Managing the Risk of Legionnaires' Disease in Emergency Safety Showers, Eyebaths, and Facewash Fountains

Guidance produced by a
Water Management Society Working Party
First published June 2008

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Introduction

Management and control of Legionnaires' disease is described in the HSE Approved Code of Practice and Guidance Document 'Legionnaires' disease. The control of legionella bacteria in water systems' (L8). This document is divided into three main parts. These are:

The Approved Code of Practice,
Guidance on the control of legionella in cooling water systems, and
Guidance on the control of legionella in hot and cold water services.

L8 recognises that other types of water system can potentially harbour the legionella bacteria that give rise to Legionnaires' disease. Some of these systems are listed in Appendix 1 of L8 as *Checklist 3: Other risk systems*. This Checklist gives brief guidance on controlling legionella bacteria in the systems listed, but this guidance does not match the detail given earlier in L8 on controlling legionella in cooling systems and in hot and cold water services.

The document presented here is one of a series published by The Water Management Society. Each document in the series highlights a specific type of system in which it is recognised that there is a risk of Legionnaires' disease from the proliferation of legionella bacteria. The purpose of each document in the series is to discuss the issues that give rise to the risk and to offer guidance on controlling this risk. It should be noted that, although this guidance is given in some detail, each system is unique and the approach adopted in controlling the risk must therefore be based on the risk assessment of each specific system.

It should be emphasised that the guidance offered here is the considered opinion of The Water Management Society. No guidance document can offer complete protection from risk, but it is the Society's belief that, if this guidance is followed, then the risk of contracting Legionnaires' disease will be controlled and so reduced.

Legionella will grow in any water system where:

- The temperature of the water is between 20 and 45°C in any part of that system
- There is sediment, sludge or other nutrients which will support microbial growth
- There are biofilms (or slimes) which may support the potential for legionella survival and growth
- There is scale and/or corrosion (iron is a growth factor for legionellae)

Where there is also the potential for aerosols to be formed there is an increased risk for causing Legionnaires disease.

Areas of no or low flow (stagnant areas) increase the risk of microbial growth.

Emergency Safety Showers, Eyebaths, and Facewash Fountains

It is important to keep the risk of contracting Legionnaires' disease from an emergency safety shower, eyebath, and facewash fountain in perspective. The purpose of the unit clearly is to provide a measure of protection to the victim of accidental exposure to hazardous chemicals, etc. The risk of contracting Legionnaires' disease is therefore a secondary consideration and must not be allowed to diminish the function of the primary objective of the unit.

Neither should it be assumed that Legionella are the only microbial species that can give rise to health risks in such a system. Skin and eye problems can also arise from risk of exposure to species such as *Acanthamoeba*, which can cause keratitis and *Pseudomonas aeroginosa*, which are not within the scope of this document.

Emergency safety showers, eyebaths, and facewash fountains are found wherever there is a risk of individuals coming into skin or eye contact with hazardous substances, e.g., .chemicals such as strong acids and alkalis, radiation, and microbial hazards. They might also be installed where there is a risk of burns or scalds or of foreign bodies entering the eyes. They are found throughout industrial sites, in laboratories, and in some public buildings (e.g., hospitals) where hazardous substances are used. Their purpose is to be available for use in emergency situations to provide a plentiful supply of water to wash the affected area. In general, a wash time of 10 – 15 minutes is required. By their very nature, they remain unused for long periods of time. In recognition of this, L8 Appendix 1, *Checklist 3* under the heading 'Emergency showers and eye wash sprays' recommends that they are flushed through and purged to drain every six months or more frequently if recommended by manufacturers.

Large industrial sites with emergency safety showers, eyebaths, and facewash fountains often have more than one source of water supply. The UK health and safety legislation applicable to emergency safety showers, eyebaths, and facewash fountains generally requires water to be 'clean and cool'. The American Standard specifies that only potable water should be used. The German DIN Standard specifies that, when used in a laboratory, emergency eyebaths are required to be supplied from a drinking water source.

Where prolonged full-body irrigation is not required, i.e., when it is unlikely that whole body contamination will occur, the use of a sterile water bottle is favoured; this needs to be changed at regular intervals in line with the 'use-by-date', as the bottles ultimately become brittle. The quality of water stored for long periods of time in plastic bottles may also deteriorate due to microbial growth and cause eye infections.

When designing an emergency safety shower, eyebath, and facewash fountain system, there are four essential requirements. These are:

a) an adequate water flow,
b) ease of operation,
c) instant and positive operation, and
d) reliability.

Industrial emergency safety showers differ in design requirements from those used in laboratories, especially with regard to flow rates. In a laboratory, the quantities of chemical handled are relatively small, and laboratory emergency safety showers therefore have lower design flow requirements than industrial ones.

Industrial emergency safety showers are designed to deliver a conical deluge of water from the shower head at a minimum rate of 75 litres/min from a water pressure of 2.1 bar (30psi) (30 litres/min from 1 bar for laboratory units). Industrial eyebaths and facewash fountains are designed to deliver a minimum flow of 11.5 litres/min (6 litres/min from 1 bar for laboratory units).

Units are designed to be readily accessible, easily activated, and quick acting, with valves that stay open so that the hands remain free to remove contaminated clothing.

They are designed to have instant and positive operation, since every second counts in an emergency. Maximum flooding action is required within 1 second.

Reliability is vital. Emergency safety showers, eyebaths, and facewash fountains must be capable of performing to their required design parameters even after long periods of idleness. They must therefore be made to a very high quality standard with robust corrosion resistant components. Units located outdoors must not freeze in cold climates; neither should they overheat in hot climates. They must be easily accessible at all times and not used as storage areas (either temporary or permanent).

Emergency safety showers, eyebaths, and facewash fountains that are located outdoors often have supply lines to the unit that are insulated and fitted with trace heating to prevent freezing in cold climates. Insulation also protects against high water temperatures in hot climates.

Emergency safety showers, eyebaths, and facewash fountains can either be fed directly from a water supply, or they can incorporate a tank in which the shower, eyebath, and facewash fountain water is stored. The latter is especially popular where warm water decontamination is essential to wash off certain specific hazardous substances. The tanks are fitted with thermostatically controlled immersion heaters to heat the stored water.

Water temperature is an important issue in the design of emergency safety showers, eyebaths, and facewash fountains. Temperatures in excess of 38^{o}C have proven to be harmful to the eyes and can enhance chemical interaction with eyes and skin. Temperatures of 40^{o}C and above can result in first degree burns on skin that has already been damaged by burns or abrasion. Medical evidence suggests that cool water is better for washing chemicals off the skin as it soothes the affected area and also closes the pores, which reduces absorption of the chemical through the skin. The American Standard recommends a minimum showering temperature of 15^{o}C.

Commonly used materials of construction are galvanised steel, stainless steel, and plastics. Plastics are used extensively in emergency safety showers, eyebaths, and facewash fountains because they do not corrode. They are used in the construction of eyebath bowls, valve levers, outer jackets on heated models, and water storage tanks. Plastic coating over stainless steel is effective at minimising corrosion on operating handles and linkages, and stainless steel nuts, bolts and washers are commonly used. ABS and GRP components are also commonly used.

Testing and Servicing

L8 recommends that little-used systems should be flushed on a weekly basis.

The American Standard specifies that emergency safety showers, eyebaths, and facewash fountains should be flushed at least once a week to verify proper operation. In high hazard environments, as identified by risk assessment, eyebaths and face-wash fountains should be tested daily to verify proper operation and cleaned frequently. Tests should be logged and audited.

A comprehensive service procedure would include the following:

Activation of the shower / eyebath / facewash to flush the line and verify proper operation.
Removal and cleaning and disinfection of the eyebath / facewash 'Y' strainer.
Cleaning and disinfection of nozzles and roses.
Cleaning of the shower exterior and cleaning eyebath and facewash units.
Activation of the eyebath to set volume controls and adjust flow regulators.
Cleaning and disinfection of tanks on tank showers using 50 mg/l of free chlorine for 1 hour.
Checking water temperatures, thermostat operation and thermostat settings.
Legionella sampling and testing under certain recommended circumstances are described in the Guidance section of this document
The recommended frequencies at which each of these operations should be conducted are discussed in the Guidance section of this document.

Factors Affecting Legionella Risks Associated with Emergency Safety Showers, Eyebaths, and Facewash Fountains

The following factors need to be considered when assessing the risk of contracting Legionnaires' disease from emergency safety showers, eyebaths, and facewash fountains.

Water Quality – Water supplied to the unit might come directly from the mains. However, on industrial sites it could come from a process water source. Industrial process waters are often pre-treated to make them suitable for their intended industrial purpose. Water qualities vary depending on pre-treatment. Ideally, only mains should be used for emergency showers because of the increased risk of infection on physically or chemically damaged skin.

Supply Pipelines – Emergency safety showers, eyebaths, and facewash fountains remain idle for long periods. The water in the supply line to the unit is also idle from the point of common supply. The risk assessment must consider the condition of the supply line, materials of construction, and the volume (i.e., length and internal diameter) of water held in the stagnant zone from the common supply to the unit compared with the volume replaced during routine flushing.

Tank Storage – Where stored water must be used for emergency showers the quality of the water must be maintained to potable quality standards because of the increased infection risk. In units with stored water, the condition and design of the water storage tank must be considered when assessing the risk. The tank should be kept clean and free from corrosion and should be designed to minimise the risk of ingress of foreign bodies, e.g., dust, insects, etc. The risk assessment should also consider the volume of stored water compared with the volume replaced during routine flushing.

Temperature – *Legionella pneumophila* proliferate in the temperature range 20 – 45^{o}C. When assessing the risk in emergency safety showers, eyebaths, and facewash fountains it is therefore important to assess the temperature of the water used and to consider seasonal variations. In units with tank storage, the thermostatically set water temperature must be considered. In warm weather, particularly in the summer, account should be taken of the potential for growth if mains water input exceeds 20^{o}C.

Flushing Regime – The frequency of flushing, the length of flushing time, and the water flow rate at each flushing should be taken into account and compared with the volume of water in the stagnant zone (supply pipeline or storage tank).

Maintenance, Cleaning, and Disinfection – The risk assessment should also consider the comprehensiveness of the maintenance schedule, the frequency of cleaning and disinfection, and the method used during cleaning and disinfection.

Management and Procedures – Management structure, definition of responsibilities, lines of communication, training, written procedures, record keeping, etc., are all important factors when assessing the risk. These issues are all covered in detail in L8.

Guidance on Managing the Risk of Legionnaires' Disease in Emergency Safety Showers, Eyebaths, and Facewash Fountains

Water Quality – Water used in emergency safety showers, eyebaths, and facewash fountains should preferably be of mains water quality. If process water is used, then it should be of suitable quality, i.e., clean / filtered and pre-treated as required.

Equipment Condition – It is important to keep equipment in good, clean condition, free from nutrients, corrosion and deposits so that *Legionella* bacteria are denied the environment in which they could proliferate.

Water Temperature – *Legionella* bacteria proliferate in the temperature range 20 – 45^{o}C. Wherever possible, water temperatures in emergency safety showers, eyebaths, and facewash fountains should be kept below 20^{o}C. If there are reasons why this cannot be done, e.g., higher temperatures are needed to decontaminate certain chemicals, then other, more stringent, precautionary measures should be taken to control the risk, e.g., a more regular flushing regime and / or more frequent cleaning and disinfection.

Flushing Regimes – When determining the flushing frequency and length of time for a flushing regime for a directly fed emergency safety shower, eyebath, and facewash fountain system, the aim should be to flush thoroughly, e.g. drawing off a volume at least three to five times the volume of water held in the stagnant zone. This can be calculated from pipe size and length from the point of common supply to the unit, plus knowledge of the design flow rate of the unit at the pressure of the water supply system.

When determining the frequency and length of time for each flush for a tank-fed system, the calculation should take into account the volume of water stored in the tank and the design flow rate at the pressure of the unit. It is also important to calculate the volume of water in the supply pipe from the common supply to the storage tank make up valve and to compare this with the volume of stored water.

The following Table gives a guide to pipe sizes and water volumes.

Supply Pipe Size	Approximate Volume per Metre	3 x Volume per Metre	5 x Volume per Metre
22mm	380ml	1.2 litres	1.9 litres
28mm	615ml	1.9 litres	3.1 litres
35mm	960ml	2.9 litres	4.8 litres
42mm	1.4 litres	4.2 litres	7.0 litres
54mm	2.3litres	6.9 litres	11.4 litres

L8 recommends in Appendix 1, *Checklist 3* that flushing should be conducted every six months or more frequently if recommended by manufacturers. Elsewhere in L8 (Paragraph 165 and Appendix 1, *Checklist 2*), weekly flushing of little used showers and taps is recommended. The most appropriate frequency should be determined by the risk assessment. It is, in any case good practice to activate the unit once a week to verify proper operation.

Inspection and Cleaning & Disinfection – L8 recommends in Appendix 1, *Checklist 2* that hot and cold water system shower heads are cleaned and disinfected quarterly or as necessary. It is recommended here that the quarterly regime should be extended to include emergency safety shower, eyebath, and facewash fountain shower heads, nozzles, and roses, and eyebath / facewash 'Y' strainers. The cleaning and disinfection procedure should be as described in L8, i.e., 50 mg/l of free chlorine for one hour. . It must be emphasised that any cleaning must take place without removal of the system from service unless an alternative is available. Since 100% of people are susceptible to chemical burns, and only approximately 1% to contracting legionnaires' disease, there must always be washing water available in case of spillage during the operation.

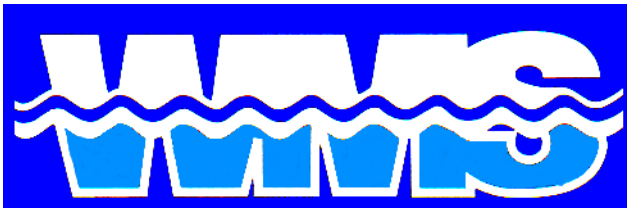
L8 recommends in Paragraph 182(a) that cold water storage tanks should be inspected annually. The same Paragraph and Paragraph 190 recommend that the tank should be cleaned and disinfected if the inspection deems it to be necessary. In view of the potential for stagnation of water in a tank-fed emergency safety shower, eyebath, and facewash fountain system, it is recommended that the tank is inspected monthly and cleaned and disinfected at quarterly intervals.

Since the risk of exposure to hazardous chemicals greatly exceeds the risk of contracting Legionnaires' disease from the emergency shower system, it is important not to overlook this when planning the cleaning and disinfection of the header tank, shower head, eyebath, and face-wash fountain. The timing of the cleaning and disinfection operation should be subject to risk assessment and done when the risk of exposure to hazardous chemicals is nil or at its lowest. Collaboration with Site Safety Officers is imperative in the planning and implementation of any clean and disinfection. Factors that might be considered are: a) can the job be done when hazardous chemicals are not present, e.g., during a shutdown, b) if some risk of exposure to hazardous chemicals is inevitable, can temporary alternative emergency shower arrangements be made, e.g., use of a mobile unit or an adjacent emergency shower?

Temperature Monitoring – L8 recommends that cold water outlet temperatures at sentinel taps are measured monthly after running the tap for two minutes. It is recommended here that weekly temperatures are monitored. This can be done conveniently at the time of flushing.

Sampling and Testing for Legionella – L8 makes no specific recommendations on sampling and testing for Legionella bacteria in domestic hot and cold water distribution systems including domestic showers, except in special circumstances, e.g., where temperature regimes cannot be or are not being maintained, under some conditions where biocides are being dosed, and where there is an

especially vulnerable population, e.g., in certain hospital wards. (See L8 paragraph 185 for full details.). However, in view of the potential for stagnation in emergency safety shower, eyebath, and facewash fountain systems, it is recommended that Legionella sampling and testing is done if the risk assessment indicates the presence of a particularly high risk. Circumstances that might be considered to constitute such a high risk are, for example, tank water storage temperatures or supply line temperatures between 20 and 45^{o}C, corrosion problems in the system or the supply to it, deposits in the system or the supply to it, unavoidably long periods of water stagnation, etc. The chosen frequency of sampling should be quarterly, unless the risk assessment indicates that more frequent sampling is necessary.



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