

**Scottish Health Technical Memorandum**  
**04-01:**  
Water safety for healthcare premises:  
Part C: TVC Testing Protocol

# Contents

	<i>Page</i>
<b>Acknowledgements .....</b>	<b>3</b>
<b>Preface .....</b>	<b>4</b>
About Scottish Health Technical Memoranda.....	4
<b>1. Introduction .....</b>	<b>7</b>
1.1 Preamble .....	7
<b>2. Collection procedure and location of samples .....</b>	<b>8</b>
2.1 Samples collection procedure .....	8
2.2 Location of samples .....	8
<b>3. Frequency of sampling .....</b>	<b>9</b>
3.1 General.....	9
<b>4. Sampling organisation.....</b>	<b>10</b>
4.1 General.....	10
4.3 Sampling (following BS7592: 2008 guidelines) .....	10
<b>5. Results expected.....</b>	<b>14</b>
5.1 General.....	14
<b>References.....</b>	<b>16</b>

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## Acknowledgements

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Health Facilities Scotland would like to thank the National Water Services Advisory Group for their contributions and efforts in the production of this Scottish Health Technical Memorandum (SHTM) 04-01 Part C.

## Preface

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### About Scottish Health Technical Memoranda

Engineering Scottish Health Technical Memoranda (SHTMs) give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare.

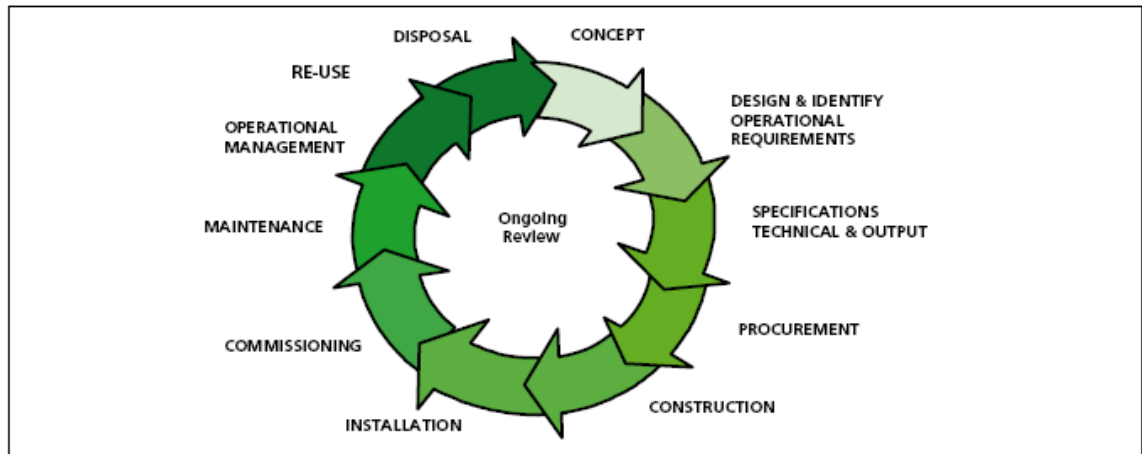
The focus of SHTM guidance remains on healthcare-specific elements of standards, policies and up-to-date established best practice. They are applicable to new and existing sites, and are for use at various stages during the whole building lifecycle: Healthcare providers have a duty of care to ensure that appropriate engineering governance arrangements are in place and are managed effectively. The Engineering Scottish Health Technical Memorandum series provides best practice engineering standards and policy to enable management of this duty of care.

It is not the intention within this suite of documents to repeat unnecessarily international or European standards, industry standards or UK Government legislation. Where appropriate, these will be referenced.

Healthcare-specific technical engineering guidance is a vital tool in the safe and efficient operation of healthcare facilities. Scottish Health Technical Memorandum guidance is the main source of specific healthcare-related guidance for estates and facilities professionals.

The core suite of eight subject areas provides access to guidance which:

- is more streamlined and accessible;
- encapsulates the latest standards and best practice in healthcare engineering;
- provides a structured reference for healthcare engineering.



Healthcare building life-cycle

## Structure of the Scottish Health Technical Memorandum suite

The series of engineering-specific guidance contains a suite of eight core subjects:

Scottish Health Technical Memorandum 00: Policies and principles (applicable to all Scottish Health Technical Memoranda in this series).

Scottish Health Technical Memorandum 01: Decontamination

Scottish Health Technical Memorandum 02: Medical gases

Scottish Health Technical Memorandum 03: Heating and ventilation systems

Scottish Health Technical Memorandum 04: Water systems

Scottish Health Technical Memorandum 05: Reserved for future use

Scottish Health Technical Memorandum 06: Electrical services

Scottish Health Technical Memorandum 07: Environment and sustainability

Scottish Health Technical Memorandum 08: Specialist services

Some subject areas may be further developed into topics shown as -01, -02 etc and further referenced into Parts A, B etc.

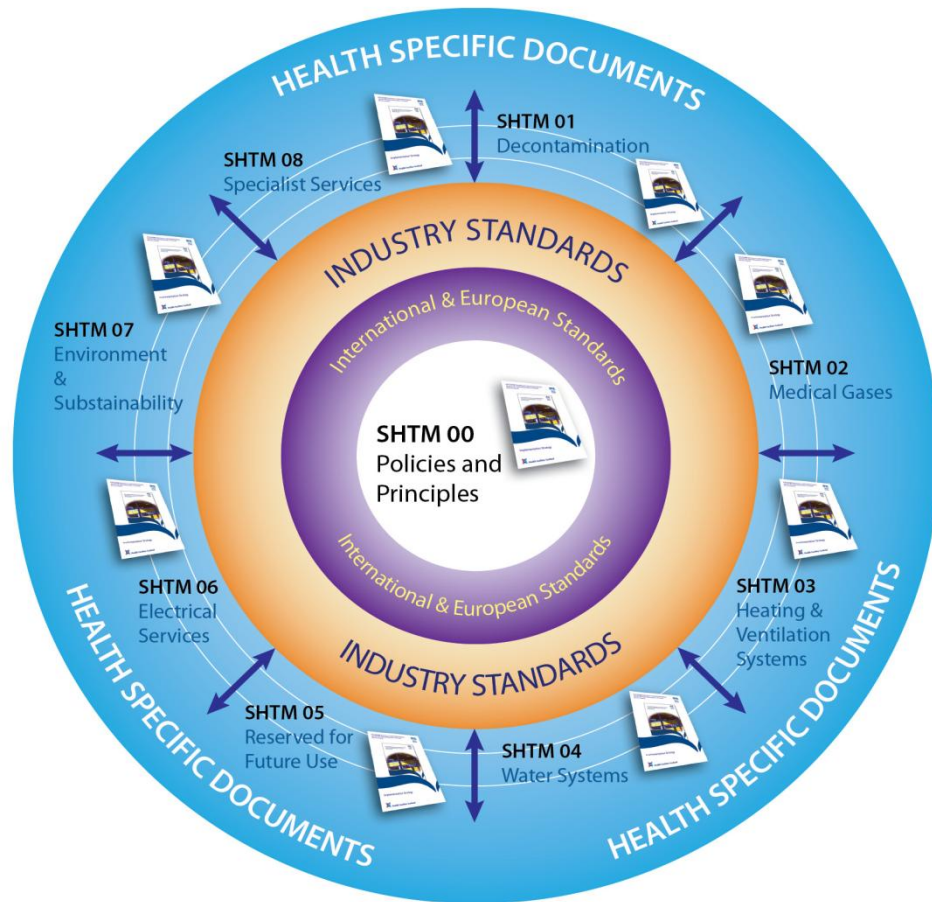
Example: Scottish Health Technical Memorandum 06-02 Part A will represent: Electrical safety guidance for low voltage systems.

In a similar way Scottish Health Technical Memorandum 07-02 will simply represent: Environment and Sustainability – EnCO<sub>2</sub>de.

All Scottish Health Technical Memoranda are supported by the initial document Scottish Health Technical Memorandum 00 which embraces the management and operational policies from previous documents and explores risk management issues.

Some variation in style and structure is reflected by the topic and approach of the different review working groups.

Health Facilities Scotland wishes to acknowledge the contribution made by professional bodies, engineering consultants, healthcare specialists and NHS staff who have contributed to the review.



Engineering guidance structure

# 1. Introduction

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## Preamble

- 1.1 Although Scottish Health Technical Memorandum (SHTM) 04-01 Part B paragraph 9.1 states that routine quality control microbiological testing for TVCs is no longer considered to be necessary (other than where there are taste or odour problems), many estates personnel invariably have them undertaken on a regular basis after acceptance of installations as a 'rule of thumb' indicator by which an abnormal change assists in identifying potential problems at an early stage. This narrative sets out procedures to be followed.

## 2. Collection procedure and location of samples

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### Samples collection procedure

- 2.1 Sampling points should be selected on the basis of risk assessments relating to system configuration or patient susceptibility.
- mark all sampling locations on up to date “As Fitted” drawings;
  - allocate each sampling location a unique reference number;
  - follow the procedures set out in The European Directive 98/83/EC.

### Location of samples

- 2.2 Samples should be taken from:
- inlet and outlet at cold water storage tanks;
  - incoming main, close to meter, where facilities exist to do so;
  - possible stagnant areas within tanks pending rectification of any identified problem;
  - beginning, mid-point and end of cold distribution system (i.e. sentinel outlets);
  - special supplies to kitchens, pharmacies, etc;
  - calorifier outlet;
  - nearest hot water tap to calorifier;
  - most distant hot water tap from calorifier (i.e. sentinel outlet);
  - return to calorifier;
  - typical samples from heated circulating water.



## 3. Frequency of sampling

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### General

3.1 This should be carried out quarterly

- although TVCs are in themselves innocuous the testing procedures are intended to provide an early warning system whereby elevated TVCs should trigger some form of action to determine the identity of the organism and implement the appropriate treatment;
- this could inform adjustment of disinfection doses, cleaning and flushing procedures.

## 4. Sampling organisation

### General

- 4.1 United Kingdom Accreditation Service (UKAS) or ISO 9002 accredited laboratories should always be used for analysis.
- 4.2 Sampling should be undertaken in accordance with European and British Pharmacopoeia requirements to test the total number of bacteria, yeasts and moulds within water services distribution pipework.

### Sampling (following BS7592: 2008 guidelines)

#### Sample Containers

- 4.3 For testing samples of Coliforms, Escherichia coli, Pseudomonas Aeruginosa, Aerobic Colony Counts and Environmental Mycobacteria 1 x sterile 500ml plastic bottle should be used containing a pre-dosed standard volume of neutraliser to neutralise any residual disinfectant in the water.

**Note:** The most commonly used neutraliser, which is appropriate for chlorinated or brominated water systems and those using ozone or hydrogen peroxide, is sodium thiosulphate. For mains water and hydrotherapy pools, 18 mg/litre sodium thiosulphate should be added. However, for cooling towers, 180 mg/litre (i.e. sufficient to neutralise 50mg chlorine per litre) must be used. If alternative disinfection methods are used, the laboratory should be contacted to obtain the appropriate neutraliser, if one is available.

For testing samples of *Legionella* (and other pathogenic bacteria such as Salmonella, Campylobacter and E.coli O157) 1 x sterile 1 litre plastic bottle (NB: using 2 x 500ml plastic bottles might be more practical) should be used containing standard amounts of pre-dosed neutraliser (dependent on bottle capacity) to neutralise any residual disinfectant in the water, all as above. Sampling procedures should be adhered to rigorously.

The same sample bottle is often used for *Legionella* and TVC counts testing but separate bottles for each are advised to be technically correct.

Sampling for Indicator Organisms (TVCs) should be undertaken as laid down in "The Microbiology of Drinking Water, 2010, Part 2: "Practice and procedures for sampling" published by the Environment Agency.

#### Sampling tap water

- 4.4 The following sampling procedure should be followed:
- where possible, ensure that the tap is in good condition with no leaks. Mixer taps should be avoided if possible;
  - remove any internal and external fittings such as hosing;

- clean the end of the tap thoroughly with a clean disposable cloth (and detergent if necessary). Sterilise with sodium hypochlorite solution (sufficient to give 1% available chlorine) made up on the day of use, or chlorine dioxide foam. Sterilisation can be carried out by preparing a hypochlorite solution in a measuring jug and by suspending it under the tap such that the end of the tap is immersed in the solution for 2 - 3 minutes. Alternatively, use a wash bottle to spray hypochlorite solution onto the outside and inside of the tap spout. Leave for 2 - 3 minutes before rinsing;

**Safety Note:** Sodium hypochlorite is highly corrosive and should be handled with care. Nitrile gloves and goggles should be worn, and if contact with skin, eyes or clothes occurs, wash the affected area immediately with copious amounts of water. Contact with clothes may result in a bleaching effect.

- turn on the tap gently to avoid unnecessary aerosol production and run water to waste for two to three minutes;

**Note:** For initial system sampling take a Post-Flush sample (as defined in BS 7592: 2008) at sentinel points without disinfection. Where there is an initial concern with a particular outlet location – say, a combined system and outlet problem – a BS Pre-Flush sample should be taken. If concerns persist with an outlet location (typically, a known dead-leg issue or lack of, or low, water use, a further BS Pre-Flush sample should be taken followed by disinfection before a BS Post-Flush with disinfection sample. Water should be allowed to run hot for 1 minute and cold for 2 minutes by which sampling would be temperature calibrated.

- aseptically open a labelled sterile bottle (1 litre or 500ml bottle containing neutraliser; as paragraph 4.3), fill almost to the brim with water, replace and tighten the lid and shake the bottle to distribute the sodium thiosulphate;
- there is no prescriptive cooling method or temperatures but ideally, water samples should be transported as taken but stored at between 6°C and 18°C if a delay is anticipated prior to despatch to a (remote) laboratory. Samples should be transported out of the sun as outlined in BS6068 and ISO 11731. Most samples are transported in shopping trolleys or plastic trays as soon as possible. Guidelines do not require samples to be cooled down prior to transportation. However they should be submitted to the accredited laboratory to ensure that they can be examined promptly, ideally the same day, but always within 24 hours of collection. Where the accredited laboratory is on campus where the samples are drawn, the timescale from source to lab should be no greater than 2 hours. If there is a delay in sending samples to a laboratory, they should be stored at between 6°C and 18°C.

### Sampling Shower or Mixer Tap Water

4.5 The following sampling procedure should be followed:

- normally use a 1 litre sample which should be taken from each shower head/outlet;
- before turning on the shower/outlet, adjust the temperature setting to the midpoint for non-thermostatic taps and the normal use temperature (35°C to 43°C) for thermostatic taps;
- place a sterile plastic bag over the shower head/outlet and secure with a rubber band. Using sterile scissors cut off one of the bottom corners of the bag to form a funnel. Use this funnel to fill the bottle;
- replace and tighten the lid and shake the bottle to distribute the sodium thiosulphate;
- all water samples for *Legionella* analysis should be stored at an ambient temperature (approximately 20°C), in the dark, and returned to the accredited laboratory as soon as possible to ensure that they can be examined promptly, preferably the same day but at the latest so that processing can begin within 24 hours of taking the sample.

### Sampling Swimming, Spa and Hydrotherapy Pool Water

4.6 The following sampling procedure should be followed from a number of sample points and from the balance tank (and swab samples from inside/behind any jets):

- outside shoes should be removed or plastic shoe coverings should be worn if entering swimming pool areas;
- wipe the outside of a sterile bottle (500ml sample bottle containing neutraliser as [paragraph 4.3](#)) with an alcohol wipe if not individually packed, and label with a waterproof marker or ball point pen;
- aseptically open the bottle;
- immerse the bottle, keeping the long axis approximately horizontal but with the neck pointing slightly upwards to avoid loss of the neutralising agent;
- once the bottle is immersed to about 200–400mm below the surface, tilt the bottle to allow it to fill, leaving a small headspace;
- on removal from the water, immediately replace the cap and shake the sample to disperse the neutralising agent;
- water samples should be stored between 2°C and 8°C, and submitted to the laboratory in a timely way to ensure that they are examined on the day of collection or at least within 24 hours of the collection;
- if both routine testing parameters and *Legionella* are required, then separate 1 litre and 500ml samples should be taken;
- it is also good practice to determine total and combined disinfectant levels and pH value from the same site as the microbiological sample. These should be determined in a separate sample collected in a bottle without any neutralising agent (e.g. a sterile plastic universal) and the tests carried out at the pool-side. These results together with information on the number of users in the pool at the time of sampling should accompany the sample to

the laboratory. Also the number of bathers should be noted together with the type of disinfectant in use;

- identification information for each individual sample should be given to the accredited laboratory to confirm;
  - the specific sampling point;
  - the room/location of sampling point;
  - the premises, building block, floor etc.

## 5. Results expected

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### General

- 5.1 Tests could take between 5 and 10 days to complete:
- an early warning can be requested by phone or email to confirm product failing to meet its specification prior to completion of testing;
  - micro-organisms for which tests are to be carried out would include E coli, staphylococcus aureus and pseudomonas aeruginosa;
  - written reports to be provided on completion via paper copies and email advising the number of bacteria, yeasts and moulds per gram of product;
  - in smaller healthcare premises, depending on configuration of systems, it may be possible to continue functioning despite adverse readings by switching to bottled supplies for drinking water purposes.

### Sampling Procedures

- 5.2 The Sampling and Leachate Testing should to be undertaken is detailed in SHTM 04-01 Part E.
- 5.3 As described in [paragraph 4.4](#) sampling must follow that set out in BS7592: 2008 Code of Practice and BS EN ISO 5667-1: 2007 on Water Quality Sampling. Those organising sampling must make clear in advance which water quality technique is to be undertaken in order that systematic conclusion on risk can be drawn.
- 5.4 For initial water system sampling take a Post-Flush sample (as defined in BS7592: 2008) at sentinel points without disinfection. Where there is an initial concern with a particular outlet location – say, a combined system and outlet problem – a BS Pre-Flush sample should be taken. If concerns persist with an outlet location (typically, a known dead-leg issue or lack of, or low, water use, a further BS Pre-Flush sample should be taken followed by disinfection before a BS Post-Flush with disinfection sample. Water should be allowed to run hot for 1 minute and cold for 2 minutes by which sampling would be temperature calibrated.

### Interpretation of results and further actions

- 5.5 Where water quality sampling in a water system confirmed (acceptable) *Legionella* results **less than 100 CFUs/Litre** – the Authorised Person (Water) would be informed and provided with copies of the samples in writing and associated record keeping. The Authorised Person (Water) would provide interpretation (with the Consultant Microbiologist when and where required) on the results and confirm if any actions are required.
- 5.6 Where water quality sampling in a water system confirmed *Legionella* results in **excess of 100, but less than 1,000 CFUs/Litre** – the Authorised Person

(Water) and Consultant Microbiologist must be informed and provided with copies of the samples in writing. The Consultant Microbiologist would provide interpretation on the results and confirm the necessary actions prior to bringing the water system into use.

- 5.7 Where water quality sampling in a water system confirmed *Legionella* results in **excess of 1,000 CFUs/Litre** *immediate* action must be taken and the Consultant Microbiologist and Authorised Person (Water) must be informed and provided with copies of the samples in writing. They will immediately confirm the necessary actions prior to re-sampling and bringing the water system into use when (acceptable) *Legionella* results are reliably less than 100 CFUs/Litre.

**Note:** Where continued water system sampling is required, this would be undertaken on a weekly frequency.

- 5.8 Where the results of three consecutive weekly water system samples remained below 100 CFUs/Litre, the Authorised Person (Water) and Consultant Microbiologist would be informed and sampling would revert to a monthly sampling frequency.
- 5.9 Where the results of three consecutive monthly Water System samples remained below 100 CFUs/Litre, the Authorised Person (Water) and Consultant Microbiologist would be informed and sampling would revert to a 3-monthly sampling frequency.

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