UNIVERSITY OF LEICESTER

## Estates and Digital Services (EDS)
## (including water assets directly under its control)

# WATER SAFETY PLAN

**Book 1 of 3 – General Considerations**

**This Water Safety Plan 'Book' was approved by the University of Leicester Building Services Engineer (Water) on:**

**Date:** 17th April 2025
**Name:** Paul Gamble

**Version:** 10.0

**Date of Issue:** 17th April 2025
**Date of Review:** one year from issue

**Not to be read in isolation of other WSP Books 2 and 3**

**THIS DOCUMENT HAS BEEN RE-ISSUED AS VERSION 10.0 WITH NO CHANGES TO IT'S CONTENTS SINCE VERSION 9.0 WAS ISSUED**


HYDROP

**HYDROP E.C.S.**

PREPARED BY: Mike Koumi BSc (Hons)
University Authorising Engineer (Water)
and amended by:
Gavin Wood
University Authorising Engineer (Water)

Wrens Court, 55 Lower Queen Street, Sutton Coldfield, West Midlands, B72 1RT
Tel: 0121 354 2030 Fax: 0121 354 8030
info@hydrop.com www.hydrop.com

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# i. DISTRIBUTION CONTROL

This EDS Water Safety Plan (WSP) has a controlled circulation and should not be copied without the permission of the Director of Asset Management and Compliance.

All WSP books are under control of the Building Services Engineer (Water), who instructs any required changes to the current approved document. The current copy of the WSP is to be uploaded upon instruction of the Building Services Engineer (Water) to the University of Leicester EDS intranet where it can be accessed by all parties.

Where changes are requested by persons other than the Building Services Engineer (Water), draft changes are issued to the originator of the change, and the Building Services Engineer (Water) for approval. If after a week no comments are returned, the changes are incorporated into a final copy to be issued as above.

This WSP book shall not be used in isolation, and should be issued and read in conjunction with EDS's Water Safety Plan "Book 2 of 3 Processes, Procedures and Permits" and "Book 3 of 3 Design Installation and Commissioning" documents.

The WSP should not be printed, or stored in other locations than the approved location to ensure the version used is the latest approved version.

# ii. MANAGEMENT INFRASTRUCTURE

| Management Level | Position | Contact Details |
|---|---|---|
| EDS | Duty Holder - Vice Chancellor | E: ecs-service@le.ac.uk<br>T: 0116 252 2319/5851 |
| | Director of EDS | E: ecs-service@le.ac.uk<br>T: 0116 252 2319/5851 |
| | Director of Asset Management and Compliance | E: ecs-service@le.ac.uk<br>T: 0116 252 2319/5851 |
| | Director of Projects and Planning (Capital Development) | E: ecs-service@le.ac.uk<br>T: 0116 252 2319/5851 |
| | Director of Campus Services (Catering, Residences, Grounds Maintenance, Conferencing, Housekeeping Services) | E: ecs-service@le.ac.uk<br>T: 0116 252 2319/5851 |
| | Health, Safety and Compliance Officer | E: ecs-service@le.ac.uk<br>T: 0116 252 2319/5851 |
| | Water Systems Operational Responsible Person | E: ecs-service@le.ac.uk<br>T: 0116 252 2319/5851 |
| | Authorising Engineer (Water) | Gavin Wood<br>HYDROP ECS<br>t: +44 (0)121 354 2030<br>m: +44 (0)791 905 1881<br>e: gavin@hydrop.com |
| | External Independent Water Hygiene Contractors | WCS Group Ltd<br>t: 0113 306 0400 |
| | | Hydro-X Water Treatment Ltd<br>t: 01909 565 133 |

Roles and Responsibilities as described in the University's current Water Safety Policy which constitute the 'Operational Water Management Team' for Estates and Digital Services.

# 1. INTRODUCTION AND AIM

The University attaches the greatest importance to the health, safety and welfare of staff, students, contractors and visitors. It is considered essential that management and staff should work together positively to achieve an environment compatible with the provision of the highest quality services where health hazards to students, staff and others are minimised, so far as is reasonably practical.

This Water Safety Plan (WSP) - Procedural Document is aimed at the management of Water Quality including Legionella from EDS including water assets directly under its control, 'Risk Management' perspective and must be used in conjunction with the University's Water Safety Policy and other pertinent management documents.

The Health and Safety Executive's publication 'Legionnaire's Disease, The Control of Legionella bacteria in water systems Approved Code of Practice and Guidance' (HSE L8) provides a framework and guidance for EDS to achieve compliance relative to the hazards posed by poor water quality particularly where Legionella bacteria may be present.

It is accepted that it is for EDS management and staff to do all that is reasonably practicable to achieve compliance with the guidance requirements detailed above and other regulations and guidance with regard to the maintenance of good water quality within all water assets directly under the control of EDS. Where appropriate, training and information and any necessary control measures will be provided by EDS. It is the intention of EDS to ensure the effective implementation of this statement and to keep it under consideration in all aspects of Health and Safety Management practice and decision-making. It is expected that this WSP will be complied with by all the EDS employees and by all appointed contractors, in whatsoever capacity, with or without contractual agreements.

This WSP provides the guidance, instruction, specification and infrastructure for the implementation of EDS's Water Quality Management & Control programme, as implemented and managed by EDS. This includes the control of Legionella, hygiene, safe hot water and cold water and drinking water systems.

The management procedures, detailed herein, shall seek to ensure that compliance with this WSP is continuing and not notional. As part of EDS commitment to providing a fully compliant service, it is necessary that all design, installation, commissioning, regular tests and checks set out in this document shall be carried out even if they cause minor disruption to services, and that comprehensive records will be maintained.

This document shall be used in conjunction with all other pertinent policies.

This WSP book shall not be used in isolation, and should be issued and read in conjunction with "Book 2 of 3 Processes, Procedures and Permits" and "Book 3 of 3 Design, Installation and Commissioning" documents.

# 2. APPLICATION AND SCOPE

2.1 Extent of application:

This WSP applies to water assets directly under its control of EDS.

Where any of the requirements of this WSP, whether in-whole or in-part thereof, cannot be adhered to as detailed, formal application for derogation, using Management Pro-forma No. 'Permit to derogate from instructions detailed in the WSP', must be submitted to the Director of Asset Management and Compliance for approval. The request for derogation must be accompanied by a robust rationale detailing the reasons for seeking derogation and alternative processes and procedures proposed. No deviation from the requirements of this WSP, either implicit or explicit, is allowed without suitably signed and dated permit.

2.2 Scope:

The scope of this WSP shall extend but not be limited to:

a. Domestic Cold Water Services – Storage and Distribution
b. Domestic Hot Water Services - Generation Storage and distribution
c. Faucets, showers, bib taps, etc.
d. Thermostatic Mixing Valves (TMV)/Thermostatic Mixing Taps (TMT)
e. Drinking Fountains/water coolers/dispensers
f. Vending Machines
g. Irrigation Systems
h. Fire hose reels (where they are supplied by or share facilities with the domestic water system(s)
i. Emergency Showers/ Eye Washers
j. Wet Air Conditioning
k. Portable Air Conditioning Units
l. Water Butts
m. Other systems considered to pose a risk

# 3. MICROBIOLOGICAL CONTROL METHODS

3.1 General Considerations:

Within EDS, management of water systems and associated end-of-line fittings to reduce the risk of microbial growth including opportunistic pathogens such as *Legionella sp.* is vital to 'User' safety. It requires on-going maintenance and surveillance of control measures employed.

The plant and equipment used in these buildings which have water in the system and can affect the water supply or the atmosphere must be monitored regularly and be subjected to the following regime:

a. The systems must be carefully designed so as to minimise aerosols.
b. The material used in construction would not harbour or provide nutrient for bacteria.
c. They must be designed to be readily drained and cleaned.
d. The systems must be maintained in a clean and sound condition.
e. All plant and distribution pipe-work must be clearly labelled.
f. The water quality must be maintained by ensuring the systems are kept in a good condition.
g. Careful monitoring of the precautions.
h. Records must be kept of the maintenance performed, results obtained and actions taken.

3.2 Temperature:

EDS shall employ 'Temperature Control' as the primary method of Legionella control within the domestic water systems under their control. This is achieved by maintaining temperatures of:

a. Cold water stored at temperatures of <20°C*.
b. Cold Water Services (CWS) Distribution at <20°C.
c. Stored hot water at ≥60°C.
d. Hot Water Services (HWS) Stored and Flow at Hot Water Generation point at ≥60°C to maximum 65°C
e. Recirculating hot water at all parts of the system ≥50°C.
f. Non recirculating hot water at ≥50°C within one minute of flushing the outlet.

3.3 Alternative and As-Required Supplementary bacterial control measures:

3.3.1. General:

Where water quality indicates that temperature control alone may not be sufficient to control bacterial contamination, EDS requires that an alternative/additional and/or supplementary control measures be employed to achieve the required bacterial contamination control parameters.

Any additional/supplementary control measures to be employed shall be supported by all necessary 'approval-for-use' certification from the relevant authorities and be suitable and safe for use. In addition, installation of such alternative/additional and/or supplementary control measures must be supported by a detailed and robust installation and management rationale which must be approved by the Director of Asset Management and Compliance before commissioning.

EDS requires that water temperature management and control measures in any new builds and major refurbishments are supported, where shown to be necessary due to possibility that the primary control measure (temperature control) may not sufficient to control bacterial contamination on its own, by a suitable additional/supplementary control measure such as chlorine dioxide or copper described below.

Many different types of supplementary control measures chemicals are available, however, before any such control measures are utilised, the Director of Asset Management and Compliance, who would consult with Safety Services and system user, must consider: their safety; suitability; accreditation status and usage permission before being proposed for ratification.

3.3.2 Chlorine dioxide (ClO2):

ClO2 is an oxidising biocide/disinfectant that when used correctly, has been shown to be effective at controlling both Legionella and biofilm growth in hot and cold water systems. In the appropriate application, it may be used to aid Legionella control where maintaining a conventional temperature regime is difficult or where the removal of all dead legs and little used outlets is impractical. ClO2 is usually produced on site from a chlorite-based precursor using a ClO2 generator or dosing system by reaction with one or more other chemical precursors or by a catalytic oxidation process. Use of chlorine dioxide as a Legionella control strategy is subject to BS EN 12671:2016 and European Biocidal Products Regulation BPR Regulation (EU) 528/2012 and national conditions of use. The EDS team shall achieve this by proportionally injecting the biocide into various parts of the system and maintaining levels of ClO2 at:

a. Point of injection – between 0.25 and 0.5mg/l. Any level fluctuations must only be tolerated within this range and care must be exercised to ensure that the level of ClO2 at the nearest outlet does not exceed 0.5mg/l.
b. Point of delivery (measured at sentinel outlets) – between 0.1 and 0.5mg/l
c. Byproduct testing shall be carried out at reverification to ensure chlorine dioxide, chlorite and chlorate levels are below 0.5mg/l as chlorine dioxide at point of injection. Chlorate may be omitted from the test if commissioning tests show the generator type does not produce significant levels of chlorate.

EDS management shall ensure that adequate processes, procedures and any necessary equipment are suitably implemented and installed to ensure avoidance of overdosing. In addition, the dosing system and associated components shall be included in suitable and sufficient maintenance and monitoring contract delivered by a suitably competent specialist contractor.

In order to ensure maximum efficiency of the control methods employed, it is important to keep all systems clean and adequately used at all times and at the correct temperatures and levels of ClO2.

3.4 Planned Maintenance and Surveillance Programme:

In order to ensure that the devised Risk Management Programme is effective in minimising or controlling the risk of Legionellosis, the EDS (or others on its behalf) shall undertake a number of periodic inspection, monitoring and surveillance tasks. The actual frequency of the tasks adopted, shall depend on a number of criteria such as the type of building, type of occupants and history of the plant/system. The typical Planned Maintenance and Surveillance Programme is described in detail in Section 7.

3.5 Shot-dosing (Hyper-disinfection):

During specific circumstances, when either methods of bacterial control is shown, by the various PPM Programme Monitoring Tasks, to be failing, the water quality shall be recovered and maintained by the use of shot-dosing of a suitable disinfecting agent, the levels of which must be maintained within the agreed limits detailed in WSP Book 2.

The disinfection agents to be used and specific method shall be subject to a risk assessment to be approved by EDS.

3.6 Maximisation of Efficacy Control Measures:

In order to ensure maximum efficiency of all the control methods described above, all systems shall be kept clean and adequately used at all times and the correct temperatures and chemical parameters achieved.

In order to maximise the efficacy of control measures, all facilities which are no longer required, must be removed from the system by cutting back their supply to the nearest live 'T'. If a facility is required for future use, particularly in ‘single-service’ systems, it would be necessary to re-configure its supply pipework ensuring that an isolation valve (incorporating a non-return valve (NRV) where practicable) is located as near to the nearest live 'T' as possible thus reducing the length of dead-leg pipework as much as practicable.

When considering identified redundant pipework, *the primary consideration must always be to remove the redundant pipework completely where possible and practicable.*

The EDS management Team will continue to consider new developments and improvements in the field of Water Quality 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.

The EDS management Team shall ensure that accurate records and drawings are available, which cover all the hot and cold-water systems. Such drawings shall be accurately maintained and updated following any modification. In addition, all services shall be easily identified.

All staff and third-parties, who are engaged in the management of Water Quality in EDS including water assets directly under its control, shall be suitably trained and competent, appropriate to the task they perform.

In order to ensure that Water Quality Management and Control processes and procedures being implemented remain effective, it is important to ensure that any changes to the systems design, installation and use; the primary water supply; method of water treatment and 'change-of-use' of a facility are notified to the Water Systems Operational Responsible Person. A Risk Assessment shall be carried out, in all such instances, to determine the effect of any changes to the level of risk and to allow for any required changes to the risk management regime. All identified elevation of risk levels shall also be reported to all pertinent departments to allow for required local changes to their risk management regime to be implemented.

Regulations require notification to the water undertaker of any proposed changes and additions to the water supply system in any EDS premises. Prior to making any changes, a risk assessment shall be carried out. Further details can be found on the WRAS website.

3.7 Infrequently used outlets:

The risk from water borne bacteria growing and proliferating in peripheral parts of the domestic water system, such as infrequently used outlets and dead legs off the re-circulating hot water system, may be minimised by regular use of these outlets. When outlets are not in regular use, regular and frequent flushing of these devices for several minutes can significantly reduce the risk of water borne bacteria proliferation in the system. Once started, this procedure has to be sustained and logged, as lapses can result in a critical increase in water borne bacteria at the outlet. Where there are high-risk 'User's identified, more frequent flushing may be required.

The EDS management Team shall ensure that:

a. 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.
b. When assessed and deemed ‘infrequently/inadequately used’, all taps shall be flushed at least weekly for a minimum of three minutes and reported using the University’s approved logbook system.
c. If the outlet is fitted with a Point-of-use (POU) filter, the filter shall be removed in order to flush the tap and refitted upon completion of the flushing process, unless the manufacturer’s instructions advise otherwise. A record shall be kept of when they were flushed.
d. Where installed and where taps can be programmed to flush automatically they should be set to flush for a minimum of two minutes and, where possible and practicable, such flushing shall be recorded on the building management system.

3.8 Ad-hoc Risk Management and Control Processes:

The EDS management Team (or others on its behalf) shall, in addition to the Planned Maintenance Programme, undertake certain *Ad-Hoc* and *As Required* tasks which will be required periodically. The execution of such tasks shall depend on a number of criteria such as: the condition of systems; the status of control measures; biological activity; etc.

3.9 Bacteriological sampling of water systems:

Sampling shall be carried out to determine system contamination, and assess risk where required by the EDS Management Team.

Sampling shall only be considered under the following circumstances:

a. Significant failure of the agreed control regime for buildings under EDS control.
b. Following recommendation by risk assessment.
c. As a part of commissioning assurance for project work under certain circumstances, see WSP book 3 for requirements.

Sample locations and type shall be determined by the EDS Management Team, with help from the AE-W where required.

Sampling when agreed, will be instructed to the appointed sampling contractor only, who will arrange the collection of the samples. No sampling is to be carried out by other contractors, or sub-contractors without written permission from the Building Services Engineer (Water).

Microbiological Sampling must be carried in accordance with 'Microbiological Sample Collection Protocol' in WSP book 2.

3.10 Instrument Calibration:

Temperature and chemical measurement equipment and water sampling equipment for carrying out monitoring works shall be calibrated on an annual basis and the certification of calibration appropriately provided and appropriately retained in the electronic logging system. Calibration service providers shall be accredited via UKAS calibration and accredited to ISO 17025.

3.11 Water Butts:

Water Butts shall not be allowed to be fitted without authority from EDS. Where essential to University Business, each Water Butt shall be fitted only following approval from EDS in line with Permit provided in WSP book 2.

It is accepted that Water Butts will not be able to comply with temperature control in line with other Water Systems, and cannot be prevented from being contaminated. Therefore to minimise risk to acceptable levels, Water Butts shall only be allowed to be used where aerosol is minimised. Training in the use of the Water Butts shall be recorded, and Water Butts not allowed to be used by unauthorised persons. Also see WSP book 3.

3.12 Connection or Removal of Facilities:

Connecting new water fed equipment and disuse of connected equipment create demand and stagnation issues for the water systems. To ensure these connections are suitably managed and suitable to the feed systems, all connections or disconnections should be notified and approved before taking place. All connections to water systems are subject to Water Regulations which require Water Regulations approval for all alterations to systems, either by pre-approval by Water Undertaker notification or fitting by Approved Contractors. Approval, and notice to EDS will be required for all items to be connected to the water systems.

3.13 Water Features:

Where water features are subject to University Estates control, they shall receive a suitable and sufficient risk assessment. In addition to any controls advised by the risk assessment, any water features determined to have possibility of aerosol generation shall as a minimum have a monthly condition inspection to include temperature monitoring of the system. Where temperature monitoring is carried out, the contingency measures shall be in line with those required for domestic water systems, and the temperature monitoring recorded in the electronic logbook system to allow automatic recording of defects.

# 4. SCALDING CONTROL METHODS

Scalding control in EDS including water assets directly under its control shall be based on a suitable and sufficient risk assessment. Where scalding protection is shown by the risk assessment to be required, it shall be achieved by the installation of Thermostatic Mixing Valves (TMVs) and/or Thermostatic Mixing Taps (TMTs) which shall be maintained in accordance with manufacturers' instructions.

The temperature from all such outlets shall be measured on a regular basis and set at:

- 43°C max for showers
- 43°C max for basins
- 44°C Max for baths

In areas where the risk has been assessed and found to be low, general 'Warning! Hot Water' notices (examples below), to indicate and warn users of the potential of scalding.




TMVs/TMTs can be removed if fitted to locations which, following a risk assessment, are determined to be unnecessary and that their removal is safe to do so and approved, in writing, by the Director of Asset Management and Compliance, before being carried out.

In line with University scalding assessment, very high temperatures may provide additional scalding risk, and prevent use of hot taps. To limit this risk, hot water generation shall not exceed a stored, or flow temperature of 65°C.

# 5. RISK ASSESSMENTS

5.1. Legionella:

A suitable and sufficient Legionella risk assessment compliant with: a) UKAS ISO/IEC 17020:2012; b) HSG274 Parts 2 and 3 (2024); c) BS 8580 part 1 – 'Water quality: risk assessments for *Legionella* control – Code of Practice'; shall be carried out on all EDS including water assets directly under its control, in accordance with Section 2.1 - Extent of application, 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 assessments shall be reviewed and/or updated when there are significant changes to statutory standards, operational requirements and when there are significant changes to a building's domestic water and wet air systems.

The assessments shall be commissioned by the Director of Asset Management and Compliance and the process managed by the Water Systems Operational Responsible Person.

The risk assessments shall be carried out by suitably qualified and accredited (UKAS ISO/IEC 17020:2012) externally appointed specialists who shall be totally independent from all other contractors working with the University and possesses the necessary competence and resources to complete the tasks proficiently and safely.

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 purpose of the assessment is to enable a valid decision to be made about:

a. The risk to health, i.e. whether the potential for harm to health from exposure is reasonably foreseeable unless adequate precautionary measures are taken.
b. What control measures are to be implemented to minimise the risk from exposure to Legionella.

The assessment shall include identification and evaluation of potential sources of risk and:

a. The particular means by which exposure to Legionella is to be prevented; or
b. If prevention is not reasonably practicable, the particular means by which the risk from exposure to Legionella is to be minimised.

The Risk Assessments will enable the EDS Management Team to demonstrate that all the pertinent factors, and the steps needed to prevent or minimise the risk, have been considered.

The status of each assessment shall be reviewed, at least annually, or when there is uncertainty over their validity using Management Pro-forma No.2: 'Risk Assessment Status Enquiry Pro-forma'. This process will assist in the validation of each risk assessment to allow for instructions to be given to commission new risk assessments, where required. New assessments should be considered when there are:

a. changes to the plant or water or its use;
b. changes to the user and/or use of the building in which it is installed;
c. the availability of new information about risks or control measures;
d. changes to key personnel;
e. the results of checks indicating that the control measures are no longer effective.

In identifying and assessing the risks in any water systems and in drawing up and applying the necessary control measures, notice should be taken of this WSP.

The risk assessment shall take into consideration the following:

a. The potential of bacterial contamination of the all areas of the system including plant and equipment.
b. The potential of bacterial amplification.
c. The potential of bacterial transmission.
d. The potential of exposure to the bacteria.
e. The susceptibility of the 'User'.

In addition, the risk assessment shall include risk analysis on the following areas of the domestic and process water systems:

5.1.1 Cold Water Services - Storage

a. Physical condition and hygiene standard of all associated Water Storage Tanks.
b. Design and configuration of all associated Water Storage Tanks.
c. Capacity requirements and available storage capacities of all associated Water Storage Tanks.
d. Temperature profiles of all associated Water Storage Tanks.
e. Water Supply Regulations parameter compliance of all associated Water Storage Tanks, including location and accessibility.

5.1.2 Cold Water Services - Distribution

a. Physical condition of all associated distribution pipe-work (where reasonable accessible).
b. Design and configuration of all associated distribution pipe-work.
c. Temperature profiles of all associated distribution services and outlets.
d. Presence of dead-legs and areas of low-flow within all the associated distribution services.
e. Presence of flexible hoses, aerators, strainers, non-touch taps.
f. Presence of vending machines and water dispensers.
g. Usage considerations of all associated distribution services.

5.1.3 Hot Water Services - Hot Water Generation and Storage

h. Physical condition of all associated Hot Water Generating Units.
a. Design and configuration of all associated Hot Water Generating Units
b. Temperature profiles of all associated Hot Water Generating Units, to include; flow, return and drain temperatures.
c. Capacity requirements and available storage capacities of all associated Hot Water Generating Units.
d. Presence of temperature stratification within associated Water Storage Calorifier or Plate Heat Exchanges Buffer Vessel.

5.1.4 Hot Water Services - Distribution

a. Physical condition of all associated distribution pipe-work.
b. Design, configuration and accessibility of all associated distribution pipe-work.
c. Temperature profiles of all associated distribution services and outlets.
d. Presence of dead-legs and areas of low-flow within all the associated distribution services.
e. Usage considerations of all associated distribution services.
f. Presence of space-heating within all associated distribution pipe-work.
g. Presence of flexible hoses, aerators, strainers, non-touch taps.
h. Presence of undesired lengths of blended water pipe-work within all associated distribution services.

5.1.5 TMVs and TMTs

Condition, temperature profiles, accessibility and operation status of all TMVs/TMTs within all associated distribution services.

5.1.6 Showers and associated shower heads

Condition, temperature profiles, accessibility and operation status of all showers and associated shower heads within all associated distribution services.

5.1.7 'Wet' Air Conditioning

a. Physical condition of all associated Air Handling Units.
b. Design, configuration and accessibility of all associated Air Handling Units.
c. Method of humidification and operation status of all humidifiers within all associated Air Handling Units.
d. Condition, design and configuration of drip-trays within all associated Air Handling Units.
e. Condition, design and configuration of traps/U-bends within all associated Air Handling Units.
f. Physical condition and hygiene standards of duct-work of all associated Air Handling Units where practicable.

5.1.8 Adiabatic Coolers

a. Type of unit.
b. Potential to cause an aerosol.
c. Potential of aerosol being inhaled.
d. Physical condition units and associated plant.
e. Location, design, configuration and accessibility of all units.
f. Water Treatment Programmes in place and their efficacy (if applicable).
g. Maintenance Programme and Hygiene Standards employed.

5.1.8 Management, Maintenance, Monitoring and Record Keeping

a. Presence and adequacy of all implemented Monitoring and Maintenance Programmes in place by EDS.
b. Presence of and adequacy of all implemented Record Keeping Programmes in place.
c. Presence of and adequacy of all implemented Auditing Programmes in place.

All areas listed above must be measured and expressed numerically indicating the contribution of each area to the overall Risk.

5.1.9 Schematic Diagrams and Photographic Representation

a. Schematic diagrams shall be produced for each system surveyed risk assessed and included in the risk assessment reports.
b. Electronic photographs shall be included in the report to illustrate the status and condition of the system surveyed and to highlight particular problems identified during the survey process.

5.2 Post-risk assessment requirements:

5.2.1 Preparation of remedial works "Priority Charts"

From all data and information gathered during the Site Survey, a Works Priority Listing shall be produced, by the risk assessor, for the site surveyed and a detailed 'Remedial Works Priority Listing' shall also be produced in order to allow for the correct scheduling of all proposed works.

5.2.2 Preparation of site specific 'Pre-planned Maintenance' (PPM) Programmes)

A detailed and sufficient Pre-Planned Maintenance Programme shall be produced for each Site surveyed. The Programme shall include; the type of works, the frequency of works and all relevant works specifications. The Water Systems Operational Responsible Person must report to the EDS Management Team on the status of completion of PPM Programme tasks thus allocated.

5.2.3 Interim Reports

For all buildings/areas assessed to be of Moderate Risk or higher, the Risk Assessor shall issue a Management Pro-forma No.3: 'Urgent - Interim Problem Notification Pro-forma' indicating any necessary immediate corrective

and remedial actions that need to be carried out. In addition, the 'Interim Problem Notification Form' shall indicate the Short/Medium-term and Long-term corrective and remedial actions that need to be carried out. Water Systems Operational Responsible Person must report to the EDS Management Team on the status of completion of remedial works thus allocated.

#### 5.2.4 Consultancy Memoranda

Any additional instructions and advice from the Risk Assessor shall be issued to the Water Systems Operational Responsible Person using Management Pro-forma No. 4: 'Consultancy Memorandum Pro-forma' which shall clearly indicate the nature of any faults/problems discussed and the resulting Risk caused. In addition, any corrective action or remedial works required shall be clearly stated and listed and prioritised in terms of urgency.

### 5.3 Preparation of Action Plan

On completion of the Risk Assessments the Operational Water Management Team shall undertake the following procedure:

a. Develop schemes for risk minimisation and control in order of priority giving consideration to cost, risk and difficulty.
b. List all buildings in priority order of non-compliance and potential risk.
c. Devise a management programme for the minimisation of risks so that an action plan identifying resources and timescales is drawn up.
d. Manage the programme and identify compliance failures for remedial action.
e. Review the programme of the action plan at annual intervals and record progress in implementing the work. All changes to the water systems and functional content shall be recorded and evaluated.

# 6. WATER SYSTEM/PLANT DESIGN INSTALLATION AND MAINTENANCE

For detailed information on water system/plant design, installation and commissioning refer to EDS Water Safety Plan Books 2 and 3, Design, Installation and Commissioning, and Procedures and Processes documents.

# 7. MAINTENANCE AND CARE OF WATER SYSTEMS AND EQUIPMENT

7.1 Planned Maintenance and Surveillance Programme:

In order to ensure that the devised Risk Management Programme is effective in minimising or controlling the risk of Legionellosis, the EDS Management Team (or others on its behalf) shall undertake a number of periodic inspection, monitoring and surveillance tasks. The actual frequency of the tasks adopted, shall depend on a number of criteria such as the type of building, type of occupants and history of the plant/system.

7.2 General Considerations:

"As-Required" is determined by the results of each visit and is dependent on various measured parameters such as; physical condition, biological activity (if applicable), temperature, usage frequency etc. and decided by the EDS Management Team. All necessary procedures must be agreed prior to commencement.

PPM Programme tasks, shall include but not be limited to:

| Task Reference (LEG) No. | Task Details |
|---|---|
| LEG 01 | Distribution and Outlet Temperature Monitoring |
| LEG 02A | ClO2 Level Monitoring |
| LEG 03 | Water Storage Tank – Temperature Monitoring |
| LEG 04 | Water Storage Tank – Visual General Inspection |
| LEG 05 | Water Storage Tank - 24 hr Drop-test |
| LEG 06 | Storage Calorifier or Plate Heat Exchanger Buffer Vessel – 24 hr Temperature Profiling |
| LEG 07 | Storage Calorifier or Plate Heat Exchanger Buffer Vessel –Manual Temperature Monitoring |
| LEG 08 | Storage Calorifier or Plate Heat Exchanger Buffer Vessel –Visual General Inspection including drain flushing |
| LEG 09 | Circulation and destratification pumps visual inspections and servicing |
| LEG 10 | Expansion and Pressurisation Vessel Flushing (Non Flow-Through types only) |
| LEG 11 | Cistern Type Water Heaters – Temperature Monitoring |
| LEG 12 | Cistern Type Water Heaters – Inspection of Tank Section |
| LEG 13 | Cistern Type Water Heaters – Clean and Disinfection |
| LEG 14 | Low Volume Water Heater @ ≥15 litres– Temperature Monitoring |
| LEG 15 | Combination Boiler – Temperature Monitoring |
| LEG 16 | Instant Water Heater @ ≤15 litres– Temperature Monitoring – Temperature Monitoring |
| LEG 17 | Thermostatic Mixing Valves/Taps – Temperature Monitoring |
| LEG 18 | Thermostatic Mixing Valves/Taps – General Condition Inspections & servicing |
| LEG 19 | Thermostatic Mixing Valves/Taps – Clean, Descale and Disinfection |
| LEG 21 | Shower Heads– Head Replacement / Clean and Disinfection |
| LEG 22 | Air Conditioning/Air Handling –Trap cleaning and disinfection |
| LEG 23 | Air Conditioning/Air Handling – General Inspection/Clean & disinfection |
| LEG 24 | Air Conditioning/Air Handling –Clean & disinfection |
| LEG 37 | Water coolers and water dispensers – sanitisation and inspection |
| LEG 38 | Water Butt – Visual inspection, Cleaning and Disinfection |
| LEG 39 | Non-Thermostatic Shower Mixer Valves – Visual Inspection |
| LEG 40 | Water Feature routine inspection |

For detailed information on Planned Maintenance and Surveillance Programme task specifications and associated certificates of conformity, refer to EDS 'Processes, Procedures and Permits' document.

7.3 Planned Maintenance Programme - Task Frequencies (To be carried out by EDS staff and/or other Service Provider):

| PPM TASK | | | TASK FREQUENCY | TASK/ PROCESS №. Or Section of WSP |
|---|---|---|---|---|
| HOT & COLD WATER DISTRIBUTION AND OUTLETS | Temperature Monitoring and general inspection of outlets | | MONTHLY<br>NON-BLENDED SENTINEL OUTLETS ONLY<br>(PLUS A PERCENTAGE OF ALL OUTLETS TO ENSURE 100% COVERAGE OF ALL OUTLETS IN A TWELVE-MONTH PERIOD) | LEG 01A/ LEG 01B |
| | Flushing of Dead Legs or outlets with infrequent use including emergency showers and eye-wash stations – three minutes hot and cold for each outlet | | WEEKLY | LEG 35 |
| | Clean & Disinfection | | AS REQUIRED | LEG 29/ LEG 30/LEG 31 |
| WHERE INSTALLED ONLY<br>SUPPLEMENTARY BACTERIAL CONTROL DOSING | ClO2 | | DAILY (Reactive Maintenance)<br>CHECK THE QUANTITY OF CHEMICALS IN THE RESERVOIR.<br>CHECK THE RATE OF ADDITION OF THE CHEMICAL TO THE WATER SUPPLY<br>CHECK THE CONCENTRATION OF THE CHEMICAL AT DOSING POINTS<br>(NON-BLENDED OUTLETS ONLY) | LEG 02A |
| | | | WEEKLY (Water Hygiene Monitoring Contractor)<br>CHECK THE QUANTITY OF CHEMICALS IN THE RESERVOIR.<br>CHECK THE RATE OF ADDITION OF THE CHEMICAL TO THE WATER SUPPLY<br>CHECK THE CONCENTRATION OF THE CHEMICAL AT DOSING POINTS<br>(NON-BLENDED OUTLETS ONLY) | |
| | | | MONTHLY<br>CHECK THE CHEMICAL CONCENTRATION AT A REPRESENTATIVE NUMBER OF OUTLETS (NON-BLENDED OUTLETS ONLY) | |
| | | | ANNUALLY<br>AND AS REQUIRED BY MANUFACTURER'S INSTRUCTIONS<br>FULL AND INTERIM SERVICE IN LINE WITH MANUFACTURER REQUIREMENTS. | |
| WATER STORAGE TANKS | Temperature Monitoring | | 6-MONTHLY<br>PLUS WHEN THE MAJORITY OF SENTINEL OUTLET TEMPERATURES ARE >20°C | LEG 03 |
| | Visual Condition Inspections | | 6-MONTHLY | LEG 04 |
| | Clean & Disinfection | | AS REQUIRED | LEG 27/LEG 28 |
| | Pressurisation Vessel Flushing (Non Flow-Through types only) | | MONTHLY | LEG 10 |
| CALORIFIERS TO INCLUDE:<br>Plate heat exchangers and buffer vessels<br>Where multiple calorifiers are linked, the monitoring must include the flow and return of EACH unit and not just common flow & return. | Temperature Monitoring | Automatic<br>(*Where BMS is fitted) | *CONSTANT ON BMS | LEG 07 |
| | | Manual<br>(Where BMS is not fitted) | MONTHLY<br>PLUS WHEN A SIGNIFICNT NUMBER OF SENTINEL OUTLET TEMPERATURES ARE <50°C | |
| | General visual inspections and Drain Sludge Flushing (All Calorifier types) | | QUARTERLY<br>Extend to annual if evidence shows no sludge present | LEG 08 |
| | Destratification pumps visual inspections and servicing | | ANNUALLY | LEG 09 |
| | Pasteurisation | | AS REQUIRED | LEG 32 |
| | Expansion Vessel Flushing (Non Flow-Through types only) | | WEEKLY | LEG 10 |
| CISTERN TYPE WATER HEATERS | Temperature Monitoring | | MONTHLY | LEG 11 |
| | Inspection of cold tank section | | 6 - MONTHLY | LEG 12 |
| | Clean & Disinfection | | AS REQUIRED | LEG 13 |
| LOW VOLUME WATER HEATERS<br>Water heaters of <100 - ≥15 litres storage capacity, including Combi boilers | Temperature Monitoring and Condition Inspection | | MONTHLY | LEG 14/ LEG 15 |

| | | | |
|---|---|---|---|
| **INSTANT WATER HEATERS** Water heaters of <15 litres storage capacity | **Temperature Monitoring and Condition Inspection** | **MONTHLY** | **LEG 16** |
| **SHOWER HEADS** | **Shower Heads– Head Replacement/Clean and Disinfection** | **QUARTERLY** | **LEG 21** |
| **TMVs/TMTs AND THERMOSTATICALLY MIXED SHOWER MIXING VALVES** | **Temperature monitoring** | **ANNUALLY** | **LEG 17** |
| | **General Condition Inspections** (Including Fail-Safe checks) | **ANNUALLY** | **LEG 18** |
| | **Servicing, Cleaning and Disinfection** | **AS REQUIRED BY INSPECTION** | **LEG 19** |

| **PPM TASK (Continued/...)** | | TASK FREQUENCY | TASK/ PROCESS Nº. Or Section of WSP |
|---|---|---|---|
| **NON-THERMOSTATICALLY MIXED SHOWER MIXER VALVES** | **General Condition Inspections** (Including Fail-Safe checks) | **ANNUALLY** | **LEG 39** |
| **WET AIR CONDITIONING/AIR HANDLING** | **Trap Cleaning and Disinfection** | **QUARTERLY** | **LEG 22** |
| | **General Inspections** | **6-MONTHLY** | **LEG 23** |
| | **Cleaning & Disinfection of Drip Tray, Chiller Batteries and internal Surfaces** | **AS REQUIRED BY INSPECTION** | **LEG 24** |
| | **Split Units clean/disinfection** | **6-MONTHLY** | **AS MANUFACTURER INSTRUCTIONS** |
| **WATER DISPENSERS and WATER COOLERS** | **General Maintenance including clean and disinfection** | **6-MONTHLY** (CONTRACTOR) | **LEG 36** |
| | **Sanitisation** | **WEEKLY (CONTRACTOR)** | **LEG 37** |
| **WET RISERS** | **Flushing** | **As advised by risk assessment and Estates and Digital Services Management Team and Fire Officer** | **LEG 35** |
| **FIRE HYDRANTS** | **Flushing** | **As advised by risk assessment and Estates and Digital Services Management Team and Fire Officer** | **LEG 35** |
| **WATER BUTTS** | **Visual Inspection, Cleaning and Disinfection** | **ANNUALLY** | **LEG 38** |
| **WATER FEATURES WITH AEROSOL GENERATION** | **Visual Inspection, and Temperature Monitoring** | **MONTHLY** | **LEG 40** |
| **REDUCED PRESSURE ZONE VALVES (RPZ)** | **Service in line with Water Regulations Requirements** | **ANNUALLY** | **WATER UNDERTAKER INSTRUCTION** |

7.4 Contingency Management:

When the Water Quality Management and Control parameters have been breached and cannot be maintained, The EDS Management Team (or others on its behalf), shall ensure that the detailed processes and procedures described in Section 14 are followed in order to enable the failing parameters to be brought back into control.

7.5 Estates Repairs and Replacements

Where Estates repairs and replacements are to be undertaken, water quality shall be maintained by a clean tools and disinfected parts procedure. This shall be carried out in line with procedure LEG26a - Estates repairs and replacement components disinfection. Where full system disinfection is required, or conditions allowing this procedure are not met, the works, or project should be handled in line with the requirements of WSP Book 3.

# 8. AD-HOC RISK MANAGEMENT AND CONTROL PROCESSES AND ASSOCIATED CERTIFICATES OF CONFORMITY

In order to ensure that the devised Risk Management Programme is effective, the EDS Management Team (or others on its behalf) shall undertake certain *Ad-Hoc* and *As Required* tasks which may be required periodically. The execution of such tasks shall depend on a number of criteria such as: the condition of systems; the status of control measures; biological activity; etc. Some of the tasks listed below, may, under certain circumstances, be included in the PPM Programme, for example; LEG 32, pertaining to 'Dead Legs/Areas of Infrequent Use Usage Evaluation & Flushing' is also included in the PPM Programme. *Ad-hoc* and *As Required* tasks, shall include but not be limited to:

| Task Reference (LEG) No. | Task Details |
|---|---|
| LEG 25 | Microbiological Sample Collection Protocol |
| LEG 26 | Small sized pipework installation projects and associated components pre and post installation cleaning and disinfection |
| LEG 27 | Water storage tank cleaning and disinfection using Sanosil (Silver stabilised hydrogen peroxide) |
| LEG 28 | Water storage tank cleaning and disinfection using Sodium hypochlorite - Spray Method and/or Soak Method |
| LEG 29 | Domestic water services disinfection using Sanosil (Silver stabilised hydrogen peroxide) |
| LEG 30 | Domestic water services disinfection using Chlorine Dioxide (ClO2) as the disinfecting agent |
| LEG 31 | Domestic water services disinfection using Sodium hypochlorite (NaClO) as the disinfecting agent |
| LEG 32 | Calorifier or Plate Heat Exchanger Buffer Vessel Pasteurisation |
| LEG 33 | Domestic Water HWS distribution system pasteurisation |
| LEG 34 | Point of Use (POU) filter installation and replacement |
| LEG 35 | Dead Legs/Areas of Low-Use - Usage Evaluation & Flushing |
| LEG 36 | Management of Water Dispensers/Water Coolers |

For detailed information on ad-hoc risk management and control processes and associated certificates of conformity, refer to EDS 'Processes, Procedures and Permits' document.

# 9. INSTALLATION AND COMMISSIONING OF REFURBISHED AND NEW-BUILD FACILITIES

For detailed information on installation and commissioning of refurbished and new-build, refer to EDS WSP Book 3 'Design, Installation and Commissioning' document.

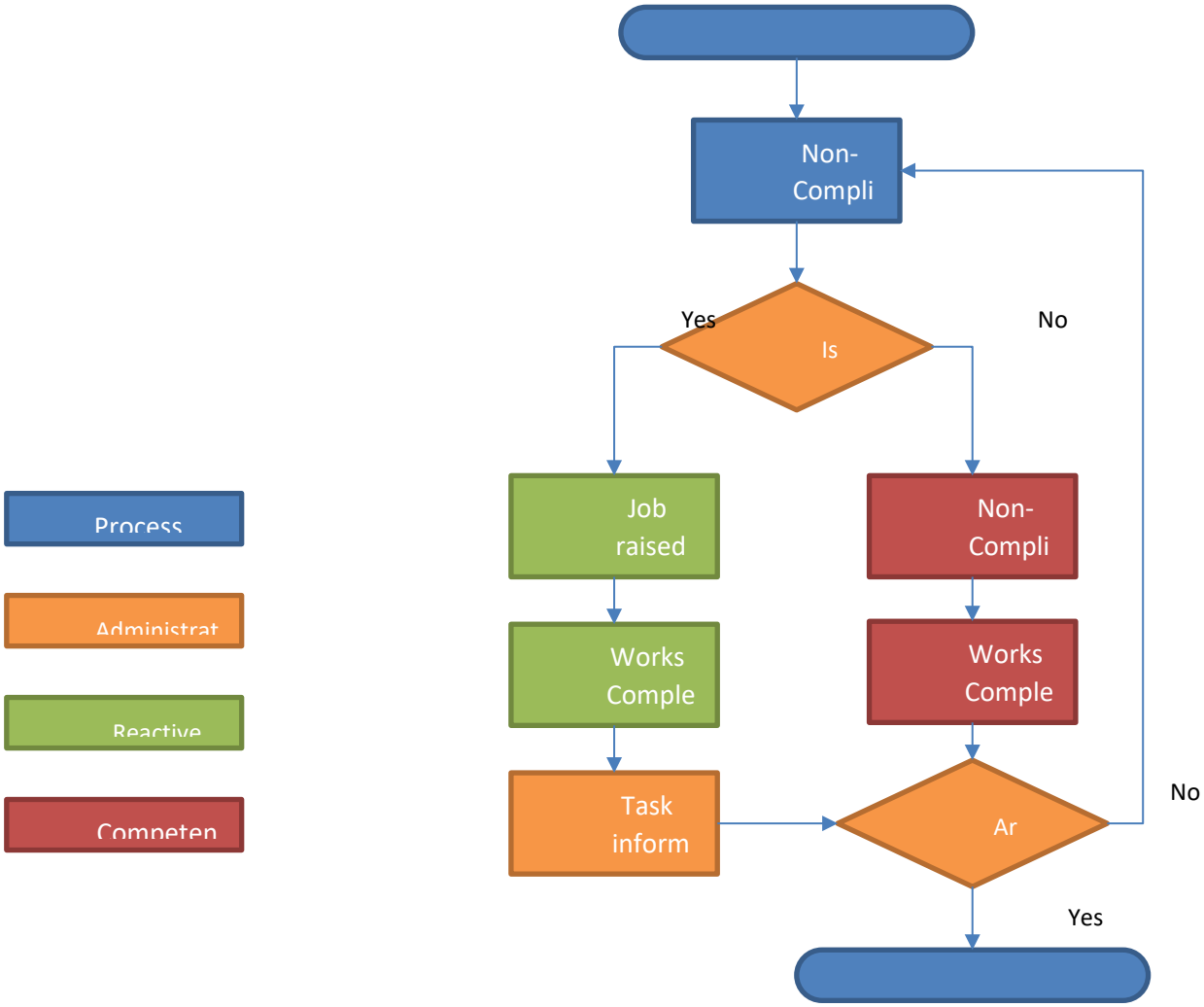
# 10. RECORD KEEPING

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 for at least five years showing the information specified in the ACOP.

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 detailed information required in the log will depend on the type and complexity of the system or water service to which it applies.

The purpose of a Log-Book system is to improve the efficiency and effectiveness of installation and maintenance, and also to provide a record of various tasks and observations so that the plant history can be reviewed at any time by the maintenance staff. It will prove essential in the operation of a planned plant maintenance scheme, and, if properly followed, will prevent unacceptable conditions developing as a result of ineffective maintenance.

Log Book Management is carried out using ZetaSafe and in accordance with the flow diagram detailed below:




The Log-Book system must:

a. Identify the installation requiring attention and how it operates.
b. Record results of the initial commissioning (if available) and any re-commissioning so that observations made during maintenance checks can be compared.
c. Define the maintenance task or observation required and the frequency.

d. Provide for 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.
e. Provide preliminary guidance on fault diagnosis and checking to assist with immediate on-site correction or adjustment.
f. Provide dates and results of inspections, tests and all associated works and procedures.
g. Provide dates for next scheduled inspection, test and associated works visits.

These entries should bear the signature of the person carrying out the task and should be kept available for inspection for at least five years from completion.

Details of operational and functional tasks must be drawn up for the site by EDS. These, together with the completion of Log-Books, will enable a proper historical record to be compiled of all works carried out and observations made.

Frequencies are indicated for initial guidance only, as they will vary to suit the operation of the system on site, its location, the design parameters and particular provisions, for example manual operation rather than automatic control methods. The user's needs must be considered before commencing any operational or maintenance tasks and the timing for these tasks must be considered and carefully planned in order to minimise inconvenience.

The control of Legionella is a continuing responsibility. Effectiveness of precautionary measures should be continually monitored and a continuing Programme to ensure awareness should be devised.

# 11. AUDITING

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

The University's Authorising Engineer (Water) shall carry out an audit of the processes and procedures being carried out to assess compliance with the approved Code of Practice L8. The results of the audit shall be reported, by to the EDS Management Team within a month of the audit process. The audit process must include, but not be limited to:

a. Level of implementation of control measures
b. Legislation compliance
c. Risk Management Status

# 12. TRAINING REQUIREMENTS

The Director of Asset Management and Compliance shall have the responsibility of periodically assessing the training requirements of staff associated with Water Quality Management and Control and recommending suitable training where required and as described in the Water Safety Policy. In addition, each EDS Management Team member shall report to the Head of Planned Maintenance any ad-hoc training requirements for associated staff.

Training will be carried out *at least* two-Yearly to ensure the competency of staff. Attendance shall be recorded and relevant training certificates maintained for inspection if required.

Individual records shall be kept for these staff, and staff shall not be allowed to perform their duties without supervision until their training is completed. The level of knowledge should be regularly assessed and should be programmed and continuous rather than sporadic.

# 13. CONTINGENCY MEASURES

13.1 Higher than recommended CWS temperatures:

**Results Interpretation and Specific Action Required:** The information below is meant to indicate some possible causes and suitable remedial action and shall not be considered exhaustive. Each failure must be considered in detail and the causes suitably addressed.

| Result | Possible cause | Remedial Action |
|---|---|---|
| Mains greater than 20°C | 1. High ambient temperatures | • Consider on-line disinfectant to augment and negate temperature control as primary bacterial control method.<br>• Consider increasing water through-put by *strategic flushing to reduce water retention time.<br>• Schedule a retest of the outlet, if retest fails, carry out biological sampling (Legionella)** to ascertain effect of increased CWS temperatures.<br>• When temperature exceeds 20°C ***persistently; increase frequency of biological sampling (Legionella) to MONTHLY to ascertain effect of increased CWS temperatures. |
| Tank temperature greater than 20°C AND greater than 2oC above mains temperature | 1. Tank over capacity | • Reduce stored water capacity to reduce water retention time.<br>• Carry out biological sampling (Legionella) to ascertain effect of increased CWS temperatures. |
| | 2. Lack of adequate tank insulation | • Install or improve tank insulation. |
| | 3. High tank room temperatures | • Increase tank room ventilation. |
| Outlet temperature more than 20°C. | 1. Areas of "low-flow" or dead-legs in the system and lack of adequate use causing stagnation | • Review Legionella Risk Assessment<br>• Schedule a retest of the outlet, if retest fails, carry out biological sampling (Legionella) to ascertain effect of increased CWS temperatures. |
| | 2. Lack of adequate insulation | • Install or improve pipework insulation. |
| | 3. Source of heat in close proximity to CWS pipes | • Consider increasing insulation<br>• Consider relocation of heat source if practicable.<br>• Consider on-line disinfectant to negate temperature control as primary bacterial control method.<br>• Review Legionella Risk Assessment<br>• Schedule a retest of the outlet, if retest fails, carry out biological sampling (Legionella)** to ascertain effect of increased CWS temperatures.<br>• When temperature exceeds 20°C ***persistently; increase frequency of biological sampling (Legionella) to MONTHLY 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.

**Biological sampling must be carried out as described in LEG 25 - 'Microbiological sample collection protocol'. On receipt of biological analysis results, follow the procedures described in Section 14.6 - 14.17 Result Interpretations and appropriate actions".

***Persistently indicates that measured temperature exceeds 20°C on at least two consecutive temperature monitoring visits.

**NOTE:** Ensure that all temperature measuring instruments including: thermometers; gauges and BMS Temperature monitoring points are adequately calibrated.

13.2 Lower than recommended HWS temperatures:

**Results Interpretation and Specific Action Required:** The information below is meant to indicate some possible causes and suitable remedial action and should not be considered exhaustive. Each failure must be considered in detail and the causes suitably addressed.

| 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.<br>• If temperature <50°C, and has been such for >4 hours, carry-out pasteurisation of vessel.<br>• Carry out biological sampling (Legionella) to ascertain effect of decreased HWS temperatures. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 2. Thermostat failure | • Replace thermostat.<br>• If temperature <50°C, and has been such for >4 hours, carry-out pasteurisation of vessel.<br>• Carry out biological sampling (Legionella) to ascertain effect of decreased HWS temperatures. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 3. Primary heating supply isolated | • Employ heating supply.<br>• Carry-out pasteurisation of vessel before use.<br>• Carry out biological sampling (Legionella) to ascertain effect of decreased HWS temperatures. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 4. Primary heating failure | • Repair primary heating supply.<br>• Carry-out pasteurisation of vessel before use.<br>• Carry out biological sampling (Legionella) to ascertain effect of decreased HWS temperatures. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 5. Generation units under-rating/under capacity | • Consider capacity vs demand and replace unit with more suitably sized vessel.<br>• Carry-out pasteurisation of replacement vessel prior to being put into service. |
| | 6. Temperature taken with contact probe | • Obtain 'direct' temperature, using calibrated thermometer, from ideally located sampling point and reconsider results. |
| | 7. Gauges and/or BMS temperature monitoring points not calibrated | • Calibrate all gauges and/or BMS monitoring points and reconsider results. |
| Distribution temperatures <50°C when Flow temperature >60°C in a significant number of outlets[♆] | 1. Excessive heat loss. | • Inspect HWS and CWS insulation and upgrade where practicable.<br>• Carry out biological sampling (Legionella) to ascertain effect of decreased HWS temperatures. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 2. Trace heating faulty or set at incorrect temperature. | • 5. Failure of Trace Heating system or Trace Heating system not extending to extremities of the system.<br>• Inspect the Trace heating system and repair/replace if necessary or extend system to allow for temperature maintenance to system spurs.<br>• Carry out biological sampling (Legionella) to ascertain effect of decreased HWS temperatures. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 3. Areas of "low-flow" or dead-legs in the system | • Increase water through-put by strategic flushing to reduce water retention time.<br>• Carry out biological sampling (Legionella) to ascertain effect of decreased HWS temperatures. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 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. |

| | | |
|---|---|---|
| | | • Carry out biological sampling (Legionella) to ascertain effect of decreased HWS temperatures. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |

ǂSignificant number of outlets constitutes a minimum of 12% of outlets in each system under surveillance.

*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.

**Biological sampling must be carried out as described in LEG 25 - 'Microbiological sample collection protocol'. On receipt of biological analysis results, follow the procedures described in Section 13.6 - 13.9 Result Interpretations and appropriate actions".

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

**NOTE:** Ensure that all temperature measuring instruments including: thermometers; gauges and BMS Temperature monitoring points are adequately calibrated.

13.3 Dead-legs and areas of infrequent use:

**Results Interpretation and Specific Action Required:** The information below is meant to indicate some possible causes and suitable remedial action and should not be considered exhaustive. Each failure must be considered in detail and the causes suitably addressed.

| 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.<br>2. Carry out biological sampling (Legionella) to ascertain effect of the dead-leg. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 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.<br>2. Consider the removal of the outlet.<br>3. Carry out biological sampling (Legionella) to ascertain effect of the dead-leg. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 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.<br>2. Ensure that the users undertake flushing of all identified infrequently used outlets on a twice weekly basis as described in LEG 35 - 'Dead Legs/Areas of Low Usage Evaluation and Flushing'.<br>3. Where infrequently used facilities are deemed to be no longer required, they should be reported to the Health, Safety and Compliance Officer EDS. |

*Biological sampling must be carried out as described in LEG 25 - 'Microbiological sample collection protocol'. On receipt of biological analysis results, follow the procedures described in Section 13.6 - 13.9 Result Interpretations and appropriate actions"

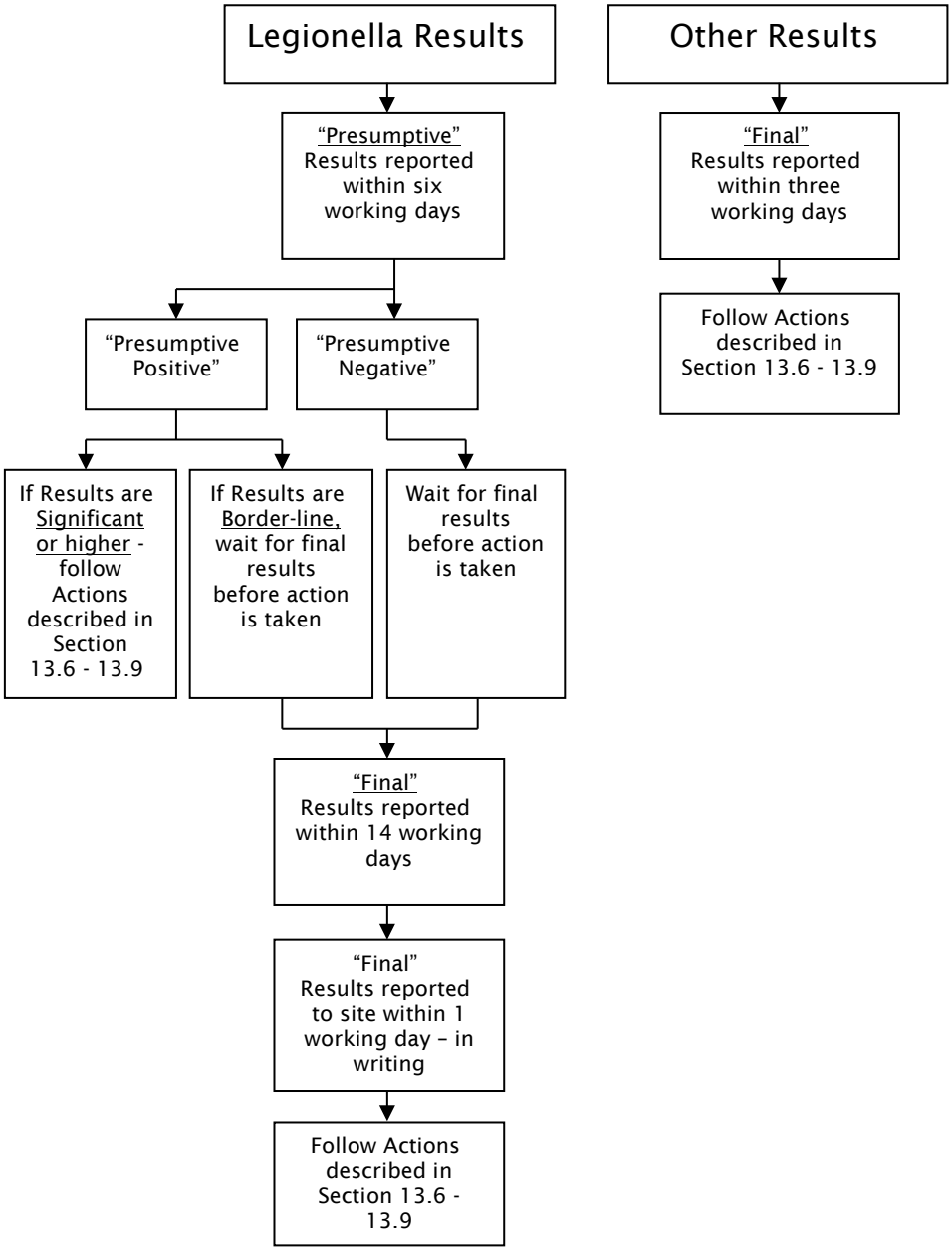
14.4 Lower and/or higher than recommended ClO2 levels:

**Results Interpretation and Specific Action Required:** The information below is meant to indicate some possible causes and suitable remedial action and should not be considered exhaustive. Each failure must be considered in detail and the causes suitably addressed.

| Result | Possible cause | Remedial Action |
|---|---|---|
| <0.25ppm at dosing point | 1. Chemical(s) levels depleted | • Check chemical(s) levels and top-up if depleted.<br>• If lower than recommended levels persist for more than three days, carry out *biological sampling (Legionella) to ascertain effect of the lower than recommended levels. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 2. Dosing equipment malfunctioning | • Check operating status of dosing equipment and contact service provider if found to be malfunctioning.<br>• If lower than recommended levels persist for more than three days, carry out *biological sampling (Legionella) to ascertain effect of the lower than recommended levels. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| >0.8ppm at dosing point | 1. Dosing equipment malfunctioning | • Isolate dosing equipment to disable further dosing of chemical.<br>• Check operating status of dosing equipment and contact service provider if found to be malfunctioning.<br>• Purge the system thoroughly until chemical level falls to within the recommended limits.<br>• Check random strainers/aerators for signs of significant biofilm contamination.<br>• If higher than recommended levels persist for more than three days, carry out *biological sampling (Legionella) to ascertain effect of the higher than recommended levels particularly to ascertain the potential of increased biofilm shearing. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| <0.1ppm at sentinel outlet | 1. Chemical(s) levels depleted | • Check chemical(s) levels and top-up if depleted.<br>• If lower than recommended levels persist for more than three days, carry out *biological (Legionella) to ascertain effect of the lower than recommended levels. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 2. Dosing equipment malfunctioning | • Check operating status of dosing equipment and contact service provider if found to be malfunctioning.<br>• If lower than recommended levels persist for more than three days, carry out *biological sampling (Legionella) to ascertain effect of the lower than recommended levels. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| | 3. 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.<br>• If lower than recommended levels persist for more than three days, carry out *biological sampling (Legionella) to ascertain effect of the lower than recommended levels. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |
| >0.5ppm at sentinel outlet | 1. Dosing equipment malfunctioning | • Isolate dosing equipment to disable further dosing of chemical.<br>• Check operating status of dosing equipment and contact service provider if found to be malfunctioning.<br>• Purge the system thoroughly until chemical level falls to within the recommended limits.<br>• Check random strainers/aerators for signs of significant biofilm contamination.<br>• If higher than recommended levels persist for more than three days, carry out *biological sampling (Legionella) to ascertain effect of the higher than recommended levels particularly to ascertain the potential of increased biofilm shearing. Upon receipt of results, follow protocol described in Section 13.6 - 13.9 of this document. |

**Biological sampling must be carried out as described in LEG 25 - 'Microbiological sample collection protocol'. On receipt of biological analysis results, follow the procedures described in Section 13.6 - 13.9 Result Interpretations and appropriate actions".

14.5 Results Reporting – How Am I Told About The Results?



13.6 Microbiological analysis results control parameters and interpretation key:

| Analysis Sample | Reported Results | Result Interpretation |
|---|---|---|
| Aerobic count<br>TVCC | None Detected- <1000cfu/ml | Pass |
| | >1,000cfu/ml | Fail |
| | *TVC should <u>not be</u> considered as quantitative but qualitative instead - indicative of changing conditions. Because of this, a 'base' line should be considered and established, which is representative of 'typical' conditions in any given system at any given time (taking into consideration variations in ambient conditions which may have an impact on TVC results).*<br>*These base lines differ from system to system and are dependent on numerous variables which must be established in order to understand the significance of the base line. If your base line is typically around the 100cfu/ml count then notice should be taken when results indicate an increase of a $10^1$ as these indicate proliferation - because of changing conditions in the system which need to be identified and addressed to bring back under control. The stringent levels in the WSP were set originally as we were in the middle of contamination. No problem with these being reviewed.* | |
| *Legionella sp*. | None Detected | Negative - Pass |
| | <100cfu/l | Insignificant - Pass |
| | >100cfu/l - <1,000cfu/l | Significant - Fail |
| | >1,000cfu/l | Highly Significant - Fail |
| Coliforms and *E. coli* | None Detected | Negative - Pass |
| | <1cfu/100ml | Negative - Pass |
| | >1cfu/100ml | Highly Significant - Fail |

13.7 Microbiological analysis results (Excluding *Pseudomonas aeruginosa*) - Pre-flush samples:

***A local risk assessment shall be carried out following specific requests from the Health, Safety and Compliance Officer EDS, using 'Pro-forma No. 5 Local Legionella Contamination Risk Assessment' found in 'Processes and Procedures and Permits' document.***

| PRE-FLUSH SAMPLE RESULT | | |
|---|---|---|
| **Result** | **Interpretation** | **Remedial Action** |
| Negative | N/A | • No action required.<br>• Consider the Post-flush results and action accordingly where required. |
| Insignificant | Insignificant levels of localised contamination only, if in the absence of positive post flush sample results. | • Flush outlet and review 'Usage Evaluation and Flushing' records and action accordingly.<br>• Clean and disinfect all aerators and flow straighteners. Renew where required. Consider their permanent removal.<br>• No re-sample required. Put outlet back in-use.<br>• Consider the Post-flush results and action accordingly where required.<br>• Review Management & Control Programme to ensure adequate and correct implementation. |
| Significant | Significant levels of localised contamination only if in the absence of positive post flush sample results. | • Carry out a local risk assessment in accordance with 'Pro-forma No. 5 Local Legionella Contamination Risk Assessment' found in 'Processes and Procedures and Permits' document.<br>• Consider the Post-flush sample result<br>• Outlet shall be removed from its location. Outlet shall be dismantled to its smallest component, cleaned and disinfected as described below:<br>1. Using extended test tube cleaning brushes the internal body shall be cleaned with a solution of 5ppm chlorine dioxide.<br>2. All other components shall be soaked for a 1 hour period in a 50ppm chlorine dioxide solution.<br>3. Clean and disinfect associated aerators and flow straighteners and TMV strainers. Renew where required. Consider their permanent removal.<br>4. All parts shall then be rinsed in clean cold water (from a different source if necessary).<br>5. A visual trace shall be carried out in and around the immediate area to establish any dead legs or very low usage outlets not connected to the return circuit.<br>6. Photographic evidence shall be provided.<br>• Flush outlet and review 'Usage Evaluation and Flushing' records and action accordingly.<br>• Carry out Re-sample no earlier than 48 hrs after the clean and disinfection. If this is a repeat +ve result, widen the sample locations schedule to ascertain extent of contamination results and action accordingly where required.<br>• Full report shall be issued on the receipt of the re-sampling results.<br>• Review Management & Control Programme to ensure adequate and correct implementation. |
| Highly Significant | Highly Significant levels of localised contamination only if in the absence of positive post flush sample results. | • Take outlet out of use immediately.<br>• Carry out a local risk assessment in accordance with 'Pro-forma No. 5 Local Legionella Contamination Risk Assessment' found in 'Processes and Procedures and Permits' document.<br>• Carry out all the steps, described in the 'Significant' section above.<br>• Where possible, install POU filter and put outlet back in-use whilst waiting re-sample results. Where the installation of POU filter is not possible, keep outlet out-of-use but continue to flush on a daily basis whilst waiting for the results.<br>• On the advice of the Health, Safety and Compliance Officer EDS, continue to keep the outlet out-of-use until negative results received from re-samples.<br>• Review Management & Control Programme to ensure adequate and correct implementation. |

13.8 Microbiological analysis results (Excluding *Pseudomonas aeruginosa*) - Post-flush samples:

***A local risk assessment shall be carried out following specific requests from the Health, Safety and Compliance Officer EDS, using 'Pro-forma No. 5 Local Legionella Contamination Risk Assessment' found in 'Processes and Procedures and Permits' document.***

| POST-FLUSH SAMPLE RESULT | | |
|---|---|---|
| **Result** | **Interpretation** | **Remedial Action** |
| Negative | N/A | • No action required. |
| Insignificant | Insignificant levels of systemic contamination, if in the presence of other post flush positive sample results. | • Carry out a local risk assessment in accordance with 'Pro-forma No. 5 Local Legionella Contamination Risk Assessment' found in 'Processes and Procedures and Permits' document.<br>• If found in the absence of others (in the majority) post flush positives; clean and disinfect all aerators and flow straighteners associated with outlets which return positives. Renew where required. Consider their permanent removal.<br>• No re-sample required. Put outlet back in-use.<br>• If found in the presence of other (in the majority) post-flush positives, carry out remedial action as described above and thoroughly and repeatedly flush the whole system and carry out re-sample. If this is a repeat positive result, widen the sample locations schedule to ascertain extent of contamination.<br>• On the advice of Health, Safety and Compliance Officer EDS; consider system disinfection and re-sample, no earlier than 48 hrs after the disinfection process.<br>• Review Management & Control Programme to ensure adequate and correct implementation. |
| Significant | Significant levels of systemic contamination, if in the presence of other post flush positive sample results. | • Carry out a local risk assessment in accordance with 'Pro-forma No. 5 Local Legionella Contamination Risk Assessment' found in 'Processes and Procedures and Permits' document.<br>• If found in the absence of others (in the majority) post flush positives; the outlet shall be removed from its location and dismantled to its smallest component, cleaned and disinfected as described below:<br>1. Using extended test tube cleaning brushes the internal body shall be cleaned with a solution of 5ppm chlorine dioxide.<br>2. All other components shall be soaked for a 1 hour period in a 50ppm chlorine dioxide solution.<br>3. Clean and disinfect associated aerators and flow straighteners and TMV strainers. Renew where required. Consider their permanent removal.<br>4. All parts shall then be rinsed in clean cold water (from a different source if necessary).<br>5. A visual trace shall be carried out in and around the immediate area to establish any dead legs or very low usage outlets not connected to the return circuit.<br>6. Photographic evidence shall be provided.<br>• Carry out Re-sample, no earlier than 48 hrs after the clean and disinfection. If this is a repeat positive result, widen the sample locations schedule to ascertain extent of contamination.<br>• If found in the presence of other (in the majority) post-flush positives, carry out remedial action as described above **and** carry-out system disinfection (including all source units) and re-sample (including from the incoming mains and all source units,, no earlier than 48 hrs after the disinfection process. If this is a repeat positive result, widen the sample locations schedule to ascertain extent of contamination.<br>• Review Management & Control Programme to ensure adequate and correct implementation.<br>• If persistent post-flush positive, consider the installation of an on-line disinfection system capable of controlling bacterial contamination independent to temperature control requirements. |

| POST-FLUSH SAMPLE RESULT (Continued//...) | | |
|---|---|---|
| **Result** | **Interpretation** | **Remedial Action** |

| | | |
|---|---|---|
| Highly Significant | Highly significant levels of systemic contamination, if in the presence of other post flush positive sample results. | • Take outlet out of use immediately.<br>• Carry out a local risk assessment in accordance with 'Pro-forma No. 5 Local Legionella Contamination Risk Assessment' found in 'Processes and Procedures and Permits' document<br>• If found in the absence of others (in the majority) post flush positives; the outlet shall be removed from its location and dismantled to its smallest component, cleaned and disinfected as described below:<br>1. Using extended test tube cleaning brushes the internal body shall be cleaned with a solution of 5ppm chlorine dioxide.<br>2. All other components shall be soaked for a 1 hour period in a 50ppm chlorine dioxide solution.<br>3. Clean and disinfect associated aerators and flow straighteners and TMV strainers. Renew where required. Consider their permanent removal.<br>4. All parts shall then be rinsed in clean cold water (from a different source if necessary).<br>5. A visual trace shall be carried out in and around the immediate area to establish any dead legs or very low usage outlets not connected to the return circuit.<br>6. Photographic evidence shall be provided.<br>• Carry out Re-sample, no earlier than 48 hrs after the clean and disinfection. If this is a repeat positive result, widen the sample locations schedule to ascertain extent of contamination.<br>• Carry out Re-sample no earlier than 48 hrs after the clean and disinfection. If this is a repeat positive result, widen the sample locations schedule to ascertain extent of contamination.<br>• If found in the presence of other (in the majority) post-flush positives, take whole system out of use and carry out remedial action as described above **and** carry-out system disinfection (including all source units) and re-sample (including from the incoming mains and all source units,, no earlier than 48 hrs after the disinfection process. If this is a repeat positive result, widen the sample locations schedule to ascertain extent of contamination<br>• On the advice of the Health, Safety and Compliance Officer EDS continue to keep system out-of-use until negative (satisfactory) results received from re-sample results in high risk 'User' areas, or, again on the advice of the Health, Safety and Compliance Officer EDS and where practicable, install POU filters to allow continued use of the system whilst awaiting for sample results.<br>• Review Management & Control Programme to ensure adequate and correct implementation.<br>• If persistent post-flush positive, consider the installation of an on-line disinfection system capable of controlling bacterial contamination independent to temperature control requirements. |

13.9 Legionella contamination local risk assessments:

The following are additional actions to follow in the event of Highly Significant *Legionella* biological sample analysis result or a confirmed or suspected diagnosis of a Legionellosis. In addition, a local risk assessment 'Pro-forma No. 5 Local Legionella Contamination Risk Assessment', as described 'Processes and Procedures and Permits' document shall be carried out following specific requests from the Health, Safety and Compliance Officer EDS.

The purpose of the Local Risk Assessment is to carry out a detailed coordinated assessment of the 'User's environment and water system in an area where a 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, where practicable and appropriate, an assessment of the 'User's health shall be carried out so that appropriate measures are taken to protect any 'User's 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 EDS Management Team.

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

# 14. THE COURSE OF ACTION IF AN OUTBREAK OF LEGIONNAIRES' DISEASE IS SUSPECTED

The University will usually be informed of a suspected outbreak of Legionnaires Disease by a member of the Health and Safety Manager or Health and Safety Executive. If an outbreak is suspected, then the EDS Management Team shall normally work in association with the Public Health Laboratory and the local Medical 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 Act 1974. 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 Engineers role is an important one - guiding specialists to the various water systems within the building, and, in particular, 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:

a. the domestic hot and cold water system distribution;
b. showers or spray washing equipment;
c. drainage systems and taps;
d. whirlpool baths or therapy pools;
e. humidifiers in ventilation systems;
f. cooling coils in air conditioning systems;
g. fountains and sprinklers;

To assist in such investigations the EDS Management Team need to be able to provide details of all associated equipment, its location, technical data, the operating, 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.

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 EDS Management Team is responsible for identifying the cause of infection and will advise on cleaning, disinfection, any engineering modifications and long-term control measures.

# 15. MAJOR OUTBREAK PLAN

Please refer to the 'Guidance on the Control and Prevention of Legionnaires' Disease in England Technical Paper 1 - Disease Surveillance  Date of Issue: August 2010 Document code: LegDisTP1 Version: 01.00