Compatibility Regulations	HMSO	1992	

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Publication ID	Title	Publisher	Date	Notes
	Food Safety (Temperature Control) Regulations	HMSO	1995	
	Food Safety (General Food Hygiene) Regulations	HSMO	1995	
SI 2451	Gas Safety (Installation and Use) Regulations	HMSO	1998	
SI 917	Health & Safety (First Aid) Regulations	HMSO	1981	
SI 682	Health & Safety (Information for Employees) Regulations	HMSO	1989	
SI 2792	Health and Safety (Display Screen Equipment) Regulations	HMSO	1992	
SI 341	Health and Safety (Safety Signs and Signals) Regulations	HMSO	1996	
SI 1380	Health and Safety (Training for Employment) Regulations	HMSO	1990	
SI 2307	Lifting Operations and Lifting Equipment Regulations (LOLER)	HMSO	1998	
SI 3242	Management of Health and Safety at Work Regulations	HMSO	1999	
SI 2793	Manual Handling Operations Regulations	HMSO	1992	
SI 3017	The Medical Devices Regulations	HMSO	1994	
SI 1790	Noise at Work Regulations	HMSO	1989	
SI 2225	The Notification of Cooling Towers and Evaporative Condensers Regulations	HMSO	1992	
SI 3139	Personal Protective Equipment (EC Directive) Regulations	HMSO	1992	
SI 2966	Personal Protective Equipment at Work (PPE) Regulations	HMSO	1992	
SI 2169	The Pressure Systems and Transportable Gas Containers Regulations	HMSO	1989	
SI 574	The Private Water Supplies (Scotland) Regulations	HMSO	1992	
	The Public Health (Notification of Infectious Disease) (Scotland) Regulation	HMSO	1988	
	The Public Health Act (Infectious Disease) Regulations	HMSO	1975	
SI 2306	Provision and Use of Work Equipment Regulations (PUWER)	HMSO	1998	

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Publication ID	Title	Publisher	Date	Notes
SI 3163	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)	HMSO	1995	
SI 1333	The Water Supply (Water Quality) (Scotland) Regulations (amendment)	HMSO	1991	
SI 3004	Workplace (Health, Safety and Welfare) Regulations	HMSO	1992	
British Standards				
BS 6700	Specification for design, installation, testing and maintenance services supplying water for domestic use within buildings and their curtilages	BSI Standards	1997	
BS 7206	Specification for unvented hot water storage units and packages	BSI Standards	1990 (1997)	
BS 6920	Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on water quality	BSI Standards	1996	
BS 7592	Sampling for Legionellae organisms in water and related materials	BSI Standards	1992	
European Union Directives				
80/778/EEC	The Quality of Water Intended for Human Consumption	EEC		
Scottish Health Technical Guidance				
SHTM 2005	Building management systems	EEF	1999	CD-ROM
SHTM 2023	Access and accommodation for engineering services	EEF	1999	CD-ROM
SHTM 2024	Lifts	EEF	1999	CD-ROM
SHTM 2025	Ventilation in healthcare premises	EEF	1999	CD-ROM
SHTM 2027	Hot and cold water supply, storage and mains services	EEF	1999	CD-ROM
SHGN	'Safe' hot water and surface temperatures	EEF	1999	CD-ROM
SHPN 1	Health service building in Scotland	HMSO	1991	
SHPN 2	Hospital briefing and operational policy	HMSO	1993	
SHTN 1	Post commissioning documentation for health buildings in Scotland	HMSO	1993	
SHTN 2	Domestic hot and cold water systems for Scottish Health Care Premises	EEF	1999	CD-ROM
SHTN 4	General Purposes Estates and Functions Model Safety Permit-to-work Systems	EEF	1997	

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Publication ID	Title	Publisher	Date	Notes
	NHS in Scotland – Scotconcode Scottish Infection Manual: Guidance on core standards for the control of infection in hospitals, healthcare premises and at the community interface	EEF	1999	Version 3
NHS in Scotland Firecode				
HTM 81	Fire precautions in new hospitals	EEF	1998	CD-ROM
HTM 82	Alarm and detection systems	EEF	1998	CD-ROM
HTM 83	Fire safety in healthcare premises: general fire precautions	EEF	1998	CD-ROM
HTM 84	Fire safety in NHS residential care properties	EEF	1998	CD-ROM
HTM 85	Fire precautions in existing hospitals	EEF	1998	CD-ROM
HTM 86	Fire risk assessment in hospitals	EEF	1998	CD-ROM
HTM 87	Textiles and furniture	EEF	1998	CD-ROM
Fire Practice Note 3	Escape bed lifts	EEF	1998	CD-ROM
Fire Practice Note 4	Hospital main kitchens	EEF	1998	CD-ROM
Fire Practice Note 5	Commercial enterprises on hospital premises	EEF	1998	CD-ROM
Fire Practice Note 6	Arson prevention and control in NHS healthcare premises	EEF	1998	CD-ROM
Fire Practice Note 7	Fire precautions in patient hotels	EEF	1998	CD-ROM
Fire Practice Note 10	Laboratories on hospital premises	EEF	1998	CD-ROM
UK Health Technical Guidance				
EH 40	HSE Occupational Exposure limits	HSE	Annual	As required
MES	Model Engineering Specifications	NHS Estates	1997	
	The colonisation of water in United Kingdom transplant units with Legionella bacteria and Protozoa and the risk to patients	HEEU	1995	
	Pseudomonas Aeruginosa in whirlpool baths	HEEU	1997	

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Publication ID	Title	Publisher	Date	Notes
Public Health Laboratory Services				
	Spa pool working party	PHLS	1994	
	Hygiene for hydrotherapy pools	PHLS	1990	
	Hygiene for spa pools: guidance for their safe operation	PHLS		
Miscellaneous References				
	Model Water Byelaws: Dept. of the Environment	HMSO	1986	
	Chemical Disinfection in Hospitals (second edition)	PHLS	1993	
	Water Byelaws Scheme's (WBS) Water Fittings and Materials Directory (WFMD).			
	Department of rehabilitation: a design guide	DHSS	1974	
	The central sterilization club, hygiene for hydrotherapy pools	PHLS	1990	
	A guide to pre-commission cleaning of water systems	BSRIA	1991	

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