UNIVERSITY OF CAMBRIDGE
Estate Management

Guidance

Water Safety Procedures Including Written Scheme

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Introduction

Purpose
To provide guidance on the practical implementation of 'The University of Cambridge Standard for Water Safety' and describes suitable methodologies for the provision of safe hot, cold and drinking water and ventilation systems.

Objectives
To provide practical strategies and procedures to enable the implementation of the Standard for Water Safety.
To enable the University to comply with applicable legislation, statutory regulations and codes of practice.

For Use By:
Estate Management

Related Standards and Guidance
Any Standards or guidelines that directly impact or are impacted by this Standard:

Standard for Water Safety
Health and Safety Standard

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1 Procedural Specifications

1.1 Introduction

It is the responsibility of any person employed by The University of Cambridge, referred to as 'the University' in this document, in whatsoever capacity to comply with the requirements of this Guidance.

This Guidance provides the guidance, instruction, specification and infrastructure for the implementation of the University of Cambridge' Standard for Water Safety. The guidance given develops upon the University of Cambridge' Standard for Water Safety and is considered essential to a coordinated water safety management system.

It is expected that this procedure will be complied with by all the University's Employees and by all appointed contractors, in whatsoever capacity, with or without contractual agreements.

Management procedures shall seek to ensure that compliance with this document is continuing and not notional.

As part of the University's commitment to providing a fully compliant service, it is necessary that all regular tests and checks set out in this document shall be carried out even if they cause minor disruption to University services, and that comprehensive records will be maintained.

Should audit demonstrate that a Department is not following the requirements in the Standard or this Guidance document, this will be reported to the Water Safety Compliance Group (WSCG) who may decide to refer the department to the Sub Committee for Biological Safety Committee.

2 Application and Scope

2.1 Extent of Application

This document draws on the statutory obligations and management guidance established within the Health & Safety Executive's (HSE) Legionnaires' disease. The control of *Legionella* bacteria in water systems. Approved Code of Practice and guidance, L8 (ACOP L8), it will be administered by the following overarching arrangements:

i) Ownership of the document belongs to Estate Management (EM);
ii) The WSCG will monitor the management objectives and monitor arrangements of directorates, divisions and departments;
iii) Each department will have an appointed "Departmental Responsible Person" who will ensure suitable controls are in place to manage any identified risk from *Legionella* bacteria in areas under their control;
iv) The day-to-day operational responsibility for controlling any identified risk from *Legionella* bacteria, and other water borne pathogens lies with the University directorates, divisions and departments "Departmental Responsible Person"

Without exception, this Guidance and its implementation, shall apply to all persons occupying buildings under the Central University's direct control, as denoted in the framework established within the University's Health and Safety Standard.

Autonomous corporations and institutions within the University including college properties and *domus* areas have their own duty and responsibility for the management of their own health and safety risks, with their own policies and procedures, which should include control of *Legionella* and other water borne pathogens.
The Universities operational estate and University controlled buildings have been assessed, using a Risk Rating Matrix, by EM and have been designated as High, Medium or Low Risk for *Legionella* associated infections. The ratings are calculated using an Occupancy rating multiplied by System Condition matrix.

The ratings are reviewed annually by the WSCG.

Where there is uncertainty regarding a properties risk rating, the responsibility is with the Landlord to assess and document.

2.2 Scope

The scope of this document shall include but not be limited to:

i) Domestic Cold Water Services – Storage and Distribution;
ii) Domestic Hot Water Services – Generation, Storage and Distribution;
iii) Faucets, showers, bib taps, etc;
iv) Thermostatic Mixing Valves (TMV)/Thermostatic Mixing Taps (TMT);
v) Drinking Fountains and Vending Machines;
vii) Irrigation Systems;
viii) Firefighting Systems;
ix) Emergency Showers/ Eye Washers;
x) Wet Air Conditioning, including Adiabatic Cooling Systems;
xi) Air Conditioning Units, Cooling Systems and Humidifiers;
xii) Expansion Vessels linked to Cold and Hot water systems;
xiii) Other systems considered to pose a risk.

Any other equipment owned, installed and maintained by the Departments will be covered by Procedural notes prepared by the individual Departments.

3 Microbiological Control Methods

Management of water systems will reduce the risk of microbial growth including opportunistic pathogens such as *Legionella* will improve the safety of the staff, students and visitors to the University. It requires on-going maintenance and surveillance of control measures employed.

Appendices 2 and 3 provide guidance on troubleshooting causes of failures in the regime stated below.

Ongoing communication is essential between the Department and EM when continuing out of range results and findings are being noted to ensure they are being managed in a timely manner.

An ongoing audit programme which will include the Departments Log Books will act as an additional check that the issues that need communicating to EM are taking place.

3.1 Temperature

The University shall employ 'Temperature Control' as the primary method of *Legionella* control within the domestic water systems (as far as is reasonably practicable). This is achieved by maintaining temperatures of:

i) Cold water at temperatures of < 20°C;
ii) Cold Water Services (CWS) Distribution at <20°C;
iii) Stored hot water at >60°C (where exceeding 15 litres);
iv) Hot Water Services (HWS) Flow at >60°C;
v) HWS Distribution at all outlets at >50°C (>55°C for premises where Healthcare is administered);
vi) HWS Return at >50°C;
vii) HWS Low content (below 15 litres) storage >50°C.

3.2 Avoidance of Stagnation

Experience has shown that avoiding stagnation is highly important in keeping bacterial counts within acceptable limits. This is achieved by the following:

i) Designing and installing new systems so that the risk of stagnation is minimised;
ii) Minimising Stored Water;
iii) Removing any ‘blind ends’ on distribution pipework so far as is practicable ;
iv) Ensure all ‘dead-legs’ are either flushed or removed;
v) Flushing or removing low use outlets and any associated pipework.

3.3 Maintain Cleanliness

Pipework, distribution, storage, plant and outlets shall be maintained in a clean condition at all times as far as is reasonably practicable to avoid providing nutrients to bacteria.

3.4 Department Evaluation & Flushing

All outlets shall be regularly evaluated, by the local Department Responsible Person, to confirm they are well used and are still required. Each department shall undertake weekly flushing by the Responsible Person or nominated person(s).

i) All outlets assessed and deemed to be 'disused' shall be considered for removal from the system ensuring that their removal does not create dead-legs;

ii) When assessed and deemed "infrequently/inadequately used", all taps shall be flushed at least 1 x weekly for a minimum of two minutes, or until the temperature stabilises to that of the rest of the system;

iii) If the outlet is fitted with a POU filter, the filter shall be removed in order to flush the tap unless the manufacturer's instructions advise otherwise.

3.5 Failure of Microbiological Control Methods

During specific circumstances, when the above methods of bacterial control are shown, by the various PPM Programme Monitoring Tasks and/or sampling, to be failing, the water quality shall need to be recovered and maintained.

More details on specific contingency procedures can be found in Appendix 3 - Troubleshooting & Contingency Measures: Microbiological Sampling.

If the failure is in a small part of the system, extensive flushing (i.e. daily) is often adequate to maintain biological control. *Legionella* samples shall be taken to confirm this is the case.

If the failure is on a larger scale or is systemic then use of shot-dosing of a suitable disinfecting agent may need to be considered, the levels of which must be maintained within the recommended limits for achieving disinfection as specified within the current edition of BS8558: Clause 5.2.3 Flushing and Disinfection, L8 – The Control of Legionella bacteria in water systems – Approved Code of Practice & Guidance and PD 855468, Guide to the flushing and disinfection of services supplying water for domestic use within buildings and their curtilages.

Depending on risk it may be necessary to protect students, staff and others from exposure from the affected outlet(s) until microbiological control is achieved. This can be achieved by the use of filters or taking the outlet(s) out of use.

3.6 Water bacterial analysis sampling

The microbiological control measures shall be supported by a robust water bacterial analysis sampling process which will be in line with the L8 – The Control of *Legionella* bacteria in water systems – Approved Code of Practice & Guidance. Sample locations are selected by EM and the WSCG.

3.6.1 Commencing Sampling

The following are situations where sampling may be initiated

i) As required by the WSCG;
ii) As a measurement of the efficacy of a supplementary dosing regime;
iii) When the maintenance regime and or routine monitoring indicates significant failure of control parameters;
iv) When HWS and CWS outlet temperatures are persistently outside the recommended temperature limits;
v) Re-sampling following positive biological results;
vi) During a suspected outbreak;
vii) During a confirmed outbreak (as instructed by the outbreak investigating officer).

3.6.2 Ceasing Sampling

Microbial sampling should cease in a controlled and measured way. The decision to cease sampling should take into account the following factors and be considered on an outlet by outlet basis.

i) Is the outlet temperature reaching control parameters within allotted time?
ii) Have the last three samples come back negative?
iii) Is the department undertaking routine sentinel point checks?

Should all answers be yes then sampling may reduce as specified in Appendix 3E.

If all answers are yes after a 3 monthly sample then sampling may cease at that individual outlet.

3.7 Supplementary Dosing

Where it is found that *legionella* control is not being achieved by the above methods or temperature control is consistently failing then another biocidal control method will be considered as a secondary control measure.

Any installed dosing systems will be installed and maintained in line with current guidance ensuring the recommended treatment levels are being effectively maintained, at all times, to help maintain water quality.

Any additional dosing installation will only be installed after full and detailed communication with the local Departments to ensure the treatment will not adversely affect any of their equipment or processes.

Full records of all servicing and monitoring are to be kept on site.

3.8 New Control Methods and Guidance

The WSCG will continue to consider new developments and improvements in the field of water safety, management & control, in order to ensure that the control of the prevailing risks, posed by the systems and operations on its sites, is constantly reviewed and improved and always maintained at the maximum level practicable.

4 Scalding Control Methods

Scalding control in all University's premises whether owned or occupied by the University under lease or other Service Level Agreements (SLAs) shall be based on a suitable and sufficient risk assessment to determine the need for the installation of Thermostatic control in line with L8 and HSG274 Part 2. The Risk Assessment is to be in the University of Cambridge format and kept in the building O&M Manuals. The Risk Assessment will also help determine the type of thermostatic control to be installed.

Where a scalding risk is assessed as low (eg where healthy users immerse their whole body), type 2 TMVs that can be overridden by the users can be installed. Where a scalding risk is considered significant then type 3 TMVs that are pre-set and fail-safe should be provided and should be checked regularly to ensure they are failsafe if the cold water supply pressure is interrupted.

Scalding control shall be achieved ideally by Thermostatic Mixing Taps (TMT's) or Thermostatic Mixing Valves (TMV's) if the installation of the integrated taps is not possible. The Thermostatic Mixing Taps are preferred as they draw cold water through each time the outlet is used, thus helping to minimise the risk of local water stagnation.

It is the University's requirement, however, that TMVs/TMTs shall be removed, where practicable, and general "Warning! Hot Water" notices used following local risk assessment.

Thermostatic Mixing Taps (TMT's) or Thermostatic Mixing Valves (TMV's) shall be maintained and monitored in line with current guidance and manufacturers recommendations.

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5 Risk Assessments

5.1. *Legionella* Risk Assessment

EM will insure that suitable and sufficient *Legionella* Risk Assessment compliant with ISO/IEC 17020, BS8580 and ACOP L8 shall be carried out, in order to identify and assess the risk of legionellosis and water quality issues from work activities and water sources on the premises and organise any necessary precautionary measures. The *Legionella* Risk Assessments will cover all water, cooling and air systems within the property being assessed.

The risk assessments shall be reviewed and/or updated when there are significant changes to statutory standards, operational findings or when there are significant changes to a building's domestic water or air systems. The Department Responsible Person has the duty to inform EM of any changes in water systems so the review process can be initiated.

The Risk Assessment process and management of the remedial actions are detailed in a series of EM Flow Charts.

A maximum time frame for updating the Risk Assessment has been set in accordance with the building risk class as set by EM:

Table 1 - Frequency of Assessment

Class	**Description**	**Maximum Frequency**
A	High Risk	1 Year
B	Medium Risk	2 Years
C	Low Risk	3 Years
D	Very Low Risk	4 Years
E	No Risk	Not Required

The assessments shall be commissioned by EM the process managed by the Responsible Person – EM or the nominated deputy. They shall be carried out by a person that possesses the necessary competence and resources to complete the tasks proficiently and safely. New and revised risk assessments will be commissioned as and when required.

Risk assessments must also be carried out on all department owned processes and equipment that uses or contains water e.g. ice machines, scientific equipment, portable humidifiers; humidified incubators. These must be commissioned by the department directly.

All risk assessments shall be procured from University approved *Legionella* Risk Assessment contractors.

***Legionella* Risk Assessment Process**

Systems which are susceptible to colonisation by *Legionella*, and which incorporate means for creating and disseminating water droplets, will be identified, and the risk they present will be assessed. Risks will be assessed not just for the routine operation of the system, but also in unusual circumstances such as; breakdown, abnormal operation, design, installation and commissioning. Action plans, and work procedures developed and implemented to reduce the risk to a minimum.

The objective of the Risk Assessment is to institute management procedures to ensure that compliance is continuing and not notional. The Risk Assessment must outline and to place on record, a descriptive plan of the extent, condition and design of the domestic water and air handling systems within the building surveyed, and to assess the risk of bacterial contamination posed by these systems, particularly the *Legionella* species.

All recommendations made in the risk assessment, must reasonable and proportionate. They are to be made with the specific requirements of the University and must take into account manpower and financial limitations.

The assessment shall contain the following information as a minimum:

i) Executive summary Risk potential;
ii) Risk potential;
iii) Plant survey details;
iv) Schematic drawings;
v) System information;
vi) Asset facilities listing;
vii) Photography;
viii) Responsible person delegations;
ix) Training considerations;
x) Management documents;
xi) Details of logging systems in place.

The assessments, written schemes and implementation of precautionary measures, will be carried out by someone with the necessary competence and resources to complete the tasks proficiently and safely. If the expertise required is not available within the University, it may be necessary to

appoint one or more experts from outside the University with clear, written responsibilities and lines of communication.

The risk assessments will enable the Responsible Person(s) to demonstrate that all the pertinent factors, and the steps needed to prevent or minimise the risk, have been considered.

Where the assessment demonstrates that there is no reasonably foreseeable risk or that risks are insufficient and unlikely to increase, no further assessment or measures are necessary. However, should the situation change, the assessment should be reviewed and any necessary changes implemented.

The assessment will be reviewed whenever there is reason to believe that the original assessment may no longer be valid or in accordance with the schedule detailed above. This may be because of:

i) Changes to the assets or water or its use;
ii) Changes to the use of the building in which it is installed;
iii) The availability of new information about risks or control measures;
iv) The results of checks indicating that the control measures are no longer effective.

In identifying and assessing the risks in any water system and in drawing up and applying the necessary control measures, notice should be taken of the HSE Guidance Notes, appropriate ACOP's and British Standards.

A written operational plan will be devised based on the results of the risk assessments. This will clearly identify who has overall accountability for the premises, and who is responsible for devising and carrying out the procedures.

Inadequate management, lack of training and poor communication have all been identified as contributory factors in outbreaks of Legionnaires' disease. It is therefore important that those people involved in assessing risk and applying precautions are competent, trained and aware of their responsibilities.

5.2 *Legionella* contamination local risk assessments

The following are recommended additional actions to follow in the event of either "Significant" or "Highly Significant" *Legionella* biological sample analysis result or a confirmed or suspected diagnosis of a Legionellosis infection. In addition, a local Risk Assessment shall be carried out by the University's Water Consultant.

The purpose of the Local Risk Assessment is to carry out a detailed coordinated assessment of the students, staff, environment and water system in an area where a "Significant" or "Highly Significant" *Legionella* biological sample analysis result has indicated that there may be a problem. The Risk Assessment shall consider the maintenance records for the area, flushing records and also investigate the water systems in the area to identify the underlying cause of the problems and set out the remedial action necessary to address the threat. In addition, an assessment of the users of the water services shall be carried out so that appropriate measures are taken to protect any users that may be considered to be susceptible to infection.

A Local Risk Assessment is a team exercise that requires the input from the appropriate members of the WSCG, EM, Water Consultant and Department Responsible Person/s.

The outcomes of Local Risk Assessments shall be considered by the WSCG to identify any "Lessons Learned" from the incident.

6 Maintenance Regimes

6.1 Task frequencies to be carried out

Table 2 sets out the procedures to be followed and act as the basis for a Written Scheme. The University recognises that the Written Scheme for each building will differ depending upon installed assets. The Written Scheme is dynamic and will require updating when changes are made to the installed assets. The Departmental Responsible Person must inform EM when changes have been made which may render the Written Scheme invalid.
EM will hold the procedures centrally and will inform the Departmental Responsible Persons when updates have been issued. It is the responsibility of the Departmental Responsible Person to update their Log Book accordingly.

Table 2

SFG20 Procedure Reference No	Asset	*Changes to Procedure Made By Employer*	*Departmental Responsibility*	*EM Responsibility*
29-06	Plate Heat Exchangers			*All Task Items*
29-08	Heating Calorifiers - MTHW, HTHW or Steam			*All Task Items*
32-02	Hot Water Services - General		Task Items No's 2 (Flushing) , 3 and 4	Task Items No's 1, 5 to 6 inclusive
32-03	Introductory Procedures - Calorifier Types			*All Task Items*
32-04	Introductory Procedures - Calorifier			*All Task Items*
32-05	Calorifier Heated by LTHW			*All Task Items*
32-06	Hot Water Calorifiers Heated by MTHW, HTHW or Steam			*All Task Items*
32-07	Hot Water Supply Calorifiers		Task Item No 1	Task Items No's 2 - 11 inclusive
32-08	Calorifier and Heat Exchange Controls			*All Task Items*
32-09	Hot Water Cylinders		Task Item No 1	Task Items No's 2 - 11 inclusive

32-10	Unvented Hot Water Systems		Task Item No 1	Task Items No's 2 - 11 inclusive
32-11	Thermal Storage Cylinder (Individual Dwellings for DHWS)		Task Item No 1	Task Items No's 2 - 10 inclusive
32-12	Expansion Vessels	Task Item No. 5 reduced to 3 months	Task Items No 1 and 5	*All Remaining Task Items*
32-12	Direct Fired Water Heater			*All Task Items*
32-14	Instantaneous Electric Water Heaters (Non Drinks Type)		Task Item No 1	Task Items No's 2 - 5 inclusive
32-15	Packaged Electric Water Heaters - Cistern Type (Non Drinks)		Task Item No 2	Task Items No's 1, 3 - 11 inclusive
32-16	Vented Hot Water Systems		Task Item No 1	Task Items No's 2 - 9 inclusive
33-01	Cold Water Evaporator - Drum Type			*All Task Items*
33-02	Direct Steam Injection Type			*All Task Items*
33-03	Humidifiers - Electrode Boiler			*All Task Items*
33-04	Humidifiers - Compressed Air type			*All Task Items*
33-05	Humidifiers - Ultrasonic			*All Task Items*
33-06	Humidifiers - Resistance Heater			*All Task Items*
33-08	Humidifiers - Spray			*All Task Items*
35-01	Thermal Insulation			*All Task Items*
40-03	Trace Heating - Electrical			*All Task Items*
40-11	Steam Services			*All Task Items*
40-12	Flash Steam Vessel			*All Task Items*
40-16	Water Buffer Surge Tanks			*All Task Items*
40-17	Water Services - Above Ground	Procedure Task frequency reduced to 12 months		*All Task Items*
40-25	Pressurisation Units			*All Task Items*
45-12	Cold Water Booster			*All Task Items*
48-08	Water Saving Devices and Meters	Task Item Nos 7 and 11 removed Task Item Nos 5 and 12 frequency reduced to 12 months		*All Remaining Task Items*

51-01	Showers		Task Item No 4 (Employer responsible for removable spray heads only, Contractor responsible for fixed heads)	Task Items No's 1 - 2 and 5 - 10 inclusive
56-01	Introductory Procedures - Storage Tanks			*All Task Items*
56-02	Cold Water Storage Tanks and Cisterns		Task Item No 1 and 2	Task Items No's 3 - 14 inclusive
61-04	Combination Tap Assemblies, Mixing Valves/Taps	Task item no. 3 removed as covered under 51-01		*All Remaining Task Items*
61-05	Shower Valves			*All Task Items*
62-08	Reduced Pressure Zone Valves			*All Task Items*
65-01	Introductory Procedures - Water Treatment			*All Task Items*
65-02	Ion Exchange Plant - Base Exchange Softening - Commercial			*All Task Items*
65-03	Ion Exchange Plant - Base Exchange Softening - Domestic (capacity usually below 50 litres)			*All Task Items*
65-04	Special Water Treatment Systems			*All Task Items*
65-05	Filtration, Conditioning and pH Correction - Central Plant			*All Task Items*
65-06	Filtration and Conditioning - Point of Use			*All Task Items*
65-07	Reverse Osmosis			*All Task Items*
65-14	Chlorine Dioxide Low Dosing Water Systems			*All Task Items*
87-13	Insurance Periodic Inspections			*All Task Items*

Tasks 33-01 – 33-08 cover Humidifiers and fall under SFG20 Specialist Installations rather than water.

6.2 Temperature Recording

All temperature testing will be undertaken with UKAS accredited temperature probes with the calibration undertaken on an annual basis with records made available. The probes must all have provision of 2 K-Type Inputs which allow for contact pipework temperatures to be taken. The Departmental Responsible Person is responsible for the purchase of temperature recording equipment for use in areas under their control.

6.3 Record Keeping

Records pertaining to Water Hygiene and Safety will be stored using a Log Book. Given the structure of the University, the format of the log book is set out in Figure 1

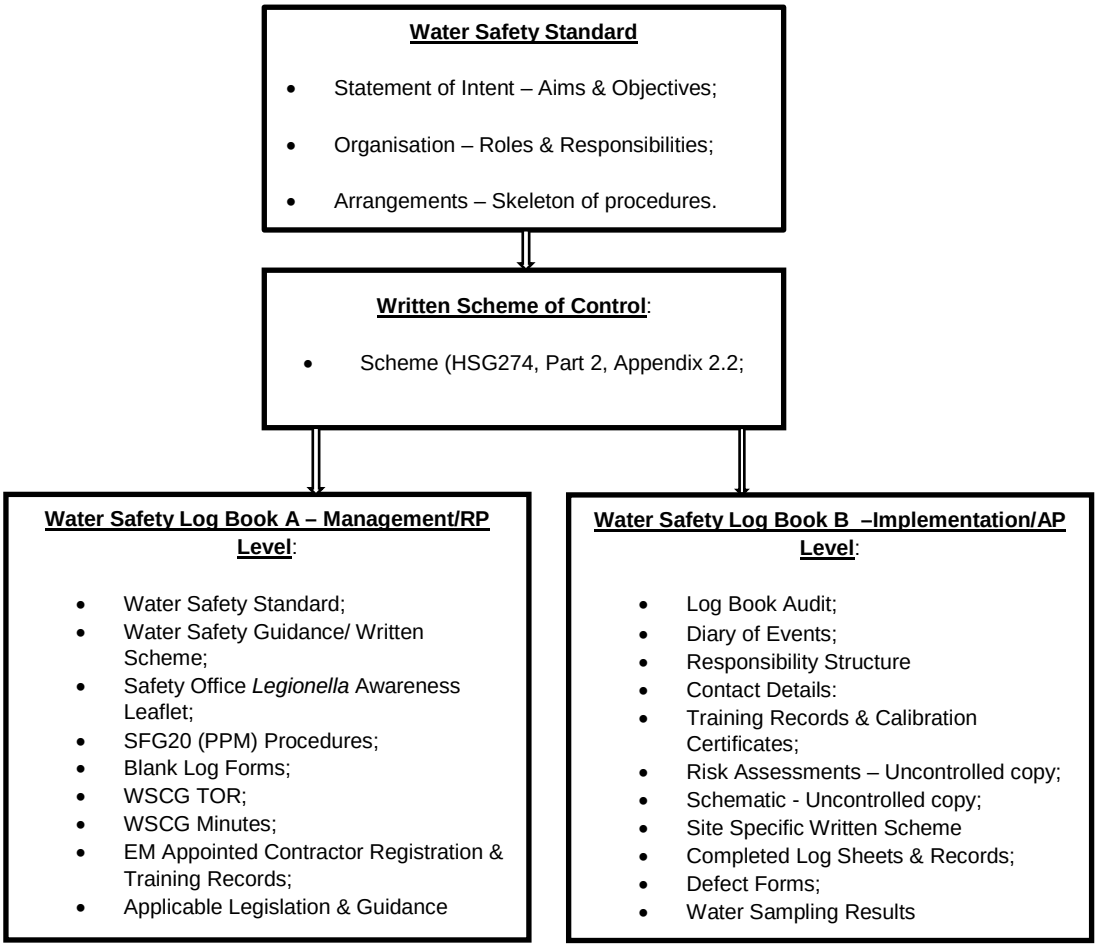
Generally, Log Book A will contain Estate wide information pertaining to Water Hygiene and Safety. Part B will contain building specific information pertaining to Water Hygiene and Safety.

The EM Responsible Person shall ensure the documents in Part A and B are suitable and sufficient. Should there be updates to any aspect of documents used as part of the Log Book, then the EM Responsible Person shall communicate these to all Departmental Responsible Persons.

The Departmental Responsible Person shall ensure that Part B is updated as and when required. Should they be in receipt of a communication from the EM Responsible Person of an update to a document, they must update their building Log Book as required.

Log Books shall be audited to ensure the efficacy of the ongoing Written Scheme.

Figure 1



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7 *Pseudomonas aeruginosa* Management

7.1 Overview

Due to the nature of the work ongoing in certain properties and departments the management of *Pseudomonas aeruginosa* maybe a local potential risk to the users of the water services. It will be the responsibility of the Departments to identify this, carry out risk assessments and implement control measure and monitoring, if required.

The EM Responsible Person is available to provide expert advice if required.

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8 Capital Projects and Minor Works

8.1 Overview

The primary consideration of any design and installation is to ensure that there is no increase in the potential of bacterial growth and proliferation from the mains water entering a water system. The principles of keeping the water systems clean, at the right temperature and moving should be considered at all stages.

All water systems and equipment shall be designed, installed and use materials in accordance with current statutory and mandatory standards and the current version of the University's design guide - 'EM Design and Standards Brief for University Services and Construction Work'.

The detailed guidance of HSG 274 plus any applicable BS/EN standards and manufacturer's instructions shall be adhered to (so far as is reasonably practicable).

Any derogations from approved guidance shall be agreed with the EM Responsible Person and the Water Consultant.

Where the installation is small then the minor works procedure detailed in 9.1 may be sufficient.

Only Plumbing Contractors that are WaterSafe accredited are to be used for any plumbing work, no matter how small the project.

8.2 General Design Considerations

Please refer to the Universities Design Standad "Section 8 : Domestic & Process Water Systems for further details.

Generally;

i) All system designs to be in line with current water regulations, Legislation and guidance;
ii) Ensure that the primary supply is a good as possible (i.e. of wholesome 'potable' quality);
iii) If the supply is not of good quality the design should allow to provide adequate treatment;
iv) Consider the intended "User" in terms of their risk and individual requirements;
v) Ensure that all fittings and materials used do not increase the potential of microbial growth or proliferation and are WRAS approved;
vi). Plant, pipework, fittings, tanks and storage vessels shall be located or protected in such a way to avoid undue external influences (e.g. extreme temperatures);

vii) Ensure the levels of stored water are not excessive (e.g. tanks achieve a turnover not exceeding 12 hours in normal use), or preferably avoid stored water completely where risk assessment has identified a minimal risk to operations;
Hot water storage vessels (above 15 litres), generators and plate heat exchangers shall can maintain contents at >60°C at all times when in normal use;

viii) Where multiple storage vessels, tanks, plate heat exchangers etc. are used they shall be connected in parallel and designed so that the contents are used simultaneously;

ix) Consider local Point of Use (PoU) or Instant heaters <15 litres where stored hot water is not essential;

x) Ensure the design allows for easy maintenance (this includes access to isolation valves), and for ease of cleaning/disinfection;

xi) The design shall avoid the creation of 'dead legs' and 'blind ends'. Where work is being planned in phases the valves for the next section shall be so positioned to avoid stagnation or the dead leg shall be subject to a flushing programme until the pipework goes into use;

xii) Ensure the number of outlets is minimised to ensure good water turnover;

xiii) Use outlets designed to keep generation of aerosols to a minimum as far as is practicable;

xiv) Only fit Thermostatic control where a Risk Assessment deems the scalding risk is 'moderate' or high. The type of thermostatic control must be in line with industry standards for the user group;

xv) If an outlet is unlikely to be frequently used (e.g. daily) then consideration shall be given to removal of the outlet and any associated pipework from the design (or physical removal of the pipework if an existing system is being modified);

xvi) Manufacturers to be consulted regarding the fittings' correct commissioning.

8.3 Considerations During Installation

i) Are the plans being accurately followed?

ii) If connecting onto an existing system have 'before' and 'after' microbiological tests of the existing system been undertaken?

iii) If works are being undertaken on an existing system, have biological samples been undertaken of the existing system, allowing sufficient time for the sample results to be undertaken and results known prior to commencing the work? This is to ensure that the person(s) carrying out the install are not placed at undue risk

iv) If works are on an existing 'live' system regular flushing will need to be undertaken unless the area remains in full use throughout the duration of the works.

v) Has installation been regularly flushed following "wetting"?

vi) Are hot water warning labels fitted on all non-blended hot outlets?

8.4 Considerations during Commissioning

i) Have the plans been accurately followed?
ii) Have all water temperatures been set and correctly and are they being achieved as specified?
iii) Have all Thermostatic mixing valves and taps been commissioned correctly?
iv) Has installation been pressure tested correctly?
v) Have all strainers, filters and traps been cleaned correctly?
vi) Have all water treatment chemical levels been set correctly and are they being achieved as specified?
vii) Have all BMS system criteria been set correctly and are they being achieved as specified?
viii) Has a system clean and disinfection been carried out in accordance with 'PD 855468 Guide to the flushing and disinfection of services supplying water for domestic use within buildings and their curtilage' and as close to hand over as possible?
ix) Have adequate number of biological analysis samples been collected correctly and as specified and have pass-fail parameters been agreed?

8.5 Hand-Over

i) Have the plans been accurately followed?
ii) Has a *Legionella* Risk Assessment been completed?
iii) Have the O&M Manuals been provided upon handover?
iv) Are all commissioning data, disinfection certificates, biological analysis results available?
v) Have all measured criteria shown to be within specification?
vi) Have the requirements of the Technical Procedure Instructions been followed?
vii) Have appropriate procedures been implemented to ensure "safe-system" conditions between hand-over and (staggered) occupation?
viii) Has the Department Responsible Person been made aware of the installation details to ensure the appropriate monitoring programme is put in place, including monitoring of water treatment systems?

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9 Small Works Projects

9.1 Small Works Projects

This principle applies to small works projects only (This is generally when the works value is up to £25k) and there is minimal risk of disturbing the balance of the existing system.

Disinfection should be carried out on the new pipework and components.

If the installation is on a higher risk system biological samples shall be undertaken at a point nearest to the planned ‘break in’ point prior to works commencing. Sufficient time should be allowed for the sample results to be undertaken and results known prior to commencement to ensure that the person(s) carrying out the install are not placed at undue risk.

Following the ‘break in’ on higher risk system biological samples shall be undertaken again from the nearest point to the ‘break in’ and at the new outlet to ensure that biological burden has not been increased due to the installation. If it is found an issue has been created follow the guidance within this procedure to ensure persons are not placed at undue risk.

On completion, the appropriate documentation shall be completed and kept on record.

10 Record Keeping

10.1 Defect Log/Maintenance Regime

To ensure that precautions continue to be carried out and that adequate information is available for checking what is done in practice, a record should be kept and maintained for at least five years showing the information specified in the ACOP L8 and HSG 274 guidance.

All records to be kept within building specific Log Books which are kept and maintained by the Department Responsible Person. If the record is due to some work ordered and managed by the EM Department a scanned in electronic copy of the work sheet and results is provided to EM for storing electronically. A note is also made in the site Log Books of any EM work undertaken on the water systems.

Precautionary measures and treatments, monitoring results and remedial work should be logged and signed or initialled by the person who has carried out the work. Sufficient information should be recorded to show what measures have been taken and how they have been monitored.

The complexity, frequency and priority of the maintenance tasks will be based on the findings of the Risk Assessment carried out and O&M for the system being maintained and monitored, the maintenance and monitoring programme will be as comprehensive as is reasonably practicable to achieve based on the risk severity and resources needed to minimise the risk.

Details of operational and functional tasks must be drawn up for the site by the EM Responsible Person or Water Consultant. These, together with the completion of the PPM Log Books and Defect Log, will enable a proper historical record to be compiled of all works carried out and observations made.

10.2 Operation and Maintenance Manuals

It is important that all new systems and/or significant modifications have a suitable and sufficient Operation and Maintenance (O&M) Manual. The level and detail of information required will depend on the type and complexity of the system or water service to which it applies.

The O&M should:

i) Identify the installation requiring attention and how it operates;
ii) Record results of the initial commissioning (if available) and any re-commissioning so that observations made during maintenance checks can be compared;

iii) Define the maintenance task or observation recommended and the frequency;
iv) Provide details or forms for setting up the recording of maintenance observations and results and for comments to be made in respect of any defect seen during the inspection. This facility should exist for each item of plant individually and for overall system observations;
v) Provide preliminary guidance on fault diagnosis and checking to assist with immediate on-site correction or adjustment;
vi) Facilitate cataloguing and cross-referencing to other O&M for plant/installations on the same Site (for example, the refrigeration plant, the chilled water installation, the air conditioning plant and the heat source);
vii) The shut down and start up procedures when a building is de-commissioned.

11 On-Going Monitoring and Audit

The WSCG shall, collectively, be responsible for auditing all processes being carried for the Management & Control of *Legionella*.

11.1 Reporting

The EM Responsible Person will provide a quarterly report of Water Hygiene and Safety issues. This report as a minimum will provide information on

i) Compliance with ACOP L8 and HSG274;
ii) Buildings with significant issues;
iii) Any other areas of concern relating to Water Safety.

The report will be presented to the WSCG. In turn the report will be presented to the Sub-Committee for Biological Safety to appraise them of progress.

11.2 Audit

The EM Responsible Person shall instruct the Water Safety Consultant to undertake an annual audit, or more frequently if deemed necessary, of the processes and procedures being undertaken for the Management & Control of *Legionella* within each department. The objective is to assess compliance with the ACOP L8 and HSG 274. The results of the audit shall be reported to the EM Responsible Person and the WSCG.

The Audits will include, but not limited to,

i) progress on the *Legionella* Risk Assessments and remedial works in order to reduce the overall risk;
ii) efficacy of the "Written Scheme";
iii) audit of the Departmental Log Book and recording of any areas of concern;
iv) audit of EM record keeping.

A summary of the audit findings and recommendations will be presented to the Sub-Committee for Biological Safety to appraise them of progress.

12 Communications

Communication procedures are particularly important given that both EM and departments are responsible for different aspects of the "Written Scheme". It is essential that both parties communicate with each other should the "Written Scheme" be found to be failing. Good communication will prevent un-necessary elevation of risk.

As a guide, communication between EM and Departments should occur when:

i) control measures are failing leading to loss of primary control and temperatures being recorded out of parameter;
ii) assets are not operating within normal parameters;
iii) changes occur which affect the Planned Maintenance Program i.e. the removal or installation of asset;
iv) when it is believed the existing Risk Assessment has become invalid;
v) where there have been changes in personnel responsible for aspects of managing the "Written Scheme";
vi) changes occur to applicable Regulations, standards and guidance;
vii) when a Risk Assessment has taken place;
viii) when a positive count has been identified.

The above list is a guide and communication may be required in many other circumstances

13 Actions If An Outbreak Of Legionnaires' Disease Is Suspected or Confirmed

The University will usually be informed of a suspected outbreak of Legionnaires Disease by a member of the WSCG or Health and Safety Executive. If an outbreak (two or more linked cases in a 6 month period) is suspected, then the WSCG will normally work in association with the Public Health England and the Officer for Environmental Health to search for the source of the causative organism. This search is a specialist task which involves epidemiological studies and taking water samples for analysis.

The Health and Safety Executive may be involved in the investigation of outbreaks under the Health and Safety at Work etc Act. Local authority environmental health officers may also be involved.

It is essential that NO ONE drains or disinfects the systems before samples have been taken. The Responsible Persons role is an important one - guiding specialists to the various water systems within the building, and to the points from which samples can be taken. Easy access to these sampling points is essential.

An investigation would concentrate upon all potential sources of *Legionella* infection including:

i) The domestic hot and cold water system distribution;
ii) Showers or spray washing equipment;
iii) Drainage systems and taps;
iv) Whirlpool baths or therapy pools;
v) Humidifiers in ventilation systems;
vi) Cooling coils in air conditioning systems;
vii) Fountains and sprinklers;
viii) Specialist departmental equipment that uses or contains water.

To assist in such investigations EM and the Department will need to be able to provide details of all associated equipment, its location, technical data, the operating, and maintenance and spares information on all the above installations. They must assist by advising the investigating team as to the extent of servicing on the site and locating taps and sample points. All records must be made available where requested.

Off-site information will also be required such as whether there has been any local excavation or earth moving works; alterations to water supply systems or drainage systems or any other factors which may have a bearing on the site.

The Water Consultant in conjunction with the WSCG, EM and Department Responsible Persons are responsible for identifying the cause of infection and will advise on cleaning, disinfection, any engineering modifications and long-term control measures.

13.1 At the End of the Outbreak

After the investigation into the suspected or confirmed outbreak is officially considered over, a final meeting of WSCG shall be held to:

i) Review the action taken by all participants and to identify any areas for further improvements;
ii) Recommend if necessary changes which will reduce the chance of recurrence of the outbreak.

13.2 Interim and Final Reports

The WSCG is responsible for providing any interim reports and the final report at the conclusion of the outbreak, which must be signed by:

i) Department Responsible Person for the site(s) affected;
ii) EM Responsible Person;
iii) Water Consultant.

14 Appointments

The University will appoint formally in writing, persons who have the responsibility for ensuring and undertaking work on water systems as part of a “Written Scheme”. The WSCG will be responsible for administering the appointments ensuring those appointed to devise strategies, carry out control measures and undertake associated monitoring are appropriately informed, instructed, trained and assessed as to their competency.

14.1 Appointment Letter

The appointment letter will set out the role and responsibilities of the role they are to be appointed to and to confirm they are suitably qualified. The appointee will sign and return a copy of the

appointment letter acknowledging their acceptance of the duties set out within the appointment letter.

14.2 Estate Management

The University of Cambridge will appoint in writing a "Responsible Person" competent to:

i) Identify and assess the risk of legionellosis resulting from work activities;
ii) Develop, implement and maintain appropriate and suitable Management Systems, Personnel Training programmes and plant treatment procedures;
iii) Develop and maintain adequate records in order to demonstrate compliance with best practice and fulfil legal obligations and;
(iv) Ensure compliance with the Standard and supporting procedures.

14.3 Departments

The University of Cambridge will appoint in writing a "Departmental Responsible Person" for each department who is competent to:

i) Identify and assess the risk of legionellosis resulting from work activities;
ii) Develop, implement and maintain appropriate and suitable Management Systems, Personnel Training programmes and plant treatment procedures;
iii) Develop and maintain adequate records in order to demonstrate compliance with best practice and fulfil legal obligations and;
(iv) Ensure compliance with the Standard and supporting procedures,

in liaison with EM for areas under their direct control. In addition, the Departmental Responsible Person" must ensure the above occurs for all assets which are deemed a departmental responsibility i.e. research equipment.

14.4 Water Hygiene and Safety Consultant

The University of Cambridge will appoint in writing a Water Hygiene and Safety Consultant who is competent to assist EM in managing Water Hygiene and Safety across the estate.

15 Further Information

Estate Management – EMWaterSafety@admin.cam.ac.uk
University Specialist Advisor (for Water Safety)
Safety Office leaflet HSD175B *Legionella* Awareness, FAQ
Health and Safety Executive http://www.hse.gov.uk/legionnaires/

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References

British Standard Institution. *BS 8580 Water Quality – Risk assessments for Legionella Control.* Milton Keynes:BSI.

British Standard Institution. *BS 8558 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages.* Milton Keynes:BSI.

Control of Substances Hazardous to Health (COSHH) Regulations (as amended). SI 3386.

Health and Safety Executive. Approved Code of Practice and guidance on regulations.

Legionnaires' disease: The control of *Legionella* bacteria in water systems (L8). Health and Safety Executive.

Health and Safety Executive. **HSG274 Legionnaires' disease – technical guidance. Part 2: The control of *legionella* bacteria in hot and cold water systems**. Health and Safety Executive.

Health and Safety Executive. **HSG274 Legionnaires' disease – technical guidance. Part 3: The control of *legionella* bacteria in other risk systems**. Health and Safety Executive.

The Management of Health and Safety at Work (Amendment) Regulations. SI 438.

The Water Supply (Water fittings) Regulations . SI 1506.

The Water Supply (Water Quality) Regulations . SI 614.

University of Cambridge. *Water Standard (HSD081B).* Cambridge: University of Cambridge

University of Cambridge. *Sites and Buildings Regulations*. Cambridge: University of Cambridge

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Appendix 1: Glossary

ACOP	Approved Code of Practice
Adiabatic	A device that uses water as a cooling medium
Calorifier	A device for the production of Domestic Hot Water
Cistern	A storage device for water
Cooling Tower	A device that uses water as a cooling medium
Copper and Silver Ionisation	A device that uses the combination of copper and silver to control bacteria
Chlorine Dioxide	A device that uses chlorine to control bacteria
Cylinder	A device to store water, normally DHW
Dead End	A section of pipe with no outlet
DHW	Domestic Hot Water
Flush	A means of reducing stagnation
HSG 274	HSE publication relating to Water Hygiene best practice
Health Technical Memorandum	Department of Health guidance document
L8	The ACOP relating to water safety
Log Book	A document used to store records pertaining to water safety
Little Used Outlet	an outlet used infrequently
Nutrient	a food source that will encourage the growth of bacteria
PPM	Pre Planned Maintenance
Pseudomonas aeruginosa	*Pseudomonas aeruginosa* is a Gram-negative bacterium, commonly found in wet or moist environments
Responsible Person	A person with authority to make resource decisions for an area
Risk Assessment	A legal document required to assess the risk from water services
Sample	The taking of water to determine quality
Sentinel	The extremity of a system or sub-circuit of a system
Stagnation	No or little flow
Thermal Control	A means of controlling *Legionella* through temperature
TMV	Thermostatic Mixing Valve, a device for scald control
Written Scheme	A documented method of controlling the risk

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Appendix 2: Troubleshooting & Contingency Measures

All Faults and out of specification results are to be reported, by the Departmental Responsible person, to the EM Helpdesk, in a timely manner where a reactive job will be raised and actioned accordingly.

If EM find the problem, or receive microbiological results, EM are to notify the Departmental Responsible Person, at the earliest possible time where actions will be agreed and actioned using the procedures in this document.

2A Higher than recommended CWS temperatures

Result	Possible cause	Remedial Action
Mains >20°C	1. High ambient temperatures	Consider on-line disinfectant to augment and temperature control as primary bacterial control method Increase water through-put by *strategic flushing to reduce water retention time. **Consider carrying out biological (TVC) sampling to ascertain effect of increased CWS temperatures. When temperature exceeds 20°C ***persistently; consider carrying out biological sampling (TVC) MONTHLY to ascertain effect of increased CWS temperatures.
Tank temperature significantly greater than mains temperature	Tank over capacity	Reduce stored water capacity to reduce water retention time Increase water through-put by strategic flushing to reduce water retention time Consider carrying biological sampling (TVC) to ascertain effect of increased CWS temperatures. Upon receipt of results, follow protocol described in Appendix 3 of this document

	Lack of adequate tank insulation	Install or improve tank insulation
	High tank room temperatures	Increase tank room ventilation (if practicable)

Outlet temperatures significantly greater than mains/tank temperatures	Areas of “low-flow” or dead-legs in the system and lack of adequate use causing stagnation	Increase water through-put by strategic flushing to reduce water retention time. Consider carrying out biological sampling (TVC) to ascertain effect of increased CWS temperatures.
	Lack of adequate insulation of pipework	Install or improve pipework insulation.
	Heating pipes in close proximity to CWS pipes	Increase insulation Consider relocation of CWS/heating pipes (if practicable). Consider on-line disinfectant to negate temperature control as primary bacterial control method. Consider carrying out biological sampling (TVC) to ascertain effect of increased CWS temperatures.

*Strategic flushing comprises of the introduction of flushing of all identified infrequently used outlets and also of outlets which are suitably located on the system to enable the thorough and speedy purging of the CWS to allow for the reduction of water temperatures to within recommended limits.

** On receipt of biological analysis results, follow the procedures described in Appendix 3

***Persistently indicates that measured temperature exceeds 20$^{\circ}C$ between at least two consecutive temperature monitoring visits.

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2B Lower than recommended HWS temperatures

Result	Possible cause	Remedial Action
Stored and/or Flow temperatures <60°C	1. Low "Set" temperatures for hot water generation of <60°C	• Increase temperature to ≥60°C. • If temperature <50°C, consider carrying-out pasteurisation of vessel. • Consider biological sampling (TVC) to ascertain effect of decreased HWS temperatures.
	2. Thermostat failure	• Replace thermostat • Carry-out pasteurisation of vessel before use • Consider biological sampling (TVC) to ascertain effect of decreased HWS temperatures.
	3. Primary heating supply isolated or failed	• Repair/reinstate heating supply • Carry-out pasteurisation of vessel before use • Consider biological sampling (TVC) to ascertain effect of decreased HWS temperatures.
	4. Generation units under-rating/under capacity	• Consider capacity vs demand and replace unit with more suitably sized vessel • Carry-out pasteurisation of replacement vessel prior to being put into service
	5. Temperature taken with contact probe	• Obtain 'direct' temperature, using calibrated thermometer, from ideally located sampling point and reconsider results or apply compensation factor
	6. Gauges and/or BMS temperature monitoring points not calibrated	• Calibrate all gauges and/or BMS monitoring points and reconsider results
Return temperature <50°C when Flow temperature	1. Distribution system short circuiting	• Carry out investigation of distribution pipe-work to locate possible short-circuit
	2. Circulation pump	• Upgrade circulation pump to a suitable rating

>60°C	under rated	• Consider biological sampling (TVC) to ascertain effect of decreased HWS temperatures.
	3. Circulation pump faulty	• Replace/repair circulation pump
	4. Temperature measurement taken down stream of cold supply	• Re-measure temperature from location upstream of cold supply
	5. Temperature taken with contact probe	• Obtain direct temperature, using calibrated thermometer, from ideally located sampling point and reconsider results or apply compensation factor
	6. Gauges and/or BMS temperature monitoring points not calibrated	• Calibrate all gauges and/or BMS monitoring points and reconsider results
	7. Return pipework partially or completely blocked	• Consider pipework replacement

Distribution temperatures <50°C when flow temperature >60°C	1. Excessive heat loss.	• Inspect HWS and CWS insulation and upgrade where practicable • Consider biological sampling (TVC) to ascertain effect of decreased HWS temperatures.
	1. Return pipework partially or completely blocked	• Consider pipework replacement
	3. Areas of low-flow or dead-legs in the system	• Increase water through-put by strategic flushing to reduce water retention time • Consider biological sampling (TVC) to ascertain effect of decreased HWS temperatures.
	4. Presence of space-heating apparatus on the HWS system	• Investigate the presence of heat loss due the presence of space heating (towel rails, linen cupboard heaters, etc.) and remove from the system • Consider biological sampling (TVC) to ascertain effect of decreased HWS temperatures.
	5. Failure of Trace Heating system or Trace Heating system not extending to extremities of the system	• Inspect the trace heating system and repair/replace if necessary or extend system to allow for temperature maintenance to system spurs • Consider biological sampling to ascertain effect of decreased HWS temperatures.

*Strategic flushing comprises of the introduction of flushing of all identified infrequently used outlets and also of outlets which are suitably located on the system to enable the thorough and speedy purging of the HWS to allow for the reduction of water temperatures to within recommended limits

** On receipt of biological analysis results, follow the procedures described in Appendix 3

***Persistently indicates that measured temperature below 50°C between at least two consecutive temperature monitoring visits.

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2C Dead-legs and areas of infrequent use

Result	Remedial Action
Notification of dead-legs	1. Remove dead-leg by cutting it back to the main distribution pipe-work ensuring that 'T' piece is removed where practicable 2. Consider carrying out biological sampling (TVC) to ascertain effect of the dead-leg. Upon receipt of results, follow protocol described in Appendix 3 of this document
Notification of Low and Infrequently Used outlets	1. Increase water through-put by the introduction of scheduled strategic flushing to reduce water retention time 2. Consider the removal of the outlet 3. Consider carrying out biological sampling (TVC) to ascertain effect of the dead-leg. Upon receipt of results, follow protocol described in Appendix 3 of this document
General	1. Ensure that all users are advised on the potential risks and appropriate actions required to prevent the likelihood of proliferation and exposure to *Legionella* bacteria in infrequently used/disused outlets 2. Ensure that the users undertake flushing of all identified infrequently used outlets on a weekly (minimum) 3. Where infrequently used facilities are deemed to be no longer required, they should be reported to the Department Responsible Person for removal

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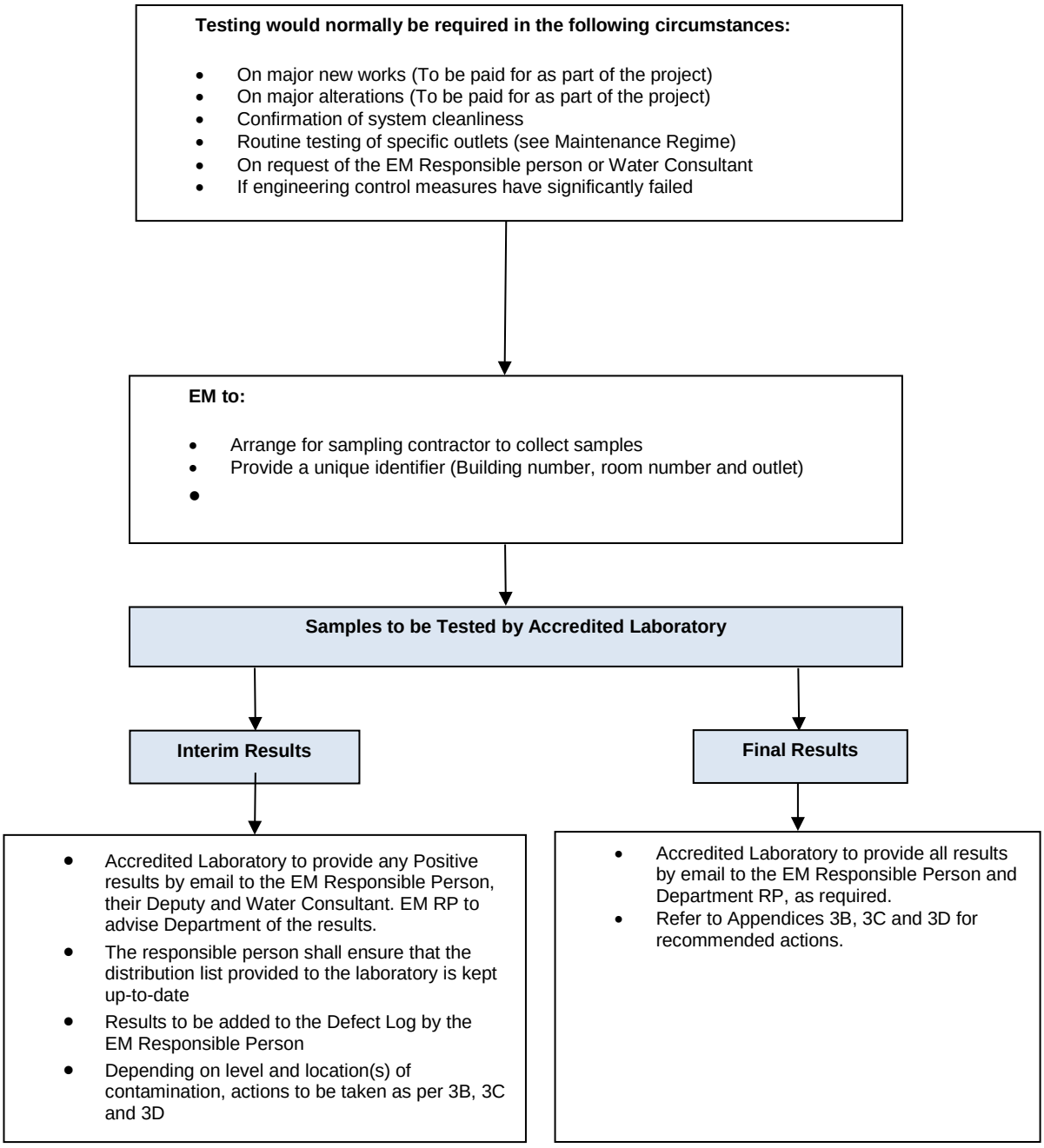
Appendix 3: Microbiological Sampling

3A Testing and Reporting Procedure (all sample types)



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3B Results Interpretation

Analysis Sample	Reported Results		Result Interpretation
Aerobic count TVC	None Detected		Negative
	22°C	>10cfu/ml - <1,000cfu/ml	Insignificant
	22°C	>1,000cfu/ml - <10,000cfu/ml	Significant
	22°C	>10,000cfu/ml	Highly Significant
	None Detected		Negative
	37°C	>10cfu/ml - <100cfu/ml	Insignificant
	37°C	>100cfu/ml - <1,0000cfu/ml	Significant
	37°C	>1,000cfu/ml	Highly Significant

*Legionella (any sp*ecies)	None Detected	Negative
	<100cfu/l	Insignificant
	>100cfu/l - <1000cfu/l	Significant
	>1000 cfu/l	Highly Significant

Coliforms*, and E. coli*	None Detected	Negative
	<1cfu/100ml	Negative
	>1cfu/100ml	Highly Significant

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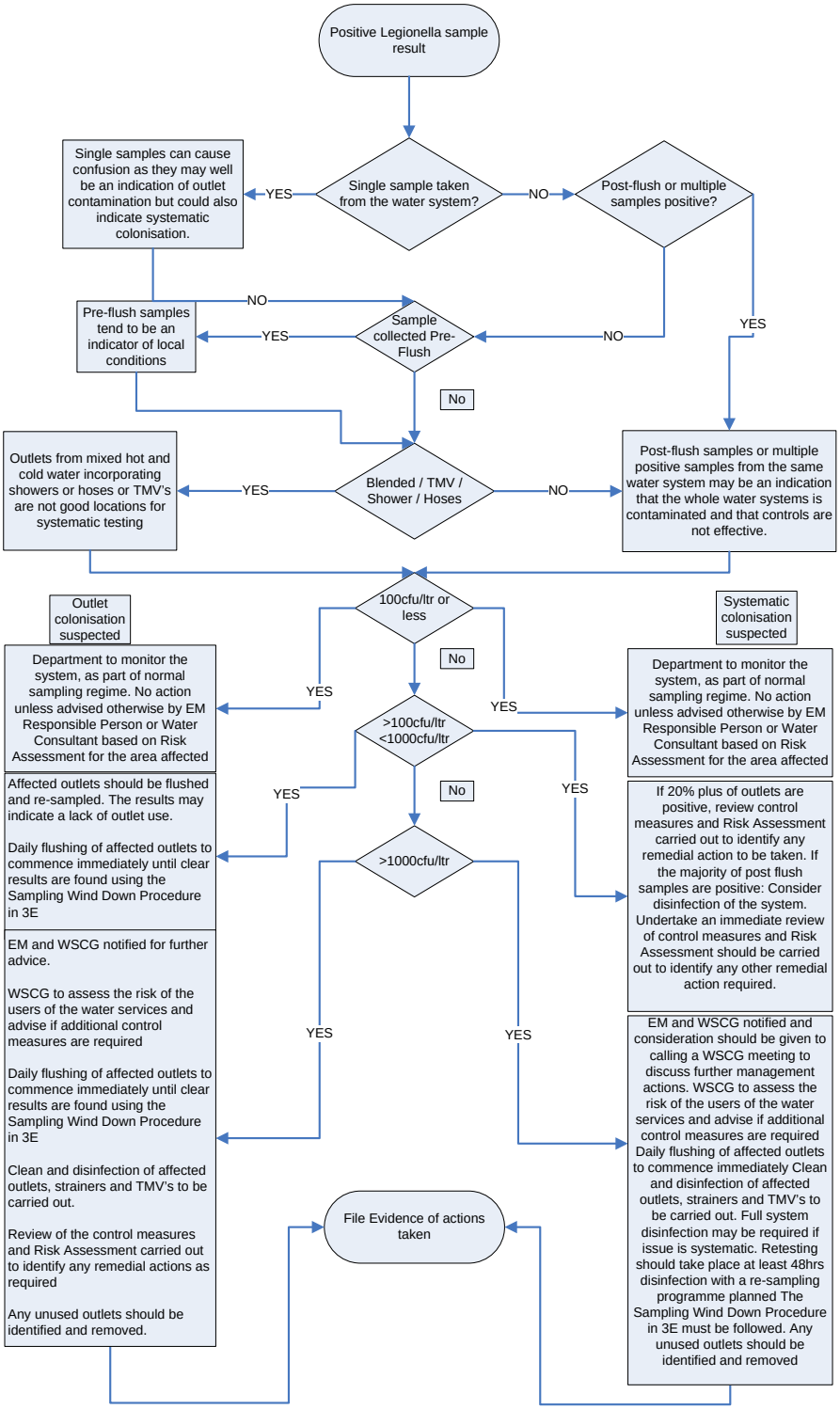
3C Positive Sample Recommended Actions (*Legionella* Specific Samples)



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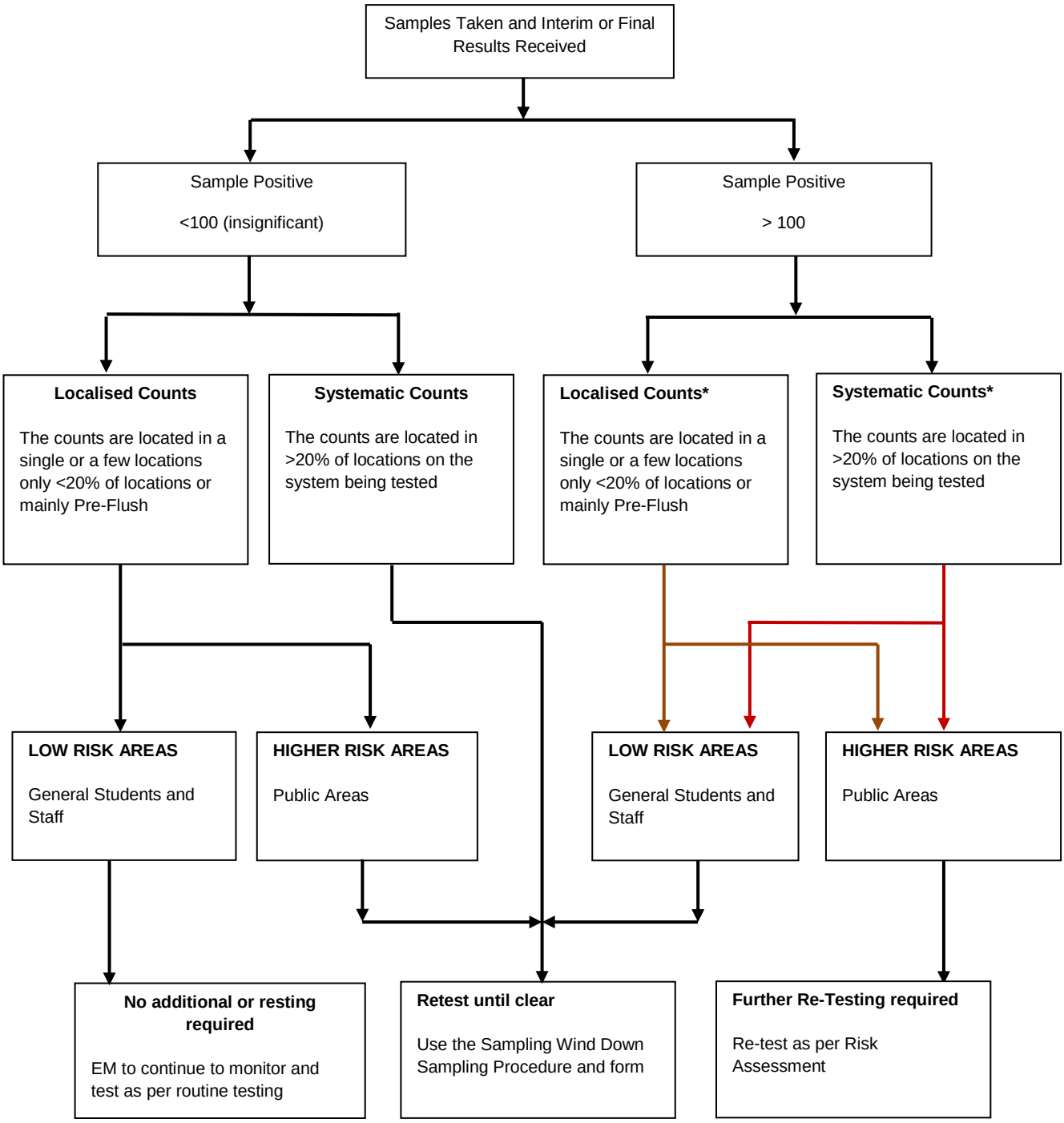
3D Re-test Guidance Following Positive Results (*Legionella* Specific Samples)

This guidance is for the retesting part only following positive results found during routine or requested sampling for *Legionella*. Refer to 3C.



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3E *Legionella* Sampling Wind Down Procedure

Date

Outlet no

1) Is the outlet temperature reaching control parameters within allotted time?
2) Have the last three samples come back negative?
3) Is the department undertaking routine sentinel point checks?

		Response Yes/No	Red	Amber	Green
1)	Is the outlet temperature reaching control parameters within allotted time?	Yes			
2)	Have the last three samples come back negative?	Yes			
3)	Is the department undertaking routine sentinel point checks?	Yes			

If all three answers are green, sampling can be reduced using the following

Weekly, repeat the above questions, if all responses positive then sampling can reduce to fortnightly. If one of the control measures fails repeat weekly sampling.

Fortnightly, repeat the above questions, if all responses positive then sampling can reduce to monthly. If one of the control measures fails repeat weekly sampling.

Monthly, repeat the above questions, if all responses positive then sampling can reduce to 3 monthly. If one of the control measures fails repeat weekly sampling.

3 Monthly repeat the above questions, if all responses positive then sampling can reduce to 6 monthly. If one of the control measures fails repeat weekly sampling.

All records maintained in the Buildings Log Book and EM advised of progress

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Appendix 4 – Consultation List

Consultation List **A completed list should accompany every guideline/Standard** ***(This gives evidence on who has seen this procedure and any comments made)***		**University of Cambridge**
Name of Person	**Department or Committee**	**Comments**