SCOTTISH HOSPITALS INQUIRY

Bundle of documents for Oral hearings commencing from 19 August 2024 in relation to the Queen Elizabeth University Hospital and the Royal Hospital for Children, Glasgow

Bundle 27 - Miscellaneous Documents

Volume 3

SCOTTISH HOSPITALS INQUIRY

Table of Contents

From: Wilson, Andy [redacted]
Sent: 02 October 2018 14:41
To: Wilson, Andy; INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE); Gibson, Brenda; MacLeod, Calum; Anderson, Kathryn; RANKIN, Annette (NHS NATIONAL SERVICES SCOTLAND); Armstrong Jennifer (NHS GREATER GLASGOW & CLYDE); Stephen.Bowhay[redacted]; Carlton, Sharon; Connelly Karen (NHS GREATER GLASGOW & CLYDE); Devine, Sandra; Dick Lorraine (NHS GREATER GLASGOW & CLYDE); Dodd Susan (NHS GREATER GLASGOW & CLYDE); MCLAUGHLAN, Edward (NHS NATIONAL SERVICES SCOTLAND); Hackett Janice (NHS GREATER GLASGOW & CLYDE); Hamilton Pauline (NHS GREATER GLASGOW & CLYDE); Hill Kevin (NHS GREATER GLASGOW & CLYDE); Howat Angela (NHS GREATER GLASGOW & CLYDE); Hunter William (NHS GREATER GLASGOW & CLYDE); STORRAR, Ian (NHS NATIONAL SERVICES SCOTLAND); Joannidis Pamela (NHS GREATER GLASGOW & CLYDE); angela.johnson[redacted]; Kane Maryanne (NHS GREATER GLASGOW & CLYDE); Kennea, Lynne; Kennedy Iain (NHS GREATER GLASGOW & CLYDE); Lang Ann (NHS GREATER GLASGOW & CLYDE); Office, Press; phpu[redacted]; Powrie Ian (NHS GREATER GLASGOW & CLYDE); Pritchard Lynn (NHS GREATER GLASGOW & CLYDE); Purdon Colin (NHS GREATER GLASGOW & CLYDE); Redfern James (NHS GREATER GLASGOW & CLYDE); Robertson Lynne (NHS GREATER GLASGOW & CLYDE); Rodgers Jennifer (NHS GREATER GLASGOW & CLYDE); Somerville, Emma; Kathleen.Thomson[redacted]; STEELE, Tom (NHS GREATER GLASGOW & CLYDE); Walsh Thomas (NHS GREATER GLASGOW & CLYDE)
Subject: RE: IMT Ward 2A, RHC

Been informed access could not be provided during clinic hours today so I have arranged for plumbers to go in first thing tomorrow morning so these two rooms will be completed by 09:00 tomorrow morning.

Thanks,
Andy

Andrew S. E. Wilson | CEng MIMechE
Sector Estates Manager (South & Clyde)

[redacted]

From: Wilson, Andy
Sent: 02 October 2018 14:27
To: Wilson, Andy; Inkster, Teresa (NHSmail); Gibson, Brenda; MacLeod, Calum; Anderson, Kathryn; RANKIN, Annette (NHS NATIONAL SERVICES SCOTLAND); Armstrong, Jennifer; Bowhay, Stephen; Carlton, Sharon; Connelly, Karen; Devine, Sandra; Dick, Lorraine; Dodd, Susie; MCLAUGHLAN, Edward (NHS NATIONAL SERVICES SCOTLAND); Hackett, Janice; Hamilton, Pauline; Hill, Kevin; Howat, Angela; Hunter, William; STORRAR, Ian (NHS NATIONAL SERVICES SCOTLAND); Joannidis, Pamela; Johnson, Angela; Kane, Mary Anne; Kennea, Lynne; Kennedy, Iain; Lang, Ann; Office, Press; PHPU; Powrie, Ian; Pritchard, Lynn; Purdon, Colin; Redfern, Jamie; Robertson, Lynne; Rodgers, Jennifer; Somerville, Emma; Thomson, Kathleen; STEELE, Tom (NHS GREATER GLASGOW & CLYDE); Walsh, Tom
Subject: RE: IMT Ward 2A, RHC

The two OPD rooms requested will be completed today.

Thanks,
Andy

Andrew S. E. Wilson | CEng MIMechE
Sector Estates Manager (South & Clyde)

[redacted]

[redacted]

From: Wilson, Andy
Sent: 02 October 2018 12:13
To: Inkster, Teresa (NHSmail); Gibson, Brenda; MacLeod, Calum; Anderson, Kathryn; RANKIN, Annette (NHS NATIONAL SERVICES SCOTLAND); Armstrong, Jennifer; Bowhay, Stephen; Carlton, Sharon; Connelly, Karen; Devine, Sandra; Dick, Lorraine; Dodd, Susie; MCLAUGHLAN, Edward (NHS NATIONAL SERVICES SCOTLAND); Hackett, Janice; Hamilton, Pauline; Hill, Kevin; Howat, Angela; Hunter, William; STORRAR, Ian (NHS NATIONAL SERVICES SCOTLAND); Joannidis, Pamela; Johnson, Angela; Kane, Mary Anne; Kennea, Lynne; Kennedy, Iain; Lang, Ann; Office, Press; PHPU; Powrie, Ian; Pritchard, Lynn; Purdon, Colin; Redfern, Jamie; Robertson, Lynne; Rodgers, Jennifer; Somerville, Emma; Thomson, Kathleen; STEELE, Tom (NHS GREATER GLASGOW & CLYDE); Walsh, Tom
Subject: RE: IMT Ward 2A, RHC

I was awaiting confirmation of the list of remaining rooms which were to be identified for 2A patients.

I have just seen there was a separate email on Friday morning regarding these specific two rooms along with a further update after 16:00 Friday afternoon.

Unfortunately, I was on annual leave on Friday and I understand this was not raised at the IMT for it to be escalated further. This will be auctioned asap.

Andy

Andrew S. E. Wilson | CEng MIMechE
Sector Estates Manager (South & Clyde)

[redacted]

From: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE) [redacted]
Sent: 02 October 2018 11:38
To: Gibson, Brenda; MacLeod, Calum; Anderson, Kathryn; RANKIN, Annette (NHS NATIONAL SERVICES SCOTLAND); Armstrong, Jennifer; Bowhay, Stephen; Carlton, Sharon; Connelly, Karen; Devine, Sandra; Dick, Lorraine; Dodd, Susie; MCLAUGHLAN, Edward (NHS NATIONAL SERVICES SCOTLAND); Hackett, Janice; Hamilton, Pauline; Hill, Kevin; Howat, Angela; Hunter, William; STORRAR, Ian (NHS NATIONAL SERVICES SCOTLAND); Joannidis, Pamela; Johnson, Angela; Kane, Mary Anne; Kennea, Lynne; Kennedy, Iain; Lang, Ann; Office, Press; PHPU; Powrie, Ian; Pritchard, Lynn; Purdon, Colin; Redfern, Jamie; Robertson, Lynne; Rodgers, Jennifer; Somerville, Emma; Thomson, Kathleen; STEELE, Tom (NHS GREATER GLASGOW & CLYDE); Walsh, Tom; Wilson, Andy
Subject: [ExternaltoGGC]Re: IMT Ward 2A, RHC

Hi, can estates colleagues action this request as soon as, thanks. Brenda - is there a particular room?
Kr
Teresa

Sent from my BlackBerry 10 smartphone on the EE network.

From: Gibson, Brenda
Sent: Tuesday, 2 October 2018 10:45 AM
To: MacLeod, Calum; Anderson, Kathryn; RANKIN, Annette (NHS NATIONAL SERVICES SCOTLAND); Armstrong Jennifer (NHS GREATER GLASGOW & CLYDE); Stephen.Bowhay[redacted]; Carlton, Sharon; Connelly Karen (NHS GREATER GLASGOW & CLYDE); Devine, Sandra; Dick Lorraine (NHS GREATER GLASGOW & CLYDE); Dodd Susan (NHS GREATER GLASGOW & CLYDE); MCLAUGHLAN, Edward (NHS NATIONAL SERVICES SCOTLAND); Hackett Janice (NHS GREATER GLASGOW & CLYDE); Hamilton Pauline (NHS GREATER GLASGOW & CLYDE); Hill Kevin (NHS GREATER GLASGOW & CLYDE); Howat Angela (NHS GREATER GLASGOW & CLYDE); Hunter William (NHS GREATER GLASGOW & CLYDE); STORRAR, Ian (NHS NATIONAL SERVICES SCOTLAND); INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE); Joannidis Pamela (NHS GREATER GLASGOW & CLYDE); angela.johnson[redacted]; Kane Maryanne (NHS GREATER GLASGOW & CLYDE); Kennea, Lynne; Kennedy Iain (NHS GREATER GLASGOW & CLYDE); Lang Ann (NHS GREATER GLASGOW & CLYDE); Office, Press; phpu[redacted]; Powrie Ian (NHS GREATER GLASGOW & CLYDE); Pritchard Lynn (NHS GREATER GLASGOW

& CLYDE); Purdon Colin (NHS GREATER GLASGOW & CLYDE); Redfern James (NHS GREATER GLASGOW & CLYDE); Robertson Lynne (NHS GREATER GLASGOW & CLYDE); Rodgers Jennifer (NHS GREATER GLASGOW & CLYDE); Somerville, Emma; Kathleen.Thomson[redacted]; STEELE, Tom (NHS GREATER GLASGOW & CLYDE); Walsh Thomas (NHS GREATER GLASGOW & CLYDE); Wilson, Andy
Subject: RE: IMT Ward 2A, RHC

I understood that a filter would be fitted to the tap in a clinic room in outpatients and a drain cleaned to allow children with central lines to have these accessed in clinic without going to ward 6A. A letter was given to parents with this instruction last week after it had been approved by Jane Grant. I understand that this work has not happened and children with central line s are all having to go to ward 6A this morning where there is limited capacity. Can you please clarify what is happening so that we can re write to parents before next Tuesday.

Brenda

From: MacLeod, Calum
Sent: 02 October 2018 09:48
To: Anderson, Kathryn; 'Annette Rankin'; Armstrong, Jennifer; Bowhay, Stephen; Carlton, Sharon; Connelly, Karen; Devine, Sandra; Dick, Lorraine; Dodd, Susie; 'Eddie McLaughlan'; Gibson, Brenda; Hackett, Janice; Hamilton, Pauline; Hill, Kevin; Howat, Angela; Hunter, William; 'Ian Storrar'; Inkster, Teresa (NHSmail); Joannidis, Pamela; Johnson, Angela; Kane, Mary Anne; Kennea, Lynne; Kennedy, Iain; Lang, Ann; Office, Press; PHPU; Powrie, Ian; Pritchard, Lynn; Purdon, Colin; Redfern, Jamie; Robertson, Lynne; Rodgers, Jennifer; Somerville, Emma; Thomson, Kathleen; 'Tom Steele'; Walsh, Tom; Wilson, Andy
Subject: IMT Ward 2A, RHC

Good morning

Please find attached the minutes from Friday's IMT regarding Ward 2A, RHC.

The next IMT is being held on Thursday 4th October at 1300, Seminar Room GWS-027, Level 3, RHC.

Can you please forward any apologies onto to myself.

Kind Regards

Calum MacLeod
Infection Prevention & Control Administrator
Level 2, Zone 1, Office Block
Queen Elizabeth University Hospital
G51 4TF

[redacted]

[redacted]

From: Moir, Peter
Sent: 23 July 2015 11:49
To: Mitchell, Clare
Cc: Powrie, Ian; Williams, Craig; Jenkins, Gary
Subject: RE: QUEH - LEVEL 4 WARD B WORKS

Clare

Thanks for this

Allyson Hirst is trying to set up a meeting on this hopefully tomorrow am.

Regards

Peter

From: Mitchell, Clare
Sent: 22 July 2015 17:13
To: Moir, Peter
Cc: Powrie, Ian; Williams, Craig; Jenkins, Gary
Subject: RE: QUEH - LEVEL 4 WARD B WORKS

Hi Peter,

Either Jackie Barmanroy or myself will be involved as both involved to date. Can you keep us both on the distribution list. I have enclosed an HAI Scribe for completion. This is usually completed by the Estates department or the contractor.

Regards

Clare

Clare Mitchell
Lead Infection Control Nurse
South West Sector
Administration Building
Southern General Hospital
Govan Road - G51 4TF
[redacted]

From: Moir, Peter
Sent: 22 July 2015 11:02
To: Mitchell, Clare
Cc: Powrie, Ian; Williams, Craig; Jenkins, Gary
Subject: QUEH - LEVEL 4 WARD B WORKS

Clare

As you may be aware BMT have moved back to the Beatson while aspects of the ventilation system are being reviewed and adaptations made by Brookfield Multiplex.

These works are due to commence on Monday 27th July and will run until the end of September 2015. The Board require to undertake an HAI Scribe review prior to works commencing, but before I issue further information in advance of a meeting, can I confirm if it will be yourself who will be the lead for Infection Control and prepare the HAI Scribe docs.

If you can confirm I will issue further information and set up a meeting with myself and Ian.

Thanks

Peter Moir
ARIAS

Deputy Project Director

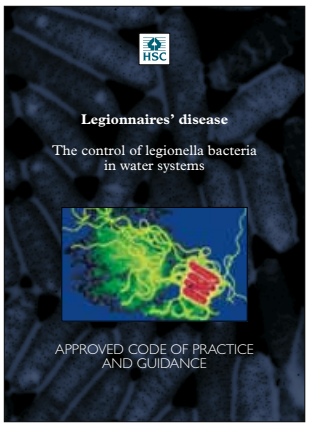
South Glasgow Hospitals Project Office
NHS Greater Glasgow & Clyde
Room L1/25
Management Building
1345 Govan Road
Glasgow G51 4TF

Tel: [redacted]
Mob: [redacted]
Em: [redacted]

Legionnaires' disease

The control of legionella bacteria in water systems

Approved Code of Practice and guidance



This is a free-to-download, web-friendly version of L8, (Third edition, published 2000). This version has been adapted for online use from HSE's current printed version.

You can buy the book at www.hsebooks.co.uk and most good bookshops.

ISBN 978 0 7176 1772 2
Price £8.00

This book is written for dutyholders, including employers and those with health and safety responsibilities for others, to help them comply with their legal duties. These include identifying and assessing sources of risk, preparing a scheme to prevent or control risk, implementing, managing and monitoring precautions, keeping records of precautions and appointing a manager to be responsible for others.

The Approved Code of Practice and guidance give practical advice on the legal requirements concerning the risk from exposure to legionella bacteria. The Code also gives guidance on compliance with the relevant parts of the Management of Health and Safety at Work Regulations 1999.

First published 1991
Second edition 1995
Third edition 2000
Reprinted 2001 (twice), 2002, 2004, 2006, 2007, 2008

ISBN 978 0 7176 1771 2

This Code has been approved by the Health and Safety Commision, with the consent of the Secretary of State. It gives practical advice on how to comply with the law. If you follow the advice you will be doing enough to comply with the law in respect of those specific matters on which the Code gives advice. You may use alternative methods to those set out in the Code in order to comply with the law.

However, the Code has a special legal status. If you are prosecuted for breach of health and safety law, and it is proved that you did not follow the relevant provisions of the Code, you will need to show that you have complied with the law in some other way or a Court will find you at fault.

This document also contains guidance issued by the Health and Safety Commission and Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

Contents

Notice of Approval

By virtue of section 16(4) of the Health and Safety at Work etc. Act 1974, and with the consent of the Secretary of State for the Environment, the Health and Safety Commission has on 23 November 1999 approved the Code of Practice entitled Legionnaires' disease: the control of legionella bacteria in water systems.

The Code of Practice gives practical guidance with respect to sections 2, 3, 4 and 6 of the Health and Safety at Work etc. Act 1974 and regulations 6, 7, 8, 9 and 12 of the Control of Substances Hazardous to Health Regulations 1999.

The Code of Practice comes into effect on 8 January 2001 and on that date the Code of Practice entitled *The prevention or control of legionellosis (including legionnaires' disease)* (L8rev) shall cease to have effect.

Signed

Avril Adams
Secretary to the Health and Safety Commisson

9th November 2000

The Health and Safety Commission (HSC) and the Health and Safety Executive (HSE) merged on 1 April 2008 to form a single national regulatory body. From that date, the Health and Safety Executive became responsible for approving Codes of Practice, with the consent of the Secretary of State.

Acknowledgements

HSE thanks the following organisations for providing representatives with technical expertise, which was used when preparing the guidance that appears in Part 2 of this publication: British Association for Chemical Specialities (John Lindemann); Building Services Research and Information Association (Reginald Brown); The Chartered Institution of Building Services Engineers (Geoffrey Brundrett); Department of Medical Microbiology, Royal Liverpool University Hospitals (Tom Makin); Environmental Services, Port and City of London (Roger Watson); NHS Estates (Ian Fraser); and The Water Management Society (Mike Iddon).

We also wish to acknowledge the contributions made by the following during the consultation: the City of Westminster; the Drinking Water Inspectorate; Group Investigating Legionnaires' Disease; the Scottish Centre for Infection and Environmental Health; and the Water and Environmental Microbiology Research Unit of the Public Health Laboratory Service.

Introduction

1 This Approved Code of Practice gives practical advice on the requirements of the Health and Safety at Work etc Act 1974 (HSWA) and the Control of Substances Hazardous to Health Regulations 1999 (COSHH) concerning the risk from exposure to legionella bacteria. In particular it gives guidance on sections 2, 3, 4 and 6 (as amended by the Consumer Protection Act 1987) of HSWA and regulations 6, 7,8, 9 and 12 of COSHH. The Code also gives guidance on compliance with the relevant parts of the Management of Health and Safety at Work Regulations 1999 (MHSWR).

2 This publication replaces two separate documents: the 1995 Approved Code of Practice and the technical guidance, HSG70. This has allowed information to be consolidated, with the aim of making it easier to read and understand the duties under the law. Since the last revision, the Health and Safety Executive (HSE) and others have funded research to assess the efficacy of new and alternative control strategies. This new document incorporates the findings of that research and explains how such strategies can be used safely and effectively.

3 This Code applies to the risk from legionella bacteria (the causative agent of legionellosis including Legionnaires' disease) in circumstances where the Health and Safety at Work etc Act 1974 applies.

4 To comply with their legal duties, employers and those with responsibilities for the control of premises should:

(a) identify and assess sources of risk - this includes checking whether conditions are present which will encourage bacteria to mulitply, eg is the water temperature between 20-45°C; there is a means of creating and disseminating breathable droplets, eg the aerosol created by a shower or cooling tower; and if there are susceptible people who may be exposed to the contaminated aerosols (see paragraphs 23-38);
(b) prepare a scheme for preventing or controlling the risk;
(c) implement, manage and monitor precautions - if control measures are to remain effective, then regular monitoring of the systems and the control measures is essential (see paragraphs 61-65). Monitoring of general bacterial numbers can indicate whether microbiological control is being achieved (see paragraphs 124-129 and 183-184). Sampling for legionella is another means of checking that a system is under control (see paragraphs 130-131 and 185-189);
(d) keep records of the precautions; and
(e) appoint a person to be managerially responsible.

5 The Code and guidance also set out the responsibilities of suppliers of services such as water treatment and maintenance as well as the responsibilities of manufacturers, importers, suppliers and installers.

Background to the disease and organisms

6 Legionnaires' disease is a potentially fatal form of pneumonia which can affect anybody, but which principally affects those who are susceptible because of age, illness, immunosuppression, smoking etc. It is caused by the bacterium *Legionella pneumophila* and related bacteria. Legionella bacteria can also cause less serious illnesses which are not fatal or permanently debilitating (see Box 1). The collective term used to cover the group of diseases caused by legionella bacteria is legionellosis.

7 On average there are approximately 200-250 reported cases of Legionnaires' disease each year in the United Kingdom (UK). It is thought, however, that the the total number of cases of the disease may be generally underestimated. About half of cases are associated with travel abroad. Infections which originate in the UK are often sporadic, for which no source of infection is traced. However, clusters of cases also occur and outbreaks have been associated with cooling tower systems and hot and cold water systems in factories, hotels, hospitals and other establishments.

Box 1: Legionellosis (including Legionnaires' disease)

- Legionnaires' disease was first identified following a large outbreak of pneumonia among people who attended an American Legion Convention in Philadelphia in 1976. A previously unrecognised bacterium was isolated from lung tissue samples which was subsequently named *Legionella pneumophila*.

- It is normally contracted by inhaling legionella bacteria, either in tiny droplets of water (aerosols), or in droplet nuclei (the particles left after the water has evaporated) contaminated with legionella, deep into the lungs. There is evidence that the disease may also be contracted by inhaling legionella bacteria following ingestion of contaminated water by susceptible individuals. Person-to-person spread of the disease has not been documented. Initial symptoms of Legionnaires' disease include high fever, chills, headache and muscle pain. Patients may develop a dry cough and most suffer difficulty with breathing. About one third of patients infected also develop diarrhoea or vomiting and about half become confused or delirious. Legionnaires' disease can be treated effectively with appropriate antibiotics.

- The incubation period is between 2-10 days (usually 3-6 days). Not everyone exposed will develop symptoms of the disease and those that do not develop the 'full blown' disease may only present with a mild flu-like infection.

- Infection with legionella bacteria can be fatal in approximately 12% of reported cases. This rate can be higher in a more susceptible population; for example, immunosuppressed patients or those with other underlying disease. Certain groups of people are known to be at higher risk of contracting Legionnaires' disease; for example, men appear more susceptible than women, as do those over 45 years of age, smokers, alcoholics, diabetics and those with cancer or chronic respiratory or kidney disease.

- The disease is usually diagnosed by a combination of tests. The organism may be cultured from the patient's sputum, bronchial washings or lung tissue. Alternatively, tests are used to measure the presence of antibodies in the blood and, increasingly, tests are available to measure specific antigens in the patient's urine.

- *L. pneumophila* is also responsible for a short feverish form of the illness without pneumonia, known as **Pontiac fever**. Its incubation period is typically between 2-3 days. Another species of legionella, *L. micdadei*, is responsible for a similar form of the illness without pneumonia called **Lochgoilhead fever** after an outbreak in Lochgoilhead, Scotland. The incubation period can be up to 9 days. A high percentage of those exposed to this agent tend to be affected. However, there have been no recorded

deaths associated with either Pontiac or Lochgoilhead fevers.

- To date, approximately 40 species of the legionella bacterium have been identified. *L. pneumophila* causes about 90% of cases. Sixteen different serogroups of *L. pneumophila* have been described; however, *L. pneumophila* serogroup 1 is most commonly associated with cases of Legionnaires' disease in the UK.

- *L. pneumophila* serogroup 1 can be further sub-divided to distinguish between strains most commonly associated with Legionnaires' disease. Additionally, 'genetic fingerprinting' methods such as Restriction Fragment Length Polymorphism (RFLP) and Amplified Fragment Length Polymorphism (AFLP) can be valuable tools in the investigation of outbreaks. Such methods of typing can sometimes provide a means of linking the organisms isolated from patients to the sources of cases of outbreaks.

8 Cases of Legionnaires' disease have occurred among staff in the workplace (factories, offices, shops and hospitals); visitors (delivery drivers) and members of the public (patients, hotel guests or passers-by).

Natural history of the legionella bacterium

9 Legionella bacteria are common and can be found naturally in environmental water sources such as rivers, lakes and reservoirs, usually in low numbers. Legionella bacteria can survive under a wide variety of environmental conditions and have been found in water at temperatures between 6°C and 60°C. Water temperatures in the range 20°C to 45°C seem to favour growth. The organisms do not appear to multiply below 20°C and will not survive above 60°C. They may, however remain dormant in cool water and multiply only when water temperatures reach a suitable level. Temperatures may also influence virulence; legionella bacteria held at 37°C have greater virulence than the same legionella bacteria kept at a temperature below 25°C.

10 Legionella bacteria also require a supply of nutrients to multiply. Sources can include, for example, commonly encountered organisms within the water system itself such as algae, amoebae and other bacteria. The presence of sediment, sludge, scale and other material within the system, together with biofilms, are also thought to play an important role in harbouring and providing favourable conditions in which the legionella bacteria may grow. A biofilm is a thin layer of micro-organisms which may form a slime on the surfaces in contact with water. Such biofilms, sludge and scale can protect legionella bacteria from temperatures and concentrations of biocide that would otherwise kill or inhibit these organisms if they were freely suspended in the water.

11 As legionella bacteria are commonly encountered in environmental sources they may eventually colonise manufactured water systems and be found in cooling tower systems, hot and cold water systems and other plant which use or store water. To reduce the possibility of creating conditions in which the risk from exposure to legionella bacteria is increased, it is important to control the risk by introducing measures which:

(a) do not allow proliferation of the organisms in the water system; and
(b) reduce, so far as is reasonably practicable, exposure to water droplets and aerosol.

Legislation - health and safety law

12 Duties under the HSWA extend to risks from legionella bacteria which may arise from work activities. The MHSWR provide a broad framework for controlling health and safety at work. As well as requiring risk assessments, they also require employers to have access to competent help in applying the provisions of health and safety law; to establish procedures to be followed by any worker if situations presenting serious and imminent danger were to arise; and for co-operation and co-ordination where two or more employers or self-employed persons share a workplace.

13 Only the courts can give an authoritative interpretation of law in considering the application of these Regulations and guidance to people working under another's direction, the following should be considered: if people working under the control and direction of others are treated as self-employed for tax and national insurance purposes they may nevertheless be treated as their employees for health and safety purposes. It may therefore be necessary to take appropriate action to protect them. If any doubt exists about who is responsible for the health and safety of a worker this could be clarified and included in the terms of a contract. However, it should be remembered that a legal duty under section 3 of HSWA cannot be passed on by means of a contract and there will still be duties towards others under section 3 of HSWA. If such workers are employed on the basis that they are responsible for their own health and safety, legal advice should be sought before doing so.

14 More specifically the COSHH Regulations provide a framework of actions designed to control the risk from a range of hazardous substances including biological agents. The essential elements of COSHH are:

(a) risk assessment;
(b) prevention of exposure or substitution with a less hazardous substance if this is possible, or substitution of a process or method with a less hazardous one;
(c) control of exposure where prevention or substitution is not reasonably practicable;
(d) maintenance, examination and testing of control measures, eg automatic dosing equipment for delivery of biocides and other treatment chemicals;
(e) provision of information, instruction and training for employees; and
(f) health surveillance of employees (where appropriate, and if there are valid techniques for detecting indications of disease) where exposure may result in an identifiable disease or adverse health effect.

15 The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR) require employers and others, eg the person who has control of work premises, to report to HSE, accidents and some diseases that arise out of or in connection with work. Cases of legionellosis are reportable under RIDDOR if a doctor notifies the employer and if the employee's current job involves work on or near cooling systems that use water or hot water service systems in the workplace. Further details can be obtained in HSE guidance.[1]

16 Those who have, to any extent, control of premises, have a duty under the Notification of Cooling Towers and Evaporative Condensers Regulations 1992 to notify the local authority in writing with details of 'notifiable devices'. These consist of cooling towers and evaporative condensers, except when they contain water that is not exposed to the air and the water and electricity supply are not connected. Although the requirement is to notify the local authority, the Regulations are enforced by the relevant authority for the premises concerned. Forms are available from local authorities or the local HSE office. If a tower becomes redundant and is decommissioned or dismantled, this should also be notified. The

main purpose of these Regulations is to help in the investigation of outbreaks (see Appendix 2).

17 The Safety Representatives and Safety Committees Regulations 1977 and the Health and Safety (Consultation with Employees) Regulations 1996 require employers to consult trade union safety representatives, other employee representatives, or employees where there are no representatives, about health and safety matters. This includes changes to the work that may affect their health and safety at work, arrangements for getting competent help, information on the risks and controls, and the planning of health and safety training. Further information and details of additional guidance can be found in a free HSE leaflet.[2]

Part 1: The Approved Code of Practice

Scope and application

ACOP

18 This Approved Code of Practice applies to the control of legionella bacteria in any undertaking involving a work activity and to premises controlled in connection with a trade, business or other undertaking where water is used or stored and where there is a means of creating and transmitting water droplets which may be inhaled, thereby causing a reasonably foreseeable risk of exposure to legionella bacteria.

19 A reasonably foreseeable risk of exposure to legionella bacteria exists in:

(a) water systems incorporating a cooling tower;
(b) water systems incorporating an evaporative condenser;
(c) hot and cold water systems; and
(d) other plant and systems containing water which is likely to exceed 20°C and which may release a spray or aerosol (ie a cloud of droplets and/or droplet nuclei) during operation or when being maintained.

Guidance

20 Experience has shown that cooling towers, evaporative condensers and hot and cold water systems in a wide variety of workplaces present a risk of exposure to legionella bacteria. Further guidance on systems that may present a risk can be found in Part 2. Not all of the systems listed in paragraph 19 will require elaborate assessment and control measures. A simple risk assessment may show that the risks are low and in such case no further action will be necessary. Examples include small, domestic-type water systems where temperatures and turnover are high, or where instantaneous water heaters are used.

21 A water system includes all plant/equipment and components associated with that system, eg all associated pipe-work, pumps, feed tanks, valves, showers, heat exchangers, quench tanks, chillers etc. It is important that the system is considered as a whole and not, for example, the cooling tower in isolation. Deadlegs and parts of the system used intermittently, eg test loops in engineering factories and injection moulding machines, also need to be included as part of the system since they can create particular problems with microbial growth going unnoticed. Once brought back on-line they can cause heavy contamination, which could disrupt the efficacy of the water treatment regime.

22 For other systems, such as humidifiers and air washers, spa baths and pools, car/bus washes, wet scrubbers, indoor fountains and water features, advice on control measures is given in the text and in Table 3 of Appendix 1.

Identification and assessment of the risk

Regulation

Control of Substances Hazardous to Health Regulations 1999, Regulation 6
Management of Health and Safety at Work Regulations 1999, Regulation 3
Health and Safety at Work etc. Act 1974, Sections 2, 3 and 4.

ACOP

23 A suitable and sufficient assessment is required to identify and assess the risk of exposure to legionella bacteria from work activities and water systems on the premises and any necessary precautionary measures. The assessment is carried out by or on behalf of:

(a) the employer, where the risk from their undertaking is to their employees or to others; or
(b) a self-employed person, where there is a risk from their undertaking to themselves or to others; or

ACOP

(c) the person who is in control of premises or systems in connection with work where the risk is present from systems in the building (eg where a building is let to tenants but the landlord retains responsibility for its maintenance).

24 In conducting the assessment, the person on whom the statutory duty falls is required to have access to competent help to assess the risks of exposure to legionella bacteria in the water systems present in the premises and the necessary control measures.

25 The assessment should include identification and evaluation of potential sources of risk and:

(a) the particular means by which exposure to legionella bacteria is to be prevented; or
(b) if prevention is not reasonably practicable, the particular means by which the risk from exposure to legionella bacteria is to be controlled.

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

27 The assessment needs to be reviewed regularly and, in any case, whenever there is reason to believe that the original assessment may no longer be valid.

Guidance

28 Before any formal health and safety management system for water systems can be implemented, a risk assessment has to be carried out to decide the possible risks. The purpose of the assessment is to enable a decision to decide:

(a) the risk to health, ie whether the potential for harm to health from exposure is reasonably foreseeable unless adequate precautionary measures are taken;
(b) the necessary measures to prevent, or adequately control, the risk from exposure to legionella bacteria.

29 The risk assessment also enables the person on whom the statutory duty falls to show that all the pertinent factors, and the steps needed to prevent or control the risk, have been considered.

30 In conducting the assessment, the person on whom the statutory duty falls needs to have access to competent help and advice. Further guidance on this is in paragraph 44. This source of advice may not necessarily be within the person's organisation but may be from a consultancy, water treatment company or a person experienced in carrying out risk assessments. Employers are required to consult employees or their representatives about the arrangements for getting competent help and advice (see paragraph 17).

31 It is the duty of the responsible person (see paragraph 39) to make reasonable enquiries to ensure that organisations such as water treatment companies or consultants, together with personnel from the occupier's organisation, are competent and suitably trained and have the necessary equipment to carry out their duties within the written scheme in a safe and adequate manner. Further guidance on this is in paragraphs 44-46 and 50.

Guidance

Carrying out a risk assessment

32 A number of factors are required to create a risk of acquiring legionellosis, such as:

(a) the presence of legionella bacteria;
(b) conditions suitable for multiplication of the organisms eg suitable temperature (20°C-45°C) and a source of nutrients eg sludge, scale, rust, algae and other organic matter;
(c) a means of creating and disseminating breathable droplets eg the aerosol generated by a cooling tower or shower; and
(d) the presence (and numbers) of people who may be exposed, especially in premises where occupants are particularly vulnerable, eg healthcare.

33 While there will inevitably be common factors associated with the many and varied types of premises being assessed, the individual nature of each site should be taken into account. In complex systems or premises, a site survey of all the water systems should be carried out and should include an asset register of all associated plant, pumps, strainers and other relevant items. This should include an up-to-date drawing/diagram showing the layout of the plant or system, including parts temporarily out of use. A schematic diagram would be sufficient. It should then be decided which parts of the water system, for example, which specific equipment and services, may pose a risk to those at work or other people.

34 The following list contains some of the factors which should be considered, as appropriate, when carrying out the assessment:

(a) the source of system supply water, for example, whether from a mains supply or not;
(b) possible sources of contamination of the supply water within the premises before it reaches the cold water storage cistern, calorifier, cooling tower or any other system using water that may present a risk of exposure to legionella bacteria;
(c) the normal plant operating characteristics; and
(d) unusual, but reasonably foreseeable operating conditions, for example breakdowns.

35 Where there is a risk, the significant findings of the assessment should be recorded (if there are five or more employees). In any case, it may be necessary to record sufficient details of the assessment to be able to show that it has been done. The record of the assessment should be linked to other relevant health and safety records and, in particular, to the written scheme referred to in paragraph 53.

36 Employers are required to consult employees or their representatives on the identified risks of exposure to legionella bacteria and on the measures and actions taken to control the risks. The employees should be given an opportunity to comment on the assessment and control measures and the employer has to take account of these views. It is therefore important for employers to publicise to employees that a legionella risk assessment has been performed and one means by which employers could ensure that employees are informed of the measures and actions taken to control risks, and have an opportunity to comment on the risk assessment, would be by displaying the appropriate parts of the risk assessment.

37 It is essential that the effectiveness of the control measures is monitored and decisions made on the frequency and manner of this monitoring.

38 The assessment should be reviewed regularly (at least every two years) and, whenever there is reason to suspect that it is no longer valid. An indication of when

Guidance

to review the assessment and what needs to be reviewed should be recorded. This may result from, for example:

(a) changes to the water system or its use;
(b) changes to the use of the building in which the water system is installed;
(c) the availability of new information about risks or control measures;
(d) the results of checks indicating that control measures are no longer effective;
(e) a case of Legionnaires' disease/legionellosis is associated with the system.

Managing the risk: management responsibilities, training and competence

Regulation

Control of Substances Hazardous to Health Regulations 1999, Regulations 8 and 12
Health and Safety at Work etc. Act 1974, Sections 2, 3 and 4
Management of Health and Safety at Work Regulations 1999, Regulation 5

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39 If the assessment shows that there is a reasonably foreseeable risk and it is reasonably practicable to prevent exposure or control the risk from exposure, the person on whom the statutory duty falls (see paragraph 23) should appoint a person or persons to take managerial responsibility and to provide supervision for the implementation of precautions.

40 Persons who carry out the assessment and who draw up and implement precautionary measures should have such ability, experience, instruction, information, training and resources to enable them to carry out their tasks competently and safely. In particular, they should know:

(a) potential sources and the risks they present;
(b) measures to be adopted, including precautions to be taken for the protection of people concerned, and their significance; and
(c) measures to be taken to ensure that controls remain effective, and their significance.

41 Where the above expertise is not possessed by the person or persons appointed under paragraph 39, it may be necessary to enlist help and support from outside the organisation. In such circumstances, the person or persons appointed under paragraph 39 should take all reasonable steps to ensure the competence of those carrying out work who are not under their direct control and that responsibilities and lines of communication are properly established and clearly laid down.

42 Management and communication procedures should be periodically reviewed as appropriate.

Guidance

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

44 The duty holder (see paragraph 23) should appoint a person to take day-to-day responsibility for controlling any identified risk from legionella bacteria. The appointed 'responsible person' should be a manager, director, or have similar status and sufficient authority, competence and knowledge of the installation to ensure that all operational procedures are carried out in a timely and effective manner. If a duty-holder is self-employed or a member of a partnership, and is competent, they may appoint themselves. The responsible person should have a clear understanding of their duties and the overall health and safety management

Guidance

structure and policy in the organisation. Further guidance is given in *Successful health and safety management* HSG65.[3]

Competence

45 Those who are appointed to carry out the control measures and strategies should be suitably informed, instructed and trained and their suitability assessed. They should be properly trained to a standard which ensures that tasks are carried out in a safe, technically competent manner. Regular refresher training should be given and records of all initial and refresher training need to be maintained. Although training is an essential element of competence, it is not the only factor - it should be viewed as is a product of sufficient training, experience, knowledge and other personal qualities which are needed to undertake a job safely. Competence is dependent on the needs of the situation and the nature of the risks involved.

Implementation of the control scheme

46 The implementation of the system control scheme should be regularly and frequently monitored and everyone involved in any related operational procedure should be properly supervised. Staff responsibilities and lines of communication should be properly defined and clearly documented.

47 Arrangements should be made to ensure that appropriate staff levels are maintained during all hours that the water system is in operation. The precise requirements will depend on the nature and complexity of the water system. In some cases, for example where there is complex cooling plant, shift working and arrangements to cover for all absences from duty, for whatever reason, may be necessary. Appropriate arrangements should be made to ensure that the responsible person or an authorised deputy can be contacted at all times.

48 Call-out arrangements for people engaged in the management of water systems which operate automatically also need to be made. Details of the contact arrangements for emergency call-out personnel should be clearly displayed at access points to all automatically or remotely controlled water systems.

49 Communications and management procedures are particularly important where several people are responsible for different aspects of the operational procedures. For example, responsibility for applying precautions may change when shift-work is involved, or when the person who monitors the efficacy of a water treatment regime may not be the person who applies it. In such circumstances, responsibilities should be well defined in writing and understood by all concerned. Lines of communication should be clear, unambiguous and audited regularly to ensure they are effective. This also applies to outside companies and consultants who may be responsible for certain parts of the control regime.

50 The employment of contractors or consultants does not absolve the duty holder of responsibility for ensuring that control procedures are carried out to the standard required to prevent the proliferation of legionella bacteria. Organisations should make reasonable enquiries to satisfy themselves of the competence of contractors in the area of work before entering into contracts for the treatment, monitoring, and cleaning of the water system, and other aspects of water treatment and control. More general information on selecting a health and safety consultancy can be found in a free HSE leaflet.[4]

51 An illustration of the levels of service which should be expected from service providers can be found in the Code of Conduct developed jointly by the Water Management Society and the British Association for Chemical Specialities (WMS/BACS).[5] The Code of Conduct does not have any legal status under health and

Guidance

safety law, but should help occupiers choose a suitable service provider to help them control the risks from legionella bacteria.

Preventing or controlling the risk from exposure to legionella bacteria

Regulation

Control of Substances Hazardous to Health Regulations 1999, Regulation 7 and 9
Health and Safety at Work etc. Act 1974, Sections 2, 3 and 4

ACOP

52 Where the assessment shows that there is a reasonably foreseeable risk, the use of water systems, parts of water systems or systems of work that lead to exposure has to be avoided so far as is reasonably practicable.

53 Where this is not reasonably practicable, there should be a written scheme for controlling the risk from exposure which should be implemented and properly managed. The scheme should specify measures to be taken to ensure that it remains effective. The scheme should include:

(a) an up-to-date plan showing layout of the plant or system, including parts temporarily out of use (a schematic plan would suffice);
(b) a description of the correct and safe operation of the system;
(c) the precautions to be taken;
(d) checks to be carried out to ensure efficacy of scheme and the frequency of such checks; and
(e) remedial action to be taken in the event that the scheme is shown not to be effective.

54 The risk from exposure will normally be controlled by measures which do not allow the proliferation of legionella bacteria in the system and reduce exposure to water droplets and aerosol. Precautions should, where appropriate, include the following:

(a) controlling the release of water spray;
(b) avoidance of water temperatures and conditions that favour the proliferation of legionella bacteria and other micro-organisms;
(c) avoidance of water stagnation;
(d) avoidance of the use of materials that harbour bacteria and other micro-organisms, or provide nutrients for microbial growth;
(e) maintenance of the cleanliness of the system and the water in it;
(f) use of water treatment techniques; and
(g) action to ensure the correct and safe operation and maintenance of the water system.

Guidance

55 Once the risk has been identified and assessed, a written scheme should be prepared for preventing or controlling it. In particular, it should contain such information about the system as is necessary to control the risk from exposure.

56 The primary objective should be to avoid conditions which permit legionella bacteria to proliferate and to avoid creating a spray or aerosol. It may be possible to prevent the risk of exposure by, for example, using dry cooling plant, adiabatic cooling systems or point-of-use heaters (with minimal or no storage). Where this is impractical, the risk may be controlled by minimising the release of droplets and by ensuring water conditions which prevent the proliferation of legionella bacteria. This might include engineering controls, cleaning protocols and other control strategies. Decisions should be made about the maintenance procedures and intervals, where relevant, on equipment used for carrying out the control measures. Legionella bacteria may be present in very low numbers in many water systems but careful control will prevent them from multiplying.

Guidance

57 In general, proliferation of legionella bacteria may be prevented by:

(a) avoiding water temperatures between 20°C and 45°C - water temperature is a particularly important factor in controlling the risks;
(b) avoiding water stagnation, which may encourage the growth of biofilm;
(c) avoiding the use of materials in the system that can harbour or provide nutrients for bacteria and other organisms;
(d) keeping the system clean to avoid the build-up of sediments which may harbour bacteria (and also provide a nutrient source for them);
(e) the use of a suitable water treatment programme where it is appropriate and safe to do so; and
(f) ensuring that the system operates safely and correctly and is well maintained.

58 The scheme should give details on how to use and carry out the various control measures and water treatment regimes including:

(a) the physical treatment programme - for example, the use of temperature control for hot and cold water systems;
(b) the chemical treatment programme, including a description of the manufacturer's data on effectiveness, the concentrations and contact time required;
(c) health and safety information for storage, handling, use and disposal of chemicals;
(d) system control parameters (together with allowable tolerances); physical, chemical and biological parameters, together with measurement methods and sampling locations, test frequencies and procedures for maintaining consistency;
(e) remedial measures to be taken in case the control limits are exceeded, including lines of communication; and
(f) cleaning and disinfection procedures.

59 The scheme should also describe the correct operation of the water system plant including:

(a) commissioning and recommissioning procedures;
(b) shutdown procedures;
(c) checks of warning systems and diagnostic systems in case of the system malfunctions;
(d) maintenance requirements and frequencies; and
(e) operating cycles - including when the system plant is in use or idle.

60 Detailed guidance on how to effectively prevent or control exposure can be found in Part 2.

Review of control measures - monitoring and routine inspection

61 If precautions are to remain effective, the condition and performance of the system will need to be monitored. This should be the responsibility of the responsible person or, where appropriate, an external contractor or an independent third party and should involve:

(a) *checking* the performance of the system and its component parts;
(b) *inspecting* the accessible parts of the system for damage and signs of contamination; and
(c) *monitoring* to ensure that the treatment regime continues to control to the required standard.

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62 The frequency and extent of routine monitoring will depend on the operating characteristics of the system, but should be at least weekly.

63 Testing of water quality is an essential part of the treatment regime, particularly in cooling towers. It may be carried out by a service provider, such as a water treatment company or consultant, or by the operator, provided they have been trained to do so and are properly supervised. The type of tests required will depend on the nature of the system and further details are given in Part 2 for both cooling towers and hot and cold water systems.

64 The routine monitoring of general bacterial numbers (total viable count) is also appropriate as an indication of whether microbiological control is being achieved. This is generally only carried out for cooling towers, rather than hot and cold water systems. Periodic sampling and testing for the presence of legionella bacteria may also be relevant to show that adequate control is being achieved. However, reliably detecting the presence of legionella bacteria is technically difficult and requires specialist laboratory facilities. The interpretation of results is also difficult; a negative result is no guarantee that legionella bacteria are not present. Conversely, a positive result may not indicate a failure of controls as legionella are present in almost all natural water sources. Further guidance on bacteriological monitoring and interpretation of test results can be found in Part 2.

65 The results of monitoring and testing should be interpreted by a suitably experienced and competent person and any remedial measures, where necessary, should be carried out promptly.

Record keeping

Regulation

Control of Substances Hazardous to Health Regulations 1999, Regulations 6 and 9
Management of Health and Safety at Work Regulations 1999, Regulation 3 and 5
Health and Safety at Work etc. Act 1974, Sections 2, 3 and 4

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66 The person or persons appointed under paragraph 39 shall ensure that appropriate records are kept, including details of:

(a) the person or persons responsible for conducting the risk assessment, managing, and implementing the written scheme;
(b) the significant findings of the risk assessment;
(c) the written scheme required under paragraph 53 and details of its implementation; and
(d) the results of any monitoring, inspection, test or check carried out, and the dates. This should include details of the state of operation of the system, ie in use/not in use.

67 Records kept in accordance with paragraph 66 should be retained throughout the period for which they remain current and for at least two years after that period. Records kept in accordance with paragraph 66(d) should be retained for at least five years.

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68 To ensure that precautions continue to be carried out and that adequate information is available, a record of the assessment and precautionary measures and treatments should be kept. All records should be signed by those people performing the various tasks assigned to them.

69 The following items should normally be recorded:

(a) names and position of people responsible for carrying out the various tasks under the written scheme;

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(b) a risk assessment and a written scheme of actions and control measures;
(c) plans or schematic drawings of the systems;
(d) details of precautionary measures that have been carried out, including sufficient detail to show that they were carried out correctly and the dates on which they were carried out;
(e) remedial work required and carried out, and the date of completion;
(f) a log detailing visits by contractors, consultants and other personnel;
(g) cleaning and disinfection procedures and associated reports and certificates;
(h) results of the chemical analysis of the water;
(i) information on other hazards, eg treatment chemicals;
(j) cooling tower notification;
(k) training records of personnel;
(l) the name and position of the people or persons who have responsibilities for implementing the scheme, their respective responsibilities and their lines of communication;
(m) records showing the current state of operation of the system, eg when the system or plant is in use and, if not in use, whether it is drained down; and
(n) the signature of the person carrying out the work, or other form of authentication where appropriate.

Responsibilities of manufacturers, importers, suppliers and installers

Regulation

Health and Safety at Work etc. Act 1974, Section 3 and Section 6, as amended by the Consumer Protection Act 1987

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70 Whoever designs, manufactures, imports or supplies water systems that may create a risk of exposure to legionella bacteria should, so far as is reasonably practicable:

(a) ensure that the water system is so designed and constructed that it will be safe and without risks to health when used at work; and
(b) provide adequate information for the user about the risk and measures necessary to ensure that the water systems will be safe and without risks to health when used at work. This should be updated in the light of any new information about significant risks to health and safety that becomes available.

71 Suppliers of products and services, including consultancy and water treatment services, aimed at preventing or controlling the risk of exposure to legionella bacteria, should, so far as is reasonably practicable:

(a) ensure that measures intended to control the risk of exposure to legionella bacteria are so designed and implemented that they will be effective, safe and without risks to health when used at work;
(b) provide adequate information on the correct and safe use of products, taking into account the circumstances and conditions of their use;
(c) ensure that any limitations on their expertise or on the products or services they offer are clearly defined and made known to the person upon whom the statutory duty falls or the person(s) appointed to take managerial responsibility;
(d) ensure that any deficiencies or limitations which they identify in the occupier's systems or written scheme to control the risk of exposure to legionella bacteria are made known to the person upon whom the statutory duty falls or the person(s) appointed to take managerial responsibility; and
(e) ensure that their staff have the necessary ability, experience, instruction,

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information, training and resources to carry out their tasks competently and safely.

72 All water systems should be properly installed, and commissioned as appropriate.

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73 Anyone involved in the supply of water systems (eg designers, manufacturers, importers or suppliers of water systems) has duties under health and safety legislation. They must, as far as reasonably practicable, ensure that the equipment is designed and constructed so that it is safe when used at work and enables safe and easy operation, cleaning and maintenance.

74 There are a number of key points to consider in the design and construction of water systems. Cooling systems should be designed and constructed so that they:

(a) comply with relevant British Standards or their European/International equivalents;
(b) control the release of drift by fitting effective drift eliminators (such devices do not eliminate but rather reduce drift). Spray from other parts of the system should also be controlled;
(c) aid safe operation - for example, water circuitry should be as simple as possible, ideally without deadlegs, or if this is not possible, with the length of deadlegs limited;
(d) aid cleaning and disinfection - for example, those parts of the system which need regular cleaning should be easily accessible, readily removable and easily dismantled; and
(e) be made of materials which can be easily disinfected and which do not support microbial growth.

Hot and cold water systems should be designed and constructed so that they:

(a) comply with the Water Regulations (1999) and with parallel provisions in Scotland;
(b) aid safe operation - for example, without deadlegs, or if this is not possible, with the length of deadlegs limited and non-essential standby plant disconnected or removed;
(c) reduce stored cold water to a minimum needed to meet peak needs;
(d) aid cleaning and disinfection - for example, by providing suitable access points within the system; and
(e) minimise heat gain/loss - for example, water pipes and storage tanks should be insulated.

Further detailed information can be found in Part 2.

75 Manufacturers and suppliers of water systems should provide adequate information and instructions on their safe use. This should include information about those aspects of operation and maintenance which have a bearing on the risk.

76 Those who supply services, such as water treatment or maintenance services, should also make clear to the responsible person any deficiencies in the water system or measures that may pose a significant risk of exposure to legionella bacteria. They should also make the owner or responsible person aware of any limitations in their own expertise, products or services so that they can make arrangements to ensure that these deficiencies or limitations are addressed.

77 Service providers should also ensure that their staff are competent to carry out the task safely. They should be properly trained to a standard appropriate

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to the various tasks they perform, such as risk assessment, advising on water treatment measures, sampling or cleaning and maintaining water systems. A Code of Conduct[5] for organisations providing services to occupiers/owners of water systems has been developed jointly by the Water Management Society and the British Association for Chemical Specialities (WMS/BACS). This Code of Conduct does not have any legal status, but may give guidance to occupiers about the standard of service they will receive from service providers who agree to abide by the Code.

78 All staff should be suitably trained, managed, supervised, and given appropriate resources or support. In particular, they should be aware of the action to take when confronted with situations outside of their knowledge or experience.

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Part 2: Guidance on the control of legionella in water systems

The following guidance on the design and management of cooling towers, evaporative condensers and hot and cold water systems is based on, and replaces, the 1993 guidance *The control of legionellosis (including Legionnaires' disease)* HSG70 and the 1998 supplement *The control of legionellosis in hot and cold water systems* MISC150.

This does not form part of the ACOP, but rather it gives practical guidance on how to comply with the requirements of the ACOP.

Cooling systems

79 There is a range of evaporative cooling systems available which vary considerably in size and type. These systems are designed to dissipate heat, using water as a heat exchange medium, from industrial processes and air-conditioning systems (see Box 2 for a description of process and types of system). However, such systems can provide an environment for the growth of many micro-organisms, including legionella, which can be spread widely by aerosol into the area around the cooling tower.

Alternative methods of cooling

80 In some circumstances it may be possible to use alternative methods of cooling. Dry cooling, for example using air blast coolers or air-cooled condensers, will avoid the risks presented by a wet cooling tower or evaporative condenser. The option of dry cooling should therefore be considered, particularly when cooling towers are due to be replaced or when new cooling systems are planned. Large dry cooling systems have some disadvantages as they are generally larger and heavier than cooling towers, so they may be impractical where space and load limitations are limited. They may also be noisier and, while running costs and energy use are comparable for small units, cooling towers are generally cheaper to run for larger systems. These drawbacks will be partially offset by reduced maintenance requirements and savings in the use of water treatment chemicals, cleaning and disinfection costs, regular monitoring and management costs. Adiabatic cooling systems are used increasingly but if used intermittently, they may pose problems associated with water stagnation; this may result in microbiological proliferation. In practice, each case should be considered on its individual merits.

Box 2: Processes and systems

Cooling towers/evaporative condensers

There are two main types of evaporative cooling towers: (a) mechanical draught; and (b) natural draught. **Mechanical draught towers** use fans to move the air through the tower. The air can be either forced or induced through the tower. The forced draught tower (see Figure 1a), with the fan located in the side, pushes the air through the tower and out at the top. Conversely the induced draught tower, with the fan located at the top, pulls air through the tower and out at the top (see Figure 1b). In **natural draught towers** the warm return water heats the internal air causing it to rise. Cooler air is drawn in at the tower base and passes through the falling water droplets, causing evaporation.

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Figure 1a Forced draft

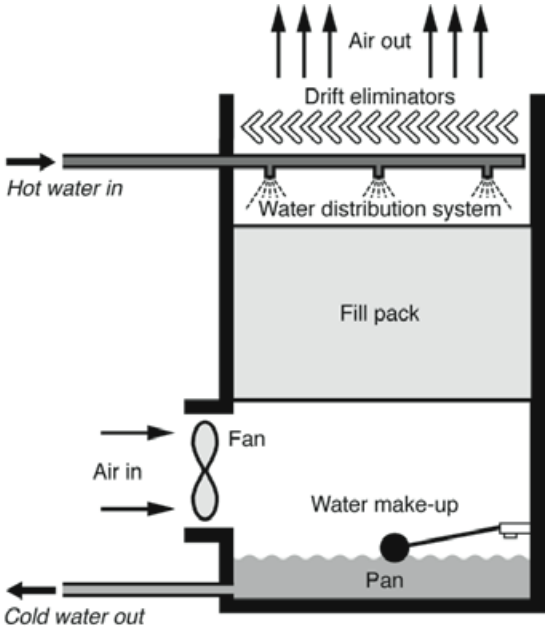
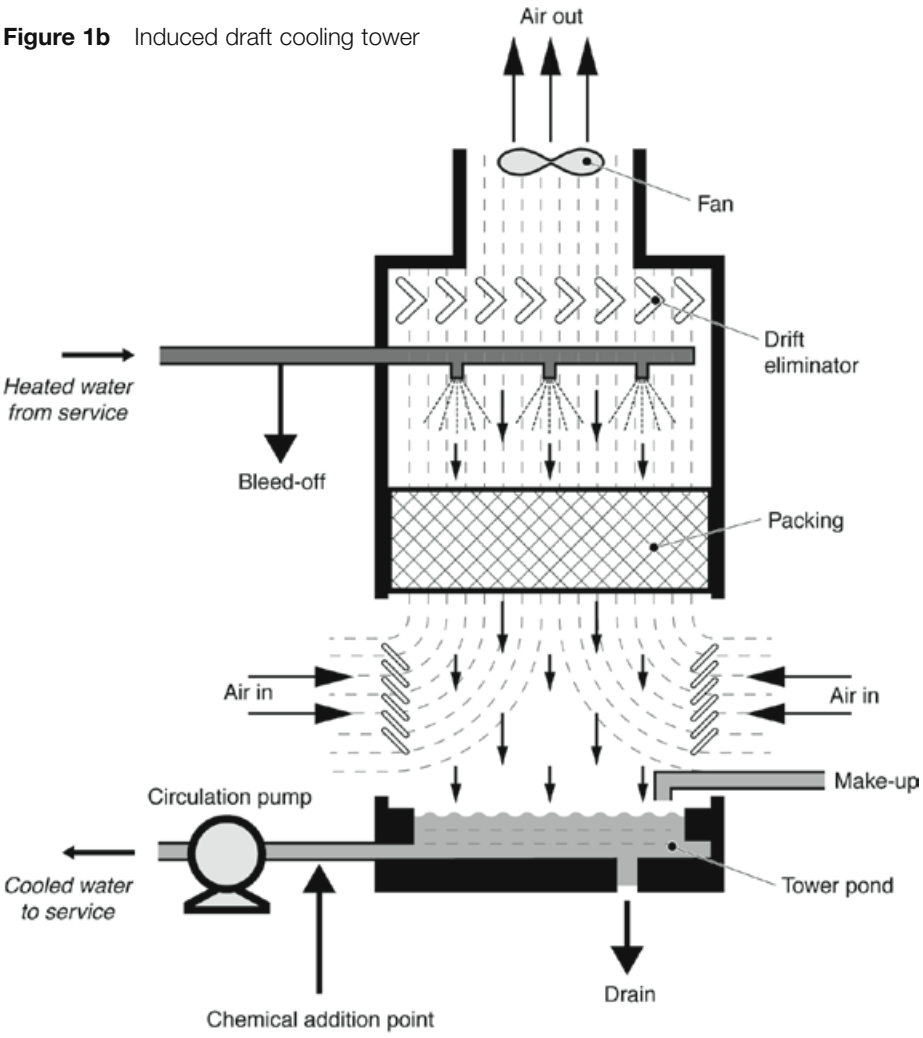


Figure 1b Induced draft cooling tower



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Heat removal and dissipation is achieved primarily by the evaporation of a portion of the recirculating cooling water. To optimise the cooling process there needs to be a large area of contact between the water and the air stream flowing through the cooling tower. This is achieved either by distributing the water over a system of splash bars or filming the water over a large surface area of packing.

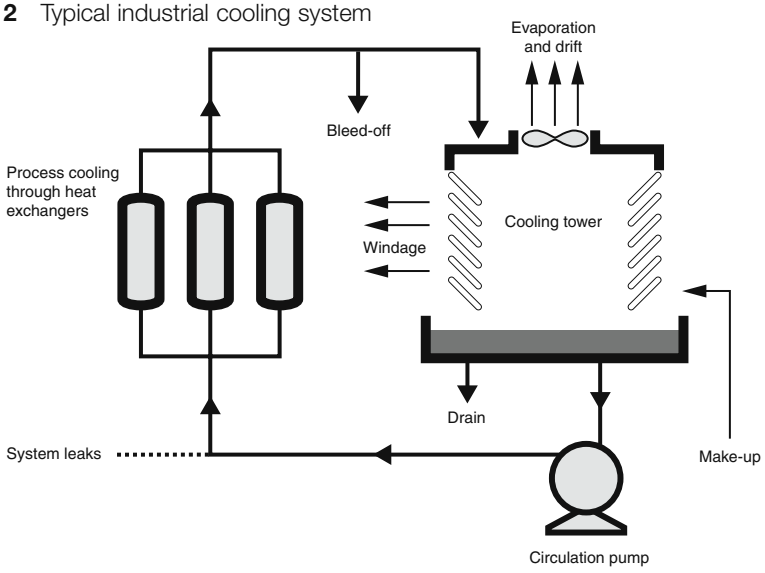
Different types of cooling towers and equipment are used because of the very wide range of cooling process applications. Open recirculating cooling systems are widely used in industry. Natural draught hyperbolic towers are commonly used in the power generation industry. Chemical, petro-chemical and steel industries may also use such towers but, more often, induced draught towers are used. Smaller industrial plants use forced or induced draught cooling towers and Figure 2 shows a typical industrial cooling system. The cooling tower used will depend on the nature of the system duty.

Evaporative condensers (see Figure 3) are sometimes used for air-conditioning or industrial cooling applications. The evaporative condenser combines the function of both the cooling tower and the conventional condenser, as water is sprayed directly over the cooling coils. The volume of water in the evaporative condenser is usually less than in a cooling system. However, cases of legionellosis have been attributed to evaporative condensers and they should therefore be regarded as presenting a similar risk and requiring similar precautions.

Air-conditioning systems

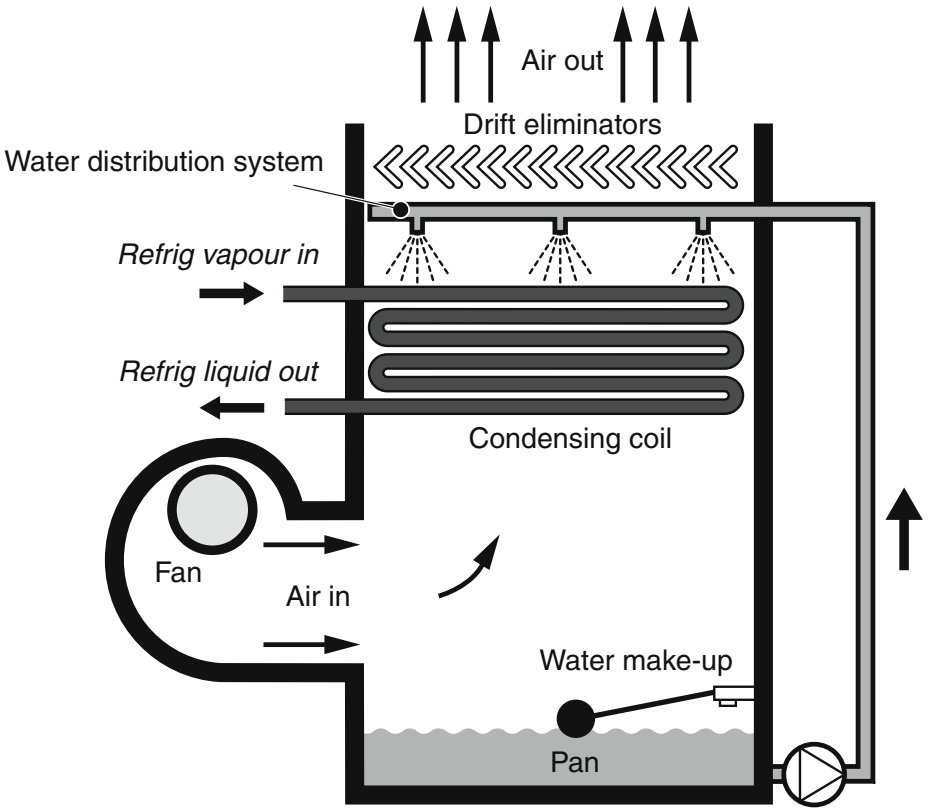
Air-conditioning is a process of treating air to control its temperature, humidity and cleanliness and distributing this air to meet the needs of the conditioned space. Since temperature and relative humidity are interdependent, typically control is established by passing the air over chilled or heated coils and this may include humidification. The air is cleaned by filtration and heat from the refrigeration cycle is removed by the condenser which is often cooled by water from a cooling tower. The cooling water is heated to around 30°C and with the potential for scale formation, corrosion and fouling this may provide an environment for the proliferation of legionella. Figure 4 shows a typical air-conditioning system.

Figure 2 Typical industrial cooling system



Guidance

Figure 3 Evaporative condenser



The ACOP says that plant or water systems should be designed and constructed to be safe and without risks to health when used at work. The following section on design and construction offers guidance on how to do this in cooling systems

81 Cooling systems should be designed and constructed so as to control the release of drift, to aid safe operation, cleaning and disinfection (see BS 4485:Part 3: 1988 and BS 4485:Part 4: 1996).[6] In particular, the following points should be considered:

(a) Drift eliminators, usually made of plastic or metal, should be installed in all towers. In spite of the name, the function of a drift eliminator is to 'reduce' rather than actually 'eliminate' aerosol drift. Although some types are more effective than others, there is no industry standard. However, they should be well fitted and selected on the basis of their ability to reduce the release of small water droplets - there should be no visible drift released from the tower. Wooden slats do not control the small droplets and should be replaced. Operating conditions, especially the discharge air velocity, affect the efficiency of drift eliminators, for example, if the fan is not running. They are not always fitted on natural draught cooling towers because they may be ineffective.

(b) The area above the cooling tower pond should be as well enclosed as possible to reduce the effects of windage. Wind movements around the tower may cause spray to escape through the sides, especially if it is poorly enclosed. This is particularly significant when the tower runs with its fan off. It may also be necessary to screen the tower or its pond to prevent the entry of birds, vermin, leaves or other debris or contaminants and to reduce solar heat gain.

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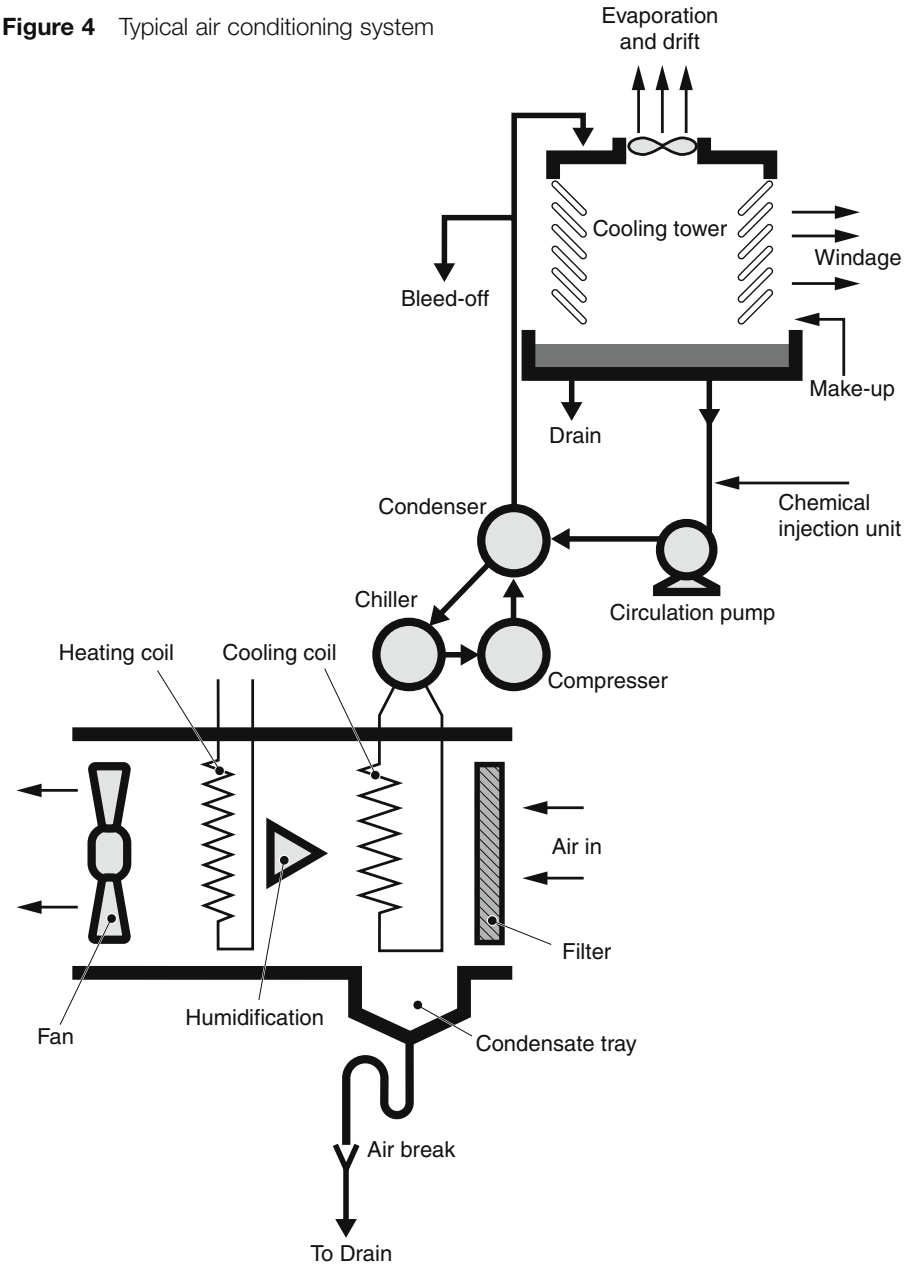
Figure 4 Typical air conditioning system



(c) The water distribution system within the cooling tower should be designed to create as little aerosol (ie small water droplets) as possible. The water circuitry should be as simple as is practicable, with the avoidance of deadlegs and 'difficult to drain' loops and bends. Easily understood and accurate schematics of the various water circuits should be available, with any deadlegs or dead ends highlighted and redundant pipework removed. The absence of water circulation means that any microbial population can be left undisturbed for long periods, allowing growth and multiplication. Any subsequent disruption of the deadleg/dead end could lead to a rapid colonisation of the water system.

(d) Those parts of the tower which become wet should be accessible for cleaning; packs should be readily removable and easily dismantled. The wetted areas of the tower should, where possible, be shaded from direct sunlight to discourage the growth of algae. The pond should have a sloping bottom with a drain connection at the lowest point which is large enough to carry away water and slurry quickly and easily. A suitably-sized drain-down valve should be located at the lowest point of the system so that it can be

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conveniently and completely drained, including all pipework and items of equipment. It may be necessary to fit supplementary drain valves to the bottom of individual items of equipment.

(e) The tower should be constructed of materials which can be readily disinfected and which do not support microbial growth. Preserved (see BS5589:1989)[7] timber may be used for the manufacture of cooling towers and packs but it needs to be impervious and easy to clean and disinfect.

(f) Make-up water may not necessarily be mains-supplied (or from another treated water supply) - it may come from rivers, lakes, bore holes and other sources. It may therefore need pre-treatment to be of equivalent quality to the mains supply. If it does not come from a treated water supply, then the quality of water entering the make-up system may show considerable variation in both chemical composition and microbial activity. This may contribute to potential risk and a strategy is required to overcome any identified problems. Inclusion of a water meter in the tower supply pipeline both for the measurement of make-up rates and for the proportional dosage of treatment chemicals is recommended.

(g) A full water treatment programme should be integrated into the system design, with provision made for sample, injection, bleed and drain points and for the incorporation of dosing and bleed equipment; ideally this should be automated.

(h) Cooling towers should be positioned as far away as possible from air-conditioning and ventilation inlets, opening windows and occupied areas, taking note of the prevailing wind direction and the wind distribution over neighbouring buildings. This should also be considered when replacing old cooling towers as it may be possible to reposition them to a more suitable location.

Management of cooling towers

82 The cooling system may consist of a cooling tower, evaporative condenser or other cooling element, the recirculating pipework, the heat exchanger, pumps and ancillary items such as supply tanks and pre-treatment equipment. All of these items should be subject to the management and control system.

The ACOP says risks from legionella should be identified and managed. The following section on commissioning, operation and maintenance of cooling towers offers guidance on some of the issues which need to be addressed in order to do this.

Commissioning

83 Systems should be properly commissioned to ensure that they operate correctly and within the design parameters. It is essential that the commissioning process is carried out in a logical and defined manner. The responsibilities of the staff carrying out the commissioning process should be clearly defined with adequate time and resources allocated to allow the integrated parts of the installation to be commissioned correctly. The same precautions taken to prevent or control the risk of exposure to legionella during normal operation of cooling systems also apply to the commissioning process.

84 When commissioning (or recommissioning) a tower, the following points should be noted (see also paragraph 135).

(a) If a new system is not to be taken into immediate service, commissioning should not be carried out until the system is required for use and should not be filled until commissioning takes place (if filled for hydraulic testing, then the system should drained and not refilled until commissioning takes place).

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(b) If a new system is to be taken into use within a week, commissioning can be carried out and the system left charged with treated water which should include a biocide. This is equally important when recommissioning existing installations which have been substantially altered following a major design or modification.
(c) The results of the commissioning process should be included as a section in the operation and maintenance manual. The availability of such baseline data enables periodic checks to be made to show that the installation continues to operate as intended.
(d) Formal arrangements should be made to check that commissioning has been completed to the standard specified, eg an independent engineer witnesses the testing and countersigns the relevant documents.

Operation

85 Cooling systems and towers should be kept in regular use wherever possible. Where a system is used intermittently or is required at short notice, it should be run once a week and, at the same time, be dosed with water treatment chemicals and water quality monitored. The whole system should be run for long enough to thoroughly distribute treated water. If a system is out of use for a week or longer (up to a month), in addition to the above, the water should be treated with biocide immediately on reuse.

86 If it is out of use for longer than a month and there are continued management/monitoring arrangements in place, the system should be kept full of treated water which should be checked (for biocide levels and water quality) and circulated once a week (see also paragraph 135). If it is not possible to ensure regular monitoring and circulation (for example if a building falls out of use) the system should be drained and sealed, with a desiccant left in the system to reduce the effects of corrosion. Full recommissioning will be required before the system can be bought back into reuse. Cooling systems that do not operate continuously, such as cooling towers that cycle on and off automatically or those on regular standby duty, require particular attention with regard to the biocide programme to ensure that effective levels of biocide are maintained at all times.

87 Operation manuals should be available for each water system. These manuals should detail, in easily understood terms, operation and maintenance procedures which enable plant operators to carry out their duties safely and effectively.

88 The manuals should include equipment as fitted and represent the system as currently in operation, and include (also as fitted) system drawings and/or schematics, manufacturers' instructions for operation and system parameters such as capabilities, throughputs and design temperatures. The total volume of the entire water circuit, ie tower pond, recirculation pipework and heat exchange equipment, should be known and recorded.

89 Specific information on the water treatment programme in use should be included. Where automatic dosing equipment is used, there should be a means of confirming that treatment is being applied. Irrespective of the dosing method, both the quantity and frequency of chemical application should be recorded.

90 Such records should be expanded to:

(a) include the results of system monitoring; and
(b) show any action required and confirmation that this has been carried out.

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91 Manuals should include details of:

(a) normal control parameters;
(b) limits, with corrective actions, for out-of-specification situations, or where plant operating conditions or make-up water quality have changed; and
(c) cleaning and disinfection procedures.

92 Where automatic controls are employed, either for chemical addition or to allow system bleed-off, they should be checked over their full operating ranges. In the specific case of conductivity controlled bleed-off, regular calibration of the conductivity cell should be carried out.

93 Standby equipment, such as towers and recirculating pumps, should operate on a rota basis eg daily on/off, or otherwise isolated and held dry. If there are standby cooling towers, specific procedures will need to be adopted to bring them into operation safely.

94 When a biocide is added to a water system, all standby equipment or pipework should be brought into circulation so that the biocide is distributed throughout the entire system.

Maintenance

95 The operations manual should include a detailed maintenance schedule which should list the various time intervals when the system plant and water should be checked, inspected, overhauled or cleaned. Provision should be made for the completion of every task to be recorded by the plant operatives.

96 Drift eliminators require particular attention with regard to maintenance so that aerosol release continues to be controlled. They should be inspected, cleaned and maintained to ensure that they are free from biofouling, corrosion, scale and other deposits and are well seated and undamaged.

Treatment programmes

The ACOP says that the risk from exposure to legionella should be prevented or controlled; precautions should include the use of water treatment techniques. The following section on treatment programmes offers guidance on how to treat water in cooling systems.

97 A complete water treatment programme based on the physical and operating parameters for the cooling system and a thorough analysis of the make-up water should be established. The components of the water treatment programme should be environmentally acceptable and comply with any local discharge requirements.

98 It is important to ensure that water treatment programmes have sufficient range of adjustment to cope with any potential variations in make-up water supply quality. This enables control to be maintained. Failure to take account of variations in quality may lead to the rapid development of uncontrolled microbiological conditions within the cooling system.

99 There are a number of factors which will influence the effectiveness of any treatment programme:

(a) corrosion;
(b) scale formation;
(c) fouling; and
(d) microbiological activity.

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These are discussed in more detail in paragraph 101-121. They are interrelated and failure to control any one may lead to all occurring simultaneously, resulting in an environment that encourages the growth of legionella. In setting up an effective monitoring and control system, it should be remembered that corrosion, scale formation and fouling are continuous physico-chemical processes and inhibitors to control such processes should be added on a continuous basis.

100 All components of the treatment programme should be preferably be dosed by pump or eductor (sometimes referred to as an ejector) systems or by a suitable halogen dosing system such as a brominator. This will minimise health and safety risks to operators and ensure that frequencies and rates of application are maintained as recommended.

Corrosion

101 In many cooling systems a significant proportion of the construction material is mild steel which is susceptible to corrosion. Although heat transfer equipment may be made of more corrosion-resistant metals such as copper or copper alloys or stainless steel, these metals also need to be adequately protected. Corrosion of steel should be inhibited as it may lead to conditions which encourage the growth of legionella.

102 There are two types of corrosion inhibitors available; **anodic** and **cathodic** and a treatment programme would generally use both types for optimum protection. The actual inhibitors used will depend on the type of system and its operation, water quality, operating temperatures, construction materials and environmental constraints. In all cases, corrosion inhibitors need to be applied continuously since their effectiveness depends on the presence of clean metal surfaces. This highlights the need for pre-commissioning cleaning and subsequent passivation of the metal surfaces. Corrosion inhibitors are commonly applied at a point of good mixing such as the suction side of the recirculating pump.

Scale

103 Scale is the localised precipitation of normally water-soluble inorganic salts. Its formation is influenced by the concentration of calcium and magnesium salts, alkalinity and pH, surface and bulk water temperatures and the concentration of the total dissolved solids.

104 Scale formation results in loss of heat transfer, reduced flow rates, loss of efficiency and deposition/corrosion. Legionella can be associated with such deposits - the scale protects the bacteria and so reduces the effectiveness of biocidal treatment.

105 Chemicals used to control scale are known collectively as scale inhibitors. The specific chemicals used will depend upon the type of scale predicted from the water chemistry and system operating conditions. In systems which contain scale, or have had a history of scaling problems, chemical analysis of the scale will ensure that the most effective treatment programme is selected.

106 There are a number of other methods of scale control including:

(a) limiting the cycles of concentration by bleed-off/blow-down;
(b) conversion of calcium and magnesium hardness into more soluble salts - generally achieved by the controlled addition of a mineral acid to the cooling water, a method more applicable to large industrial systems; and
(c) prevention of scale formation by removing the calcium and magnesium hardness salts by ion-exchange softening; this is dependent on water quality

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and system characteristics. The use of a blend of untreated and softened water may be appropriate in some instances.

107 It is common practice to apply scale inhibitors to a point of good mixing such as the suction side of the recirculating pump.

Fouling

108 The term fouling is normally applied to deposition of particulate material and debris such as:

(a) insoluble corrosion products;
(b) scale deposits;
(c) mud, silt, clay;
(d) airborne dust and debris;
(f) process contaminants; and
(g) biological matter such as insects, pollen and plant material, including the formation of slimes. Settlement will occur in low-velocity areas of the system and can lead to loss of plant performance, corrosion under the deposits, increased microbiological activity and proliferation of legionella.

109 In systems using make-up water, which has a high concentration of suspended solids, pre-clarification may be necessary. Where this is not feasible, side-stream filtration can be used to remove particulate debris introduced into the cooling tower.

110 Fouling can be controlled or alleviated through:

(a) using dispersants to prevent agglomeration (and subsequent deposition) of the particles. Chemical methods are most effective if water velocities can be maintained at or above 1 m/s. Where oil contamination is a problem, surfactants may be used, as required, to emulsify and disperse the contamination;
(b) reversing water flow through heat exchangers, centrifugal strainers, 'air bumping' or temporarily increasing water velocity by the introduction of a high-pressure water supply. Such methods should always be used with care, as there is likely to be an increase in microbiological count in the recirculating water, caused by the disturbance of the deposits, so the bleed may need to be increased to flush micro-organisms from the system.

Microbiological activity

111 The operating conditions of a cooling system provide an environment in which micro-organisms can proliferate. The water temperatures, pH conditions, concentration of nutrients, presence of dissolved oxygen, carbon dioxide, sunlight, together with large surface areas all favour the growth of micro-organisms such protozoa, algae, fungi and bacteria, including legionella.

112 Problems arise when micro-organisms are allowed to grow or flourish to excess; this can result in the formation of biofilms on system surfaces. These can:

(a) cause a reduction in heat transfer;
(b) harbour legionella and provide an environment for their growth;
(c) induce highly localised microbial corrosion;
(d) interfere with the effectiveness of corrosion inhibitors;
(e) trap particulate matter, increasing the problem of fouling; and
(f) disrupt water distribution within the tower.

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Both surface-adhering (sessile) and free-flowing (planktonic) bacteria need to be controlled for a complete and effective programme.

113 Biocides are used to control microbiological activity. They should prevent the proliferation of micro-organisms but are not required to disinfect systems. Biocides can be oxidising or non-oxidising (see Box 3 for details of use). Control, ie the frequency and quantity of additions, will depend on the microbiological activity of the system.

114 Biocides, when correctly selected, applied and controlled, as part of a comprehensive water treatment programme, have been shown to be effective in preventing the proliferation of legionella. Many factors will influence the selection of chemicals required for the treatment programme. However, the success of the treatment programme is dependent on:

(a) compatibility of all chemical components used; and
(b) adherence at all times, to the recommended application, monitoring and control procedures.

115 Biocides are routinely applied at the tower sump or the suction side of the recirculating water pump but should be dosed so that the biocide will circulate throughout the cooling system. However, in air-conditioning systems where the tower can be bypassed, the biocide needs to be added to the suction side of the recirculating pump.

Box 3: Biocides

Oxidising biocides

The halogens are dosed to give a free chlorine or free bromine reserve. This is a measure of the free halogen, the hypochlorous/hypobromous acid (HOCl/HOBr) and the hypochlorite/hypobromite ion (OCl- /OBr-). In all cases the applied dosage should be sufficient to maintain a free reserve in the range of 0.5-1mg/l chlorine/chlorine dioxide and 1.0-2.0 mg/l bromine in the return water. Reserves consistently above 2mg/l free chlorine/bromine should be avoided (except in exceptional circumstances) as this may cause system corrosion. The activity (in terms of time taken to have an effect) of chlorine is significantly reduced at alkaline pH and additions of this biocide need to be adjusted to take account of this - it can be overcome by continuous dosing. It is, in any case, preferable to apply oxidising biocides on a continuous basis but if they are applied as a shot dose, the effective concentration should be present for at least 4 out of every 24 hours. In large industrial systems, the dosage is based on water recirculation rate. This has to be sustained for a period of time, ranging from a few minutes to several hours, or even continuously, dependent on the operating characteristics of the cooling system.

For small systems, such as air-conditioning installations, halogen addition would normally be based on system volume. The system and its water chemistry will influence the choice of the best method of addition to obtain effective microbiological control. Once halogenation is stopped, the free halogen reserve is quickly lost, leaving the system open to re-infection and re-population by micro-organisms.

Non-oxidising biocides

Such biocides are generally more stable and longer lasting than oxidising

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biocides but their concentration will reduce because of depletion via water losses from the system and by degradation of the active material.

To achieve the right non-oxidising biocide concentration to kill micro-organisms, it should be added as a shot dose but may sometimes be added continuously. The frequency and volume of applications are dependent on system volume, system half-life and the biocide contact time, typically four hours. These need to be considered to ensure that the biocide concentration necessary to kill the micro-organisms is achieved. In systems with smaller water volumes and high evaporation rates it is particularly important that the above parameters are accurately determined. In the case of systems which have long retention times, the half-life of the biocide is the controlling factor.

A non-oxidising biocide programme should use two biocides on an alternating basis. Once the concentration of any biocide has been depleted to below its effective level, the system will be open to re-infection. The efficacy of non-oxidising biocides may be influenced by the pH of the water in the system and this should be taken into account to ensure that the biocide programme is effective. The following points are important in selecting a non-oxidising biocide programme:

- retention time and half-life of the system;
- microbiological populations;
- system contaminants;
- handling precautions; and
- effluent constraints.

116 Specific surfactants (biodispersants) which function by wetting biofilms and aiding penetration of the biocides into the films are often used to supplement oxidising biocide programmes. In microbiologically dirty systems which contain or readily grow biofilms, the use of biodispersants can improve the efficiency of oxidising biocides. Most non-oxidising biocide formulations already contain surfactants to improve performance.

117 Hazard data sheets should be available for all chemicals used in treatments applied to cooling towers and an assessment drawn up to ensure that those handling and applying them do so safely.

118 Where a biocide has been selected specifically for the control of legionella, the supplier should be able to present test data to demonstrate efficacy, which should include kill concentrations and contact times.

119 Regardless of the results of laboratory testing, to establish an effective biocide programme to control legionella, it should be remembered that an operating cooling system is subject to unpredictable recontamination both by legionella and sources of nutrients. Therefore regular microbiological testing needs to be carried out to ensure that the biocide programme remains effective.

120 A variety of other methods of water treatment is available. One approach relies on the electrolytic dissolution of metals such as copper and silver, thereby generating biocidal ions in solution. Another is the introduction of ozone, which produces an oxidising biocide in the water. Physical methods such as irradiation by ultraviolet (UV) light can also be used, although this is only effective when the water is clear, so it may be necessary to install a water filtration system too. Also, since UV irradiation is not a dispersive technique, additional biocides may be required to control biofilms.

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121 Each of the techniques described above has the potential advantage that they could replace the use of chemical biocides. However, they should only be used if they are capable of achieving at least the equivalent biocidal effect to those of the traditional methods.

Monitoring

The ACOP says that the risk from exposure to legionella should be prevented or controlled and that the precautions taken should be monitored to ensure that they remain effective. The following section on monitoring offers guidance on how to do this in cooling systems.

General Monitoring

122 The composition of the make-up and cooling water should be routinely monitored to ensure the continued effectiveness of the treatment programme. The frequency and extent will depend on the operating characteristics of the system, the minimum recommended frequency being once a week to ensure that dosage and bleed rates are correct (see Table 1).

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Table 1: Typical on-site monitoring checks recommended for good operating practice

Parameter	Timing	
	Make up-water	Cooling water
Calcium hardness as mg/l $CaCO_3$	Monthly	Monthly
Magnesium hardness as mg/l $CaCO_3$	Monthly	Monthly
Total hardness as mg/l $CaCO_3$	Monthly	Monthly
Total alkalinity as mg/l $CaCO_3$	Quarterly	Quarterly
Chloride as mg/l Cl	Monthly	Monthly
Sulphate as mg/l SO_4	Quarterly	Quarterly
Conductivity µs (Total dissolved solids)	Monthly	Weekly
Suspended solids mg/l	Quarterly	Quarterly
Inhibitor(s) level mg/l	-	Monthly
Oxidising biocide mg/l	-	Weekly
Temperature °C	-	Quarterly
pH	Quarterly	Weekly
Soluble iron as mg/l Fe	Quarterly	Quarterly
Total iron as mg/l Fe	Quarterly	Quarterly
Concentration factor	-	Monthly
Microbiological activity	Quarterly	Weekly
Legionella	-	Quarterly

123 The identification of changes in the water chemistry such as pH, dissolved and suspended solids, hardness, chloride and alkalinity allows any necessary corrective actions to be taken to the treatment programme or system operating conditions. In addition, chemical treatment reserves such as scale and corrosion inhibitors and oxidising biocides should be measured. Routine on-site determination of the concentration of non-oxidising biocides is not practical. The amount of non-oxidising biocide required is therefore calculated from the volume and half-life of the system. Other aspects of the treatment programme such as corrosion rates and microbiological activity will also need to be monitored.

124 The monitoring programme should also include the routine sampling and testing for the presence of bacteria, both general (aerobic) bacterial species and legionella bacteria. Since the detection of legionella bacteria requires specialist laboratory techniques, routine monitoring for aerobic bacteria is used as an indication of whether microbiological control is being achieved.

125 The most common method to measure microbiological activity within a cooling system is to use a dip slide. These are commercially available plastic slides which are coated with sterile nutrient agar - a medium on which many micro-organisms will grow, but not legionella. They are dipped into the water and incubated for 48

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hours. Any bacteria in the cooling water will grow and form colonies. Comparison with a chart will indicate the number of bacteria in the water. Dip slides should be dipped in the system water as near to the heat source as possible. If a drain cock is used it is important that any residual water is run off before the slide is dipped. The dip slide should then be replaced into its container and incubated for a minimum of 48 hours in an incubator, usually at 30°C. The incubation period and the temperature should be the same each time the test is performed.

126 Cooling tower water should be tested, using dip slides (or similar), on a weekly basis. The timing of dip slides and other microbiological sampling is important. Sampling should not be carried out if biocide has been recently added. Neither should the visible condition of the water be taken as a good indicator of the need for sampling; there are a number of chemical additions which render the water opaque. Conversely, relatively clear water may be heavily contaminated with bacteria.

127 Table 2 lists microbiological counts and the appropriate action that should be taken in response to them. While the number of micro-organisms is itself important, it is also necessary to monitor any changes from week-to-week, particularly if there are any increases in the numbers of micro-organisms detected. This should always result in a review of the system and the control strategies. A graphical representation of these data will often help to monitor any trends.

128 If the control strategy is effective, the dip slide counts should be consistently low. If an unusually high result is obtained, the test should be repeated immediately and, if confirmed, appropriate action taken (see Table 2). Consistently high microbiological counts using dip slides should be checked by laboratory-based total viable counts (TVC). The laboratory should be accredited by the United Kingdom Accreditation Service (UKAS).

Table 2: Action levels following microbial monitoring for cooling towers

AEROBIC COUNT cfu/ml at 30°C (minimum 48 hours incubation)	Legionella bacteria cfu/litre	ACTION REQUIRED
10 000 or less	100 or less	**System under control**
more than 10 000 and up to 100 000	more than 100 and up to 1000	**Review programme operation** - A review of the control measures and risk assessment should be carried out to identify any remedial actions and the count should be confirmed by immediate resampling.
more than 100 000	more than 1000	**Implement corrective action** - The system should immediately be re-sampled. It should then be 'shot dosed' with an appropriate biocide, as a precaution. The risk assessment and control measures should be reviewed to identify remedial actions.

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129 Alternative techniques for determining microbiological activity have been developed for on-site use. It is important that such methods can be clearly related to the results achieved by traditional counting methods and that appropriate action levels can be set to inform decisions on the necessary control measures.

Monitoring for legionella

130 In addition to the routine sampling for aerobic bacteria, the routine monitoring scheme should also include periodic sampling for the presence of legionella bacteria. This should be undertaken at least quarterly, unless sampling is necessary for other reasons, such as to help identify possible sources of the bacteria during outbreaks of Legionnaires' disease. More frequent sampling should be carried out when commissioning a system and establishing a treatment programme. Sampling should be carried out, on a monthly basis, until it can be shown that the system is under control. If a legionella-positive sample is found as a result of routine sampling, more frequent samples may be required as part of the review of the system/ risk assessment, to help establish when the system is back under control. The sampling method should be in accordance with ISO 11731:1998[8] and the biocide neutralised where possible. Samples should be taken as near to the heat source as possible. They should be tested by a UKAS accredited laboratory that takes part in the Public Health Laboratory Service Water Microbiology External Quality Assessment Scheme for the isolation of legionella from water. The laboratory should also apply a minimum theoretical mathematical detection limit of less than, or equal to, 100 legionella bacteria per litre of sample.

131 Legionella bacteria are commonly found in almost all natural water sources, so sampling of water systems and services may often yield positive results and the intererpretation of any results of sampling should be carried out by experienced microbiologists. Failure to detect legionella bacteria should not lead to the relaxation of control measures and monitoring. Neither should monitoring for the presence of legionella bacteria in a cooling system be used as a substitute in any way for vigilance with control strategies and those measures identified in the risk assessment.

Cleaning and disinfection

The ACOP says the risk from exposure to legionella should be prevented or controlled; precautions include maintaining the cleanliness of the system and the water in it. The following section on cleaning and disinfection offers guidance on how to do this in cooling systems.

132 The maintenance of an effective biocide regime will provide a hostile environment for microbial life (including legionella) and minimise biofouling. However, the use of biocides should not be considered in isolation but as part of the overall water treatment programme including the manual and chemical cleaning and disinfection of open cooling systems, and in particular the cooling tower.

133 Many cooling systems operate on a continuous basis where process conditions preclude total system shutdown except infrequently. Other measures, such as side-stream filtration, more frequent microbiological monitoring, continuous biocide addition etc, which are reasonably practicable, should be applied and monitored carefully.

134 Disinfection, cleaning and manual desludging of cooling towers should be undertaken at least twice a year, but more frequent cleaning may be necessary depending on local environmental conditions such as dirty atmospheres and the conclusions reached in the risk assessment. Cooling systems that have a short operating period may only need to be cleaned at the beginning and end of that

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period. If on inspection the system shows signs of a significant build-up of deposits or slime, then disinfection and cleaning should be carried out. The use of chlorine or other oxidising biocides to disinfect the tower is an effective approach, provided they are used correctly.

135 In addition to this regular disinfection, cooling towers should always be cleaned and disinfected before being put back into service:

(a) immediately before the system is first commissioned;
(b) after any prolonged shutdown of a month or longer (a risk assessment may indicate the need for cleaning and disinfection after a period of less than one month, especially in summer and for health care premises where shutdown is for more than five days);
(c) if the tower or any part of the cooling system has been mechanically altered;
(d) if the cleanliness of the tower or system is in any doubt; and
(e) if microbiological monitoring indicates that there is a problem.

Routine cleaning and disinfection

136 *Pre-cleaning disinfection* The system water should be disinfected using an oxidising biocide such as chlorine, bromine or chlorine dioxide to minimise health risks to the cleaning staff . This is done by adding either sodium hypochlorite solution or chloroisocyanurate compounds available as rapid-release tablets to achieve a measured residual of 5 mg/l free chlorine. Sodium hypochlorite solutions typically contain 10-12% available chlorine and rapid-release tablets contain 50-55% available chlorine. Such products should be handled with care and according to instructions given by the supplier. A biodispersant should also be used to enhance the effectiveness of the chlorination.

137 The chlorinated water containing 5 mg/l free chlorine should be circulated through the system for a period of 5 hours with the fan off, maintaining a minimum of 5 mg/l free chlorine at all times. However, if the system pH value is greater than 8.0, the measured residual will need to be in the range 15-20 mg/l free chlorine in order to achieve the required disinfection level. An alternative procedure to provide more effective use of chlorine is to introduce a heavy bleed-off for several hours to both reduce the pH of the system water and its chlorine demand, before carrying out disinfection. The system should then be de-chlorinated (see paragraph 144) and drained.

138 *Cleaning* Manual cleaning operations can then be carried out, with all accessible areas of the tower etc being adequately cleaned. Where practicable, the packs should be removed at least once a year and preferably every six months. If this is not practicable, it may be necessary to apply supplementary strategies such as side-stream filtration, increased monitoring etc. Accessible areas of the tower and its pack should be adequately washed but cleaning methods that create excessive spray, for example high-pressure water jetting, should be avoided. If this is not possible, the operation should be carried out when the building is unoccupied or, in the case of permanently occupied buildings, windows in the vicinity should be closed, air inlets blanked off and the area that is being water-jetted should be tented. The area should be isolated and consideration should also be given to other occupied premises in the immediate areas as well as members of the public who may in the vicinity during cleaning.

139 Cleaning staff who carry out water-jetting should wear suitable respiratory protective equipment such as a positive-pressure respirator with full facepiece or a hood and blouse. Staff who use this equipment should be adequately trained and the equipment properly maintained (see section on protection of personnel in paragraphs 199-202).

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140 Adherent scale or other deposits on the tower and distribution system that have not been removed by the above method can be dissolved using chemical descalents carefully chosen to avoid damage to the fabric of the system. If this is not possible, routine inspection and testing of water quality should be particularly thorough.

141 Finally, the system should be sluiced out until the water going to drain is clear.

142 *Post-cleaning disinfection* On completion of the cleaning operation, the system should be refilled and chlorinated to maintain a minimum level of 5 mg/l of free chlorine for a period of 5 hours with the fan off. This needs to be checked hourly to ensure that a concentration of 5 mg/l is present for the total period. Again, the use of a biodispersant will enhance the effectiveness of this chlorination. If the system volume is greater than 5m^3, the water should be de-chlorinated, drained, flushed and refilled with fresh water and dosed with the appropriate start-up level of treatment chemicals, including the biocides.

143 While the maintenance of a continuous minimum residual of 5 mg/l of free chlorine for a minimum period of 5 hours is considered the best practice, if the downtime to conduct such a lengthy operation is not available, some compromise may be necessary. Under such circumstances it may be acceptable to shorten the pre- and post-chlorination times and to increase the free chlorine level, eg 50 mg/l for 1 hour or 25 mg/l for 2 hours. This should only be done if the operators are trained in this process because, at these levels, there is a greater risk of damaging the fabric of the system. The system should then be de-chlorinated, drained, flushed and refilled with fresh water and dosed with the appropriate start-up level of treatment chemicals, including the biocides.

144 Before water containing high-residual free chlorine is discharged to drain, it should be de-chlorinated. The usual procedure is to add sodium thiosulphate, sodium sulphite or sodium bisulphite as a neutraliser. The level of free chlorine is determined by testing and the quantity of sodium salt then is calculated.

Hot and cold water services

145 There is a variety of systems available to supply hot and cold water services (see Box 4 for description of types of system). In the past, hot and cold water systems were associated with more reported outbreaks of Legionnaires' disease than cooling towers. But in recent years there have been very few outbreaks - probably due to better maintenance and care. However, since such systems are widespread and can be complex in design they still present a foreseeable risk of exposure to legionella.

Box 4: Hot and cold water systems

Gravity system with recirculation

This is the type of system found in many commercial buildings (see Figure 5). Cold water enters the building from a rising main and is stored in an intermediate cold water tank. The cold water storage tank provides backflow protection to the mains supply and a stable pressure in the system. Cold water from this storage tank is fed to the calorifier where it is heated. There is a continuous circulation of hot water from the calorifier (storage heat exchanger) around the distribution circuit and back to the calorifier. The purpose of this is to ensure that hot water is quickly available at any of the taps, independent of

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their distance from the calorifier. The circulation pump is sized to compensate for the heat losses from the distribution circuit such that the return temperature to the calorifier is not less than 50°C. It does not depend on the projected hot water demand. The pump has little effect on the pressure at the tap which is determined by the relative height of the storage tank. If a heavy hot water demand occurs then water will flow directly to the point(s) of use via the non-return valve. The expansion of water as it is heated within the system is accommodated by a slight rise in the levels of the tank and vent pipe. Ideally the vent pipe should be linked to a separate tundish/drain or else to the cold water storage tank but it should not discharge water except under fault conditions. These design principles also apply where an electrically heated cylinder or direct fired storage water heater is used instead of a calorifier. In the cold water system, water is fed by gravity directly from the cold water storage tank to the points of use without recirculation.

Gravity system without recirculation

This system is generally found in most houses and small buildings. If temperature is being used as a means of controlling legionella then designers should be considering the requirement to achieve hot water of 50°C at all points of use within 1 minute. Where there are long pipe runs between the calorifier and the point of use this may not be possible without trace heating. Trace heating is usually applied in the form of a thermostatically controlled electric resistance tape in intimate contact with the pipe. It is then covered by a good thickness of insulation. In the cold water system, water is fed by gravity directly from the cold water storage tank to the points of use.

Pressurised systems

In a mains pressure hot water system there is no intermediate cold water storage tank. The rising main is connected directly to the calorifier, water heater or plate heat exchanger. Backflow protection is provided by a double non return valve on the cold feed to the water heater. Since the water in the system will expand with temperature, an expansion vessel and a safety temperature and pressure relief valve are required. Hot water distribution from pressurised systems can be used in both recirculation and non-recirculation systems. The latter is commonly found in houses with combination heating and hot water (combi) boilers. Cold water is fed directly from the mains to the points of use.

146 Hot water systems present the greatest risk in environments which allow the proliferation of legionella, for example:

(a) at the base of calorifiers where the incoming cold water merges with the existing hot water. This water collects sedimented organic and mineral deposits which support bacterial growth, including legionella - this can then be distributed throughout the system to colonise its periphery, especially where optimum temperatures and stagnation occur eg in infrequently used outlets.
(b) water held in pipes between a recirculating hot water supply and an outlet (eg tap or shower) particularly when not in use, as they may not be exposed to biocides and high temperatures.

147 Water systems may occasionally be contaminated with legionella (usually in small numbers) which enter cold water storage systems from the mains supply. This presents little risk under normal circumstances. Legionella will only grow

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in cold water systems and the distribution pipework when there are increased temperatures (eg due to heat gain), appropriate nutrients and stagnation.

148 Cases of legionellosis have been reported in hospitals where water systems have been colonised by legionella. In addition, there have also been reports of infection when tap water was used to fill personal humidifiers and to wash jet nebulisers and other respiratory equipment. This, together with the presence of susceptible individuals, means that there may be an increased risk in health care premises and additional precautions may be needed.[9]

Substitution

149 Some of the features of gravity hot water systems which influence the risk of exposure to legionella, such as having open tanks and relatively large storage volumes, can be eliminated by moving to mains pressure systems. This requires confidence in the reliability and continuity of the mains supply and may not be acceptable in all cases. Other problems, such as the maintenance of water temperatures throughout the distribution system and changes in demand, can be simplified by changing to point-of-use water heaters with minimal or no storage. Guidance on the general principles and limitations of instantaneous water heaters is given in BS6700:1997.[10]

Design and construction

The ACOP says that plant or water systems should be designed and constructed to be safe and without risks to health when used at work.The following section on design and construction offers guidance on how to do this in hot and cold water systems.

150 The overall choice of system depends on the size and configuration of the building and the needs of the occupants. A key issue is whether cold water storage is required and how much. Some activities (health care, catering etc) rely on the continuous availability of hot and cold water but others would not be severely disadvantaged by a short-term loss of supply. Hot and cold water storage systems in commercial buildings are often over-sized in relation to the actual usage because of uncertainties in occupation at the design stage - this leads to excessive safety margins. If the design needs to allow for future growth in demand, this should be organised in a modular fashion. This enables additional plant to be added at a later stage if required (but see paragraph 152(d)).

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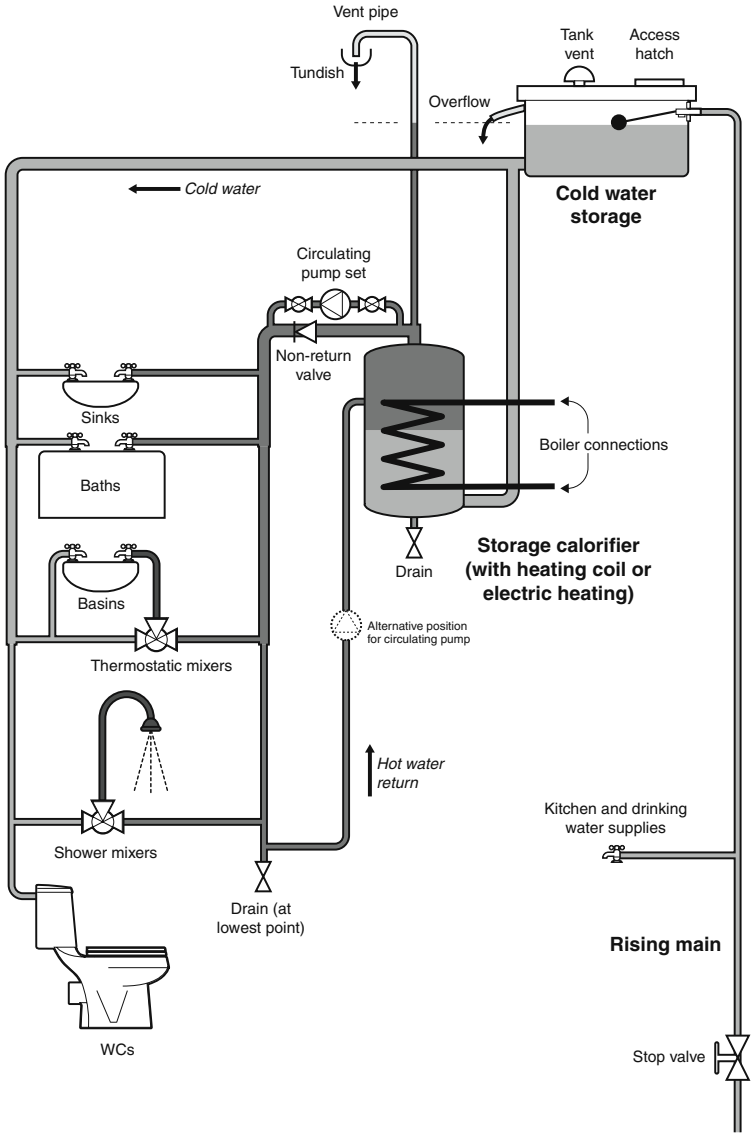
Figure 5 Typical gravity system with recirculation



151 Water service systems have to comply with the Water Supply (Water Fittings) Regulations 1999. This includes the prevention of backflow, the use of approved materials for pipework, water fittings and jointing materials. General issues of design, sizing, layout, construction and commissioning are discussed in BS6700:1997.[10] Certain aspects of the system will also have to comply with the appropriate buildings regulations.

152 Hot and cold water systems should be designed to aid safe operation by preventing or controlling conditions which permit the growth of legionella and to allow easy cleaning and disinfection. In particular, the following points should be considered.

(a) Materials such as natural rubber, hemp, linseed oil-based jointing compounds and fibre washers should not be used in domestic water systems. Materials and fittings acceptable for use in water systems are listed in the directory published by the Water Research Centre.[11]
(b) Low-corrosion materials (copper, plastic, stainless steel etc) should be used where possible.
(c) Water storage tanks should be fitted with covers which comply with the Water Regulations and insect screens fitted to any pipework open to the

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atmosphere, eg the overflow pipe and vent.

(d) Multiple linked storage tanks should be avoided because of operational difficulties due to possible unequal flow rates and possible stagnation.

(e) Accumulator vessels on pressure-boosted hot and cold water services should be fitted with diaphragms which are accessible for cleaning.

(f) The use of point-of-use hot water generators, with minimal or no storage for remote low-use outlets should be considered.

(g) Showers (excluding safety showers) should not be fitted where they are likely to be used less than once a week.

(h) Thermostatic mixing valves (TMVs) should be sited as close as possible to the point of use. Ideally, a single TMV should not serve multiple tap outlets but, if they are used, the mixed water pipework should be kept as short as possible. Where a single TMV serves multiple shower heads, it is important to ensure that these showers are flushed frequently (see paragraphs 164-7).

(i) TMVs should not be used with low-volume *spray* taps in buildings with susceptible populations.

Hot water systems

(a) The storage capacity and recovery rate of the calorifier should be selected to meet the normal daily fluctuations in hot water use without any drop in the supply temperature. The vent pipe from the calorifier which allows for the increase in volume of the water should be large enough and suitably sited on the water circuit, to prevent hot water being discharged. However, if discharged, the water should go to a tundish.

(b) Where more than one calorifier is used, they should be connected in parallel and if temperature is used as a means of control, each should deliver water at a temperature of at least 60°C. All calorifiers should have a drain valve located in an accessible position at the lowest point of the vessel so that accumulated sludge can be drained easily and the vessel emptied in a reasonable time. A separate drain should be provided for the hot water system vent (particularly if the feed to the calorifier incorporates a non-return valve).

(c) If temperature is used as the means of controlling legionella, the hot water circulating loop should be designed to give a return temperature to the calorifier of 50°C or above. The pipe branches to the individual hot taps should be of sufficient size to enable the water in each of the hot taps to reach 50°C within 1 minute of turning on the tap. Thermometer/immersion pockets should be fitted on the flow and return to the calorifier and in the base of the calorifier in addition to those required for control.

(d) In larger calorifiers, the fitting of time controlled shunt pumps should be considered to overcome temperature stratification of stored water (see paragraph 158).

(e) Hot water distribution pipes should be insulated.

(f) If temperature is used as a means of controlling legionella, trace heating should be provided on non-recirculatory hot water distribution pipework where the discharge temperature would not otherwise reach 50°C in 1 minute.

Cold water systems

(a) Low-use outlets should be installed upstream of higher use outlets to maintain frequent flow; eg a safety shower can be installed upstream of a WC. Access ports should be provided on cold water tanks for inlet valve maintenance, inspection and cleaning (more than one hatch may be needed on large tanks).

(b) The volume of cold water stored should be minimised; it should not normally be greater than one day's water use. Multiple cold water storage tanks require care in the connecting piping to ensure that the water flows through each of the tanks, so avoiding stagnation in any one tank.

(c) The cold water storage tank should be sited in a cool place and protected

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from extremes of temperature by thermal insulation. Piping should be insulated and kept away from hot ducting and other hot piping to prevent excessive temperature rises in the cold water supply; typically not more than 2°C increase should be allowed. The pipework should be easy to inspect so that the thermal insulation can be checked to see that it is in position and has remained undisturbed.

Management of hot and cold water systems

The ACOP says risks from legionella should be identified and managed. The following section on operation and maintenance of hot and cold water systems offers guidance on some of the issues which need to be addressed in order to do this.

Commissioning and recommissioning

153 Following the commissioning of a new hot water system, the water temperature should be measured continuously at the bottom and the outlet of the calorifier over a typical day. If the storage vessel is big enough to deal with the demand, the outlet temperature will be constant throughout the day. If the calorifier is too small, the outlet temperature will fall during use and remedial action may be required, particularly if temperature is used as a control method. If the system changes from the original specification, this procedure will need to be repeated.

154 If a calorifier or any substantial part of a hot water system is on standby use or has been taken out of service for longer than 1 week, the water in the calorifier should be brought up to 60°C for 1 hour before being used; this should be measured with normal circulating pumps operating and not with the system in a stagnant state. If there are standby recirculating pumps on the hot water circuits, they should be used at least once per week. If the system is to be treated with biocides as a means of controlling legionella, the biocide concentration in the system should reach normal operational levels for at least 3 hours, throughout the system, before being used.

Operation

155 *Cold water* Cold water from the water utility is usually delivered to consumer buildings with a trace of active chlorine disinfectant and fit for drinking. However, users should not rely on this to treat the hot water system. Where water comes from rivers, lakes, bore holes or other sources it needs to be pre-treated so that it is of the same quality as the mains supply. The Water Supply (Water Quality) Regulations require designers and maintainers of premises to maintain the wholesome nature of the water.

156 The Water Supply (Water Quality) Regulations permit water utilities to supply water to premises at temperatures up to 25°C. In practice, the water temperature is likely to be well below this maximum value (in the order of 5-10°C in winter and up to 20°C in summer). However, during a prolonged hot summer, the incoming water temperature at some sites can become abnormally warm. If the incoming water is above 20°C, the water undertaker should be advised to see if the cause of the high temperature can be found and removed. If this is not possible, the risk assessment should reflect this increased risk and appropriate action taken if necessary.

157 *Hot water* The water can be heated by hot water or steam from a boiler which is passed through a coiled heat exchanger sited inside the hot water storage vessel - the calorifier. Calorifiers heated directly by gas or oil flame have been shown to have the lowest incidence of colonisation by legionella. The calorifier can also be heated by electricity or by means of an electric immersion heater within the vessel.

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158 In a hot water system, cold water enters at the base of the calorifier with hot water being drawn off from the top for distribution to user points throughout the building. A control thermostat to regulate the supply of heat to the calorifier should be fitted to the calorifier near the top and adjusted so that the outlet water temperature is constant. The water temperature at the base of the calorifier (ie under the heating coil) will usually be much cooler than the water temperature at the top. Arrangements should therefore be made to heat the whole water content of the calorifier, including that at the base, to a temperature of 60°C for one hour each day. This period needs to coincide with the operation of boiler plant (or other calorifier heat source) and is usually arranged during a period of low demand eg during the early hours of the morning. A shunt pump to move hot water from the top of the calorifier to the base is one way of achieving this, however, it should not be used continuously except for about one hour each day (see above). In all cases the operation of the pump should be controlled by a time clock.

159 Alternatively, some calorifiers are fitted with coils extending to the base to promote convective mixing during heating. This mixing may not be required if using alternative treatment methodologies.

160 Ideally the calorifier will have specific connections for the shunt pump return, as low down on the calorifier as possible. For existing calorifiers without suitable connections, the drain point may sometimes be used (see Figure 6). This should not be done before cleaning and descaling of the calorifier otherwise the operation of the pump may disturb sludge or sediment.

Maintenance

161 Some form of scale control is desirable in hard water areas. This is because there is a risk of calcium being deposited at the base of the calorifier at temperatures greater than 60°C. It is recommended that an inspection port is fitted in the side of the calorifier so that the cleanliness of the base can be checked and cleaned when needed. Where one has not been fitted, any debris in the water at the base of the calorifier should be purged to a suitable drain on an annual basis. The presence of scale makes it more difficult to generate hot water efficiently in the calorifier or water heater and reduces the effectiveness of any treatment or disinfection measures. Corrosion control may be required if low-corrosion materials (copper, plastic, stainless steel etc) have not been used in the system.

162 Whenever hot taps are no longer required for use they should be removed and cut back to the recirculating loop. Where standby units are provided, there should be procedures in place to enable these units to be incorporated into routine use. Standby pumps should be changed over and used each week to avoid water stagnation. Standby calorifiers should be emptied of water and there should be specified procedures in place to be followed before they are brought back into use.

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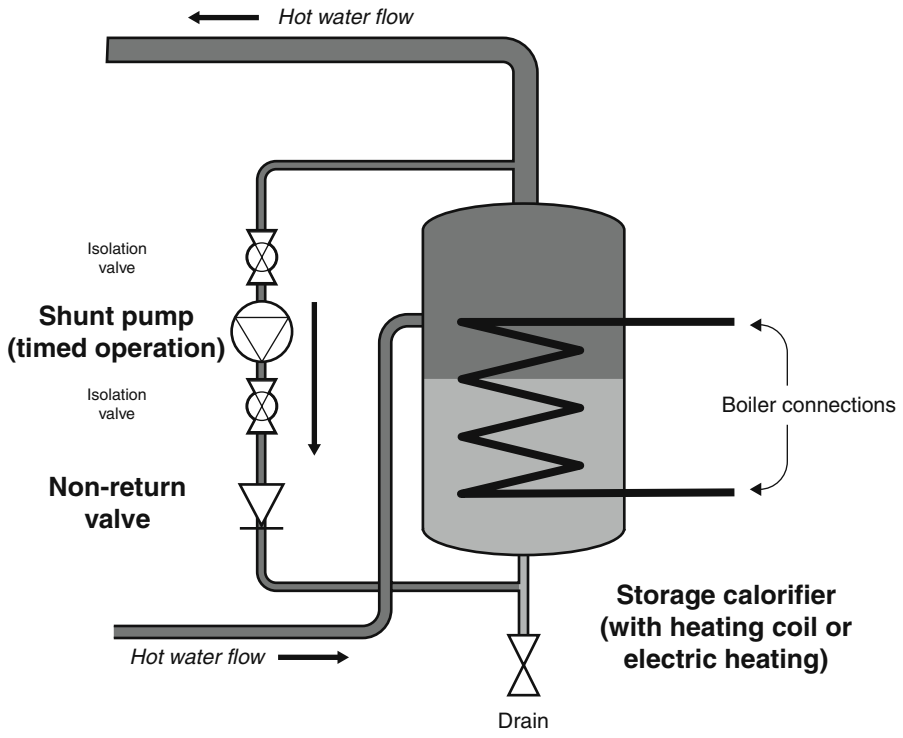
Figure 6 Shunt pump for calorifier mixing



163 Keeping water softeners and filters clean is important and best done by following the manufacturers' recommendations. Coarse filters and strainers should be checked and cleaned regularly to prevent the build-up of organic contaminants.

Regular flushing of showers and taps

164 Before carrying out the following procedures, consideration should be given to removing infrequently used showers and taps. If they are removed, the redundant supply pipework should be cut back, as far as possible, to a common supply, for example to the recirculating pipework or the pipework supplying a more frequently used upstream fitting.

165 The risk from legionella growing in peripheral parts of the domestic water system such as deadlegs off the recirculating hot water system may be minimised by regular use of these outlets. When outlets are not in regular use, weekly flushing of these devices for several minutes can significantly reduce the number of legionella discharged from the outlet. Once started, this procedure has to be sustained and logged, as lapses can result in a critical increase in legionella at the outlet. Risk assessment may indicate the need for more frequent flushing where there is a more susceptible population present, eg in hospitals, nursing homes etc.

166 Where it is difficult to carry out weekly flushing, the stagnant and potentially contaminated water from within the shower/tap and associated dead-leg needs to be purged to drain before the appliance is used. It is important that this procedure is carried out with minimum production of aerosols, eg additional piping may be used to purge contaminated water to drain.

167 Automatic drain valves fitted to showers to drain the mixer valve and shower hose after use, can produce conditions within the shower that support the growth of legionella, and are not recommended as a method for controlling the risk of exposure to legionella.

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Treatment and control programmes

The ACOP says that the risk from exposure to legionella should be prevented or controlled; precautions should include the use of water treatment techniques. The following section on treatment programmes offers advice on how to treat water in hot and cold water systems

168 It is essential that the system is kept clean (see section on cleaning and disinfection) because the efficacy of the control method (both temperature and biocide activity) may be reduced substantially in systems that are fouled with organic matter such as slimes or inorganic matter such as scale.

Temperature regime

169 This is the traditional approach to legionella control. It is recommended that hot water should be stored at 60°C and distributed so that it reaches a temperature of 50°C within one minute at outlets. Care is needed to avoid much higher temperatures because of the risk of scalding. At 50°C the risk of scalding is small for most people but the risk increases rapidly with higher temperatures and for longer exposure times. However the risk, particularly to young children, or the handicapped or elderly, and to those with sensory loss will be greater.[12,13 & 14] Where a significant scalding risk has been identified, the use of TMVs on baths and showers should be considered to reduce temperature. These need to be placed as close to the point of use as possible.

170 To ensure the correct function of fail-safe TMVs, there needs to be a minimum temperature differential between the hot and cold water supplies and the mixed water temperature. Users should refer to the manufacturers' operating instructions to ensure these devices are working safely and correctly.

Monitoring the temperature regime

171 As well as the routine monitoring and inspection outlined in paragraphs 180-182 when using temperature as a control regime, the checks in Table 3 should also be carried out and remedial action taken if necessary.

Biocide treatments

172 Where biocides are used to treat water systems they, like the temperature regime, will require meticulous control if they are to be equally effective. In such situations, if hot water is not needed for other reasons, eg for kitchens or laundries, there is no requirement to store hot water at 60°C (or distribute at 50°C) - although this is not currently permitted in NHS premises.[14] However, if water temperatures are reduced, any lapses in the biocide control regime would leave the system vulnerable. It is therefore recommended that the control system is checked at least weekly to ensure that it is operating correctly and so continuing to control legionella.

Chlorine dioxide

173 Chlorine dioxide is an oxidising biocide capable of reacting with a wide range of organic substances. Levels of 0.5 mg/l can, if properly managed, be effective against planktonic and sessile legionella in hot water systems. The Drinking Water Inspectorate prescribes a maximum value for total oxidants in drinking water supplies which is the combined chlorine dioxide, chlorite and chlorate concentration. This should not exceed 0.5 mg/l as chlorine dioxide. There are a number of commercial systems available that release chlorine dioxide into water systems and it may be necessary to contact the local water company in order to

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check that the installation complies with the requirements of the Water Regulations and, for Scotland, the Water Supply (Water Quality) (Scotland) Regulations and the Private Water Supplies (Scotland) Regulations 1992, as amended. It should be noted that maintaining total oxidant levels below 0.5 mg/l at outlets may be difficult in systems with a low turnover of water. Suppliers of commercial chlorine dioxide systems will need to consider these problems and when choosing a system these points should be checked to ensure that they have been addressed satisfactorily by the supplier.

Table 3: Monitoring the temperature control regime

Frequency	Check	Standard to meet		Notes
		Cold water	Hot water	
Monthly	Sentinel taps (see glossary)	The water temperature should be below 20°C after running the water for up to two minutes	The water temperature should be at least 50°C within a minute of running the water	This check makes sure that that the supply and return temperatures on each loop are unchanged, ie the loop is functioning as required
	If fitted, input to TMVs on a sentinel basis		The water supply to the TMV temperature should be at least 50°C within a minute of running the water	One way of measuring this is to use a surface temperature probe
	Water leaving and returning to calorifer		Outgoing water should be at least 60°C, return at least 50°C	If fitted, the thermometer pocket at the top of the calorifier and on the return leg are useful points for accurate temperature measurement. If installed, these measurements could be carried out and logged by a building management system
Six monthly	Incoming cold water inlet (at least once in the winter and once in summer)	The water should preferably be below 20°C at all times (but see paragraph 156)		The most convenient place to measure is usually at the ball valve outlet to the cold water storage tank
Annually	Representative number of taps on a rotational basis	The water temperature should be below 20°C after running the water for two minutes	The water temperature should be at least 50°C within a minute of running the water	This check makes sure that the whole system is reaching satisfactory temperatures for legionella control

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Monitoring the chlorine dioxide regime

174 For most systems, routine inspection and maintenance will usually be sufficient to ensure control (see paragraphs 180-182) if the following areas are checked at regular intervals and remedial action taken when necessary, with details of all actions being recorded (see also paragraph 172):

(a) the quantity of chemicals in the reservoir;
(b) the rate of addition of chlorine dioxide to the water supply;
(c) on a monthly basis, the concentration of chlorine dioxide should be measured at the sentinel taps - the concentration should be at least 0.1mg/l; and
(d) on an annual basis, the chlorine dioxide concentration at a representative number of outlets - the concentration should be at least 0.1mg/l.

Ionisation

175 Ionisation is the term given to the electrolytic generation of copper and silver ions for use as a water treatment. Copper and silver ion concentrations maintained at 400 µg/l and 40 µg/l respectively can, if properly managed, be effective against planktonic legionella in hot water systems. If however the water is softened, silver ion concentrations between 20-30 µg/l can also be effective, provided a minimum concentration of 20 µg/l is maintained. This level of silver still requires copper ions to complete the synergy.

176 The application of ionisation will need to be properly assessed, designed and maintained as part of an overall water treatment programme. The Water Supply (Water Quality) Regulations and Private Supply Regulations prescribe a maximum value for the level of copper and silver ions in drinking water supplies. It is important that installers of ionisation systems are aware of the need to avoid any breach of these Regulations and maintain copper and silver levels below the maximum allowable concentration. The local water company may need to be consulted to check that the installation complies with the requirements of the Water Regulations.

177 It should be noted that in hard water systems, silver ion concentrations can be difficult to maintain due to build-up of scale on the electrodes, and the high concentration of dissolved solids precipitating the silver ions out of solution. For both hard and soft water, the ionisation process is pH sensitive and it is difficult to maintain silver ion concentrations above pH 7.6. The build-up of scale and concentration of dissolved solids therefore needs to be carefully controlled so that suitable ion levels are consistently maintained throughout the system. This may need extra water treatments.

Monitoring the ionisation regime

178 For most systems, routine inspection and maintenance will usually be sufficient to ensure control (see paragraphs 180-182) if the following parameters are also monitored at regular intervals and remedial action taken when necessary, with details of all actions being recorded (see also paragraph 172):

(a) the rate of release of copper and silver ions into the water supply;
(b) the silver ion concentrations at sentinel outlets should be checked monthly - this should be at least 20µg/l at outlets;
(c) the measurement of silver ion concentrations at representative taps selected on a rotational basis once each year - this should be at least 20µg/l at outlets;
(d) the condition and cleanliness of the electrodes; and
(e) the pH of the water supply.

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Ozone and UV treatment

179 The strategies previously described are dispersive, ie they are directly effective throughout the water system downstream from the point of application. A number of other strategies are available, for example UV irradiation or ozone. These systems are not intended to be dispersive and are usually designed to have their effect at or very close to the point of application. This usually results in the active ingredient not being directly measurable in the circulating system. In large systems it may be necessary to use a number of point applications of these treatments and the system suppliers will be able to advise appropriately.

General monitoring

The ACOP says that the risk from exposure to legionella should be prevented or controlled and that the precautions taken should be monitored to ensure that they remain effective. The following section on monitoring offers guidance on how to achieve this in hot and cold waters systems.

180 All water services should be routinely checked for temperature, water demand and inspected for cleanliness and use. Ideally, the key control parameters should be monitored by a building management system if one is present. This will allow early detection of problems in maintaining the control regime.

181 The frequency of inspection and maintenance will depend on the system and the risks it presents. All the inspections and measurements should be recorded and should include:

(a) the name of the person undertaking the survey, signature or other identifying code, and the date on which it was made (computer records are acceptable); and
(b) a simple description and plan of the system and its location within and around the building. This should identify piping routes, storage and header tanks, calorifiers and relevant items of plant, especially water softeners, filters, strainers, pumps and all water outlets.

Annual check

182 This should comprise the following.

(a) Visual inspection of the cold water storage tank to check the condition of the inside of the tank and the water within it. The lid should be in good condition and fit closely. The insect screen on the water overflow pipe should be intact and in good condition. The thermal insulation on the cold water storage tank should be in good condition so that it protects it from extremes of temperature. The water surface should be clean and shiny and the water should not contain any debris or contamination. The cold water storage tank should be cleaned, disinfected and faults rectified, if considered necessary. If debris or traces of vermin are found then the inspection should be carried out more frequently.
(b) Making a record of the total cold water consumption over a typical day to establish that there is reasonable flow through the tank and that water is not stagnating. This can be done by fitting a temporary water flow meter over the outlet pipe and recording the consumption. It can also be measured by holding the ball valve supplying the water in the closed position and measuring the rate of water level drop within the vessel. Whenever the building use pattern changes, this measurement should be repeated.
(c) Draining the calorifier and checking for debris in the base of the vessel. The calorifier should then be cleaned if considered necessary.

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(d) Checking the plans for both the hot and cold water circuits to make sure they are correct and up to date - this should be done by physical examination of the circuits, if possible. Plans should be updated if necessary.
(e) Ensuring that the operation and maintenance schedules of the hot and cold water systems are readily available and up to date with named and dated actions throughout the previous year.
(f) Checking the existence of all water connections to outside services; kitchens, fire hydrants and chemical wash units. Any insulation should be checked to ensure that it remains intact. Any water outlets that are no longer used should be removed.

Microbiological monitoring

183 Routine microbiological monitoring of hot and cold water systems using dip slides or TVCs is not necessary since systems will be supplied with water that is fit to drink. Also, these systems should be totally enclosed, ie they are not open to the elements and to significant external contamination (in the same way as cooling towers).

184 However, there is the potential for micro-organisms to proliferate in various parts of hot and cold water systems. This could manifest itself in taste and odour problems and microbiological investigation should then be carried out. The conditions that supported this microbiological growth could also support legionella growth and so the system should be investigated fully.

Monitoring for legionella

185 It is recommended that this should be carried out:

(a) in water systems treated with biocides where storage and distribution temperatures are reduced from those recommended in the section on the use of temperature to control legionella. This should be carried out on a monthly basis. The frequency of testing should be reviewed after a year and may be reduced when confidence in the efficacy of the biocide regime has been established;
(b) in systems where control levels of the treatment regime (eg temperature, biocide levels) are not being consistently achieved. As well as carrying out a thorough review of the system and treatment regime, frequent samples eg weekly, should be taken until the system is brought back under control;
(c) when an outbreak is suspected or has been identified (see section in Appendix 2 on action in the event of an outbreak); or
(d) testing for legionella may also be required in hospital wards with 'at risk' patients - eg those immunologically compromised.

186 Samples should be taken as follows:

(a) *cold water system* - from the cold water storage tank and the furthest outlet from the tank. Samples may also be required from outlets in areas of particular concern, eg in hospital wards with 'at risk' patients;
(b) *hot water system* - from the calorifier outlet or the nearest tap to the calorifier outlet plus the return supply to the calorifier or nearest tap to that return supply. Samples should also be taken from the base of the calorifier where drain valves have been fitted. The furthest outlet from the calorifer should also be sampled. Samples may also be required from outlets in areas of particular concern, eg in hospital wards with 'at risk' patients.

187 The complexity of the system will need to be taken into account in determining the appropriate number of samples to take. For example, if there is more than one

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ring main present in the building, taps on each ring (as described in paragraph 186) will need to be sampled. In order to be representative of the system as a whole, samples should be of treated, circulating water and not taken from temporarily stored water, eg at TMV-controlled taps and showers. These may require sampling but this should be determined by risk assessment, eg where such fittings are used in areas where susceptible individuals may be exposed (see paragraphs 164-166 for advice on flushing of such fittings).

188 Analysis of water samples for legionella should be carried out by a UKAS accredited laboratory which takes part in the PHLS Water Microbiology External Quality Assessment Scheme for the Isolation of Legionella from Water. The interpretation of any results should be carried out by experienced microbiologists.

189 Table 4 gives guidance on action to be taken if legionella is found in the water system.

Table 4: Action levels following legionella sampling in hot and cold water systems

Legionella bacteria (cfu/litre)	**Action required**
More than 100 but less than 1000	Either: (a) If only one or two samples are positive, system should be resampled. If a similar count is found again, a review of the control measures and risk assessment should be carried out to identify any remedial actions (b) If the majority of samples are positive, the system may be colonised, albeit at a low level, with legionella. Disinfection of the system should be considered but an immediate review of control measures and risk assessment should be carried out to identify any other remedial action required.
More than 1000	The system should be resampled and an immediate review of the control measures and risk assessment carried out to identify any remedial actions, including possible disinfection of the system.

Cleaning and disinfection

The ACOP says the risk from exposure to legionella should be prevented or controlled; precautions include keeping the system and the water in it clean. The following section on cleaning and disinfection offers guidance on how to do this in hot and cold water systems.

190 Hot water services and, exceptionally, cold water services, should be cleaned and disinfected in the following situations:

(a) if routine inspection shows it to be necessary (see paragraphs 180-182);
(b) if the system or part of it has been substantially altered or entered for maintenance purposes in a manner which may lead to contamination; or
(c) during or following an outbreak or suspected outbreak of legionellosis.

191 Disinfection of the water services may be carried out in two ways:

(a) by the use of suitable chemical disinfectants, eg by chlorination (see BS6700:1997)[10] when it is necessary to disinfect the whole system including storage tanks; or

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(b) by thermal disinfection, ie by raising water temperature to a level at which legionella will not survive.

Chemical disinfection

192 Before chemical disinfection is carried out it is essential that the system is clean and it is important to ensure that all parts of the system are disinfected, not just those which are readily accessible. Chemical disinfection is usually carried out by chlorinating the water in the cold water storage tank to 20-50 mg/litre free residual chlorine. It is then allowed to flow to all parts of the system by successively opening the outlets in the system such as taps and showers (until there is a smell of chlorine), then closing them and leaving it to stand for an appropriate period. This depends on chlorine concentration (from at least one hour at 50 mg/l to at least two hours at 20 mg/l). The required concentration should be maintained in the header tank throughout the chlorination procedure and chlorine concentration needs to be monitored throughout disinfection to ensure that there is a sufficient residual chlorine level. The system should be thoroughly flushed following chlorination. Appropriate concentrations of chlorine dioxide, as recommended by the manufacturers, may also be used as a disinfectant.

193 This treatment should not be carried out by untrained personnel and should be closely supervised. Building occupants should be warned that the water is heavily chlorinated. If tanks and calorifiers are heavily contaminated by organic materials, the system should be disinfected before cleaning to reduce risks to cleaning staff and also after cleaning. It may be necessary to add chemical dispersants to remove organic fouling from pipework etc and chemical descaling may also be necessary. Where possible, cleaning methods should not create an aerosol.

Thermal disinfection

194 Thermal disinfection can be carried out by raising the temperature of the whole of the contents of the calorifier then circulating this water throughout the system for at least an hour. To be effective, the temperature at the calorifier should be high enough to ensure that the temperatures at the taps and appliances do not fall below 60°C. Each tap and appliance should be run sequentially for at least five minutes at the full temperature, and this should be measured. For effective thermal disinfection the water system needs to be well insulated.

195 Alternatively, the circulating pipework and deadlegs/ends may be thermally disinfected by means of trace heating. As before, the system should be capable of raising temperatures of the whole distribution system to 60°C or more for at least an hour.

196 The risk of scalding should be considered and particular care taken to ensure that water services are not used, other than by authorised personnel, until water temperatures have dropped to their normal operating levels.

Other risk systems

197 There are a number of other systems (which produce aerosols) which may pose a risk of exposure to legionella. These include:

Spas and whirlpool baths - a spa is a bath or a small pool where warm water is constantly recirculated, often through high-velocity jets or with the injection of air to agitate the water. The water is not changed after each user; instead it is filtered and chemically treated. The water temperature is normally greater that 30°C and the deliberate agitation creates a spray or aerosol above the

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surface of the water. They therefore present a foreseeable risk of exposure to legionella. Careful attention to design, maintenance and cleaning of equipment such as filters, and regular water treatment to prevent/control the risk from legionella is required[15]. Spa baths can be a risk even when not being used by bathers, for example when being run for display purposes. Whirlpool baths (baths fitted with high-velocity water jets and/or air injection but without water recirculation) do not present the same risk as spas because the water is discharged after each use.

Humidifiers and air washers - atomising humidifiers and spray-type air washers may use water from reservoirs or tanks where the water temperature exceeds 20°C. Unless they are regularly cleaned and maintained, they can become heavily contaminated, especially in industrial environments. The risk can be prevented by using humidifiers which do not create a spray, ie steam humidifiers. 'Portable' or 'room' humidifiers of the type that have a water supply that is sprayed or atomised into the room are not recommended for use in NHS premises.

198 The actions that need to be taken with regard to the systems outlined in paragraph 197 and for some other recognised risk systems are detailed in Appendix 1 (Checklist 3). In general, these systems and any others found to present a risk should be maintained in a clean state, will often require regular disinfection and should be monitored on a regular basis where appropriate. There is also a duty to carry out a risk assessment and to maintain records of all maintenance that is carried out together with monitoring results. Great care needs to be taken during installation and commissioning to ensure that cross connections do not occur between different water systems, eg fire mains and the cold water system.

Protection of personnel

199 Maintenance, cleaning, testing and operating procedures should all be designed to control the risks to staff and others who may be affected.

200 Cooling towers and evaporative condensers should be treated as described in the section on cleaning and disinfection and in particular, the requirement for pre-cleaning disinfection should be observed. This will only have a transient effect on legionella, but it will reduce the chance of engineering staff being exposed while working on the tower. Where possible, cleaning methods which create spray (for example, high pressure water jetting) should be avoided. If this is not possible, the operation should be carried out when nearby buildings are unoccupied or in the case of permanently occupied buildings, windows in the vicinity should be closed and air inlets temporarily blanked off.

201 As systems requiring cleaning may have been contaminated, the operator and others closely involved in the work should wear suitable respiratory protective equipment. This can be a powered filter and hood, European Class TH3 (assigned protection factor of 40) or a power-assisted filter and close-fitting full-face mask, TM3 (assigned protection factor 40). It should be borne in mind that the filter on these systems is liable to get wet, and so resistance to air can increase, causing discomfort to the operator.

202 Alternatively, a hood or full face mask fed with breathing quality compressed air may be used. The preferred equipment is a full-face close-fitting airline mask with a positive pressure demand valve, under a hood or helmet protecting the rest of the head. The air supply should come from an oil-free compressor drawing air through a filter from a location well upwind of any jetting operation or using cylinder supplies of compressed air. Further information on respiratory protective equipment

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can be obtained from *The Selection, Use and Maintenance of Respiratory Protective Equipment: a Practical Guide*.[16]

Use of treatment chemicals

203 Many water treatment chemicals, including chlorine-containing chemicals and solutions, are often hazardous and need to be used with care. The COSHH assessment and any manufacturers' recommendations need to be followed to ensure that the chemicals do not endanger the users or other people. Proprietary biocides, other than those permitted by the Water Regulations, should never be used in drinking water or in hot or cold water services and should not be discharged into sewers, storm water drains or natural watercourses without the prior permission of the relevant water company (or authority in Scotland). Contact may also need to be made with the Environment Agency in England and Wales and the Scottish Environment Protection Agency In Scotland, who may have responsibility for direct discharges into watercourses. Water treatment chemicals are not recommended for use in humidifiers and airwashers when buildings are occupied.

204 The handling of these water treatment chemicals should be carried out by trained operators under the direction of people who are suitably qualified, experienced and trained.

Appendix 1 Recommended inspection frequencies for risk systems

Checklist 1: Cooling water installations

System/service	Task	Frequency
Cooling towers and evaporative condensers	Monitor water quality, water use and biocide/chemical use to assess and ensure effectiveness of water treatment regime, including key chemical and microbiological parameters, and observations of internal condition of pond, pack and water	See Table 1
	Central control function, conductivity sensor calibration, blowdown function, uniformity of water distribution, condition of sprays/ troughs, eliminators, pack, pond, immersion heater, fans and sound attenuators	Monthly to three monthly, according to risk (See Table 1)
	Clean and disinfect cooling towers/ evaporative condensers, make-up tanks and associated systems, including all wetted surfaces, descaling as necessary. Packs should be removed and cleaned where practicable	Six monthly

Checklist 2: Hot and cold water services

Service	Task	Frequency
Hot water services	Arrange for samples to be taken from hot water calorifiers, in order to note condition of drain water	Annually
	Check temperatures in flow and return at calorifiers	Monthly
	Check water temperature up to one minute to see if it has reached 50°C in the sentinel taps	Monthly
	Visual check on internal surfaces of calorifiers for scale and sludge. Check representative taps for temperature as above on a rotational basis	Annually
Cold water services	Check tank water temperature remote from ball valve and mains temperature at ball valve. Note maximum temperatures recorded by fixed max/min thermometers where fitted	Six monthly
	Check that temperature is below 20°C after running the water for up to two minutes in the sentinel taps	Monthly
	Visually inspect cold water storage tanks and carry out remedial work where necessary. Check representative taps for temperature as above on a rotational basis	Annually
Shower heads	Dismantle, clean and descale shower heads and hoses	Quarterly or as necessary
Little-used outlets	Flush through and purge to drain, or purge to drain immediately before use, without release of aerosols	Weekly

Checklist 3: Other risk systems

System/service	Task	Frequency
Ultrasonic humidifiers/foggers and water misting systems	If equipment fitted with UV lights, check to ensure effectiveness of lamp (check to see if within working life) and clean filters	Six monthly or according to manufacturer's instructions
	Ensure automatic purge of residual water is functioning	As part of machinery shut down
	Clean and disinfect all wetted parts	As indicated by risk assessment
	Sampling for legionella	As indicated by risk assessment
Spray humidifiers, air washers and wet scrubbers	Clean and disinfect spray humidifiers/air washers and make-up tanks including all wetted surfaces, descaling as necessary	Six monthly
	Confirm the operation of non-chemical water treatment (if present)	Weekly
Water softeners	Clean and disinfect resin and brine tank - check with manufacturer what chemicals can be used to disinfect resin bed	As recommended by manufacturer
Emergency showers and eye wash sprays	Flush through and purge to drain	Six monthly or more frequently if recommended by manufacturers
Sprinkler and hose reel systems	When witnessing tests of sprinkler blow-down and hose reels ensure that there is minimum risk of exposure to aerosols	As directed
Lathe and machine tool coolant systems	Clean and disinfect storage and distribution system	Six monthly
Spa baths	Check filters - sand filters should be backwashed daily	Daily
	Check water treatment - pools should be continuously treated with an oxidising biocide	Three times daily
	Clean and disinfect entire system	Weekly
Horticultural misting systems	Clean and disinfect distribution pipework, spray heads and make-up tanks including all wetted surfaces, descaling as necessary	Annually
Dental equipment	Drain down and clean	At the end of each working day
Car/bus washes	Check filtration and treatment system, clean and disinfect system	See manufacturers' instructions
Indoor fountains and water features	Clean and disinfect ponds, spray heads and make-up tanks including all wetted surfaces, descaling as necessary	Interval depending on condition

Appendix 2 Action in the event of an outbreak

1 Legionnaires' disease is not notifiable under public health legislation in England and Wales but, in Scotland, legionellosis (ie all diseases caused by legionella) is notifiable under the Public Health (Notification of Infectious Disease) (Scotland) Regulations 1988.

2 An outbreak is defined by the Public Health Laboratory Service (PHLS) as two or more confirmed cases of legionellosis occurring in the same locality within a six-month period. Location is defined in terms of the geographical proximity of the cases and requires a degree of judgement. It is the responsibility of the Proper Officer for the declaration of an outbreak. The Proper Officer is appointed by the local authority under public health legislation and is usually a Consultant in Communicable Disease Control (CCDC). In Scotland, it is the Consultant in Public Health Medicine (CPHM) employed by the Health Board and acting as Designated Medical Officer for the local authority.

3 Local authorities will have established incident plans to investigate major outbreaks of infectious disease including legionellosis. These are activated by the Proper Officer who invokes an Outbreak Committee, whose primary purpose is to protect public health and prevent further infection. This will normally be set up to manage the incident and will involve representatives of all the agencies involved. HSE or the local authority EHO may be involved in the investigation of outbreaks, their aim being to pursue compliance with health and safety legislation.

4 The local authority, CCDC or EHO acting on their behalf (often with the relevant officer from the enforcing authorities - either HSE or the local authority) may make a site visit.

5 As part of the outbreak investigation and control, the following requests and recommendations may be made by the enforcing authority.

(a) To shut down any processes which are capable of generating and disseminating airborne water droplets and keep them shut down until sampling procedures and any remedial cleaning or other work has been done. Final clearance to restart the system may be required.
(b) To take water samples (see paragraphs 124-131, Part 2) from the system before any emergency disinfection being undertaken. This will help the investigation of the cause of the illness. The investigating officers from the local authority/ies may take samples or require them to be taken.
(c) To provide staff health records to discern whether there are any further undiagnosed cases of illness, and to help prepare case histories of the people affected.
(d) To co-operate fully in an investigation of any plant that may be suspected of being involved in the cause of the outbreak. This may involve, for example:

    (i) tracing of all pipework runs;
    (ii) detailed scrutiny of all operational records;
    (iii) statements from plant operatives and managers;
    (iv) statements from water treatment contractors or consultants.

6 Any infringements of relevant legislation, may be subject to a formal investigation by the appropriate enforcing authority.

Emergency cleaning and disinfection procedure for cooling towers

7 If a cooling water system has been implicated in an outbreak of Legionnaires' disease emergency cleaning of that system has to take place as soon as possible. The following actions should be taken, where appropriate:

(a) switch off the fan immediately;
(b) take samples for laboratory investigation before any further action;
(c) switch off the circulation pump as soon as is practicable and the system decommissioned;
(d) consult the enforcing authority before proceeding further;
(e) keep all personnel clear of the tower area;
(f) when cleared by the enforcing authority, add sodium hypochlorite to the system water to obtain a measured concentration of 50 mg/l of free chlorine;
(g) circulate the system water with the fans off for a period of at least six hours;
(h) maintain the free chlorine level at an absolute minimum of 20 mg/l at all times;
(i) use a suitable biodispersant;
(j) after six hours, de-chlorinate and drain the system;
(k) undertake manual cleaning of the tower, sump, and distribution system with cleaning staff wearing fully pressurised respirators;
(l) refill with fresh water, add sodium hypochlorite;
(m) recirculate without using the fan, at 20 mg/l of free available chlorine for six hours;
(n) de-chlorinate and drain the system;
(o) refill, recirculate and take samples for testing:
(p) re-commission system when test results detect no legionella and/or permission is granted by the enforcing authority.

8 If a water system other than a cooling system is implicated in an outbreak of Legionnaires' disease, emergency treatment of that system should be carried out as soon as possible. This will usually involve the processes in paragraphs 192-196.

Glossary

Aerosol	A suspension in a gaseous medium of solid particles, liquid particles or solid and liquid particles having negligible falling velocity.
Algae	A small, usually aquatic, plant which requires light to grow, often found on exposed areas of **cooling towers**.
Air-conditioning	A form of air treatment whereby temperature humidity and air cleanliness are all controlled within limits determined by the requirements of the air-conditioned enclosure.
Antibodies	Substances in the blood which destroy or neutralise various toxins or **components of bacteria** known generally as antigens. The antibodies are formed as a result of the introduction into the body of the antigen to which they are antagonistic as in all infectious diseases.
Bacteria	(singular bacterium) a microscopic, unicellular (or more rarely multicellular) organism.
Biocide	A substance which kills **micro-organisms.**
Biofilm	A community of **bacteria** and other **micro-organisms,** embedded in a protective layer with entrained debris, attached to a surface.
Blow-down/bleed-off	Water discharged from the system to control the concentration of salts or other impurities in the circulating water; usually expressed as a percentage of recirculating water flow.
Calorifier	An apparatus used for the transfer of heat to water in a vessel by indirect means, the source of heat being contained within a pipe or coil immersed in the water.
Chlorine	An element used in **disinfection.**
Cold water service (CWS)	Installation of plant, pipes and fitting in which cold water is stored, distributed and subsequently discharged.
Cooling tower	An apparatus through which warm water is discharged against an air stream; in doing so part of the water is evaporated to saturate the air and this cools the water. The cooler water is usually pumped to a heat exchanger to be reheated and recycled through the tower.
Concentration factor	Compares the level of dissolved solids in the cooling water with that dissolved in the **make-up water** (also known as cycle of concentration). Usually determined by comparison of either the chloride or magnesium hardness concentration.

Corrosion inhibitors	Chemicals which protect metals by: (a) passivating the metal by the promotion of a thin metal oxide film (anodic inhibitors); or (b) physically forming a thin barrier film by controlled deposition (cathodic inhibitors).
Dead end/blind end	A length of pipe closed at one end through which no water passes.
Deadleg	Pipes leading to a fitting through which water only passes when there is draw-off from the fitting.
Dip slide(s)	A dip slide is a means of testing the microbial content of liquids. It consists of a plastic carrier bearing a sterile culture medium which can be dipped in the liquid to be sampled. It is then incubated to allow microbial growth. The resulting microbial colonies are estimated by reference to a chart.
Disinfection	A process which destroys or irreversibly inactivates **micro-organisms** and reduces their number to a non-hazardous level.
Distribution circuit	Pipework which distributes water from hot or cold water plant to one or more fittings/appliances.
Domestic water services	Hot and cold water intended for personal hygiene, culinary, drinking water or other domestic purposes.
Drift	Circulating water lost from the tower as liquid droplets entrained in the exhaust air stream; usually expressed as a percentage of circulating water flow but for more precise work it is parts of water per million by weight of air for a given liquid to gas ratio.
Drift eliminator	More correctly referred to as drift reducers or minimisers - equipment containing a complex system of baffles designed to remove water droplets from **cooling tower** air passing through it.
Evaporative condenser	A heat exchanger in which refrigerant is condensed by a combination of air movement and water sprays overs its surface.
Evaporative cooling	A process by which a small portion of a circulating body of water is caused to evaporate thereby taking the required latent heat of vaporisation from the remainder of the water and cooling it.
Fill/Packing	That portion of a **cooling tower** which constitutes its primary heat transfer surface; sometimes called **'packing' or 'pack'**.
Fouling	Organic growth or other deposits on heat transfer surfaces causing loss in efficiency.
Half-life	Ratio of system volume to purge rate.

Hot water service (HWS)	Installation of plant, pipes and fittings in which water is heated, distributed and subsequently discharged (not including cold water feed tank or cistern).
Legionnaires' disease	A form of pneumonia caused by **legionella** bacteria.
Legionellae	The genus **legionella** belongs to the family legionellaceae which has over 40 species. These are ubiquitous in the environment and found in a wide spectrum of natural and artificial collections of water.
Legionella	Type of aerobic **bacterium** which is found predominantly in warm water environments. (singular of **legionellae**).
L. pneumophila	One of the causative organisms of **Legionnaires' disease.**
Legionellosis	Any illness caused by exposure to **legionella**.
Pontiac fever	A disease caused by species of legionella, an upper respiratory illness less severe than **Legionnaires' disease.**
Make-up water	Water which is added to a cooling water system to compensate for wastage (eg via system leaks), evaporative loss and bleed.
Micro-organism	An organism of microscopic size including **bacteria**, fungi and viruses.
Non-oxidising biocide	A non-oxidising biocide is one that functions by mechanisms other than oxidation, including interference with cell metabolism and structure.
Nutrient	A food source for **micro-organisms**.
Oxidising biocide	Agents capable of oxidising organic matter, eg cell material, enzymes or proteins which are associated with microbiological populations resulting in death of the micro-organisms. The most commonly used oxidising biocides are based on chlorine or bromine (halogens) which liberate hypochlorous or hypobromous acids on hydrolysis in water. The exception is chlorine dioxide, a gas which does not hydrolyse but which functions in the same way.
Pasteurisation	Heat treatment to destroy **micro-organism** usually at high temperature.
Planktonic	Free floating micro-organisms in an aquatic system.
ppm	Parts per million: a measure of dissolved substances given as the number of parts there are in a million parts of solvent. It is numerically equivalent to milligrams per litre mg/l with respect to water.

Pond/Sump	Collection of cooling water at the base of a cooling tower.
Retention time	Time a chemical is retained in the system.
Scale inhibitors	Chemicals used to control scale. They function by holding up the precipitation process and/or distorting the crystal shape, thus preventing the build-up of a hard adherent scale.
Sero-group	A sub-group of the main species.
Sentinel taps	For a hot water services - the first and last taps on a recirculating system. For cold water systems (or non-recirculating hot water systems), the nearest and furthest taps from the storage tank. The choice of sentinel taps may also include other taps which are considered to represent a particular risk.
Sessile	Aquatic micro-organisms adhering to a surface normally as part of a biofilm.
Sludge	A general term for soft mud-like deposits found on heat transfer surfaces or other important sections of a cooling system. Also found at the base of calorifiers and cold water storage tanks.
Shunt pump	A circulation pump fitted to hot water service/plant to overcome the temperature stratification of the stored water.
Slime	A mucus-like exudate which covers a surface produced by some **micro-organisms**.
Stagnation	The condition where water ceases to flow and is therefore liable to microbiological growth.
Strainers	A coarse filter usually positioned upstream of a sensitive component such as a pump control valve or heat exchanger to protect it from debris.
Thermal disinfection	Heat treatment to disinfect a system.
Thermostatic mixing valve	Mixing valve in which the temperature at the outlet is pre-selected and controlled automatically by the valve.
Total viable counts (TVC)	The total number of culturable **bacteria** (per volume or area) in a given sample (does not include legionella).
Risk assessment	Indentifying and assessing the risk from **legionellosis** from work activities and water sources on premises and determining any necessary precautionary measures.
Windage	Physical loss of water from a **cooling tower** caused by draught of air or wind - water is lost around the base of the cooling tower as a result of cross winds as opposed to **drift**.

References and further reading

References

Some of the references in this list have been updated at reprint to take account of new legislation.

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3 *Successful health and safety management* HSG65 (Second edition) HSE Books 1997 ISBN 0 7176 1276 7

4 *Getting specialist help with health and safety* Pocket card INDG420 HSE Books 2008 (single copy free or priced packs of 10 ISBN 987 0 7176 6274 6) www.hse.gov.uk/pubns/indg420.pdf

5 *The control of legionellosis: A recommended code of conduct for service providers* Water Management Society/British Association for Chemical Specialities, 1999

6 BS 4485 Part 3:1988 *Water cooling towers. Code of Practice for thermal and functional design* British Standards Institution
BS 4485 Part 4 1996 *Water cooling towers. Code of Practice for structural design and construction* British Standards Institution

7 BS 5589:1989 *Code of Practice for preservation of timber* British Standards Institution

8 BS ISO 11731-2:2004 *Water quality. Detection and enumeration of Legionella. Direct membrane filtration methods for waters with low bacterial counts* British Standards Institution

9 *The control of legionellae in health care premises. A Code of Practice: Management policy* Part 1 HTM2040 NHS Estates 1993 ISBN 0 1132 1680 7

The control of legionellae in health care premises. A Code of Practice: Design considerations Part 2 HTM2040 NHS Estates 1993 ISBN 0 1132 1679 3

The control of legionellae in health care premises. A Code of Practice: Operational management Part 3 HTM2040 NHS Estates 1993 ISBN 0 1132 1682 3

The control of legionellae in health care premises. A Code of Practice: Validation and verification Part 4 HTM2040 NHS Estates 1993 ISBN 0 1132 1681 5

The control of legionellae in health care premises. A Code of Practice: Good practice guide Part 5 HTM2040 NHS Estates 1993 ISBN 0 1132 1683 1

This Code of Practice gives day-to-day guidance on the management of hot and cold water systems and other systems where there is a risk of proliferation of legionella bacteria. It also deals with engineering and design aspects of these systems.

10 BS 6700:2006 *Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages* British Standards Institution

11 *Water fittings and materials directory* Water Regulations Advisory Service 1999 ISBN 1 8726 9956 1

12 *Health and safety in care homes* HSG220 HSE Books 2001 ISBN 0 7176 2082 4

13 *Safe hot water and surface temperatures* NHS Estates 1998 ISBN 0 1132 2158 4

14 *Hot and cold water supply, storage and mains services: Management policy* Part 1 HTM2027 NHS Estates 1995 ISBN 0 1132 2176 2

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16 *The selection, use and maintenance of respiratory protective equipment: A practical guide* HSG53 (Second edition) HSE Books 1998 ISBN 0 7176 1537 5

Further reading

A Code of Practice: The control of legionellae by the safe operation of cooling systems British Association for Chemical Specialities 1989 ISBN 0 9514950 0 3 (Some sections updated in 1995)

Cooling water treatment: *A Code of Practice* 1998 Water Management Society

Both of the above Codes of Practice give practical guidance on the day-to-day management of evaporative cooling systems.

Minimising the risk of Legionnaires' disease TM13 2000 The Chartered Institution of Building Services Engineers 2002 ISBN 1 903287 23 5

This guidance gives details of engineering and design criteria together with day-to-day management and running of hot and cold water systems.

Water Supply Regulations Guide published by and available from Water Research Centre, Oakdale, Gwent.

This guide comprises the Regulations, the DETR guidance on the regulations and supplementary guidance by the Water Regulations Advisory Scheme.

Swimming pool water: Treatment and quality standards Pool Water Treatment Advisory Group 1999 ISBN 0 951 70076 6

Further information

For information about health and safety ring HSE's Infoline Tel: 0845 345 0055 Fax: 0845 408 9566 Textphone: 0845 408 9577 e-mail: hse.infoline@natbrit.com or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG.

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STATUS IN NHSSCOTLAND

BEST PRACTICE GUIDANCE

Health Building Note 00-01

Core elements:

General design guidance for healthcare buildings

For queries on the status of this document contact
nss.hfsenquiries@nhs.net or telephone 0141207 1600
Status Note amended 14th October 2014

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DOH Document Code Part - DOH Document Title and Name
This document must be read in conjunction with current Scottish Government Policy and NHSScotland Guidance, which take precedence. These include publications in both: www.sehd.scot.nhs.uk/ and www.hfs.scot.nhs.uk/publications-/ .

Specific updates for NHSScotand use:

Chapter 1. Policy and regulatory overview
The legal, regulatory and policy framework in Scotland can differ significantly from those in England referred to in this chapter, and must take precedence. However, best practice may be similar, given that the quality and efficiency considerations, plus Equality, Health and Safety regulation, and many of the technical standards, European and British, are the same.

Department of Health

Health Building Note 00-01 General design guidance for healthcare buildings

March 2014

A49756324

Health Building Note 00-01 General design guidance for healthcare buildings

This document is available from our website at www.gov.uk/government/collections/health-building-notes-core-elements

Front cover photograph of Alder Hey Children's Health Park, Liverpool, courtesy of BDP.

Preface

About Health Building Notes

Health Building Notes give best practice guidance on the design and planning of new healthcare buildings and on the adaptation/ extension of existing facilities.

They provide information to support the briefing and design processes for individual projects in the NHS building programme.

The Health Building Note suite

Healthcare delivery is constantly changing, and so too are the boundaries between primary, secondary and tertiary care. The focus now is on delivering healthcare closer to people's homes.

The Health Building Note framework (see next page) is based on the patient's experience across the spectrum of care from home to healthcare setting and back.

Health Building Note structure

The Health Building Notes have been organised into a suite of 17 core subjects.

Care-group-based Health Building Notes provide information about a specific care group or pathway but cross-refer to Health Building Notes on generic (clinical) activities or support systems as appropriate.

Core subjects are subdivided into specific topics and classified by a two-digit suffix (-01, -02 etc), and may be further subdivided into Supplements A, B etc.

All Health Building Notes are supported by the overarching Health Building Note 00-01 in which the key areas of design and building are dealt with.

Example

The Health Building Note on accommodation for adult in-patients is represented as follows:

> "Health Building Note 04-01:
> Adult in-patient facilities"

The supplement to Health Building Note 04-01 on isolation facilities is represented as follows:

> "Health Building Note 04-01:
> Supplement 1 – Isolation facilities for infectious patients in acute settings"

Health Building Note number and series title	Type of Health Building Note
Health Building Note 00 – Core elements	Support-system-based
Health Building Note 01 – Cardiac care	Care-group-based
Health Building Note 02 – Cancer care	Care-group-based
Health Building Note 03 – Mental health	Care-group-based
Health Building Note 04 – In-patient care	Generic-activity-based
Health Building Note 05 – Older people	Care-group-based
Health Building Note 06 – Diagnostics	Generic-activity-based
Health Building Note 07 – Renal care	Care-group-based
Health Building Note 08 – Long-term conditions/long-stay care	Care-group-based
Health Building Note 09 – Children, young people and maternity services	Care-group-based
Health Building Note 10 – Surgery	Generic-activity-based
Health Building Note 11 – Community care	Generic-activity-based
Health Building Note 12 – Out-patient care	Generic-activity-based
Health Building Note 13 – Decontamination	Support-system-based
Health Building Note 14 – Medicines management	Support-system-based
Health Building Note 15 – Emergency care	Care-group-based
Health Building Note 16 – Pathology	Support-system-based

Other resources in the DH Estates and Facilities knowledge series

Health Technical Memoranda

Health Technical Memoranda give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare (for example medical gas pipeline systems, and ventilation systems).

They are applicable to new and existing sites, and are for use at various stages during the inception, design, construction, refurbishment and maintenance of a building.

All Health Building Notes should be read in conjunction with the relevant parts of the Health Technical Memorandum series.

Activity DataBase (ADB)

The Activity DataBase (ADB) data and software assists project teams with the briefing and design of the healthcare environment. Data is based on guidance given in the Health Building Notes and Health Technical Memoranda.

For ADB technical queries only, contact the ADB Helpdesk. Telephone number: 01939 291684; email: support@talonsolutions.co.uk

For new ADB customers and licence renewals only, email: adblicencerenewals@dh.gsi.gov.uk

How to obtain publications

Health Building Notes are available from the UK Goverment's website at:

https://www.gov.uk/government/collections/health-building-notes-core-elements

Health Technical Memoranda are available from the same site at:

https://www.gov.uk/government/collections/health-technical-memorandum-disinfection-and-sterilization

Foreword

'To improve is to change; to be perfect is to change often.
'We shape our buildings, and afterwards our buildings shape us' (Winston Churchill)

The overriding challenge for commissioners, regulators and providers of both health and social care and associated physical environments in which care is delivered, is reconciling the need for patient safety, effectiveness and efficiency and the need for creating a truly therapeutic environment. For this to be successful, it is essential that all who receive healthcare are aware of the nature of this interrelationship.

Achieving effectiveness and efficiency in combination with creating a safe, healing environment are of vital importance in order to address the global challenges from dwindling resources, increasing public expectations and demands. This includes meeting the needs of an aging population and the expectations from rapidly changing technological advancements. Having to do more with less while being able to achieve value for money are worthwhile goals at anytime – but they have an increased level of interest and scrutiny within a health and care context.

The above factors create an appropriate context for this new and different type of Health Building Note (HBN), an introductory HBN for the suite of HBNs. This overarching HBN gives an overview of the policy and legislative framework around capital projects in healthcare, strategic planning, master planning and building design.

Most of the content will be familiar to healthcare planners, architects and others with formal design education. However, it will also be useful for the informed client, commissioners and regulators – those who do not have detailed knowledge of capital investment projects but who want more involvement and information on the issues that are encountered in these types of project.

Illustrations/pictograms with explanatory text are used as the main focus, with photographs providing supporting precedents. Organisations should try to excel beyond simply complying with regulations that effectively just meet the minimum standards.

For HBN 00-01, the goal is to guide organisations, in terms of not only complying with a new registration regime that is based on efficacy, but also fulfilling their obligations and shared responsibilities under the NHS Constitution for ensuring that "services are provided in a clean and safe environment that is fit for purpose, based on national best practice". In so doing, this is also about good design of healthcare premises and its often integrative nature. A single idea, device, form, arrangement or choice of material can often solve a multiplicity of problems.

Dr Michael Phiri
School of Architecture
Healing Architecture Research Group

Executive summary

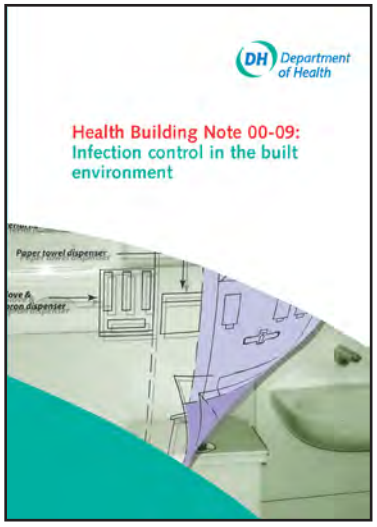
The World Health Organization defined “health” as “a state of physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1946).

Healthcare facilities should provide a therapeutic environment in which the overall design of the building contributes to the process of healing and reduces the risk of healthcare-associated infections rather than simply being a place where treatment takes place.

In turn, the healthcare planning and design process therefore needs to be correspondingly broad enough to include not only the issues surrounding the treatment of disease, but also the promotion of health and prevention of disease – essentially the creation of a safe and therapeutic care environment.

This Health Building Note (HBN) gives general design guidance for healthcare buildings. Because of its general nature, its content will be familiar to experienced architects and healthcare planners. It is intended particularly for those who are new to this work and also to patients or their advocates who may be requested to become involved. It may also be helpful for commissioning organisations and regulators, giving an overall picture of the design issues and future-proofing requirements that need to be addressed in a healthcare capital project.

An opportunity to build a new department/ facility or refurbish an existing one may only happen occasionally but when it does, it provides the opportunity to design a modern department that inspires and intuitively supports safe, effective and efficient patient care, with the flexibility to meet future developments in healthcare, technology and patient needs.



HBN 00-01 should be read in conjunction with Health Building Note 00-09 – ‘Infection control in the built environment’

Acknowledgements

The Department of Health would like to thank all those who have helped to develop and produce this guidance, including all those who commented and sent contributions during the consultation phase.

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Contents

Part 1: Policy and regulatory overview/Scope

1. Policy and regulatory overview

Assurance of estates and facilities

Introduction

1.1 One of the government's key priorities is delivering better health outcomes for patients.

1.2 The quality and fitness-for-purpose of the healthcare estate is vital for high quality, safe and efficient healthcare, and this document seeks to set out the general design principles used in the construction of the estate.

1.3 Design quality is also important in the context of healthcare building, where well-designed healthcare buildings can help patients recover their health and well-being and have a positive effect on staff performance and retention. Additionally, good design improves the efficiency of operational relationships and provides better value for money for the taxpayer and in the context of whole-life costs.

1.4 Assurance of estates and facilities in the new landscape is assessed against a set of legal requirements and standards:

- Regulation 15 of the **Health and Social Care Act 2008 (Regulated Activities) 2010** on the safety and suitability of premises;
- the registration requirements in the **CQC's standards**;
- pledges on a safe environment as outlined in the **NHS Constitution**.

Health and Social Care Act 2008 (Regulated Activities) 2010

1.5 Regulation 15 of the Act states that patients must be "protected against the risks associated with unsafe and unsuitable premises, by means of …. suitable design and layout … maintenance and ….operation".

Regulator requirements

1.6 The Care Quality Commission (CQC) regulates all providers of regulated health and adult social care activities in England. The CQC's role is to provide assurance that the care given meets essential requirements of quality and safety.

1.7 The registration requirements are set out in the Care Quality Commission (Registration) Regulations 2009 (CQC Regulations) and include requirements relating to:

- safety and suitability of premises;
- safety, availability and suitability of equipment; and
- cleanliness and infection control.

1.8 The CQC is responsible for assessing whether providers are meeting the registration requirements. Failure to comply with the CQC Regulations is an offence and, under the Health and Social Care Act 2008 (Regulated Activities) Regulations 2010, CQC has a wide range of enforcement powers that it can use if the provider is not compliant. These include the issue of a warning notice that requires

improvement within a specified time, prosecution, and the power to cancel a provider's registration, removing its ability to provide regulated activities.

Note on amendment to the CQC Regulations

New regulations are due to come into effect during 2014 and will apply to all providers of health and social care that are required to register with the CQC.

NHS Constitution

1.9 The NHS Constitution sets out the rights to which patients, public and staff are entitled. It also outlines the pledges that the NHS is committed to achieve, together with responsibilities that the public, patients and staff owe to one another to ensure that the NHS operates fairly and effectively. All healthcare organisations will be required by law to take account of this Constitution in their decisions and actions.

1.10 Healthcare organisations need to "ensure that services are provided in a clean and safe environment that is fit for purpose, based on national best practice (pledge)".

In order to deliver on this pledge, it specifically advises NHS organisations to take account of:

- the NHS Premises Assurance Model;
- national best-practice guidance for the design and operation of healthcare facilities (such as Health Building Notes (HBNs) and Health Technical Memoranda (HTMs)).

NHS Premises Assurance Model (PAM)

1.11 The NHS has developed, with the support of DH, the NHS Premises Assurance Model (NHS PAM), whose remit is to provide governance and assurance to boards of organisations that patients, staff and visitors are protected against risks associated with hazards such as unsafe premises. It has been designed to apply across the range of estates and facilities management services.

1.12 Although not mandatory, NHS PAM allows organisations that provide NHS-funded care and services to better understand the effectiveness, quality and safety with which they manage their estate and facilities services and how that links to patient experience and patient safety.

1.13 Key questions are underpinned by prompt questions which require the gathering of evidence. Healthcare organisations need to prepare and access this evidence to support their assessment of the NHS PAM.

1.14 The model also includes references to evidence and guidance (for example, HBNs and HTMs) to assist in deciding the level of NHS PAM assurance applicable to a particular healthcare organisation.

1.15 For more information on how to use the tool, visit the NHS PAM website.

Regulations and Codes of Practice

1.16 The two major pieces of legislation affecting buildings are:

- Building Regulations 2010 – regulations that govern the construction and services within buildings. Practical help on how to comply with the building regulations can be found in a series of approved documents (http://www.planningportal.gov.uk/buildingregulations/approveddocuments).
- Health and Safety at Work etc Act 1974 – regulations that govern the working conditions within buildings.

Health and safety regulations

1.17 The Health and Safety Executive (HSE) is the national regulator for workplace health and safety. The following legislation places legal duties on various dutyholders:

- Health and Safety at Work etc Act 1974, section 3
- Workplace (Health, Safety and Welfare) Regulations 1992
- Management of Health and Safety at Work Regulations 1999, regulation 3
- The Construction (Design and Management) Regulations 2007
- Manual Handling Operations Regulations.

For more information, visit the HSE's website.

Climate Change Act 2008

1.18 Healthcare organisations need to be mindful of the Climate Change Act and the resultant measures that need to be taken, particularly with regard to flooding, drought, hot weather and freezing temperatures (for further guidance, see Health Building Note (HBN) 00-07 – 'Planning for a resilient healthcare estate').

1.19 There are two main areas of focus for action with respect to climate change:

a. **Mitigation** – which reduces the impact of business functions on the climate through the lowering of carbon emissions from energy use, the reduction of water consumption, improved efficiency of transport etc. Under the Climate Change Act, the government has set up the CRC Energy Efficiency Scheme, which requires large public and private sector organisations to achieve energy-saving targets.

b. **Adaptation** – which requires measures be put in place to minimise the adverse effects of climate change (for example, flooding, storms, heatwaves and impact on air quality). With respect to buildings and infrastructure, flooding is identified as the main threat by the current UK Climate Change Risk Assessment. The next update to this assessment is expected in 2017.

Code of Practice on infection prevention and control

1.20 The information outlined in this document follows the general principles given in the 'The Health and Social Care Act 2008: Code of Practice on the prevention and control of infections and related guidance' (the HCAI Code of Practice). This Code of Practice sets out criteria against which a registered provider will be judged on how it complies with the registration requirement for cleanliness and infection control. Not all criteria will apply to every regulated activity.

1.21 The law states that the HCAI Code of Practice must be taken into account by the CQC when it makes decisions about registration against the cleanliness and infection control requirement. The regulations also say that providers must have regard to the Code when deciding how they will comply with registration requirements. The Code aims to exemplify what providers need to do in order to comply with the regulations.

Note

Infection prevention and control teams should be consulted on any design decisions. See HBN 00-09 – 'Infection control in the built environment' for guidance on design issues and how to comply with the HCAI Code of Practice.

Accessibility

1.22 Authorities need to comply with the provisions of the Building Regulations (including Approved Document M – 'Access to and use of buildings') and the Equality Act 2010.

Note that some HBNs have variations from Approved Document M. Where this is the case, the reasons are discussed in the respective documents.

Relevant government initiatives

Government Construction Strategy

1.23 The Government Construction Strategy (GCS) seeks to reduce the cost of public sector construction by 15–20% by 2015.

1.24 ProCure21+ is working with the Cabinet Office to reduce construction costs of NHS capital schemes and has signed up to deliver 14.1% cost savings by 2016. Three initiatives have been put in place to achieve this:

a. cost targeting and benchmarking – 3% savings required on every scheme;

b. standardisation of components and repeatable designs offering up to 25% savings;

c. the implementation of building information modelling (BIM) software on all ProCure21+ schemes.

1.25 For more information on these initiatives, visit the ProCure21+ website.

Common Minimum Standards

1.26 The Common Minimum Standards (CMS) for the procurement of built environments in the public sector set a requirement that:

> "All clients will aim to deliver design excellence in accordance with the principles set out in the Government Construction Strategy" (CMS 4.1).

Compliance is expected, although the CMS do make provision for practicality, achievability and value for money to be considered in certain circumstances. Details on the CMS can be found on the Common Minimum Standards web page.

1.27 The CMS recommend that Design Quality Indicators (DQIs) are used as part of ensuring all stakeholders, including end-users, are involved in the development of the output specification, design brief and in the assessment of project success. The DQIs for the health sector have been developed by the UK Construction Industry Council as a five-stage facilitated and accredited process. This replaces the Achieving Excellence Design Evaluation Toolkit originally produced by the Department of Health, which has been archived and is no longer supported.

1.28 The CMS document also recommends that an appropriate environmental assessment process such as BREEAM, or an equivalent process appropriate to the size, nature and impact of the project, should be carried out on all projects.

BREEAM for healthcare buildings replaces NEAT (NHS Environmental Assessment Tool) as the preferred environmental assessment method and certification scheme for healthcare buildings in the UK.

Government Soft Landings

1.29 The handover stage of assets is critical to ensure that the as-designed performance is achieved as soon as possible and that the ongoing operation continues to conform to as-designed parameters. This is an area identified in the GCS and it is being supported through the implementation of the Government Soft Landings (GSL) policy.

1.30 GSL means designers and constructors staying involved with healthcare buildings beyond practical completion, to assist the client during the first months of operation and beyond, to help fine-tune and de-bug the systems, and ensure the occupiers understand how to control and best use their buildings. It also provides a natural route for post-occupancy evaluation and feedback.

2. Scope of Health Building Note 00-01

Introduction to Health Building Notes (HBNs)

2.1 HBNs are the key documents for all health building, planning and briefing guidance in England. They draw together the best current knowledge for healthcare needs and should be regarded as setting standards of best practice and providing essential information on how to comply with the statutory and policy framework around the assurance of estates and facilities as outlined in paragraphs 1.1–1.15 (see Figure 1).

2.2 The main aims of HBNs are to:

- promote the design of healthcare facilities with regard to the safety, privacy and dignity of patients, staff and visitors;
- provide best practice guidance to architects, designers and healthcare planners seeking information on the special needs of typical healthcare facilities;
- help to achieve value-for-money solutions for the planning and design of healthcare facilities.

2.3 Good design is often integrative. A single idea, device, form, arrangement or choice of material can solve a multiplicity of problems. Of importance, the evidence-based design approach has the potential to improve the quality of patient experience and health outcomes while also saving time and costs.

Health Building Note 00-01

2.4 HBN 00-01 is provided as a guide to the design principles and issues that are applicable to all adult acute in-patient healthcare facilities (although the standards and principles it advocates may be appropriate to follow in all locations where healthcare is provided).

2.5 The document provides an overview of general design principles and is not a comprehensive guide. Because of its general nature, its content will be familiar to experienced architects and healthcare planners. It is intended particularly for those who are new to this work. It may also be helpful for commissioning organisations and regulators, giving an overall picture of the design issues that need to be addressed in a healthcare capital project.

2.6 Much of this guidance will also apply to mental health facilities. However, for more specific design guidance (for example, anti-ligature design), see HBN 03-01 – 'Adult acute mental health units'.

Format

2.7 Chapters 3 and 4 deal with the strategic and master planning stages. Chapter 5 looks at the design brief. Chapter 6 shows some evidence-based design ideas that can be used to inform the design brief. (For a list of all current HBNs in the series, see the Preface.)

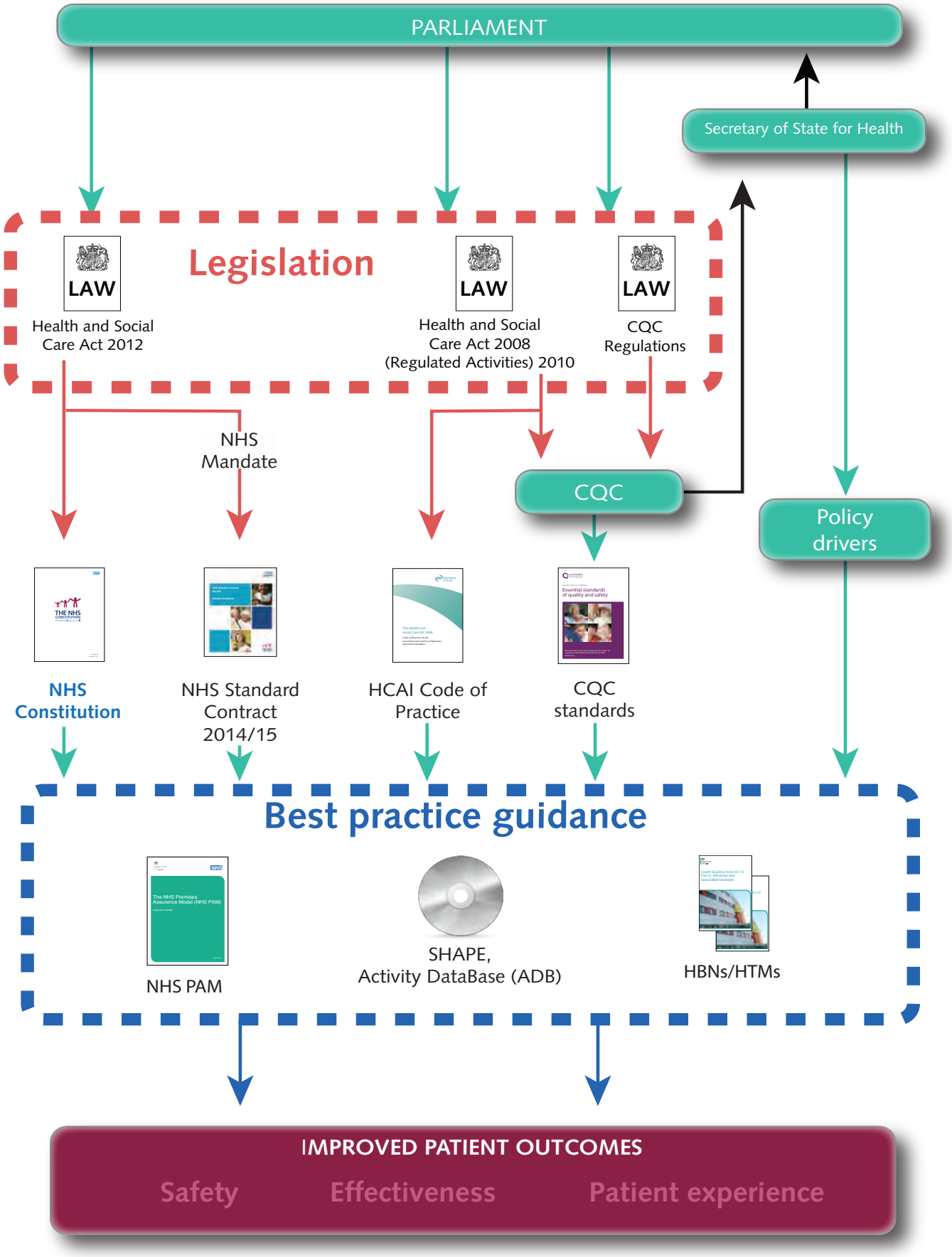


Figure 1 HBNs and the legislative framework

Part 2: Strategic and master planning

3. Strategic planning

Note

Part 2 on strategic and master planning should be read in conjunction with HBN 00-08 – 'Estatecode'.

3.1 Evashwick and Evashwick (1988) define strategic planning as "the process for assessing a changing environment to create a vision of the future; determining how the organisation fits into the anticipated environment based on its institutional mission, strengths, and weaknesses; and then setting in motion a plan of action to position the organisation accordingly".

3.2 In essence, strategic planning should attempt to answer and address the following questions:

- Where we are now?
- Where we are going?
- How we will get there?
- How we will know we are achieving our goals?

These questions will form the backbone of an estates strategy.

3.3 In healthcare, strategic planning needs to acknowledge that core services will change and flex as care models and service priorities evolve. In other words, healthcare organisations have to be responsive to the changing needs of the local population they serve and to the people who provide the service, with the focus constantly being on improving patient outcomes. The objective of strategic planning is to control these changes and to use them as an opportunity to redeploy resources in order to improve the overall quality and balance of healthcare provision.

3.4 For successful strategic planning, healthcare organisations will need to understand disease prevalence, existing and potential demands for services, and commissioning intentions, and what impact these issues will have for the estate. They will therefore need to have discussions with clinical commissioning groups (CCGs) to ensure that any assumptions made about capacity and activity modelling are consistent with commissioners' five-year plans and annual operational plans (see also NHS England's 'Everyone counts: planning for patients 2014/15 to 2018/19'). As a result, healthcare organisations will be able to determine which services they are best able to provide sustainably and identify the most efficient and effective way of delivering them in order to maximise quality of care.

3.5 Discussion and consultation should also take place with patients and the public from the very beginning of the process. This could be achieved though planning meetings, interviews, questionnaires, patient stories, design workshops, care pathways workshops and regular meetings that discuss the design and the functional content of the proposed development. Events can be publicised through local patient and public involvement groups or public notices.

3.6 Factors that are influencing the delivery of care and which are changing most rapidly are:

- demographic trends (in particular, an aging population and the projected prevalence of dementia);
- shorter lengths of stay;
- an increase in ambulatory care and surgery via community settings; and
- technological advances (for example, in surgical techniques and diagnostic imaging).

3.7 Activity can be modelled forward using a predictive modelling tool such as Strategic Health Asset Planning and Evaluation (SHAPE) (see Figure 2). This is an evidence-based application that informs and supports the strategic planning of services and physical assets across the health economy. For example, it can:

- help to compare the population needs and demographics for existing or proposed sites;
- map existing health services and look at how they would cope with increases in population;
- inform the exploration of the efficiency and effectiveness of current service models and help project future capacity requirements;
- assist the strategic estates planning process and link it to the commissioner's service planning.

3.8 Another useful tool is Activity DataBase (ADB). This software assists in the construction, briefing development, design and alteration of healthcare facilities. Room data sheets provide an activity-based approach to building design and include data on personnel, planning relationships, environmental considerations, design character, space requirements and graphical layouts (see Figure 3). Spaces designed using ADB data comply with the planning guidance in HBNs and HTMs (see Preface for contact details).

3.9 An opportunity to build a new department/ facility or refurbish an existing one may only

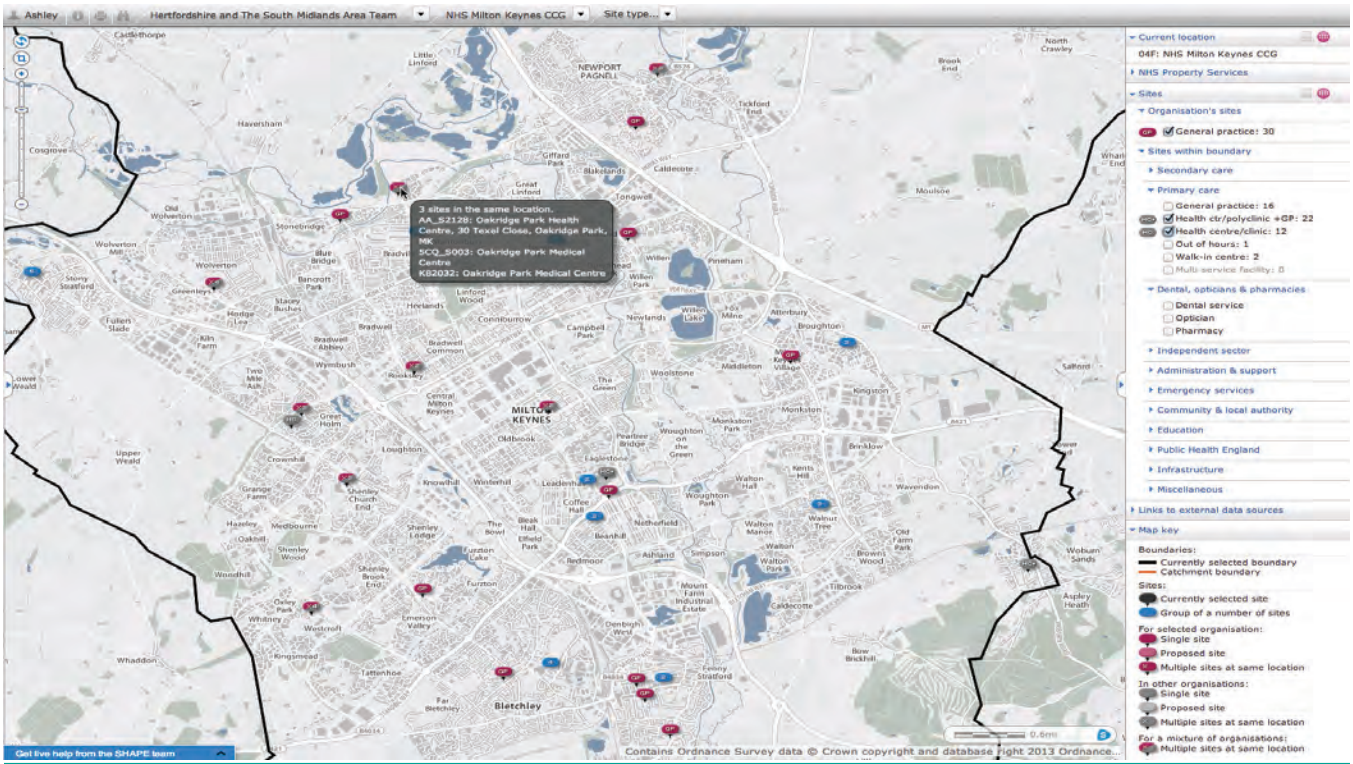


Figure 2 SHAPE boundary and sites: location of primary care sites within a CCG boundary. Spatial distribution of primary and community facilities can establish whether there are any gaps in service delivery in relation to local needs.

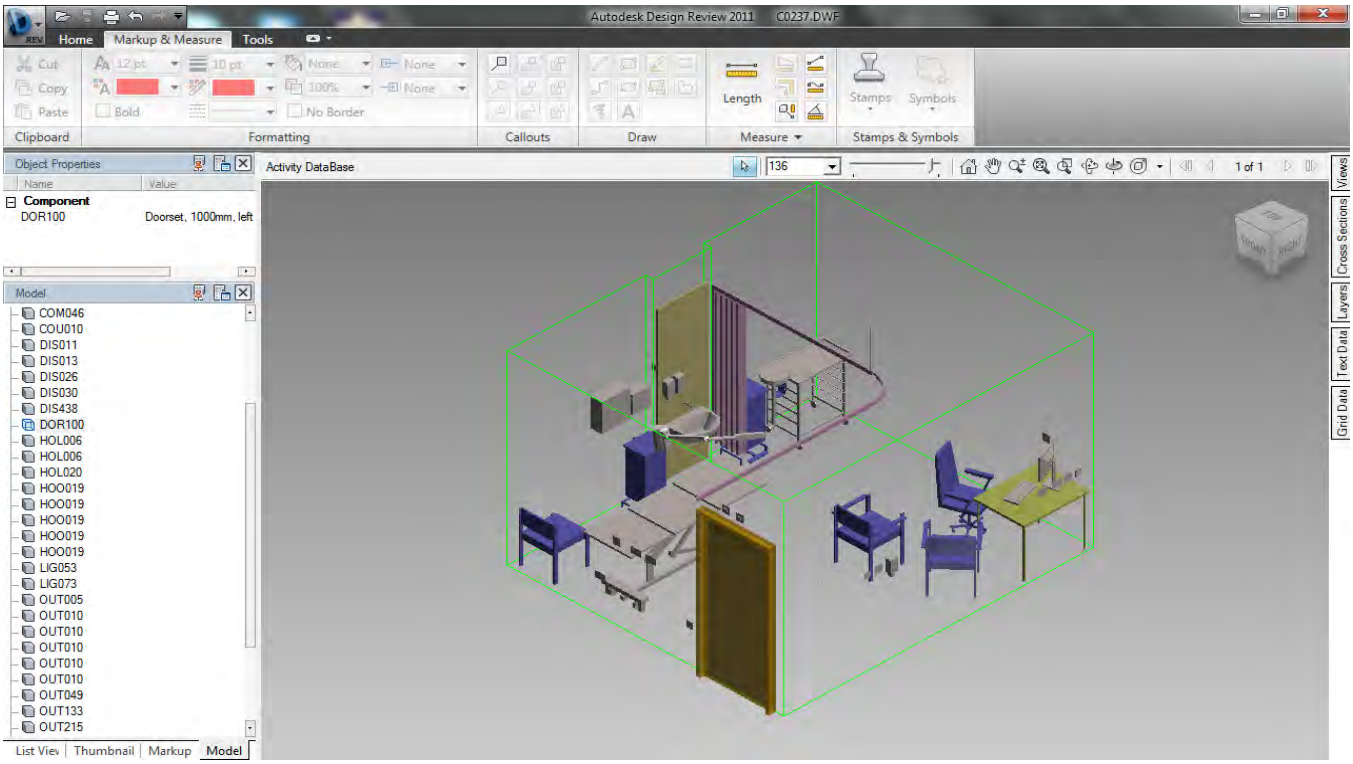


Figure 3 ADB graphical representations of room layout drawings, room elevations and three-dimensional drawings to 1:50 scale

happen occasionally but when it does, it provides the opportunity to design a modern department that inspires and intuitively supports safe, effective and efficient patient care, with the flexibility to meet future developments in healthcare, technology and patient needs. Great attention therefore needs to be focused especially during the strategic and initial project phases on the range and depth of input required from specialist skills. Often the studies undertaken at the strategic planning and evaluation stages are highly interactive, complex and demand high levels of creative thinking. It is therefore essential that this activity is properly addressed and resourced as the outcome forms the basis for all that follows. In terms of added value it holds prime position.

4. Master planning and development control plans

4.1 If the strategic planning phase reveals that a new element of clinical service is to be provided, or an existing one altered, extended or relocated, the options for housing these clinical needs must be appraised before a specific scheme is identified. This should be encapsulated in a strategic master plan and its associated development control plan (DCP). The main aims of these plans are to set out and define the particular qualities and attributes of a place and illustrate how to make the best use of them.

4.2 A master plan enables a proper appreciation of the capacities of the site as well as the buildings. It should show how much of the current clinical use can remain and the extent of any new construction that may be required. Options will usually involve:

- no building work at all (including the decommissioning and potential demolition of existing buildings);
- relocating or reassigning functions within the existing fabric of the building;
- refurbishing existing buildings;
- new developments.

Key considerations behind the development of a master plan

Shared vision

4.3 The master plan has to address the needs and desires of the patients, staff, managers and the local community to provide a clinical vision that can be supported through the delivery stage and future phases.

Ease of access and navigation

4.4 The master plan should be integrated with existing transport solutions, both public and private, as well as providing site-wide intuitive wayfinding.

4.5 Strong, simple organisational concepts will aid the relationship of the external layout to the clinical departmental adjacencies and the internal wayfinding strategy.

Maximising opportunities

4.6 As the core purpose of the master plan is to make best use of land and buildings, it will need to:

- achieve the preferred clinical solution and functional zoning; and
- address:
  - the requirements of circulation and commercial activities;
  - site disposal; and
  - regeneration opportunities.

Understanding the constraints

4.7 To achieve a sustainable master plan, the potential constraints and existing infrastructure need to be understood. This will include roads, access, below-ground services, existing

servicing hubs, plantrooms and the potential limitation that they will have on proposals.

Context and physiology

4.8 A master plan needs to consider its connection and relationship to the neighbouring community and should not be designed in isolation. It should establish the three-dimensional massing, shown in context with adjacent structures and open spaces, and set out floor-to-floor relationships, the best use of the site's topography, orientation, site boundaries, sun paths, views, landscape and building faces.

Flexibility and future-proofing

4.9 The plan needs to allow for adaptation, change and future planning, including strategic infrastructure decisions (roads, access) that minimise restrictions for future development.

Deliverability

4.10 The proposals need to be affordable and achievable (that is, addressing potential development restriction such as town planning). Consideration needs to be given to the phasing of works to allow clinical functionality to be maintained so as to minimise any potential disruption that the building work may have on existing services.

The result – a linear process

From this, a clear site strategy should emerge, defining access, building location and mass, orientation, car-parking and landscape design. The resulting design should be coherent and legible, allowing users of the building to understand how it is put together and organised as they approach it – a linear process (see Figure 4).

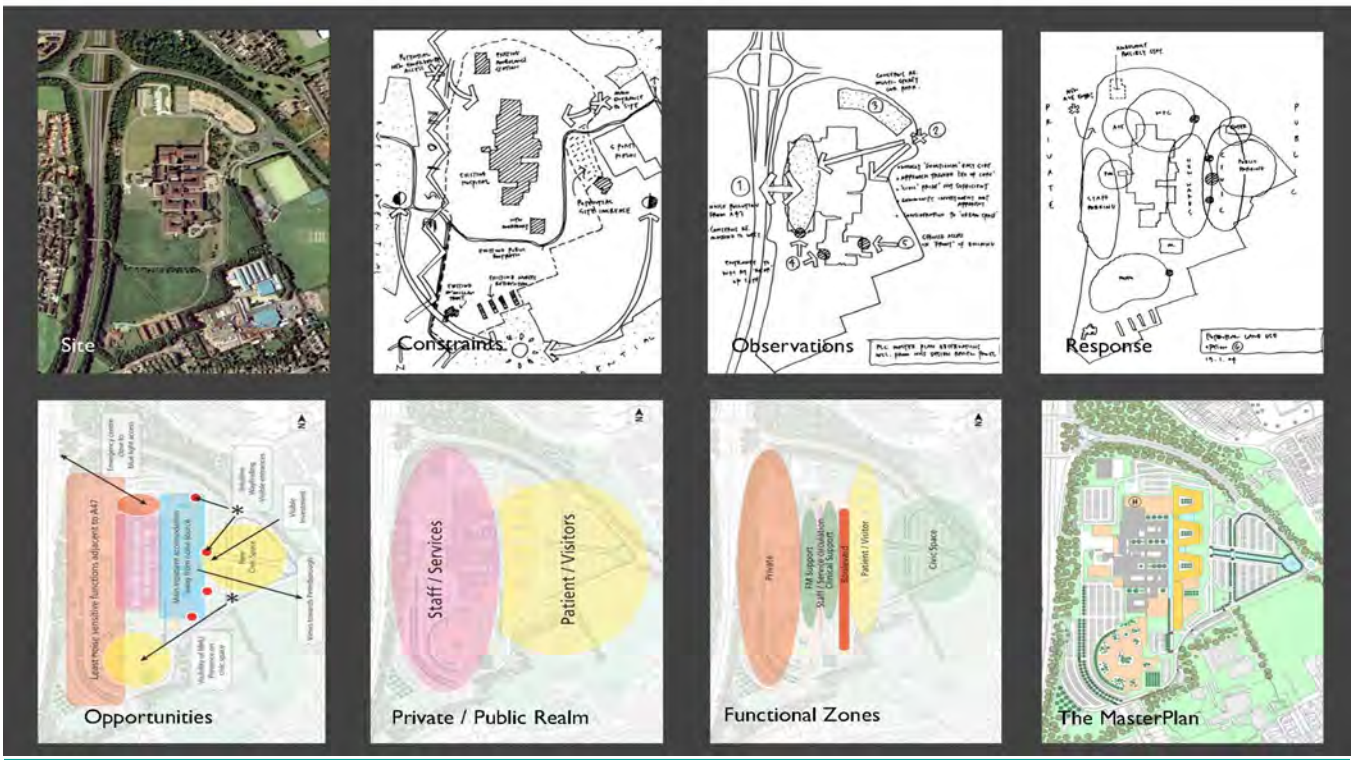


Figure 4 Masterplan development – the linear process. (Enniskillin Hospital, Courtesy of Aukett Swanke)

Summary of key considerations for the development of a master plan:

- **site information:**
  - site photos, aerial photos and key plan
  - site levels, topography
  - access and existing roads
  - existing services
  - ground conditions including hydrological conditions
  - existing trees, landscape
  - existing transport access – rail, road, other linkages
  - future/planned transport access
  - existing infrastructure/services
  - future/planned infrastructure services.
- **regional context:**
  - local area plan
  - future changes in the surrounding area
  - existing developments in surrounding area
  - existing landscape/green space/development context
  - potential for new uses on site
  - regional demand for new uses
  - competing projects
  - quality/standards/examples.
- **environmental considerations:**
  - potential noise mitigation requirements (roads, rail, air, industry etc)
  - ecological issues
  - existing and potential areas of environmental value.
- **existing buildings:**
  - clinical functionality and adjacencies
  - building and services conditions and backlog maintenance requirements
  - structure (is the structural grid suitable for the proposed function/new function?)
  - connectivity
  - accessibility
  - fire safety and strategy
  - security
  - flexibility, adaptability and future need.

Development control plan (DCP)

4.11 The master plan would, in turn, inform the DCP. This sets out the long-term development of a healthcare organisation's estate and is an essential requirement for the submission of the phase 1 full business case (FBC).

4.12 The DCP shows in diagrammatic form the major changes taking place on the site (see Figure 5):

- existing and proposed site boundaries;
- all existing and proposed buildings and services;
- phasing including the first phase and any immediately subsequent phases of development in detail;
- location and access for later phases, with indications of strategy for main communication routes and site-related infrastructure/engineering services;
- location and function of disposal sites.

Development context and external influences

4.13 The master plan and DCP need to be considered in the wider context of the healthcare organisation's policies.

4.14 The project team will need to address which services should remain on site and which services could potentially be located off-site or be provided by third-party service providers (for example, sterile services and catering).

4.15 Other external influences may define the potential value of the real estate on the open market against less valuable sites.

Examples of typical site-wide design considerations

4.16 At the master planning stage, there are certain design requirements that need to be considered as they apply across the whole site.

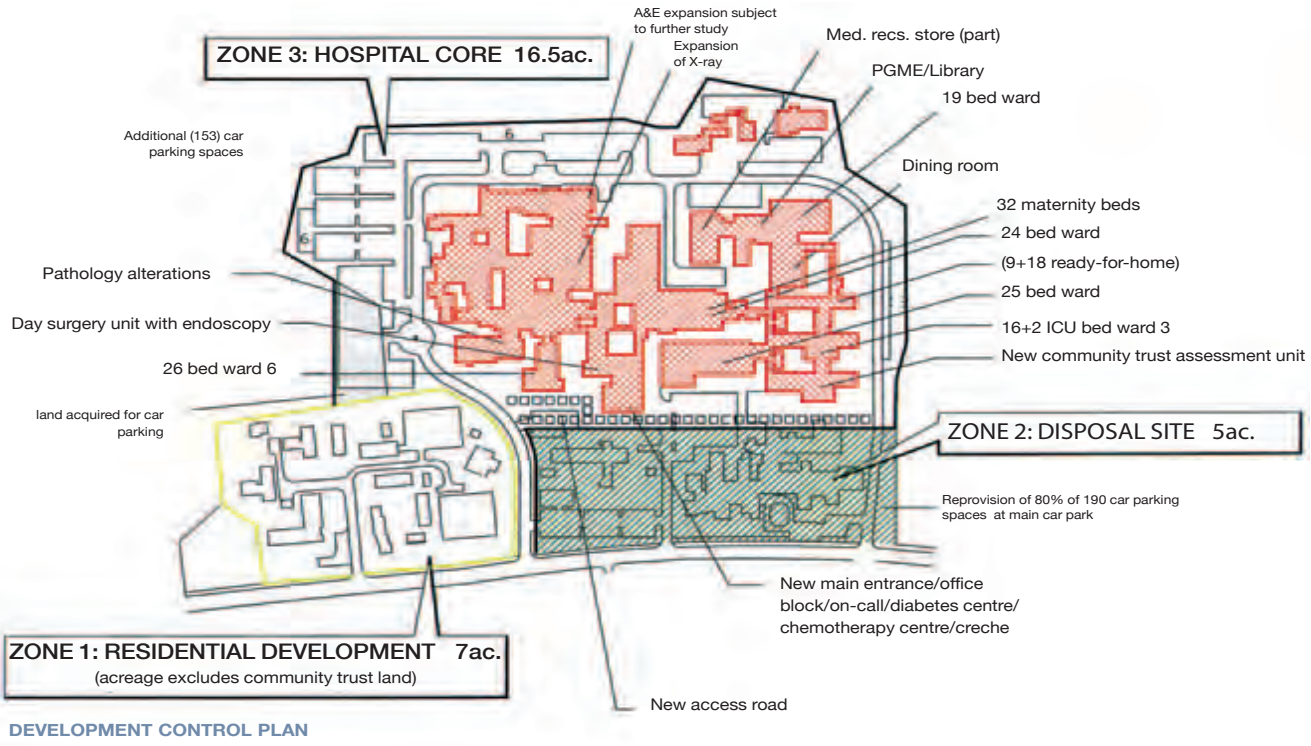


Figure 5 Example development control plan

Access

4.17 The site of any healthcare facility should be convenient both to the community and to service vehicles, including fire appliances, ambulances and other emergency vehicles. Consideration should be given to:

- access and easy circulation for patients, staff and visitors (both non-disabled and disabled) on foot, on bicycles, in cars or on public transport (sustainable transport considerations should be encapsulated in a transport plan);
- dedicated blue-light routes;
- a discrete, segregated access for goods vehicles to receiving and delivery areas.

Liaison with the local highway authority should also take place.

Flexibility, adaptability and future need

4.18 Healthcare buildings need to be adaptable and allow for changes in layout, function and patient volume. It is important therefore that the design process takes account of flexibility and continuous change (see Table 1).

4.19 One of the ways of allowing flexibility is to standardise space and components as much as possible. As well as improved patient outcomes, this will also help to achieve cost reductions.

4.20 To better understand possible future need, the project team should consider a future-planning workshop with stakeholder groups using a scenario planning approach: the potential change over a five-, ten- and 20-year period, which the facility may need to respond to.

4.21 The team should take into account lessons learnt from previous changes in service requirements, the accuracy of previous predictions and the cost of not meeting these changes.

4.22 The multidisciplinary team should consider questions such as “What if?” and “What happens if?”

Servicing

4.23 The earlier in the project the servicing options and strategies are considered, the lower will be the financial impact of changes to these services.

4.24 Understanding the location of existing services is essential to the development of any master plan, for example:

- Below-ground services may well have a no-build zone.
- The public infrastructure provision of drainage, gas and electricity may be at capacity, and additional substations etc could be cost-prohibitive.

4.25 Hospital facilities are IT-dependent and, as with the other services, it is vital that connectivity is addressed.

4.26 Hospital-specific services such as medical gases and vacuum form part of these complex master-planning considerations.

4.27 Servicing has an even bigger impact on the phasing and decant strategy of works within the retained estate.

Fire safety

4.28 The requirements of the Firecode suite of DH guidance must be considered throughout the design process. In particular, HTM 05-02 – ‘Guidance in support of functional provisions for healthcare premises’ gives guidance on functional provisions such as means of escape and access and facilities for the fire service. Clients must ensure that there is close collaboration between all those who have an interest in the fire safety provisions of the proposed premises at the earliest stage in the design and be satisfied that all such premises comply with all statutes bearing upon fire safety. The potential for trade-off between the needs of

Site	Consider additional land in the purchase of the site to allow for future expansion (parking or horizontal additions) Adjacent properties can also provide potential future options for expansion
Planning	Prepare for future scenarios by ensuring that the master plan documents physical expansion options
Adjacencies	Use zoning to separate public, treatment and staff functions for improved internal circulation and privacy Design horizontal and vertical circulation to encompass future expansion options
Access	Locate the site near public transport routes Consider purchasing adjacent or nearby land for expansion of surface parking Structured parking infrastructure (garage) can be designed for future vertical expansion where horizontal expansion is not practical
Building layout	Design a modular grid system to allow plug-and-play development of spaces and room types
Conflicts between building elements (open building)	Design to minimise conflicts between building elements Primary systems (life cycle: 50–100 years; long-term investment; unchangeable) Secondary systems (life cycle: 15–50 years; medium-term investment; adjustable) Tertiary systems (life cycle: 5–15 years; short-term investment; changeable) Ensure tertiary systems are easy to maintain and replace separately
Emergency exits	Design egress stairs and hallway widths to satisfy current regulations and standards for several different building purposes
Room design	Use universal designs and standardisation (size and equipment) to allow multiple uses for room functionality Consider large rooms/spaces to function for multiple purposes such as community events, education, classes etc For additional flexibility, incorporate conference-centre-style room dividers to create variability in space needs
Internal walls, doors and windows	Design connections for walls, doors and windows that are easy to mount and take down Use minimum technical installations in walls Standardise connections
Loading capacity (dead load)	Design floors to handle extensive dead loads (storage)
Loading capacity (live load)	Design floors to handle extensive live loads (community activity centre)
Mechanical/electrical	Consider green and sustainable energy sources to reduce long-term costs Design additional capacity for HVAC and electrical systems (20% over-capacity in HVAC and 30% output of electrical power)
Furniture	Ensure that furniture can easily fit into parts of the building, can be adapted to technical installations (modular systems) and can be easily moved
Equipment	Standardise equipment to permit movement into different areas for flexibility of function Use portable equipment where possible; when equipment must be fixed, design for other functions in room to maximise use

Table 1 Design considerations for adaptability and flexibility (Adapted from: Taylor et al 2010 (www.chcf.org)

the security and fire-safety strategies and policies should be recognised and risk-assessed at an early stage in the design process.

Security

4.29 Measures should be incorporated into the design of all healthcare buildings to help protect the safety of patients, staff and visitors and the security of the premises. These measures include the use of access control, CCTV and alarms. (See also the HSE's guidance on violence in health and social care.)

4.30 Project teams should discuss security with the local police crime prevention officer and the healthcare organisation's nominated local security management specialist (LSMS) at an early stage in the design process. The LSMS will be able to identify specific security risks and offer advice on measures that can be implemented to reduce them. Any plans to install a new security system or expand an existing one should be discussed with the LSMS.

4.31 The local fire officer and LSMS should be consulted concurrently to avoid the possibility of the demands of security and fire safety conflicting.

4.32 Project teams will need to account for lockdown capability in the planning and design of any building or refurbishment projects and how this impacts on evacuation plans. (The ability of healthcare organisations to lockdown their site or buildings fits in with their statutory responsibilities as category 1 responders as defined by the Civil Contingencies Act 2004.)

For further information, refer to the following guidance:

Managing NHS land and property:

- HTM 00 – 'Policies and principles of healthcare engineering'
- HBN 00-08 – 'Estatecode'
- HTM 07-02 – 'Encode - guidance on the procurement and management of energy in the NHS'
- HTM 07-03 – 'Transport management and car parking guidance for NHS Trusts'
- HTM 07-07 – 'Sustainable health and social care buildings'

Fire safety (Firecode) guidance:

- HTM 05-01 – 'Managing healthcare fire safety'
- HTM 05-02 – 'Guidance in support of functional provisions for healthcare premises'

Security:

- NHS Protect's (2013) 'Standards for providers 2013/14: Security management'
- NHS Protect's strategy document 'Tackling crime against the NHS: a strategic approach'
- NHS Protect's (2009) 'Lockdown guidance'
- The Association of Chief Police Officers (ACPO) 'Secured by Design – Hospitals'.
- Information Commissioner's Office (2008) 'CCTV code of practice'.

Part 3: Building design

5. The design brief

5.1 The design brief is one of the important elements that form part of the overall process in creating a healthcare project. It is essential that the brief is developed in the context of the total lifespan of the project. The brief will:

- describe clinical service needs and design vision/objectives;
- define environmental quality and sustainability objectives, whole hospital policies and departmental policies; and
- detail technical requirements and schedules of accommodation.

Strategic design issues

5.2 Some key decisions that need to be made early at the design briefing stage revolve around:

- sustainability; and
- infection prevention and control.

Sustainability

5.3 In healthcare, themes that need to be considered when designing a sustainable healthcare facility are:

- innovative design;
- creating a therapeutic environment;
- responding to future change;
- whole-life costs; and
- carbon rating.

5.4 The design brief should contain statements on the organisation's desired approach to sustainability. Integral to the design and procurement process, a commitment to sustainable design can bring real benefits in terms of reduced running costs and quality of environment for users. (General guidance on achieving sustainability in construction is set out in HTM 07-07 – 'Sustainable health and social care buildings'. For a list of British Standards on sustainability, see the References.)

Infection prevention and control

5.5 Of particular importance in the context of healthcare buildings is the need for the design brief to incorporate policy, guidance and best practice in relation to reducing healthcare-associated infections (HCAIs). It is vitally important to have a clear understanding of how the briefing, planning, design, procurement, construction, commissioning and ongoing maintenance of healthcare property can contribute to the prevention and control of HCAIs.

5.6 Guidance to ensure that prevention and control of infection issues are identified, analysed and planned for at the earliest stage of the provision of new or refurbished healthcare facilities is contained within HBN 00-09 – 'Infection control in the built environment: design and planning' (see also paragraphs 1.20–1.22).

Example design brief issues

5.7 Information in a design brief should be structured using the categories set out in

Appendix 1. This contains prompts for healthcare organisations to explore particular design issues and it can act as a checklist against which to organise briefing work. The value of this framework is that it not only sets out the briefing agenda but also identifies quality requirements and aspirations.

5.8 Some of the design issues listed in Appendix 1 are expanded upon below.

Note

Inadequate briefing for, or indecision by, the project team will result in delay and/or an unsatisfactory outcome for patients, staff, visitors and the NHS as a whole.

Model of care

5.9 The shape and size of the healthcare facility are determined by the services it tries to deliver. Therefore, the "model of care" is a fundamental building block of the design brief (see Figure 6). The model of care will reflect national and local priorities and good practice on service models and configurations. A description of how services are to be arranged on the site in the context of the overall model of care should be given, together with an impact assessment in terms of infrastructures, staffing issues, capacity and technology.

Functional requirements of the project

5.10 Once the model of care has been agreed, the next key stage in producing the design brief is to develop operational principles and policies. Operational principles describe how each service will function. They are a way of testing the impact of the overall model of care on each element of the scheme. These policies also describe how rooms and spaces for that service relate to one another so that the department can be planned in a functional way.

5.11 As mentioned in paragraphs 5.5–5.6, policies for the prevention and control of infection have a significant impact on the provision and design requirements for accommodation. See HBN 00-09 – 'Infection control in the built environment' for further guidance.

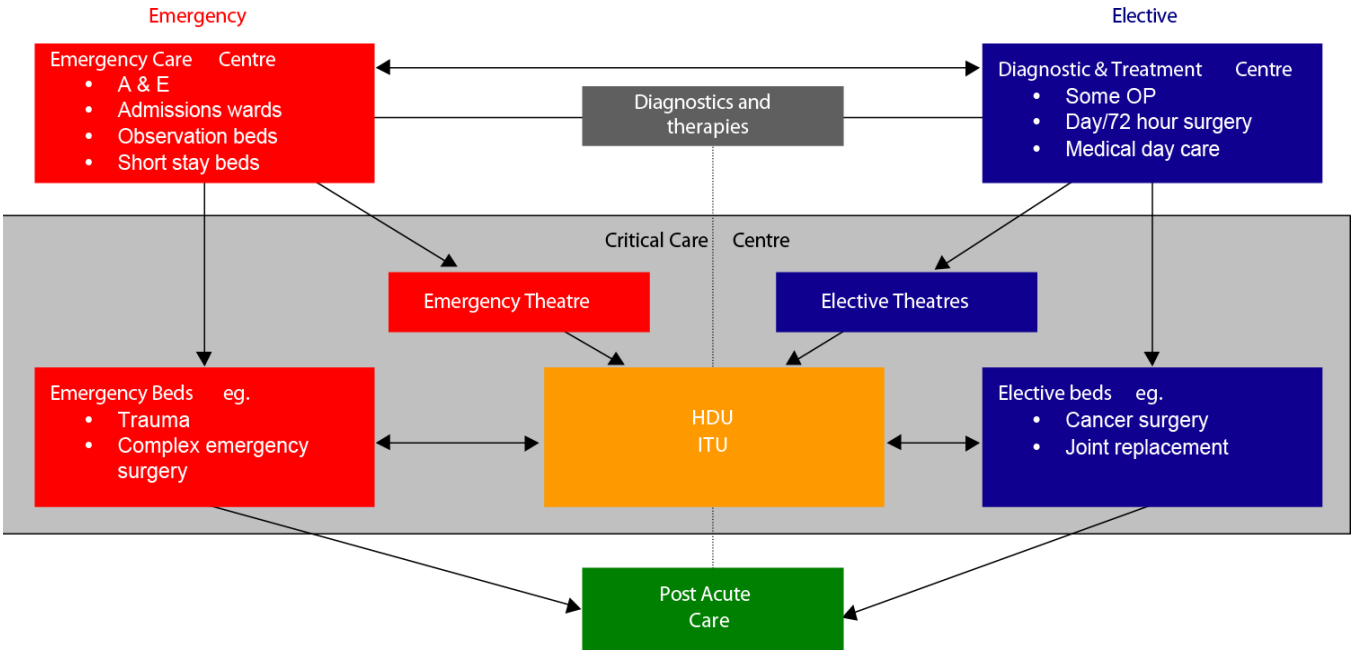


Figure 6 Example acute model of care

Adaptability

5.12 The likelihood of changes in service provision should be explored in the design brief and the requirements for expansion and flexibility prioritised as essential or desirable. The specification may be departmentally based as well as generic.

Security and ease of control

5.13 The design implications of the organisation's security and safety policy as outlined in paragraphs 4.29–4.32 should be discussed and essential requirements of the brief specified.

Access

5.14 Non-clinical support operational policies, such as access and car-parking referred to in Chapter 4 should be highlighted and supplemented as necessary with specific requirements, including those of the local authority and local highway authority with regard to transport and town planning. Access is a key issue for patients, staff and visitors, and due regard should be given to stakeholder involvement in determining policies.

Accessibility

5.15 The design brief must take account of the provisions of the Building Regulations (including Approved Document M – 'Access to and use of buildings') and the Equality Act 2010. Where there are diverging requirements with HBNs, these should be acknowledged and the chosen path clearly stated.

5.16 Design teams should refer to BS8300 and HBN 00-04 – 'Circulation and communication spaces' for additional guidance.

Space

Functional content and space requirements

5.17 Functional content is a list of departments within the scheme and their key functional unit room requirements. At the early option appraisal stage of the outline business case, functional content may be based upon guidance outlined in HBNs. The layout of individual spaces may initially be determined using Activity DataBase (ADB) (see paragraph 3.8).

5.18 However, any information on the size of rooms and circulation space within departments as provided in HBNs and ADB should be thoroughly reviewed by the clinicians and users – including patients and the public – together with technical advisers to establish the organisation's brief for the spatial requirements.

Adjacencies

5.19 Specific requirements for clinical adjacencies between specialties and clinical departments should be outlined. Priorities should be noted, with essential and desirable relationships established.

Best practice guidance on planning and design

5.20 The brief should be specific and precise about the status of guidance, distinguishing between mandatory and desirable standards. Blanket statements should be avoided.

5.21 Space recommendations in relation to room layouts are determined by reference to the space required for activities undertaken in the room and the components that aid them. Typical layout plans and elevation views are given in ADB. These serve as a starting point only and should be adapted to meet project-specific needs.

Space utilisation

5.22 Attention should be given to the use of facilities over time and the potential to share accommodation. The brief should make clear the parameters within which the design team should work. For example, two departments may each have a seminar room as part of their schedules of accommodation, but in practice they could share the same room provided the design team were able to achieve a mutually accessible location.

Generic spaces

5.23 Generic rooms are designed to accommodate a range of activities rather than being tailored for a single function/speciality or narrow range of functions. Clinical and clinical support rooms should be generic wherever possible to maximise flexibility in use. Generic rooms make up a high proportion of the spaces within healthcare buildings (see HBN 00-03 – 'Clinical and clinical support spaces').

Storage

5.24 The need for sufficient secure storage should not be underestimated. Many plans start with sufficient storage, but this space is often lost to other areas during the design process. This can have implications for both clinical practice and infection control.

Privacy and dignity

5.25 The Department of Health's delivering same-sex accommodation (DSSA) programme aims to all but eliminate mixed-sex accommodation from hospitals. Although DSSA is primarily an operational issue, the design and layout of healthcare facilities should help support the provision of same-sex accommodation.

5.26 In clinical and waiting areas, planning decisions should take account of patient culture and preferences in terms of privacy, modesty and same-sex accommodation. Preservation of patients' privacy and dignity, particularly at points of transfer between changing, sub-waiting and treatment facilities, should be given high priority, and in some cases men and women should be segregated. This may be achieved operationally, by providing separate facilities or by designing for flexibility.

5.27 For further information, reference should be made to the letter (PL/CNO/2010/3) from the Chief Nursing Officer and Director General NHS Finance, Performance and Operations.

Inclusivity

5.28 Providing a suitable environment involves recognising and respecting the diverse needs, values and circumstances of each patient, including their race, religion, gender, age, sexual orientation and any disability. These are the protected characteristics set out in the Equality Act 2010.

5.29 Designs should be:

- responsive, taking account of what people need and want;
- flexible, so that different people can use them in different ways;
- convenient, so that everyone can use them without too much effort or separation;
- realistic, offering more than one solution to help balance everyone's needs and recognising that one solution may not work for all.

Internal environment

Falls prevention

5.30 A patient falling is the most common patient safety incident. A risk assessment of the internal environment should be carried out to determine whether patients are at risk from slips, trips or falling from heights.

5.31 HBN 00-10 Part A – 'Flooring' gives guidance on the performance requirements of different types of flooring in healthcare facilities.

5.32 HBN 00-10 Part D – 'Windows and associated hardware' provides guidance on how to assess the risks of patients falling from windows and the resultant control measures.

5.33 Where assessment identifies that patients are at risk of falling from balconies, then sufficient protection should be provided to prevent them from accessing balconies or climbing over the balcony edge protection. This should take into account furniture or features with footholds which may allow access over the

barrier (for example, chairs, tables, plant pots, walls etc). For further information, see guidance from the HSE:

- slips and trips
- risks of falling from windows
- flooring selection tool
- hygienic cleaning of floors in hospitals settings

Finishes

5.34 Materials and finishes should be selected to minimise maintenance and be compatible with their intended function. Building elements that require frequent redecoration or are difficult to service or clean should be avoided. Special design consideration should be given to entrances, corners, partitions, counters and other elements that may be subjected to heavy use.

5.35 Wall coverings should be chosen with cleaning in mind.

5.36 The choice of finishes should form an integral part of the design process and be coordinated within the overall design scheme. The selection of colours and reflectances can have a significant impact on the lighting within the room and will need to be coordinated with the lighting design.

5.37 Finishes should be functional and compatible with the need for comfort, cleanliness and safety. Cleaning regimes should be considered when materials are selected. See:

- HBN 00-10 Part A – 'Flooring' and Part B – 'Walls and ceilings'
- HBN 00-09 – 'Infection control in the built environment'.

5.38 See the 'Revised Healthcare Cleaning Manual' for best practice cleaning methods, which should influence the choice of finishes. The advice of the infection prevention and control team should be sought on this matter For HSE guidance, see paragraph 5.33.

Visual and colour contrast

5.39 Visual contrast is as important as colour contrast, since some people with visual impairments confuse different colours of similar tone. Monochromatic colour schemes should therefore be avoided.

5.40 Approved Document M of the Building Regulations defines visual contrast by referring to a difference in light reflectance values. Where this document refers to visual contrast, reference should be made to the latest values in Approved Document M.

5.41 Floor colours should contrast visually with wall colours.

5.42 Fittings should contrast visually with the surface to which they are fixed and the surface against which they may be viewed.

5.43 For detailed information on the use of colour and visual contrast, see:

- Approved Document M and BS 8300;
- Dulux Trade 'A design guide for the use of colour and contrast to improve the built environment for visually-impaired people';
- Bright et al (1997) 'Colour, contrast and perception – design guidance for internal built environments';
- the Royal National Institute for the Blind (1995) 'Building sight'.

Natural lighting

5.44 Scientific evidence indicates that daylight has beneficial effects on patients (see Rubin et al (1998)), visitors and staff. It has been shown to reduce psychological problems and improve patient outcomes, and increase morale and reduce sickness levels among staff.

5.45 An external view – even if limited – has also been proved to be beneficial. Windows with no significant view are preferable to no natural light or window at all.

Natural ventilation

5.46 Use of natural ventilation is encouraged wherever possible (but see paragraphs 4.29–4.32 on security issues, and HBN 00-10 Part D – 'Windows', which discusses window restrictors and safety issues).

5.47 The use of natural cross-ventilation (reliant on window openings on opposing sides of the building) is in line with reducing carbon footprints but may conflict with requirements for acoustic privacy. Project teams should consider this issue on an individual scheme basis, balancing specific privacy requirements against the capital and revenue cost benefits, as well as the improved sustainability profile, that a naturally ventilated solution can offer.

5.48 Building orientation and design and the use of designed-in background noise can be used to mitigate the potentially adverse effects of natural cross-ventilation.

5.49 Natural ventilation should not be considered where it could jeopardise control of infection issues.

5.50 For further guidance see:

- HTM 07-02 – 'EnCode'
- HTM 07-07 – 'Sustainable health and social care buildings: Planning, design, construction and refurbishment'
- HTM 08-01 – 'Acoustics'.

Wayfinding

5.51 The use of colour and art to identify particular routes and rooms can help to reduce the number of signs required. Certain doors, for example fire-exit doors, will require specific labelling.

5.52 Reference should be made to 'Wayfinding: effective wayfinding and signing systems. Guidance for healthcare facilities'.

Art

5.53 There is sufficient evidence to demonstrate that appropriate art and decor reduces the physical and emotional stress of patients and staff. It can also be used to assist wayfinding and should be always integrated within the whole design.

5.54 On larger projects it may be beneficial to appoint an arts coordinator at an early stage to ensure that a comprehensive arts strategy is established and that artwork is properly integrated into the building's fabric. The possibility of involving the local community in the production of artwork should be actively explored.

5.55 The following documents provide useful guidance on the use of art in healthcare premises:

- Arts Council England (2007) 'A prospectus for arts and health';
- NHS Estates (2002) 'The art of good health – a practical handbook';
- NHS Estates (2002) 'The art of good health – using visual arts in healthcare'.

5.56 The Arts Council may be approached for advice on funding.

Design issues for a dementia-friendly internal environment

5.57 For a dementia-friendly environment, the design brief should take account of the considerations in Table 2.

Easily accessibility to outdoors space: visible and easy to access, transition from internal, safe and secure, attractive and meaningful, with choice of activities.
Way marking/navigation: Landmark objects, building features, signage, personalisation, localisation (maps), light orientation.
Room/space adjacencies: toilet accessibility, linkages (for example, lounge/dining/ kitchen, bedroom en-suite/shower/WC, separate services zone, indoor/ outdoor links).
Visibility/permeability: room dividers, open-planning, avoid directly facing doors, use glazed screens to indicate activities, better lighting (top factor), and signs at an inappropriate level.
Scale: domestic versus non-institutional, single-storey preferential, more spaces rather than larger, best suited to activities of daily living, short or no corridors.
Privacy/sociability: sequence of public to private, separate living space from services, define the "front' door", personal possessions, age appropriateness (1950s, no mirrors), end-of-life and extreme frailty, importance of views.
Sensory enhancement – vision: design for the aging eye (loss of visual acuity), lower contrast sensitivity, poor colour vision, less spatial awareness, poorer perception of depth.
Sensory enhancement – hearing: design for the aging ear, loss of higher pitch range, less able to differentiate sounds, less sensitivity, tinnitus, less sensitive balance.
Sensory enhancement – smell: design to acknowledge that the process of smelling takes the longest to reach the brain, and once you do smell the smell lasts longer than other senses; think about ways to tap into the olfactory sense to spark occupant behaviour, thought, emotion and intellect.
Sensory enhancement – taste: design for the basic tastes (sweet, salty, sour and bitter) and to address problems which range from distorted taste to a complete loss of the sense of taste.
Sensory enhancement – touch: design for exploration by hands to lower blood pressure, decrease pain, improve mood, reduce agitation and decrease stress-related cortisol and heart rates, but use care to avoid catastrophic reaction.

Table 2 Design issues for a dementia-friendly environment

Evidence-based design

5.58 The project team should refer to the growing body of research material indicating that the design of the healing environment impacts on patient recovery and on staff, and that good quality environments impact positively on patient care and vice versa. Further guidance is given in the next chapter on evidence-based therapeutic design ideas for the design brief.

6. Evidence-based design ideas for a therapeutic environment

"Environments are considered therapeutic (with healing qualities) when there is direct evidence that a design intervention contributes to improved patient outcomes." (Chapter 12 of 'Investing in hospitals of the future' (WHO, 2009))

6.1 Healthcare facilities should provide a therapeutic environment in which the overall design of the building contributes to the process of healing and reduces the risk of healthcare-associated infections rather than simply being a place where treatment takes place.

6.2 Healthcare buildings exist primarily for the patients and other people who use them. As mentioned, there is a growing body of evidence that if the design is right, satisfaction levels improve as do patients' health outcomes and staff productivity.

6.3 When starting to design appropriate healthcare spaces, rather than begin with the functions of rooms, research by the University of Sheffield found that it was more beneficial to concentrate on the needs and activities of all users – patients, staff and others.

6.4 Examples of activities that occur in healthcare premises include:

- arriving;
- moving around the building;
- waiting;
- resting in in-patient facilities;
- consultation, diagnosis, undergoing tests, examination and treatment;
- socialising and meeting;
- shopping;
- bathing, showering, washing, toilet and grooming;
- counselling/sanctuary.

6.5 The following sections represent the standardisation of activities/processes that are shared between clinical pathways. It has been conceived and developed by the University of Sheffield as a way of using the latest research evidence to generate design briefs (see 'Key UK references on evidence-based architectural healthcare design').

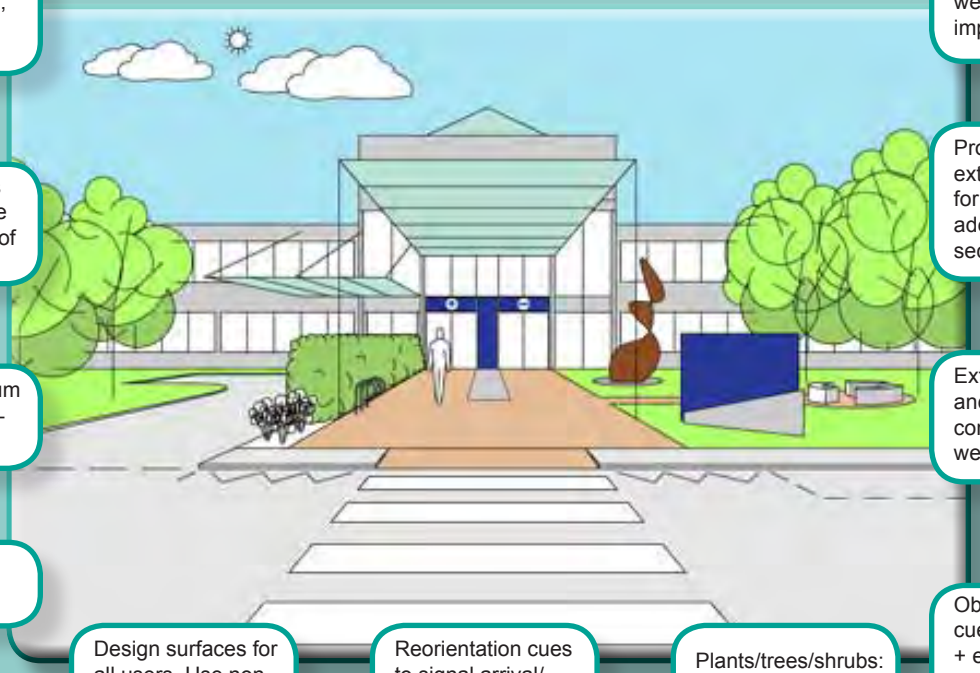
The illustrations or pictograms on the following pages are not intended to give an actual representation of the physical environment but rather the elements or design features that may be considered to aid the development of a design brief. Photographs provide precedents, i.e. good examples of design ideas.

Typical layout plans and elevation views are given in the room graphic sheets that form part of ADB's library of information. These serve as a starting point only and should be adapted to meet project-specific needs (see Chapter 3).

Arriving (outside)

Evidence	Design considerations
Evidence from many post-occupancy evaluations confirm that people like unambiguous entrances that are logically positioned in relation to the points of arrival onto a site and that are usefully indicated by the whole shape and form of the building.	• Introduction of character to the main entrance helps people identify it more readily and can create a sense of uniqueness, friendliness and individuality for buildings that often seem institutional or faceless. • Innovation at the main entrance could be in many forms: art, sculpture, landscaping, planting, fountains, architectural features etc – all of which add to a sense of modernity and progress, and provide interest.
The site as a whole should not introduce further stress by being ambiguous about where the entrance is. Surveys of users in healthcare buildings confirm that multiple entrances are confusing, are a source of security concerns, increase stress levels in patients and staff, and should be avoided. Where this is either necessary or deemed desirable, clearly locating them, making them architecturally apparent and signposting are helpful measures.	• High and generous entrance ways feel welcoming and uplifting. • Low or narrow entrances are claustrophobic and oppressive, not easily identified and can cause uncertainty. • The perceived height of the entrance way will be relative to the building rather than people, so this should be accounted for when the main building is several storeys. • Generous space leading up to the entrance further confirms its presence, projects confidence and creates an easily identifiable meeting point. • Entrance areas should provide a number of meeting points and places for people to rest or wait.
Research indicates that the extent to which both staff and patients can see out of and around the building has many benefits such as reducing stress, alleviating anxiety and adding recovery.	• There should be uninterrupted and clear views of the entrance from the approach to the site. • Low level signs and planting help maintain a clear view to the entrance way. • Interesting views can be created for people waiting or resting near the entrance.
Research findings note that patients experience positive outcomes in an environment that incorporates natural light, elements of nature, soothing colours, meaningful and varying stimuli, peaceful sounds, pleasant views and a sense of beauty.	• Protection from the elements should be provided around the entrance. • Structures such as canopies and landscaping (with trees and bushes) shelter an entrance from sun, rain, wind and, increasingly in city centres, noise. • Nature and greenery around the entrance is reassuring and calming.

Arriving (outside)



- Provide canopy for shelter from wind, rain + sun on arrival/departure
- Well-lit entrances feel safe + secure but must be free of hazards
- Provide a minimum of essential directional information
- Easy drop off/ collection point
- Design surfaces for all users. Use non-slip colour contrast materials + drop kerbs
- Reorientation cues to signal arrival/ departure & recognise different modes of arrival/ departure
- Plants/trees/shrubs: inspire confidence, security, safety + modernity but must be well-kept
- Obvious visual cues for wayfinding + easy transition (signage, art & sculpture)
- External appearance to inspire confidence + well-cared-for look
- Provide monitored external seating for waiting with adequate lighting + security
- Lighting creates welcoming cheerful impression

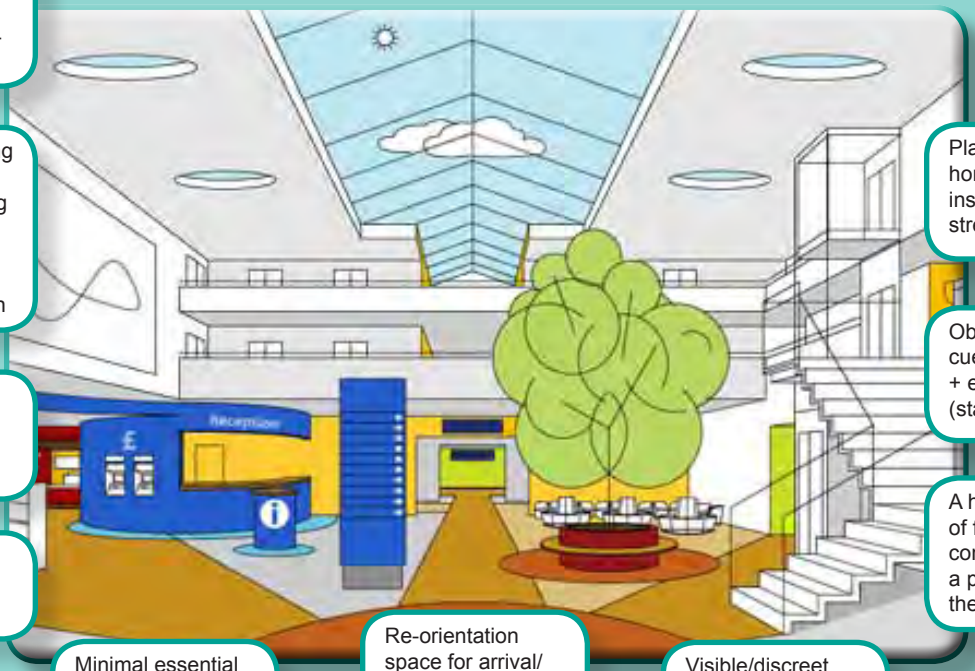
Darent Valley Hospital
(Architect: IBI Nightingale).
©Charlotte Wood

Royal Manchester Children's Hospital
(Architect: Stantec).
©Gregory Harding

Arriving (inside)

Evidence	Design considerations
Research notes that patients experience positive outcomes in an environment that incorporates natural light, elements of nature, soothing colours, meaningful and varying stimuli, peaceful sounds, pleasant views and a sense of beauty.	• Colour can be used to further brighten the entrance and make it a refreshing place. • Colour in the entrance should be bright, light, fresh and natural. • Dark, dull and cold colours should be avoided as they will make an entrance seem inhospitable and austere. • Too much colour here will detract from important signs. • Colour can be used on floors to help identify routes. • Destinations such as the reception, waiting area or a café could be further identified through the use of an associated colour.
Patients and staff like to be able to control their privacy and their interaction with others. In buildings and places where they are able to do so, people report increased satisfaction with their environments.	• Quick and discrete routes into clinical areas should be created for patients who may have arrived in ambulances or be injured or distressed. • There should be no views from the entrance to patient areas.
Research indicates that the extent to which both staff and patients can see out of and around the building has many benefits such as reducing stress and anxiety and adding recovery. People want to be able to see and to know what is going on.	• The entrance is a transitory place that people pass through on their way to other areas, so views around and beyond the entrance should be clear and uninterrupted. • The reception, information or help desk should be immediately apparent but not prevent people seeing the rest of the space or become an obstacle in itself. • People should be able to see and read signs even when the entrance is very busy. • Being able to see shops, cafés, toilets, cash machines and other facilities from the entrance makes people aware of them and reduces the need for signs. • Being able to see staircases and lifts from the entrance helps people find their way more quickly.
Post-occupancy evaluations confirm that the extent to which users of a building can come and go affects utilisation and is helpful to the morale of both patients and staff.	• There should be a clear, uninterrupted route to the reception or help desk. • Generous pathways prevent bottlenecks and confusion. • Variation in materials on the floor can create pathways and help people move around a busy space in a more organised manner.

Arriving (inside)



The Arches Community Treatment and Care Centre, Belfast (Architect: Todd Architects/Penoyre & Prasad).
©Penoyre & Prasad

Peterborough City Hospital (Architect: IBI Nightingale).
©Simon Warren

Circulation

Evidence	Design considerations
Evidence from scientific studies show that not only comfortable conditions but the ability to control levels of comfort for oneself in the different types of places are very important in reducing stress and alleviating anxiety.	• Recessed seating areas along corridors provide places for patients and staff to meet and rest. • Seating that coincides with views from corridors to the outside offers beneficial respite for patients, staff and visitors.
Design reviews indicate that a successful building has clarity of design intention, and that this is appropriate to its purpose. This intention is reflected in the way it lifts the spirits of those who work in it and are being treated in it as well as those who visit. It communicates a strong positive image of the NHS throughout all the various places such as arriving, circulation, waiting etc.	• Creating character within these spaces demonstrates a commitment to human values beyond the simply functional needs of moving around. • Corridors and circulating spaces are an opportunity to introduce design features that may not be practical or suitable in other areas of a hospital. • Innovative use of design in these areas can help healthcare organisations communicate non-functional or non-clinical information and enhance people's experience of the facility.
Post-occupancy evaluations indicate that where there are significant numbers of similar places (such as corridors, wards), less significant changes of character perhaps through colour, texture or material enable people to feel located meaningfully.	• Typical routes along corridors can be suggested by materials and colours on walls and floors. • Flooring colours and/or materials in large open circulation spaces can create pathways. • Projecting signs are easier to see when walking down a corridor than signs fixed flat against the wall. • Signs can be hung from the ceiling or fixed above transverse bulkheads in a corridor. • Introducing fake bulkheads and thresholds at junctions helps signal decision points. • Placing signs ahead of key decision points helps people to be prepared. • Repeating directions down long corridors gives reassurance. • Changes in flooring can help suggest preferred routes and also "no entry" areas. • Creating landmarks with art, sculptures and design features helps navigation.
Patients and staff like to be able to control their privacy and their interaction with others. In buildings and places where they are able to do so, people report increased satisfaction with their environments.	• Views from circulating spaces into bed and patient spaces should be limited.

Links

HBN 00-04 – 'Circulation and communication spaces'

HBN 00-10 Part A – 'Flooring' and Part B – 'Walls and ceilings'

Dalke et al 'Lighting and colour for hospital design'

The HSE's flooring selection tool

Circulation

Design day/night lighting to make passage a pleasant + safe experience. Minimise "tunnel" effect in corridors

Provide rest seating at convenient locations in long corridors

People need to be able to find their way around by building their own mental map

Distinguish major nodes that form intersections of routes from minor ones

Provide seamless handrails to be grasped by the hand for stability + support

Obvious visual cues/anchors for wayfinding + easy transition (signs, art + sculptures)

Surfaces: colour + contrast, cushioned flooring to reduce impact of falls

Re-orientation cues for passage that recognises different modes of movement and traffic flows

Plants/views can help create an environment of warmth, peace and function

Laguna Honda Hospital, San Francisco
(Architect: Stantec).
©David Wakely Photography

The Redwoods Centre, Shrewsbury
(Architect: IBI Nightingale).
©Richard Chivers

Waiting areas

Evidence	Design considerations
This includes all locations where waiting takes place. However, such places should, as much as possible, be combined with other activities. People do not normally choose to wait. The challenge is to make places that do not emphasise the emptiness and purposeless nature of waiting. Making people comfortable and giving them other distractions is a prime objective. In healthcare buildings many people may be anxious, so gentle rather than frantic distraction is recommended. Consider where possible linking these places with retail, refreshment and performance places. Consider using patient call systems that allow people to move around and choose where to wait. Patients and staff like to be able to control their privacy and their interaction with others. In buildings and places where they are able to do so, people report increased satisfaction with their environments and in turn with their treatments.	• Waiting areas must provide as much privacy as possible, especially as people may be injured or distraught. • Defined and separate personal space is of crucial importance in a waiting area. • Seating arrangements should allow for relatives and friends to sit together, but keep other parties separate. • Seating arrangements that cause people to sit next to strangers can exacerbate stress, anxiety and irritation. • Seating should allow for people on their own as well as small groups.
Research indicates that the extent to which both staff and patients can see out of and around the building has many benefits such as reducing stress and adding recovery. What people can see is important and relates to their current activity and condition.	• It is crucial that people can see the reception/staff area. • Outside views are calming, provide distraction and reduce claustrophobia. • Views of nature are beneficial to reducing anxiety while waiting.
Research studies show that not only comfortable conditions but the ability to control levels of comfort for oneself may be very important in reducing stress. Allowing patients control over their environment is desirable and may also reduce demands on reception and staff. Stress and heart rates have been proved to rise in noisy hospitals.	• Comfortable seating is a prerequisite if people are waiting a long time. • Views of reception and staff are crucial to feeling in control. • View of a clock and being able to keep track of time helps people feel in control. • Access to communications (telephone, internet etc) helps people feel in control and connected. • Refreshment should be readily available and close to the waiting area.
Patients prefer toilets to be near and to be clear about their location with the actual door not in full view of many other people. They also would like toilets and bathrooms to have a degree of sound privacy and not to cause smells. Patients would like to be able to freshen up, be clean, shave and be presentable.	• The location of toilets should be immediately apparent and within convenient reach. • Entrances to toilets should be discrete and not in view of the waiting area.
Post-occupancy evaluations indicate that users have fewer complaints when they are able to perform their duties and to operate the healthcare systems and facilities housed in the building.	• Reading matter should be available, interesting and up to date. • There should be plenty of tables provided on which to place drinks, books and belongings.

Links

HBN 04-01 – 'Adult in-patient facilities'

HBN 00-09 – 'Infection control in the built environment'

HTM 08-01 –'Acoustics'

Dalke et al 'Lighting and colour for hospital design'

See also other specialty-specific HBNs

Waiting areas

A mix of sociopetal seating arrangements
©Bryan Lawson

The Redwoods Centre, Shrewsbury (Architect: IBI Nightingale).
©Richard Chivers

In-patient rooms

Evidence	Design considerations
Activity studies have been conducted and have established minimum sizes of the space around the bed.	• Carers must have access to at least one side of the bed. • Doorways and circulation space must allow for trolleys and wheelchairs.
Evidence suggests that where adequate provision is made for relatives to stay with the patient there are many benefits including reductions in nurse-call button activity, in patient falls etc.	• Creating zones for patients, visitors and carers within the bed place helps each feel a greater sense of ownership and belonging. • Providing a sofa or sofa bed for visitors to sleep on encourages them to stay with the patient for longer periods. • Providing facilities (such as a desk) for visitors while the patient may be resting encourages them to stay. • Every bed place should have handwashing facilities.
Patients and staff like to be able to control their privacy and their interaction with others.	• Personal space and a feeling of privacy is crucial to avoiding distress, discomfort and upset to patients in bed. • Visual and audible privacy for patients undergoing treatment are crucial to maintaining patient dignity. • Single patient bedrooms provide the highest levels of privacy and dignity. • Furniture, screens and the positioning of beds can create a more personal space in multi-bed rooms. • Providing opportunities for displaying pictures and other personal possessions is important.
Studies show that when daylight is available, many building occupants like to reduce artificial lighting to allow the daylight to take effect. During the day, the seasons' natural light levels vary enormously and people generally like to be aware of this. Patients and staff express the need to be able to arrange for a range of lighting effects to avoid glare, to offer bright light for reading, to dim lights for night-time rest etc. They dislike direct and institutional lighting provided by high even levels of fluorescent lighting.	**Daylight** • All bed places should ideally be exposed to daylight. • Daylight is important for confined patients to maintain a sense of time and natural body rhythms. A lack of daylight will depress confined patients and could add to despondency. • Direct sunlight should be avoided or shaded as it can be uncomfortable and irritating for patients in bed who cannot avoid it. Bedside controls of blinds and curtains helps reduce frustration and restores a sense of independence. **Artificial lighting** • Patients should be able to control their own lighting. • Artificial lighting should be of a variety of types and levels to provide for different activities. • Low level task lighting should be provided for reading and watching TV. • Soft indirect lighting is comforting.

Links

HBN 04-01 – 'Adult in-patient facilities'

HBN 00-09 – 'Infection control in the built environment'

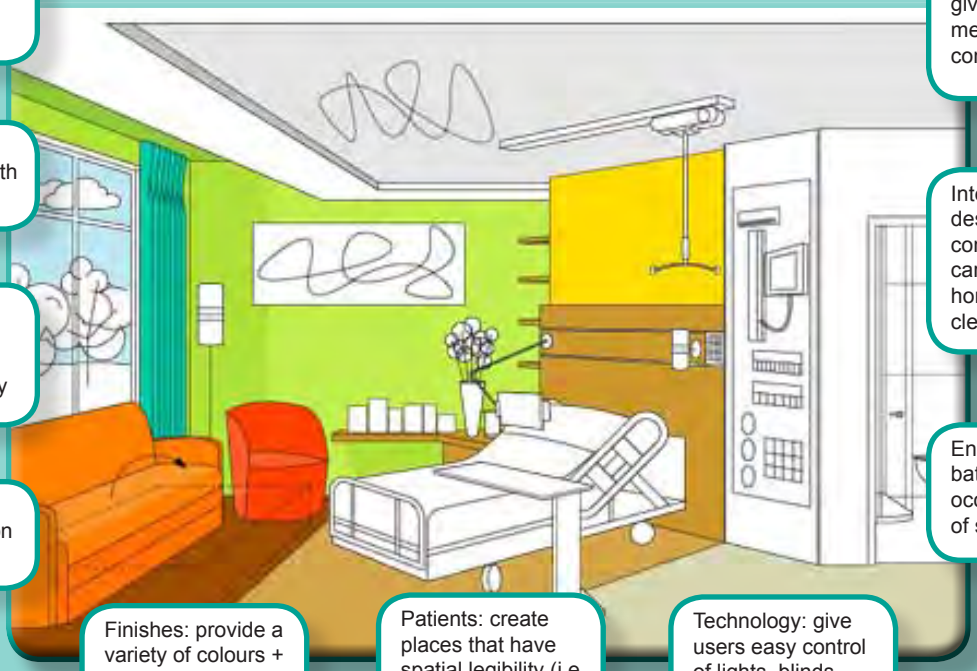
HBN 00-04 – 'Circulation and communication spaces'

HTM 08-03 – 'Bedhead services'

HTM 08-01 – 'Acoustics'

Dalke et al 'Lighting and colour for hospital design'

In-patient rooms



Brent Birth Centre, London
(Architect: Barbara Weiss Architects).
©Gareth Gardner

Alder Hey Children's Health Park,
Liverpool
(Architect: BDP).
©BDP

Consultation

Evidence	Design considerations
While being the most medically technical of all our places, these rooms should nevertheless be designed as much to make the patients feel at ease as for the efficiency of operation by clinicians. Research shows that scenes of nature whether actual or reproductions help to reduce stress.	• In places where patients may be undergoing stressful or lengthy treatment, art and views can offer calm distraction.
Patients are increasingly in dialogue with the consultant rather than just receiving information. The consultant is very likely to interact with a computer and may want to show the screen to the patient at times. It may feel discourteous to patients if the consultant has to turn away to work at a computer.	• Being able to see computer screens and look at images will make the patient feel more comfortable.
Patients show general consensus, as do staff, about wanting light and airy hospitals. This can be achieved by the use of materials, colour, natural light and artificial light.	• Domestic-style materials, finishes and décor help patients relax and feel more at ease. • Soft materials help absorb sound and reduce noise. • Natural materials such as wood feel more reassuring and human. • Hiding, disguising or designing-in the necessary medical equipment makes it less obtrusive and unfriendly and prevents a feeling of clutter and disorganisation.
Research shows the benefits of views when people spend long periods of time in a space.	• Being able to see the sky and nature gives people a feeling of wellbeing. It can even counteract the feeling of being temporarily cut off from the normal world. This will also be important to consultants who may spend long periods in these spaces.
Research shows that people not only like to feel comfortable but also like to control their environment.	• Patients may sometimes feel vulnerable or faint. Being able to open windows, change lighting and shut out background noise are important.
Links HBN 00-03 – 'Clinical and clinical support spaces' HBN 09-02 – 'Maternity care facilities' HTM 08-01 – 'Acoustics' HBN 00-09 – 'Infection control in the built environment' Dalke et al 'Lighting and colour for hospital design'	

Consultation

James Cook University Hospital, Middlesbrough
(Architect: Stantec).
©Stantec

Royal Alexandra Children's Hospital, Brighton
(Architect: BDP).
©BDP

Socialising/meeting

Evidence	Design considerations
This covers a wide range of places from those that are for specific meetings or events to those that are places simply to go to find company. The former need to be designed quite functionally whereas the latter are often more successful if they provide other reasons for being there (such as views, refreshment, reading materials etc). By contrast televisions often tend to kill the social qualities of places. Research has shown that a richer quality of life can be led by less mobile patients when tables are immediately next to seats enabling them to keep magazines, books, knitting and other materials close to hand without having them tidied away. This saves them having to call for help or leave their seat. Research shows that rooms with all movable seating tend to be controlled by cleaners who habitually arrange seats in rows or around the edge creating an unsympathetic environment. People prefer a protected back with a view of what is going on.	• Create seating arrangements that bring people together (sociopetal) in appropriate sized groups. People further than 3 metres apart are likely to feel communication is unnatural or forced. • Formal meeting places will almost certainly require free-standing furniture to allow for many arrangements. Informal places can often be created more easily by using a combination of fixed and movable seating.
Research shows that chairs in informal social meeting places will inevitably be more popular if they are near windows with views out.	• In-patients and longer term residents may spend considerable amounts of time here and they generally express a wish for such places to feel “light and airy”. • For formal meeting places, avoid glare from natural light at either the front or back of the space. • Consider seating that feels located in the place and remains in the same location to create a sense of belonging. • Unless these places are for very large formal meetings, they should be at a domestic scale.

Links

HBN 04-01 – ‘Adult in-patient facilities’

HBN 09-02 – ‘Maternity care facilities’

HBN 00-09 – ‘Infection control in the built environment’

HTM 08-01 – ‘Acoustics’

Dalke et al ‘Lighting and colour for hospital design’

Socialising/meeting

Octav Botnar Wing, Great Ormond Street Hospital (Architect: Stantec).
©Edmund Sumner

Mater Hospital, Belfast (Architect: Todd Architects/Stantec).
©Stantec

Vending areas

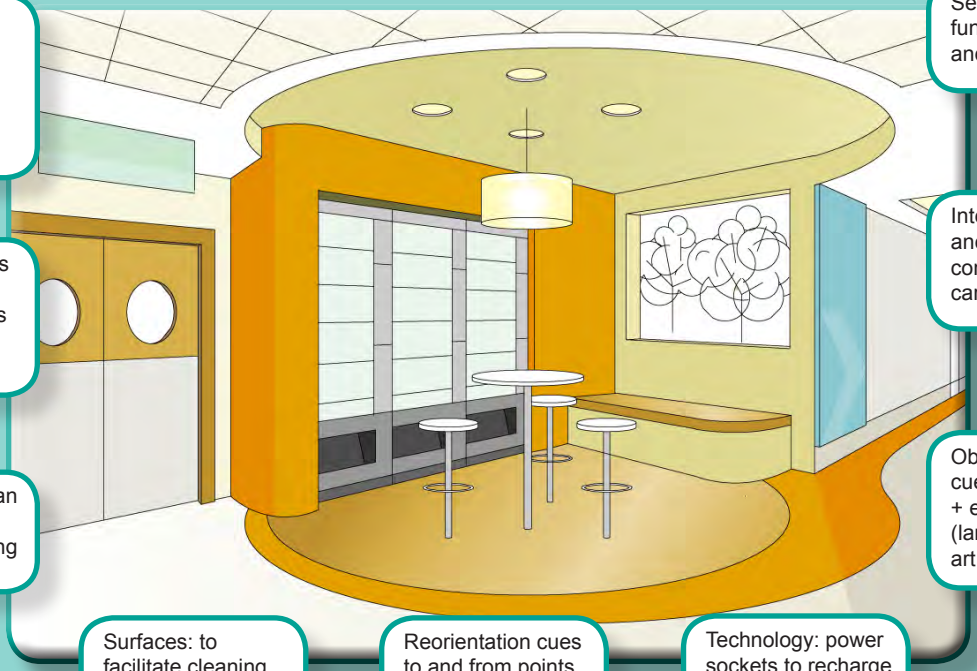
Evidence	Design considerations
This category includes all places where people conduct the essential transactions of normal life. There is no reason to see these places in healthcare facilities as being different from those that may be found in the normal public domain in towns and cities. The feeling of being in a normal place is likely to be helpful, especially to patients who may have long waits. However, a highly exploitative commercial atmosphere or one of hustle and bustle is to be avoided. People generally like places that are not uniform and homogenous but have variety and variation of scale. Having places to sit that are well protected and feel personal is particularly helpful in healthcare versions of these places. Being able to sit quietly and yet watch life going on is found to be calming and distracting.	• Arrangements of seating that are sociopetal but sociofugally separated are likely to be popular (that is, groups of seats that bring small numbers of people close together but separated by screens and orientation from other groups). This may not be possible with the density of seating used by some branded commercial operators. • To give a feeling of security, a proportion of seats should feel as if they are located in a particular place rather than floating free in space. Also planters, screens and other fixed features can help. • In high spaces, consider using line, form and colour to creating a smaller scale feeling in the seating areas.
Post-occupancy evaluations indicate that people use places such as these as landmarks to navigate around complex buildings. Giving them names and clear identities can help in this process.	• These places can also serve as landmarks for wayfinding in a complex building. • Consider linking them to other major circulation decision points such as entrances and information points. Also consider grouping retail, banking and refreshment places to create more interesting places overall. The route back to clinical areas must be clear.

Links

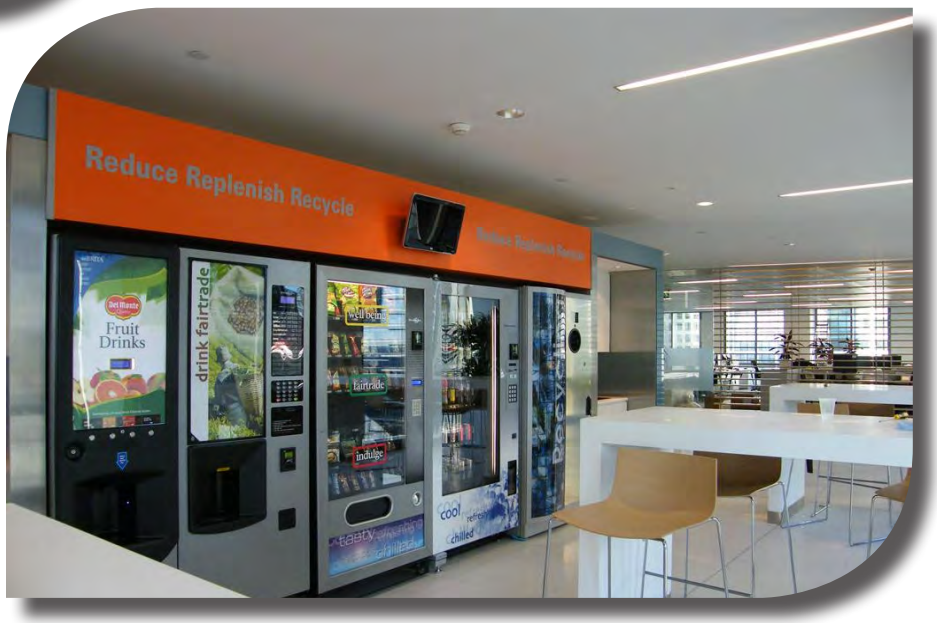
HTM 05-03 Firecode Part D – ‘Commercial enterprises on healthcare premises’

HBN 00-09 – ‘Infection control in the built environment’

Vending areas



Kidderminster Treatment Centre (Architect: Medical Architecture). ©Lisa Payne Photography



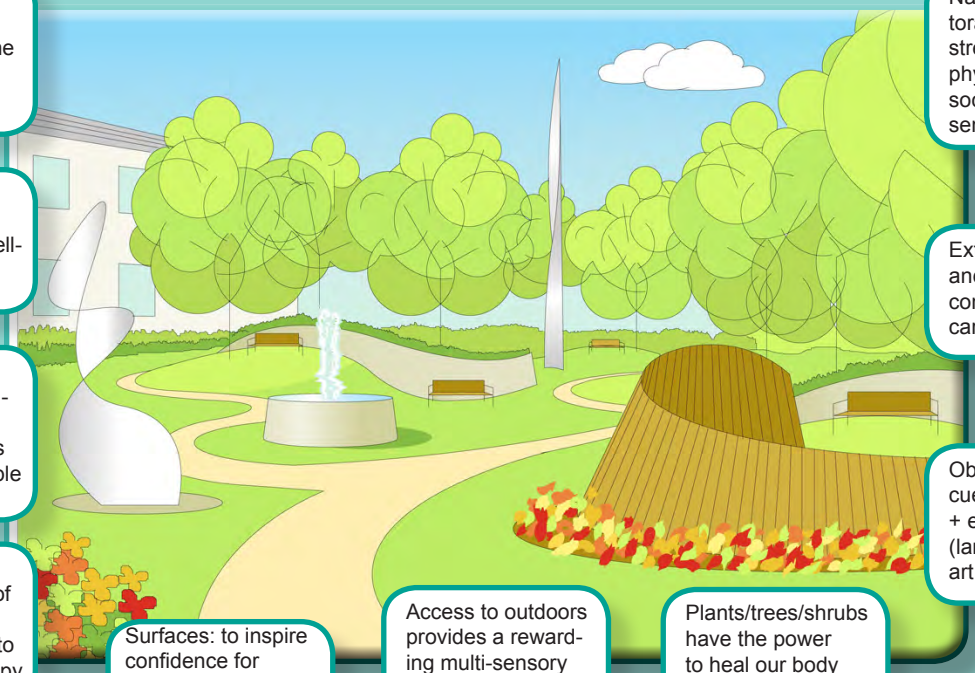
Sanctuary (outside)

Evidence	Design considerations
Nature and gently moving objects are shown to induce a sense of calmness.	• Simple calm forms and spaces can be very effective when complemented by a focus through colour and texture, either man-made or natural. • Avoid overt symbolism of a kind that speaks strongly of one religion or a set of beliefs unless this is offered in various alternatives in parallel. • Forms that are calm and orderly and yet invite subtle interpretations help to create a sense of quiet wellbeing. Carefully chosen art can be helpful.
Just as people want to sit quietly, so wandering slowly down an unfolding route is an aid to contemplation.	• A route that reveals itself progressively may be more rewarding.
Scenes of nature are found to induce calm if it is not possible to see the real thing.	• Gardens have been shown to be highly therapeutic.
People like to sit with a protected back and watch gently changing scenes of nature and life going on.	• An interesting but calm view helps therapeutic contemplation.

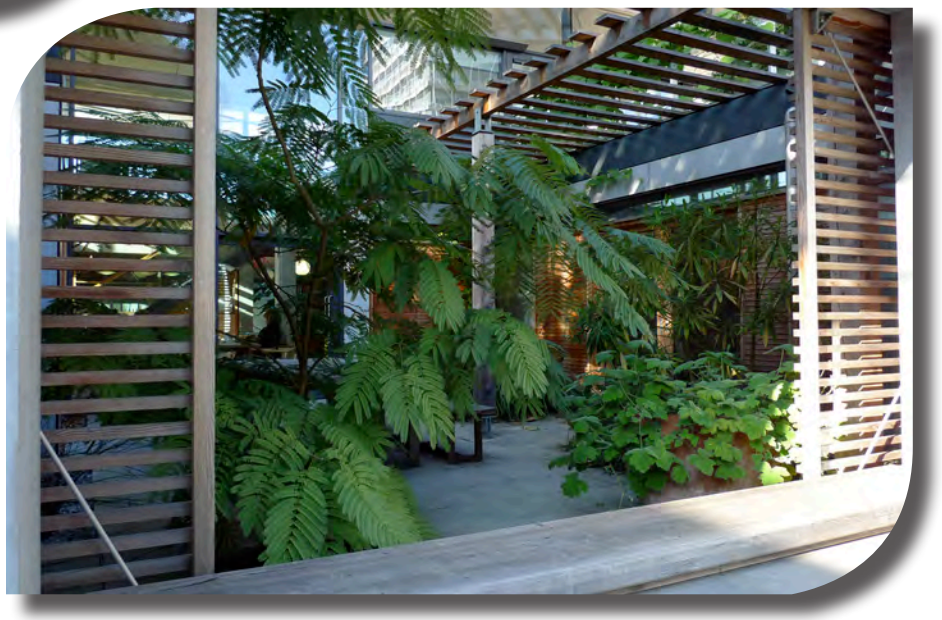
Links

King's Fund 'Enhancing the healing environment'

Sanctuary (outside)



Kirkwood Hospice
(Architect: IBI Nightingale).
©Paul White



Maggie's Centre, London
(Architect: Rogers Stirk Harbour + Partners).
©Huw Morgan/DPS

Toilets and washrooms

Evidence	Design considerations
Data shows a very large number of falls occur between the bed and the bathroom/toilet especially at night. This is true in domestic, resident and hospital environments.	• Ensure there is something to hold on to throughout the journey into and round the room. • Space must be left for patients to be assisted; in some cases, hoists may be needed. • Automatic movement-detected lighting should be considered.
Use materials that can look clean. The symbolism of cleanliness is important here as well as the normal hygiene requirements. People feel much better about themselves when in places that show evidence of being cared for by being clean.	• Use materials that can easily be cleaned and consider using flush rather than recessed joints.
Patients and visitors express a wish for places such as this to look clean as well as be clean.	• Places that make patients feel intimate and special are just as important in their own way as places of hygiene. Colour and texture should be used to give this sense of intimacy while ensuring this does not conflict with hygiene.

Links

HBN 00-02 – 'Sanitary spaces'

HBN 00-10 Part C – 'Sanitary assemblies'

HBN 00-09 – 'Infection control in the built environment'

HSE's slips and trips website

BS8300. Design of buildings and their approaches to meet the needs of disabled people. Code of practice.

Dalke et al 'Lighting and colour for hospital design'

Note

The guidance in HBN 00-02 is based on ergonomic studies, including a mock-up trial of the en-suite shower rooms. In places, the guidance differs from that provided in Approved Document M (2004) and BS 8300:2001 (2005 edition). Where this is the case, the reasons for the variations are discussed.

Toilets/washrooms

Finding the nearest available toilet can often be a critical situation

Clean + accessible toilets are important to everyone

Locate toilets where they are needed most + accessible to everyone

Finishes need to be of a high standard for durability + frequent cleaning

Reorientation cues for arrival/departure that recognises different modes of movement, disabilities + families with young children

Plants + fresh flowers may be helpful in distracting from odours/smells

Obvious visual cues for gender segregation

Interior appearance to inspire confidence + a well-cared-for look

Provide seating for those who are likely to be waiting for a carer, partner or child

Birmingham Treatment Centre
(Architect: Sheppard Robson).
©Lisa Payne Photography

Cockermouth Community Hospital and Health Centre
(Architect: IBI Nightingale).
©Paul White

Sanctuary (inside)

Evidence	Design considerations
These places can serve several needs ranging from quiet personal contemplation through counselling to a formal religious ceremony. Patients or staff may wish to follow some personal religious rituals or obligations in private. Some religions may want to offer some small congregational ceremonial service. Nature and gently moving objects have been shown to induce a sense of calmness.	• Simple calm forms and spaces can be very effective when complemented by a focus through colour and texture, either man-made or natural. • Avoid overt symbolism of a kind that speaks strongly of one religion or a set of beliefs unless this is offered in various alternatives in parallel. • Forms that are calm and orderly and yet invite subtle interpretations help to create a sense of quiet wellbeing. Carefully chosen art can be helpful.
People like to sit with a protected back and watch gently changing scenes of nature and life going on.	• An interesting but calm view helps therapeutic contemplation.

Links

HBN 04-01 – 'Adult acute in-patient facilities'

HBN 02-01 – 'Cancer treatment facilities'

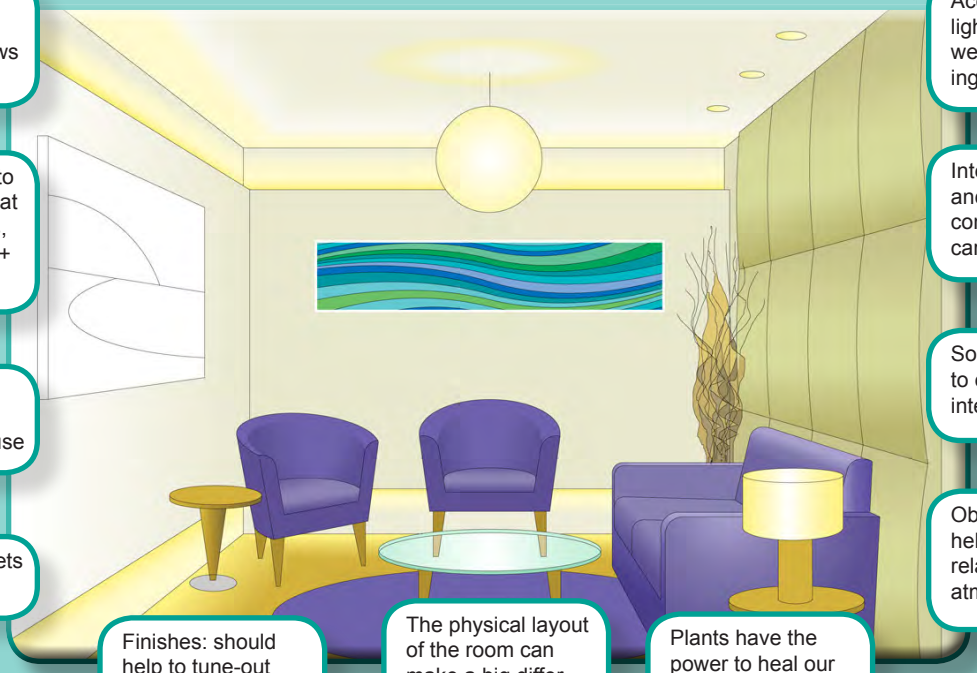
HBN 09-02 – 'Maternity care facilities'

HBN 09-03 – 'Neonatal units'

HBN 07-01 – 'Satellite dialysis unit'

HBN 03-01 – 'Adult acute mental health facilities'

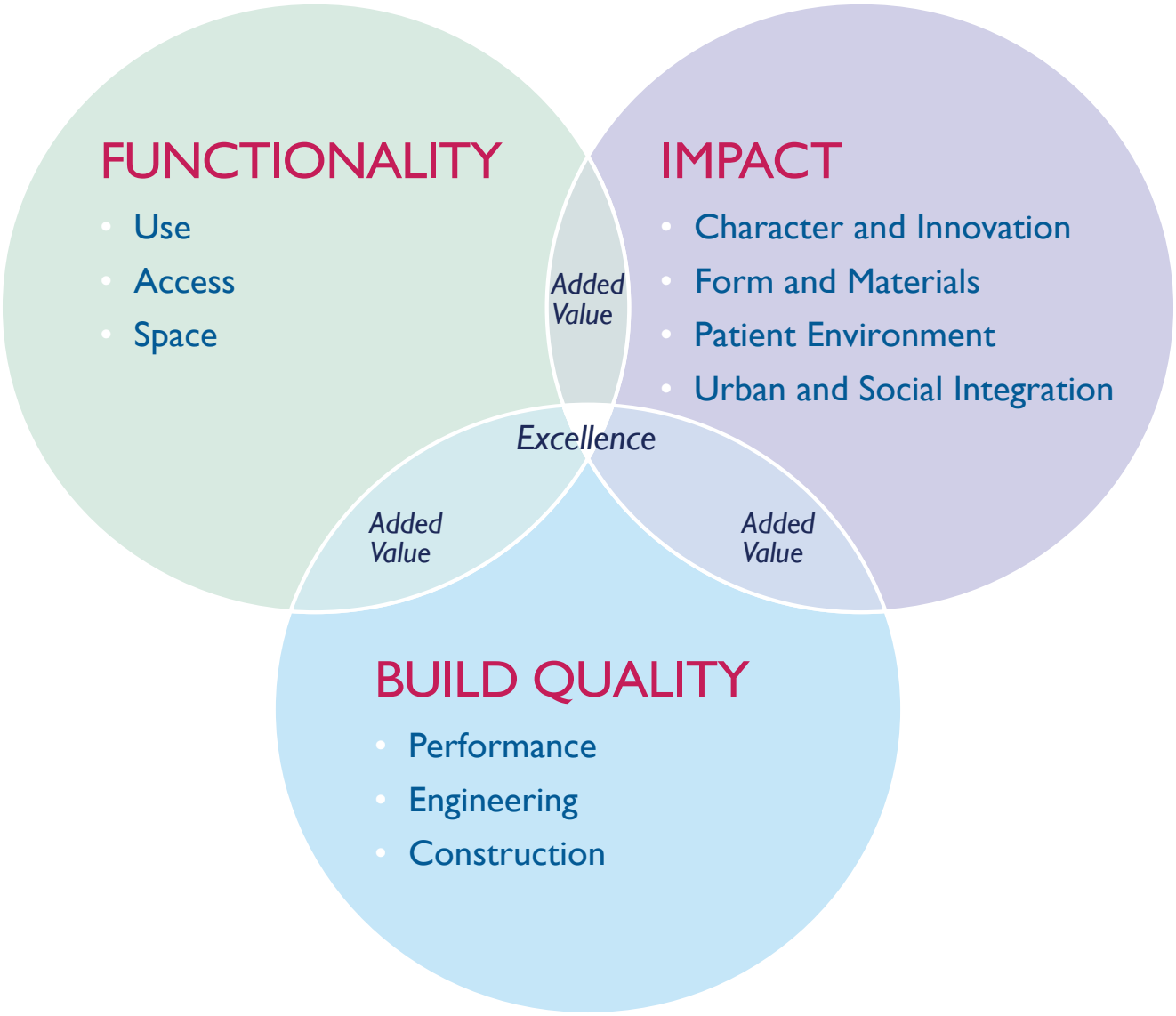
Sanctuary (inside)



Woodhaven Mental Health Unit, Southampton
(Architect: Broadway Malyan).
©Broadway Malyan

Coaching, counselling and psychotherapy room.
©Karin Peeters

Appendix 1: Example of the main components of the design brief for healthcare buildings


FUNCTIONALITY
Use
Access
Space
IMPACT
Character and Innovation
Form and Materials
Patient Environment
Urban and Social Integration
Added Value
Excellence
Added Value
Added Value
BUILD QUALITY
Performance
Engineering
Construction

FUNCTIONALITY

USE

The model of care and service philosophy

Describe the purpose of the building in detail with particular attention to patient, staff and visitor needs. Set out:

- the organisation's healthcare philosophy and design vision
- the organisation's model of care.

Functional requirements of the project

Set out:

- proposed operational policies
- the operational capacity that is being sought
- relevant future changes and projections.

The importance and dignity of individuals

The design of the building should consistently relate to patients, staff and visitors. Issues to consider:

- clinical, therapeutic and other services and complex diagnostic and specialist activities should be well integrated so that patients perceive a unified and seamless service
- information technology should be maximised to ensure that where possible information is shared efficiently between all providers in a patient-focused manner.

Work flows and logistics

Work flows and logistics within and between processes should be carefully thought through and optimised. Issues to consider:

Healthcare processes –

- departmental workflow should be direct and promote efficiency
- routes should be as short as possible
- inefficient or dangerous cross-flows must be avoided.

Logistics –

- movements of people, distribution of supplies, storage, and waste disposal should be carefully considered
- number, size and location of storage and holding bays should reflect the supply and disposal policy.

Adaptability

The building should be designed to be adaptable, to be flexible in use, to respond to change and to enable expansion.

Issues to consider:

- the design of the layout, the lighting and mechanical and electrical (M&E) controls should be versatile and flexible to allow everyday changes of use, activity and spaces
- the overall design should be capable of accommodating therapeutic, technological, organisational and formal innovations while retaining design coherence
- the structural design should enable adaptability and expansion with limited disruption
- the possibility of future change and expansion should be built into the design of all infrastructure and engineering systems
- space should be allowed for departments to expand (e.g. operating departments, wards, out-patient departments, kitchens, critical care units).

Security and ease of control

Set out the:

- security strategy and brief
- visitor monitoring strategy.

ACCESS

Access for vehicles

Set out access requirements for all vehicles, including on-site roads for ambulances, public transport, service vehicles, and fire appliances. Issues to consider:

- routes should be clearly marked
- roads, widths, turning circles etc should be safe and convenient
- the site design should encourage the use of public transport, having regard to the proximity or otherwise of public transport stops
- car-parks, access routes, loading docks and entrances should be well-lit.

Parking for visitors and staff

Set out car, motorcycle and bicycle parking requirements. Issues to consider:

- drop-off points should be appropriately provided at entrances
- signposting to parking areas should be adequate.

Goods and waste disposal vehicle segregation

Issues to consider:

- separate access routes should be provided where required
- service routes should be clearly signposted
- access and loading bays should be thought through in terms of safety and convenience.

External wayfinding and signposting

The external wayfinding and signposting strategy should be of high quality and fully integrated into the design solution. Issues to consider:

External wayfinding –

- the external appearance and site layout should support intuitive wayfinding
- distinctive landmarks (e.g. to signal the main entrance) should be incorporated into the design
- the hard and soft landscape design should support intuitive wayfinding.

Signposting –

- the signposting should be an integral part of the wayfinding strategy
- routes and signposting to and from parking areas and public transport points should be clear and obvious.

Pedestrian access

Issues to consider:

Pedestrian routes should be –

- obvious
- well-signposted
- safe from vehicles, with safe crossings
- free from obstacles
- pleasantly landscaped
- well-lit at times of darkness.

Accessibility

Issues to consider:

Internal –

- door widths into clinical spaces and clinical support spaces should generally allow for ambulant users, semi-ambulant users (including those using crutches, sticks and walking frames) and wheelchair-users;
- visual and colour contrasts should be provided for those with sensory loss.

External –

- pedestrian routes should be suitable for wheelchair users, and other people with physical or learning disabilities, and impaired sight or hearing
- there should be parking spaces reserved and marked for disabled people
- parking for disabled people should be provided close to entrances.

Integration with fire planning strategy

The fire planning strategy should be integrated to allow for ready access and egress. Issues to consider:

- compliance with Firecode guidance with provision for safe horizontal escape routes
- free access by fire-fighting appliances to the building perimeter.

SPACE

Functional content and space standards

Set out requirements for functional content and space standards. Issues to consider in addition to departmental areas:

- public and entrance areas
- social spaces for patients, staff and public
- children's areas
- scope for external franchises/commercial outlets and other add-ons
- storage
- circulation
- all relevant service requirements
- exterior terraces, play areas etc.

Adjacencies

Set out adjacency matrix indicating appropriate relationships between different functions derived from operational policies. Issues to consider:

- the interdepartmental relationships should be convenient and help efficient functioning and processing
- there should be clarity about the agreed priority of key relationships
- internal relationship within departments (main rooms, bays, storage, service rooms) should be convenient and help efficient functioning.

Best practice guidance on planning and design

Set out the guidance to be followed and, where necessary, provide the rationale for any departures from it.

- List specific Health Building Notes (HBNs), Health Technical Memoranda (HTMs) and other guidance to be adhered to. Avoid blanket statements.

Space utilisation

Issues to consider:

- spaces should be capable of being shared where appropriate – seen as a resource, not personal territory
- dual use of circulation space should be exploited where effective e.g. to encourage informal association and gathering.

Privacy, isolation and inclusivity

Set out:

- requirements of the Equality Act with regard to the diverse needs, values and circumstances of each patient.
- requirements of visual and acoustic privacy
- requirements for gender segregation (privacy and dignity)
- infection prevention and control policies and procedures including isolation rooms and beds.

Additional issues to consider:

- reception areas should enable confidential conversations without embarrassment
- the design should help to avoid unintended isolation, allowing patients to communicate with staff when needed.

IMPACT

CHARACTER AND INNOVATION

Lifting spirits and helping recovery

Issues to consider:

- the design of the building should aid therapeutic objectives
- the building should engender wellbeing and raise patients' and visitors' spirits.

Expressing excellence

Issues to consider:

- the design should express a safe, professional image of the health service
- the building should raise staff morale.

A clear vision

Issues to consider:

- the design should embody a clear and coherent vision confidently communicating its function and aspirations through its physical elements.

A stimulating design

Issues to consider:

- the design should have sufficient variety to stimulate the mind and the senses
- users and visitors should feel that the building has a positive character
- art should be integrated into the total experience of the building.

New knowledge

The design should explore with due rigour innovation in practice, technique and built form. Issues to consider:

- the development should clearly reflect the ability to adapt to new models of healthcare provision in the design
- the design should respond to best practice and innovation within architecture and the built environment
- where possible the design should develop new and transmissible knowledge about buildings for healthcare.

The value of good design

The building should in itself be a demonstration of the value of good design. Issues to consider:

- the building should show how good design can improve patients' and staff's lives and add value for the healthcare organisation over the building's lifetime.

FORM AND MATERIALS

Orientation

The building should be designed with consideration to its orientation. Issues to consider:

- sunlight and how it falls on the building
- prevailing winds and their effect, in conjunction with the building, on visitors
- how the building is entered in respect of natural points of arrival and local landmarks.

Scale and proportion

Issues to consider:

- the scale should be thought through in relation to adjoining buildings
- irrespective of the size of the building, the scale should be considered from the point of view of patients, staff and visitors so as to make them welcome.

Composition

The building's form should be pleasing and well-composed. Issues to consider:

- profile and skyline of the building from a distance and on approach
- the shapes the building is made up of
- the interplay of light and shade
- the relationship of the parts to the whole
- coherence of the parts and the whole
- consistency and attention to detail
- the integration of service elements such as rainwater pipes, flues, grilles, plantrooms, refuse bays.

External materials

Issues to consider:

- the choice of materials should be on the basis of enhancing the building as a whole
- the form and materials should be well-detailed
- the weathering, maintenance and durability of the materials should be thought through.

Colour and texture

Issues to consider:

- colours and textures where used should articulate and enrich the building's form and enhance its enjoyment.

PATIENT ENVIRONMENT

A pleasant, varied and stress-reducing environment

Issues to consider:

The internal environment generally –

- the main entrances and reception areas should be pleasant and welcoming
- the internal appearance should be calming and non-intimidating
- the building should have good acoustics
- temperatures should be comfortable in all seasons
- the air quality should be fresh.

Materials, finishes, textures –

- materials and finishes should work with the layout to create a set of varied places with degrees of privacy
- finishes, fittings, furniture and notices should be well coordinated and designed to reduce clutter
- design and selection of finishes and materials needs to take account of infection control issues.

Use of art to enhance the healing environment –

- art should be an integral part of the design of the interior
- the design should make provision for changing art displays
- the design should, where possible and appropriate, make provision for presentations of the performing arts
- the design should make provision where appropriate for art activities to take place for patients and staff.

Light and colour

Issues to consider:

Light and shade –

- light and shade should be used effectively to enhance the perception of three-dimensional space

Colour –

- the contribution of colour to providing continuity and variety, stimulation and calmness should be thought through
- colour schemes should assist wayfinding.

Daylight –

- daylight should be fully exploited to enhance the experience of patients, staff and public
- internal spaces and courtyards should be orientated for optimum sunlight penetration

Artificial light –

- lighting should be used creatively and sensitively to enhance the use and experience of the interiors.

Views

Issues to consider:

- there should be special attention to creating patient, staff and public areas with pleasant views.

Internal wayfinding

Issues to consider:

- the interior should be integrally designed to support intuitive wayfinding
- distinctive landmarks such as art and sculptures should be incorporated into the design
- where repetitious building forms are used, thought should be given to avoiding disorientation.

Spatial quality

Issues to consider:

- there should be a sense of spaciousness with overcrowding avoided
- spaces should be experienced as a sequence of attractive places with appropriate degrees of enclosure
- long, narrow corridors without daylight or views out of the building should be avoided
- circulation spaces and common areas should be designed as places in their own right – enjoyable rather than utilitarian.

URBAN AND SOCIAL INTEGRATION

A sense of place

The building should create a sense of place. Issues to consider:

- the building should be sited and designed with mind to its overall urban (rural) setting
- the building should enhance the civic qualities of its setting.

A good neighbour

Issues to consider:

- the building's height, volume and skyline should relate well to the surrounding environment
- in the design, thought should be given to what local residents and passers-by will think of the building.

A positive contribution to the community

Issues to consider:

- the design should promote a sense of belonging to and integration with the neighbourhood and wider community.

Fit with site

Issues to consider:

- the building should be well integrated with the site topography
- the spaces immediately outside the building should be pleasant
- the levels should be designed to be appropriate for entrances and access to outside spaces
- thought should be given to making land available for future development and expansion
- the design should take advantage of orientation.

Landscape design

Issues to consider:

- hard and soft landscaping, including courtyards, should be designed with regard to their therapeutic value
- the landscape design should maximise the security of pedestrians and avoid "no-go" areas
- the landscaping around the building should contribute to the neighbourhood
- the external grounds and gardens should be designed for the safety and security of all patients, staff and visitors.

BUILD QUALITY

PERFORMANCE

Daylight

Set out daylight standards to be achieved. Issues to be considered:

- there should be sufficient daylight in each area as required
- glare and solar gain should be controlled (e.g. with louvres and blinds).

Air quality

Air quality should be fresh for patients, staff and visitors. Issues to consider:

- quantity of space with natural/artificial ventilation and/or air-conditioning
- access by occupants to natural ventilation
- an appropriate level of control by occupants of heating and ventilation.

Acoustics and noise

Issues to consider:

- a good acoustic environment to deal with internally generated noise
- sufficient sound-proofing against external sound to provide comfort internally
- adequate sound insulation between rooms
- building acoustics to aid communication.

Passive thermal comfort

The design of the building fabric itself should help create thermal comfort conditions.

Issues to consider:

- passive summer cooling
- minimising solar gain
- high thermal insulation
- control of infiltration.

Durability

Issues to consider:

- the building should be able to withstand wear-and-tear in use
- the finishes should be durable.

ENGINEERING

Operational building and engineering management systems and controls

Issues to consider:

- engineering systems should be flexible, efficient and economic in use, and in use of resources
- local controls should be provided for use by staff and, where appropriate, patients
- engineering systems should operate quietly.

Specialist engineering systems

Set out the brief, requirements and standards to be followed for specialist systems including:

- medical gases
- fire engineering
- emergency generators
- batteries and standby power supplies including UPS
- nurse call, staff call and location systems
- theatre and other lighting
- cold water storage
- telephones
- ICT and other communication systems.

Standardised elements in engineering design

Consideration should be given to the use of standardised elements. Issues to consider:

- structural elements
- engineering plant and equipment
- light fittings and bed-head units
- sanitary installations
- others as appropriate.

Prefabricated elements in engineering design

Consideration should be given to the use of prefabricated elements. Issues to consider:

- structural elements
- standardised pods or modules
- plant pods or pallets
- sub-systems
- pre-wiring
- others as appropriate.

Artificial lighting

Set out quantitative standards for artificial lighting (in accordance with CIBSE Lighting Guide LG2). Issues to consider:

- energy consumption
- therapeutic benefits
- appropriateness and accessibility of control systems
- relative levels of background and task lighting.

Fire planning strategy

A clear fire planning strategy should be incorporated into the design, which should encompass the DH Firecode suite of guidance. Issues to consider:

- fire alarm and detection system
- high life risks potentially compromised by high fire loads.

Emergency backup systems

The emergency backup systems should be designed to minimise disruption. Set out emergency backup requirements and standards. Issues to consider:

- medical gases
- emergency generators
- batteries and standby power supplies including UPS

ENGINEERING

- nurse call, staff call and location systems
- heating
- theatre and other lighting
- hot water
- cold water storage
- telephones
- ICT and other communication systems.

Heating, ventilation and air conditioning systems

The heating, ventilation and air conditioning systems should be designed to operate efficiently and provide local control where appropriate and required. Set out thermal and ventilation requirements and performance standards. Issues to consider:

- maximising the use of natural ventilation
- minimising the use of heating
- minimising the use of cooling
- surface temperatures of radiators
- zoning and cut-off controls.

Energy and power systems

Set out requirements and performance standards. Issues to consider:

- optimising fuel consumption
- maximising flexibility.

Hot water and steam/operational engineering systems

Issues to consider:

- flexibility and efficiency of engineering systems
- economy in use of resources.

Note

Avoid the generation of steam unless absolutely necessary for processes.

Telecoms and IT systems

The telecommunications and data systems should be easy to operate and future-proofed as far as possible. Set out voice/data/comms brief and standards. Issues to consider:

- flexibility and efficiency
- ease of learning
- reliability.

Water and drainage system

Set out requirements and performance standards (refer to specific guidance as appropriate). Issues to consider:

- flexibility and efficiency
- minimising the use of resources
- capacity of the water supply system to provide safe potable drinking water
- adequacy of water pressures for clinical processes
- leak-proofing the drainage system plus the specific requirements of drainage systems (e.g. radioactive waste).

CONSTRUCTION

Phasing for planning or construction stages

Consider whether the project needs to be built in phases. Issues to consider:

- provision for future phases to be added with minimum disruption to the buildings in use
- consistency of phasing with the estate strategy and development control plan
- self-containment and operational quality for each phase.

Maintenance

The building should be able to be readily maintained. Issues to consider:

- the construction should be durable
- components in the building should be able to be readily cleaned, maintained or replaced when necessary.

Robust construction

Issues to consider:

- components and finishes specified should have sufficient strength and integrity for their functions or locations
- sound break out of potential nuisance to neighbours should be dealt with in the design.

Integration of engineering systems, structure and fabric

The structure, fabric and the engineering systems should be well integrated within themselves and with each other.

Health and safety

The building should be designed for health and safety in its construction and operation. Issues to consider:

- the building should support patients by conveying a feeling of safety, calmness and reliability
- clinical and other workplaces should be designed for compliance with all health and safety requirements
- the design should provide safe access and working conditions.

Standardised elements

Consideration should be given to the use of standardised elements where they promote efficiency, speed of construction, higher quality, sustainability or overall value for money.

Prefabrication/off-site construction

Consideration should be given to the use of prefabricated elements where they promote efficiency, speed of construction, higher quality, sustainability or overall value for money.

Considered construction

The methods and materials used in the building should be well thought through from the point of view of:

- efficiency
- impact on neighbours
- safety
- health.

Climate change

Sustainability and the effects of climate change should be considered in the design of the building.

Demolition and recycling

Consideration should be given in the design to the reuse of materials, recyclability and ultimate demolition.

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Health Building Note 03-01. Adult acute mental health units**.**

Health Building Note 04-01. Adult in-patient facilities**.**

Health Building Note 07-01. Satellite dialysis unit**.**

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NEW SOUTH GLASGOW HOSPITAL

Clinical Output Specification

AREA	HAEMATO-ONCOLOGY

1. INTRODUCTION

The Haemato-Oncology ward deals with patients with a range of malignant and non-malignant haematology conditions. A high proportion of the patients receive chemotherapy and are immunocompromised, making them vulnerable to infection. Advice was requested from Dr John Hood, consultant microbiologist, regarding suitable ventilation to provide a protected environment for this patient group (please see below under 'ventilation').

The Services provided include:

Inpatient services
Day case services

The specialty has 14 inpatient beds and 4 day case beds. The day case beds are located within the ward area.

The Services provided exclude:

Children's services
Outpatient services

Special Room Requirements

- Intrathecal room
- Negatively pressured, ventilated pentamidine room.
- Rooms suitable for isolation of immunocompromised patients.
- For drug preparation, a large clean utility room is required.
- Adequate storage as we have a large amount of disposables.
- Gowning lobbies are not required.
- Access to filtered water for immunocompromised patients may be a requirement
- Day case patients will attend a small ward based day area. The day area should be capable of accommodating a trolley and 3 reclining chairs.

Ventilation

Please note the haemato-oncology ward area has a very specific function and a considerably higher than average requirement for additional engineering support/infrastructure. There should be no opening windows, no chilled beams. Space sealed and ventilated. Positive pressure to rest of the hospital and all highly filtered air >90%, probably best HEPA with adequate number of positive pressure sealed HEPA filtered side rooms for neutropaenic patients as in the Beatson West of Scotland Cancer Centre.

2. LOCATION AND LINKS

External Department Links

Close to	Reason	*Category
Pharmacy aseptic suite	Delivery of cytotoxic drugs	3
Critical care	Easy access	3

*1= Essential adjacent
*2 = Important 2 minutes walking
*3 = Desirable 5 minutes walking

3. ACTIVITY

The bed requirement for the specialty is derived from the Pan Glasgow Bed Modelling Exercise.

4. TRENDS

Nil known.

5. HOURS OF SERVICE

Current Hours of Service:

Wards operational 24hours / 365 days year

Proposed Hours of Service (if different):

None

6. WORKLOAD INDICATION (weekly)

Not applicable.

7. KEY OPERATIONAL PROCESSES / ISSUES

Heavy users of Haematology, blood transfusion and biochemistry laboratories.
Imaging CT, MRI and routine CXR.

Ward clerk would greet and admit patients at front of ward.

- Day area should be at the front of the ward to stop unnecessary traffic through ward area.

- All areas should be designed with infection control a key focus, eg use of scrub sinks, elbow taps etc to allow for good hand hygiene

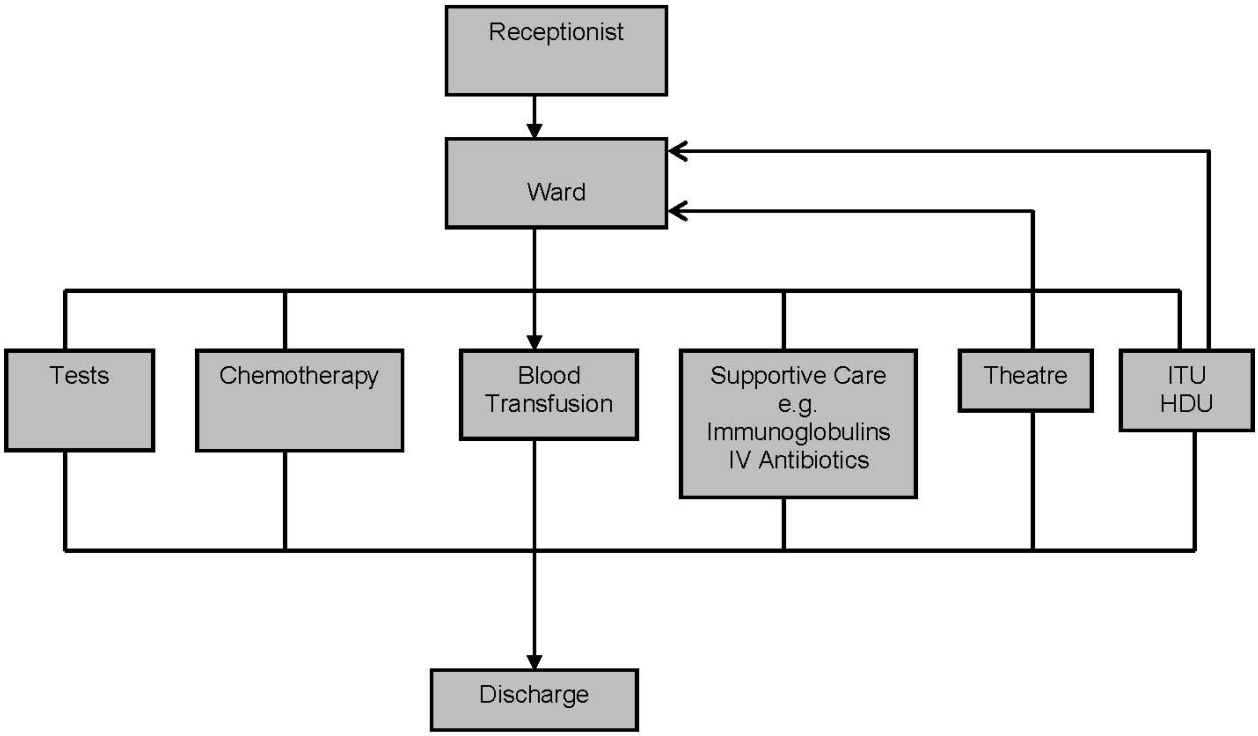
Ventilation requirements as detailed in introduction.

Ventilation

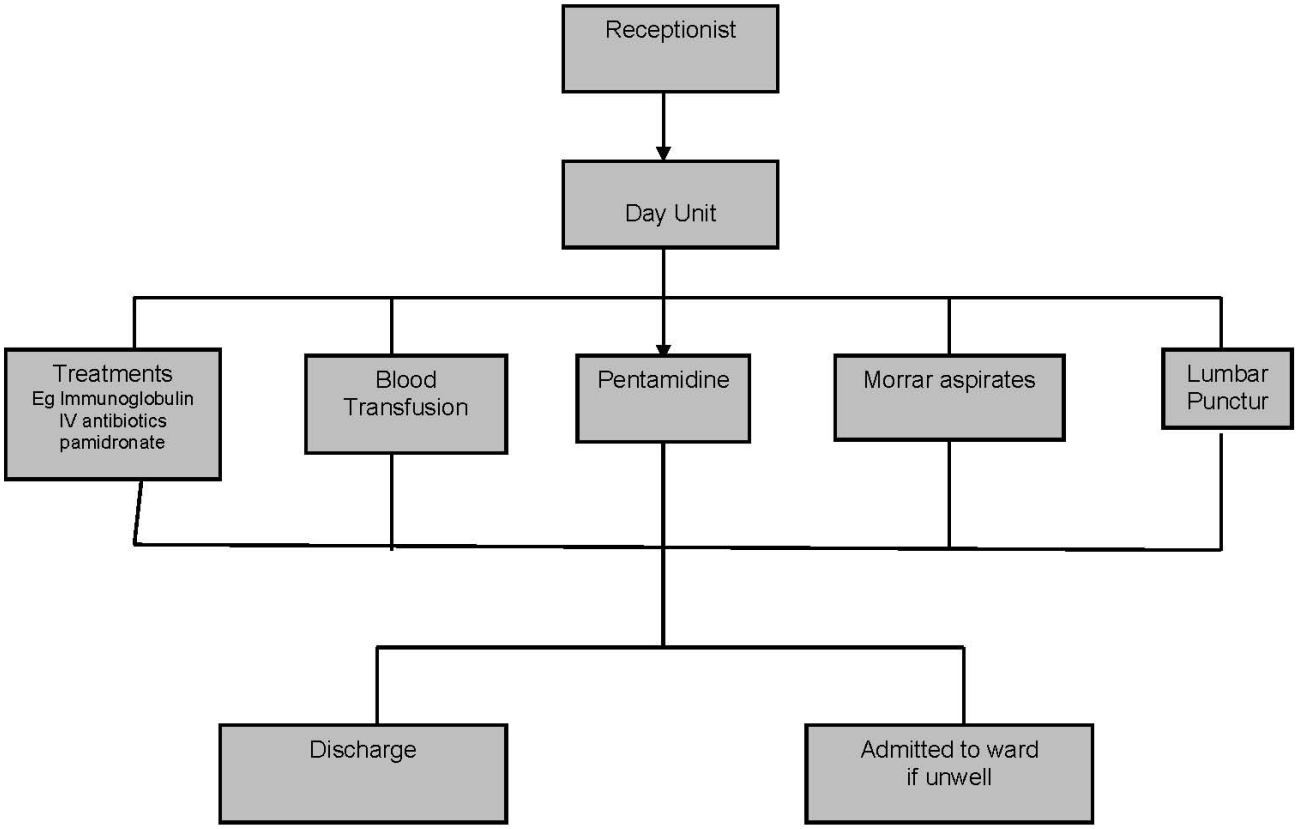
As described, for the haemato-oncology ward there should be no opening windows, no chilled beams. Space sealed and ventilated. Positive pressure to rest of the hospital and all highly filtered air >90%, probably best HEPA with adequate number of positive pressure sealed HEPA filtered side rooms for neutropaenic patients as in the Beatson West of Scotland Cancer Centre.

Require a negatively pressured, ventilated Pentamidine room. Patients will receive inhalations in this room and there must be frequent air changes to remove the contaminated exhaled air.

Inpatient Flow Chart



Day Case Flow Chart



8. EQUIPMENT

Heavy/bulky - Nil

New - Nil

Specific requirements - Nil

From: Shariff, Imran
Sent: 19 March 2020 09:33
To: Shariff, Imran
Subject: FW: BMT summary
Attachments: BMT document.doc

From: Williams, Craig
Sent: 07 July 2015 11:18
To: Armstrong, Jennifer
Cc: Walsh, Tom
Subject: BMT summary

Dear Jennifer

I have attached a document outlining the original specification and current problems with the BMT unit at QEUH. Gary Jenkins and the clinical team are happy with the contents.

Best wishes

Craig

Original Specification

The original clinical output specification from 2009 for the Heamato-oncology area at the New SGUH clearly specified that this patient group is vulnerable to infection and therefore require the provision of a protected environment. The ventilation section of this document details the following requirements in relation to this:

Please note that the haemato-oncology ward has a very specific function. There should be no opening windows The space should be sealed and ventilated . Positive pressure to the rest of the document and all highly filtered air >90%, probably best HEPA with adequate number of positive pressure sealed HEPA filtered side rooms for neutropaenic patients as in the Beatson West of Scotland Cancer Centre.

An appendix to the specification details that the HEPA filters meet EU12 standard (99.99% @ 0.3μm)

Advice for this was sought from Dr John Hood Consultant Microbiologist

Specification for rooms at WoS Cancer Centre

In the absence of definitive UK guidance on builds for severely immunocompromised patients the positive pressure side rooms are built to the CDC specification that is 12 air changes per hour and the rooms at a positive pressure to the corridor of 5-10 kPa.

Build process

Confirmation that the build was progressing as expected was sent to the clinical team on 9th December 2013 from Heather Griffin:

Thank you for your e-mail and also for your time in meeting with us the other day.
With regard to your query -

1. The spec for the Haemato-oncology area is as requested by John , in other words - hepa filtration positive to the rest of the hospital and all highly filtered air to H13 ie 99.95%. (Myra , refer to the plan I gave you).

2. The pentamidine treatment room is negatively pressured.

John is John Hood as described in the original specification above.

The expectation therefore was that the Heam-onc unit at SGUH was being built to the same standard as WoS Cancer centre.

Commissioning

The Infection control team was assured that all areas of the SGUH had been fully commissioned and validated from a Mechanical and Ventilation point of view. The details of the validation were not provided but that is not unusual as this is an

engineering specialism and ICPT's would only normally be involved in the event of significant failure. It is now apparent that Brookfield had not been required to undertake particle count test as part of their commissioning process.

Current deficiencies identified

1.HEPA Filtration for high risk patients	HEPA filtration in each room , 2 rooms verbally reported NOT to be HEPA filtered
2. Positive Pressure in each room 5-10 Pa in relation to corridor	No method of measuring pressure gradient is currently installed in any of the 4B rooms Verbally reported as 10 Rooms not sealed Not a solid ceiling, movement of ceiling tiles
3. Air exchanges required to be >12ph	Not yet achieved
4. Sealed room (0.5-sq ft leakage)	? Validation for leak testing
5) Particle counts 29th June 960-579197	Current standard at WoS Cancer Centre <1000
6) negative pressure in the pentamadine room.	Not achieved

Conclusions

1) **The original specification provided to Brookfield if delivered would have provided a safe environment for this vulnerable group of patients**
2) **Filter integrity/Particle counting would normally be required to validate areas provided with HEPA filtered air to ensure both the function of the HEPA filter and ensure the room seal. Expert Engineering advice should be sought to advise whether the commissioning process in this case was adequate. No validation data has to date been made available to the IPCT**
3) **In the light of the current provision of isolation facilities available to the Haem-Onc patients the IPCT support the return of these patients to WoS Cancer centre until the unit at the QEUH is provided to the required specification and appropriately validated**

Original Specification

The original clinical output specification from 2009 for the Heamato-oncology area at the New SGUH clearly specified that this patient group is vulnerable to infection and therefore require the provision of a protected environment. The ventilation section of this document details the following requirements in relation to this:

Please note that the haemato-oncology ward has a very specific function. There should be no opening windows The space should be sealed and ventilated . Positive pressure to the rest of the document and all highly filtered air >90%, probably best HEPA with adequate number of positive pressure sealed HEPA filtered side rooms for neutropaenic patients as in the Beatson West of Scotland Cancer Centre.

Please note that in 2009 the Beatson BMTU had been open for only 1 year and at that time there was no plans (why would there have been?) to build essentially a new BMTU at the New Southern General Hospital. The last sentence 'probably best HEPA with adequate number of positive pressure sealed HEPA filtered side rooms for neutropenic patients *as in the Beatson West of Scotland Cancer Centre*' essentially says that these rooms should be of the same standard of the BMTU rooms in level 4 of the Beatson.

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An appendix to the specification details that the HEPA filters meet EU12 standard (99.99% @ 0.3µm) This is only part of such a spec.

Advice for this was sought from Dr John Hood Consultant Microbiologist
I suspect that the sentence noted above 'probably best….' Is a quote from me.

Specification for rooms at WoS Cancer Centre

In the absence of definitive UK guidance on builds for severely immunocompromised patients the positive pressure side rooms are built to the CDC specification that is 12 air changes per hour and the rooms at a positive pressure to the corridor of 5-10 kPa.
Above is only part of a proper spec.
The spec of both the water and air quality in the top floor of the Beatson was as a result of discussions with Andy Streifel (world expert in air quality) of the University of Minnesota and Peter Hoffman (UK authority from PHLS/HPA/PHE) and my experience of the outbreak of invasive aspergillosis in Cardiac Transplant patients at GRI in the early 1990 while major building work was ongoing, the design and commissioning of the BMTU at GRI in 1999 and the design and commissioning of Level 4 of the Beatson in 2007/8.

Build process

Confirmation that the build was progressing as expected was sent to the clinical team on 9th December 2013 from Heather Griffin:

Thank you for your e-mail and also for your time in meeting with us the other day.
With regard to your query -

~~1.~~ The spec for the Haemato-oncology area is as requested by John , in other words - hepa filtration positive to the rest of the hospital and all highly filtered air to H13 ie 99.95%. (Myra , refer to the plan I gave you). This does not include the other important bits of the spec e.g. the air of the corridors around these rooms should also be filtered to a higher level – as in the Beatson + the importance of a clear visual display showing what the pressures are (among a great many other things).

1.

2. The pentamidine treatment room is negatively pressured.

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John is John Hood as described in the original specification above.

The expectation therefore was that the Heam-onc unit at SGUH was being built to the same standard as WoS Cancer centre.

This might have been the expectation but on what I have been shown it does not appear to be the case. Where are the validation documents?

Commissioning

The Infection control team was assured that all areas of the SGUH had been fully commissioned and validated from a Mechanical and Ventilation point of view. The details of the validation were not provided but that is not unusual as this is an engineering specialism and ICPT's would only normally be involved in the event of significant failure. It is now apparent that Brookfield had not been required to undertake particle count test as part of their commissioning process.

In both 1999 and 2007/2008 as the Infection Control Doctor involved in the design spec of both these units I saw that my role was crucial to ensure that both the air and water specs were both checked and verified prior to moving patients from what was seen to be from a verified safe area into the new one. Infact Andy Streifel was in Glasgow in 1999 and instructed me in the use of both microanemometers and particle counts (before we relied on pharmacy clean room staff for this). He was also in Glasgow during the Beatson Construction. In both the commissioning of the GRI and Beatson Units issues were identified. At the design and late construction stage at GRI it became clear the the spec employed would have given the patients a unit that would have been acceptable in the US in the early 1970's! (the spec had been given and signed off by clinicians!) – we quickly worked with the commissioning engineer to bring it up to that of a then US unit. There were also many issues during the commissioning period which were identified and resolved with Gordon Cheape, Alex Graham and myself .
In the Commissioning of the Beatson top floor I again saw it as my role to ensure that the specs were up to standard. I did this in conjunction with the Commissioning engineer and Mel Aitken (Estates Officer). The spec had been signed off as OK by 'someone in the Trust'. It was clear from my pressure readings that none of the rooms (29) were in any way positively pressurised. The contractor dodged and dived eventually I measured them with their subcontractor in tandem – getting the same readings. The contractor had allegedly known about these faults for months. If this

validation had not taken place these patients would have been transferred into clearly non functioning rooms. It took 1year for the rooms to be up to the required spec. During that time we found other serious faults such as lack of waterproof paint in toilet areas etc.
Although I knew about the view that BMTU patients were to be housed in the new SGH I was not involved in the spec or the commissioning (for BMTU patients).

I would also worry about the commissioning of the new DH lobbied rooms on this site as in discussion with Peter Hoffman they really need careful leak (permeability) testing and what is the programme for ongoing checking of their permeability.

Current deficiencies identified

1.HEPA Filtration for high risk patients	HEPA filtration in each room , 2 rooms verbally reported NOT to be HEPA filtered
2. Positive Pressure in each room 5-10 Pascals in relation to corridor	No method of measuring pressure gradient is currently installed in any of the 4B rooms Verbally reported as 10ph Rooms not sealed Not a solid ceiling, movement of ceiling tiles
3. Air exchanges required to be >12ph	Yes
4. Sealed room (0.5-sq ft leakage)	? Validation for leak testing
5) Particle counts 29th June 960-579197	Current standard at WoS Cancer Centre <1000

Conclusions

1) **The original specification provided to Brookfield if delivered would have provided a safe environment for this vulnerable group of patients**
2) **Particle counting would normally be required to validate areas provided with HEPA filtered air to ensure both the function of the HEPA filter and ensure the room seal. Expert Engineering advice should be sought to**

advise whether the commissioning process in this case was adequate. No validation data has to date been made available to the IPCT

3) **In the light of the current provision of isolation facilities available to the Haem-Onc patients the IPCT support the return of these patients to WoS Cancer centre until the unit at the QEUH is provided to the required specification and appropriately validated**

I agree that it is safest to return patients to the top floor of the Beatson until these rooms have been properly commissioned and validated.

John Hood
7 July 2015

Minutes of the
NHS GREATER GLASGOW AND CLYDE
BOARD INFECTION CONTROL COMMITTEE
held on
Monday 26th January 2015 at 12.00noon in
Conference Room, Southern General Hospital

Present:

Dr Jennifer Armstrong (Chair)	Board Medical Director
Ms Rosslyn Crocket	Board Nurse Director
Mr Tom Walsh	Infection Control Manager
Mr Kenneth Fleming	Head of Health and Safety
Ms Sandra McNamee	Associate Nurse Director, Infection Control
Ms Pamela Joannidis	Nurse Consultant, Infection Control
Dr Rosie Hague	Consultant Paediatrician
Professor Craig Williams	Co-ordinating ICD
Ms Liz McGovern	Specialist Pharmaceutical Public Health
Ms Lorna Murray	Corporate Facilities Manager
Dr Petar Milosevic	Consultant, Occupational Health
Dr Andrew Seaton	Consultant Physician
Dr Iain Kennedy	Consultant, Public Health
Ms Suzanne Clark	Lay Representative

In Attendance
Ann Lang (minutes)

Apologies received:
Dr David Stewart Donald Sime Dr Ray McAndrew Mari Brannigan

Item		Action
1.	**Welcome and Apologies** Apologies were received from the above mentioned.	
2.	**Minutes of the meeting held on 1 December 2014** Dr Seaton asked for amendments to the AUC section and Ann Lang is to forward Dr Seaton the AUC section for him to update.	**AL**
3.	**Matters arising** There were no matters arising that were not on the agenda.	
4.	**Standing Agenda Items**	
	4.1 HAI Reporting Template (HAIRT) December 2014 The December 2014 HAIRT was distributed with the agenda. Tom Walsh updated the group on the latest figures for SAB and CDI for the last available quarter from July – September. He said that the SAB rate for GGC is 24.1 SAB cases per 100,000 AOBDs and the HEAT target is 24 cases by 31st March 2015. With regards to CDI the rate for GGC is 33.8 cases per 100,000 AOBDs and the HEAT target is 39.7 cases or less by 31st March 2015. As of today Tom reported that there were 22 SAB cases and 19 CDI cases for the month of January. Tom Walsh advised that the rates for surgical site infections remain at or below the national average. He also stated that the rates for hip arthroplasty and repair of neck of femur procedures were both above the national average although remain within confidence limits.	

Item		Action
4.2	**Q&P HAI Report – January Update** A copy of the Q&P HAI report was distributed with the agenda and noted.	
4.3	**IC Implementation Plan 2014/15 – January Update** A copy of the Infection Prevention & Control Implementation Plan for January 2015 was distributed with the agenda. Sandra McNamee reported that this will be completed by the next Infection Control committee/meetings. She said that the ICT are progressing with the new Infection Control audit and a meeting with the software company will take place first week in February. The SSI work is progressing and a CNO letter was received and she said that we are going to look at what we may be required to carry out which could include colorectal surgery surveillance. Work regarding the new hospital is ongoing and a lot of staff have been involved in the planning and snagging stage. The Hand Hygiene Co-ordinator is involved in the new hospital for the next 6 weeks. Pamela Joannidis is carrying out training on ebola. Pamela Joannidis advised that she had met with Rosslyn, Mary Anne and Joyce Brown to discuss the new audit tool and to compare the old tool with the new tool. She said that she feels assured that using the new audit tool will assist Infection Control to focus on clinical practice. Rosslyn Crocket agreed that this was a good piece of work and that a process is in place and has been strengthened. Sandra McNamee confirmed that this Implementation Plan finishes in March and a draft 2015/16 plan will be available for the next committee. She also stated that recommendations from the Vale of Leven Inquiry will populate next year's Implementation Plan. Dr Armstrong asked if a cover sheet could be provided to say where we are and where we got to.	**SMcN**
4.4	**Policies** Whooping Cough Policy Pamela Joannidis updated the group and reported that these policies had already been to AICC and PICSG for approval. With regards to the contacts page Pamela reported that this will be updated based on the guidance received. RSV Policy A copy of the above policy was distributed with the agenda and approved. Clostridium Difficile Policy A copy of the above policy was distributed with the agenda. Pamela reported that the policy had been reviewed in light of the recommendations from the Vale of Leven Inquiry. The stool chart for c-diff has also been updated and will be used whilst a patient is symptomatic and until they are discharged. As mentioned in the Vale of Leven Report Dr Armstrong asked if reporting of c-diff deaths to the Procurator Fiscal had changed. Tom Walsh commented that the Procurator Fiscals do not want a note of all deaths and Dr Seaton stated that the advice was if a patient died of a notifiable disease this would be reported. Dr Armstrong asked for clarification on this and Tom Walsh agreed to contact David Green at the Procurator Fiscal's office to ask for the correct wording. Sandra commented that if the policy needs to be amended then we will need to update our reply to the actions for the Vale of Leven as we said that the policy will be updated by the end of January.	**TW**

Item		Action
	In relation to the surveillance of out of hospital cases Dr Kennedy reported that they are looking at putting a new system in place to identify any clusters of CDI in the community. Education Strategy / SBAR Education Strategy After recent HEI inspections and one of the recommendations from the Vale of Leven Inquiry Sandra McNamee reported that we are not clear what constitutes mandatory training. She asked the committee to consider what training should be carried out and how this can be captured. Sandra suggested that we could consider Learnpro modules as infection control update training and training on c-diff should maybe be completed within 3 months of induction. This would address the issue if HEI were to carry out an inspection. Liz McGovern said that training depends on where departments work and should be flexible. She also noted that Learnpro prompts a user when item is expired but does not re-prompt the user if not completed. Dr Armstrong stated that an email was returned to Scottish Government in relation to recommendation 42 and other recommendations of the Vale of Leven Report. She advised that she will forward this to Ann Lang to send to the committee. It was suggested that there should be further discussions with HEI on what training is required and how we can gather training information for evidence for HEI. Rosslyn Crocket agreed to take this forward. With regards to antibiotic prescribing training Dr Seaton stated that this is mandatory and tutorials are run for FY1 and 2s once a year but senior doctors do not get any direct training. Dr Hague commented that antibiotic prescribing is usually adult based and not very helpful with regards to paediatrics. Dr Armstrong asked how this training for senior doctors can be addressed. She suggested that AICC look at this for the acute site and bring back a proposal to BICC.	**JA** **RC** **DS**
4.5	**New Build Project** Professor Williams reported that in relation to the MDRTB Regulations the rooms in IDU are compliant. Discussions are still ongoing regarding the Bone Marrow Transplant Unit (BMT) and Professor Williams commented that they are engaging with HFS on this. He said the BMT unit in Paediatrics are also the same kind of rooms. Looking at the patient pathway from the Emergency Department Professor Williams advised that this was satisfactory. Dr Seaton stated that the ID Physicians commented that if there was a VHF patient the ante room should be adequately sized to deal with this eventuality and required to be assessed. He said as a group the ID Physicians would like to see the beds and ante rooms to be used for these type of patients. Dr Armstrong stressed that the keys for the new hospital were being handed over tomorrow and this would need to be discussed with David Louden as a matter of urgency. She suggested a small group meet after this meeting and she would contact David Louden to see if the ID Physicians would be able to look at this area today. In the Infectious Diseases Unit Dr Seaton advised that there are only two beds for VHF type of patients and the rest of the unit is for managing all other patients. In the Brownlee he stated that a VHF patient would be admitted via the fire exit.	**JA**

Item		Action
	Dr Kennedy advised that a sub group is commencing to look at VHF type of patients.	
5.	**Exception Reports and Updates**	
5.1	**vCJD Group** The CJD Group met last week and Dr Kennedy provided a summary of the meeting. He reported that there are two separate decontamination streams of instruments running in Paediatrics. He said the group are revisiting the high risk question in terms of population and are looking for guidance from the national group. In neuro Dr Kennedy advised that they were successful in securing money from Scottish Government to buy instruments although this money has to be spent by the end of March. Dr Armstrong suggested that Dr Kennedy contact Andrew Daly at the Board to ask his advice to transfer the capital allocation to 2015/16.	**IK**
5.2	**Antimicrobial Utilisation Committee** A copy of the last meeting of the Antimicrobial Utilisation Committee was distributed with the agenda. Dr Seaton advised that he provided an update of this committee at the last meeting Dr Armstrong commented that at the last meeting Dr Seaton discussed the number of Pharmacists per beds. Liz McGovern advised that meetings are ongoing and they are looking at the core responsibility of clinical pharmacists and the skill mix. Dr Seaton stated that he met with Norman Lannigan and Scott Bryson last week to discuss the development of a Lead Nurse Specialist for AMT. An update for ADTC (Area Drugs & Therapeutics Committee) was issued with the agenda and Dr Seaton talked through the report. He said this is a twice yearly report he produces for AICC and will replicate the report for this committee. The report includes the following points:- • Increase in comoxiclav • Increase in Piperacillin and Tazobactam • Gentamicin use has grown since 2008 • Use of newly recommended Anti Gram negative agents – Aztreonam, Fosfomycin and Temocillin which are used to reduce meropenem. Dr Seaton reported that 1 in 3 patients in GGC have antibiotics and Dr Armstrong commented that maybe HPS need to look at this if 1 in 3 patients need an antibiotic.	
5.3	Acute Infection Control Committee (AICC) The minutes of the Acute Infection Control Committee held in November were distributed with the agenda and noted. Also issued was a copy of the agenda for the latest meeting in January as the minutes were not available as yet.	
5.4	Partnership Infection Control Support Group (PICSG) The minutes of the Partnership Infection Control Support Group held in November were noted.	

Item		Action
5.5	Recent Outbreaks/Incidents Pamela Joannidis reported that no wards were closed with norovirus or influenza.	
6.	**New Business / Documents Received**	
6.1	**Guidance for Doctors Reporting Deaths to the Procurator Fiscal** This agenda item was discussed earlier.	
6.2	**HPS CDI and SAB Reports (Q3 Jul-Sep 2014)** The HPS Quarter 3 Reports (Jul-Sept 2014) for CDI and SAB were distributed with the agenda and noted.	
6.3	**VOL Inquiry Action Plan** Dr Armstrong advised that John Hamilton issued a response to the Scottish Government in relation to the Vale of Leven Inquiry. She said that she will ask John to forward this to Ann to send out to the committee.	**JA**
7.	**Update from Public Health Protection Unit** A copy of the update from Public Health Protection Unit was distributed. Dr Kennedy updated the group on some of the items included in the report:- • A cluster of four wound botulism cases have been reported in Glasgow, Ayrshire and Forth Valley from the end of December 2014. Dr Kennedy informed that there were 9 reported cases and all cases were drug users. • With regards to [redacted] Dr Kennedy reported that there has been good feedback from external partners on how this case was handled. As the patient has been discharged this incident is now closed. Dr Armstrong also wished to thank all the work involved with [redacted] and especially Brownlee Unit, PHPU and GGC laboratories. Dr Seaton also wished to express his thanks to nursing staff at Brownlee and said that ID Physicians are going through the procedures with staff and the response was regarded as excellent.	
8.	**Review of Actions** • Ann Lang to forward Dr Seaton the AUC section of the minutes for Dr Seaton to amend. • Sandra McNamee to provide a cover sheet for the Implementation Plan detailing the position where we are. • Tom Walsh to contact David Green at the Procurator Fiscal's regarding clarification on reporting of c-diff deaths. • Dr Armstrong to send Ann Lang the email that was returned to Scottish Government in relation to the recommendations of the Vale of Leven Report. • It was agreed that Rosslyn Crocket would have discussions with HEI on what training is required and how we can gather training information for evidence for HEI. • Dr Stewart to look at how training for senior doctors on acute sites can be addressed. • Dr Armstrong to arrange for a small group to meet with David Louden to see if the ID Physicians can look at the ante rooms in the new hospital. • In relation to instruments in neuro Dr Kennedy to contact Andrew Daly at the Board to ask his advice to transfer the capital allocation for this to 2015/16.	

Item		Action
9.	**AOCB** No other business was discussed.	
10.	**Date and Time of Next Meeting** The next meeting has been arranged for Monday 30 March 2015 at 1.30pm and will be held in the Conference Room, Southern General Hospital.	

2015 Meeting Dates

Date (2015)			Time	Venue
Monday	30	March	1.30pm – 3.30pm	Conference Room, Southern General Hospital
Monday	18	May	2pm – 4pm	ADM 2.16B Conference Room, Level 2, New Victoria Hospital
Monday	27	July	12noon – 2pm	Conference Room, Southern General Hospital
Monday	5	October	12noon – 2pm	Conference Room, Southern General Hospital
Monday	30	November	12noon – 2pm	Conference Room, Southern General Hospital

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NHS Greater Glasgow and Clyde

QUEEN ELIZABETH UNIVERSITY HOSPITAL

WARD 4B UPGRADE WORKS

A49756324

Contents

QEUH – Ward 4b Upgrade Works

Introduction

This documents sets out the works carried out to upgrade the 24 bedrooms in the Haemato-oncology Ward (4b) on Level 4 of the Queen Elizabeth University Hospital to achieve between 5 and 10 pascals differential pressure between the bedrooms and the corridors.

Works carried out

In order to provide a sealed room, an MF plasterboard ceiling has been installed within the 24 bedrooms. The ceiling has been taped and painted and sealed at all interfaces with adjoining walls and services. The en-suite grid and tile ceiling has been retailed but with the services and tiles silicon sealed .

To ensure that the rooms were sufficiently sealed we have carried out room air permeability testing to the parameters set out in SHPN 04-01 Supplement 1.

The recessed down lighters within the room have all been fitted with a diffuser to provide an IP44 rating.

The ventilation (Supply and extract) to the ward bedrooms is provided by Air handling unit 31 AHU63 and the corridor is provided with extract ventilation from extract fan 31-63 EF01 (both the fan and AHU are located within Plantroom 31 on Level 3). In order to provide a more robust ventilation system and to assist in achieving the desired room pressures the AHU supply fans, motors and frequency inverters (duty and standby) were uprated. The ventilation systems have been re-balanced to achieve the room differential pressures (between 5-10Pa) and the pressure from the corridor to the rest of the hospital (positive pressure). The AHU filters were replaced.

The 24 bedrooms are fitted with HEPA filtration in the supply diffusers. A new HEPA filter has been fitted and validated in each room as part of the works. DoP test ports are provided within the ductwork above the ceiling in each room to allow each room HEPA to be tested.

A digital differential pressure monitoring system has been installed within the ward. Sensors have been located above the corridor ceilings linked to air tubes in the rooms and corridor which measure the differential pressure from the room to the corridor with a read out of the pressure displayed on an panel next to the room door. The pressures of all the rooms are displayed on a central panel located at the nurses station. If the pressure in the room drops below 5Pa or above 15pa for more than 2 minutes then an alarm will sound at the room display and at the central display at the nurses station, the audible alarm can be silenced at both the room display and the central display. When the rooms return to within the parameters then the alarms will automatically reset.

Maintenance Access

There are mechanical and electrical services running above the ceiling of the rooms, this is generally, ventilation ductwork, Smoke dampers, heating pipework, duct mounted heating coil, heating controls, domestic water pipework, medical gas pipework, electrical containment, WIFI data point, fire alarm void detector, Nurse call input / output unit. In order to gain access to the maintainable items and items that may need access for fault finding (fire alarm void detector, smoke dampers, heating controls, electrical trunking, duct mounted heating coil, data point) hatches have been provided in the ceiling. These hatches have been sealed using silicon sealant and would need to be re-sealed after they have been opened for access.

QEUH – Ward 4b Upgrade Works

Commissioning & Validation

On completion of the installation works the following commissioning and validation has been carried out:

1. The Air handling Unit and Supply ductwork were cleaned and swab samples taken for analysis.
2. The AHU filters were changed
3. The ventilation systems (supply and extract) were re-commissioned
4. Air Permeability tests were carried out in the 24 rooms.
5. The room to corridor pressures were set and measured
6. The corridor to hospital pressures were measured
7. The room supply HEPA filters have been changed and challenge tests completed (DOP)
8. The new Room differential pressure monitoring system has been commissioned and validated

AHU Ref:	Room Ref	HEPA Filter Fitted	Design Air Change	Design Room Pressure	Vent Commissioned	Room Pressure Measured	HEPA Tested	Air Perm Test
31 AHU 63 Supply & Extract	HOW-031	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-029	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-026	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-024	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-021	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-020	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-017	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-015	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-012	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-011	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-009	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-067	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-064	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-062	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-059	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-058	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-055	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-053	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-050	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-202	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-198	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-195	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-193	Yes	6	5-10Pa	Yes	Yes	Yes	Yes
31 AHU 63 Supply & Extract	HOW-190	Yes	6	5-10Pa	Yes	Yes	Yes	Yes

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Our ref: SBB/524395

FAO: Gillon Armstrong
Brookfield Multiplex Europe
Site Office
Institute of Neurological Science
Queen Elizabeth University Hospital
1345 Govan Road
Glasgow
G51 4TF

Email only: [redacted]

27th October 2015

Dear Mr Armstrong

New South Glasgow Hospital –Isolation Room Testing
Adult's Hospital Ward Bed 4B

I write to confirm the results of the air permeability testing which we have undertaken on the isolation rooms within Ward 4B.

Testing was undertaken to prove compliance with the requirement of HBN 04 Supplement 1 – Isolation Facilities in Acute Settings. This requires that the enclosure have 'an average leakage rate of no more than 1 l/s of air per m^3 of envelope volume' at a positive and negative pressure differential of 20Pa. Further, the measured positive and negative leakage rates should be within 5% of each other.

Each test included the entrance lobby and main room. The ceiling mounted air supply and extract grilles were temporarily sealed with tape during the tests. No further temporary sealing was present at the time of the tests. A 'Minneapolis' door fan system was utilised to undertake each test. The fan was installed within the lobby access door to the corridor to each enclosure. A multipoint test in accordance with CIBSE TM23; 2000 was undertaken to ensure maximum accuracy.

Cont'd

Test Results

Bed 76 (HOW-190)	
Positive pressure test result;	**0.680 l/s per m² at 20Pa**
Negative pressure test result;	**0.647 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**4.85%**
Average result;	**0.664 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 77 (HOW-193)	
Positive pressure test result;	**0.856 l/s per m3 at 20Pa**
Negative pressure test result;	**0.844l/s per m3 at 20Pa**
Variation between +ve and –ve results;	**1.40%**
Average result;	**0.850 l/s per m3 at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 78 (HOW-195)	
Positive pressure test result;	**0.858 l/s per m² at 20Pa**
Negative pressure test result;	**0.886 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**3.16%**
Average result;	**0.872 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 79 (HOW-198)	
Positive pressure test result;	**0.953 l/s per m² at 20Pa**
Negative pressure test result;	**0.986 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**3.35%**
Average result;	**0.970 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 80 (HOW-202)	
Positive pressure test result;	**0.580 l/s per m² at 20Pa**
Negative pressure test result;	**0.589 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**1.52%**
Average result;	**0.0.584 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	

Test Results Continued

Bed 81 (HOW-050)	
Positive pressure test result;	**0.742 l/s per m² at 20Pa**
Negative pressure test result;	**0.744 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**0.27%**
Average result;	**0.743 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 82 (HOW-053)	
Positive pressure test result;	**0.897 l/s per m3 at 20Pa**
Negative pressure test result;	**0.917 l/s per m3 at 20Pa**
Variation between +ve and –ve results;	**2.18%**
Average result;	**0.907 l/s per m3 at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 83 (HOW-055)	
Positive pressure test result;	**0.997 l/s per m² at 20Pa**
Negative pressure test result;	**0.967 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**3.01%**
Average result;	**0.957 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 84 (HOW-058)	
Positive pressure test result;	**0.808 l/s per m² at 20Pa**
Negative pressure test result;	**0.842 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**4.04%**
Average result;	**0.825 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 85 (HOW-059)	
Positive pressure test result;	**0.847 l/s per m² at 20Pa**
Negative pressure test result;	**0.842 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**0.59%**
Average result;	**0.844 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	

Test Results Continued

Bed 86 (HOW-062)	
Positive pressure test result;	0.889 l/s per m² at 20Pa
Negative pressure test result;	0.914 l/s per m² at 20Pa
Variation between +ve and –ve results;	2.74%
Average result;	0.902 l/s per m² at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 87 (HOW-064)	
Positive pressure test result;	0.947 l/s per m² at 20Pa
Negative pressure test result;	0.919 l/s per m² at 20Pa
Variation between +ve and –ve results;	2.96%
Average result;	0.933 l/s per m² at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 88 (HOW-067)	
Positive pressure test result;	0.725 l/s per m² at 20Pa
Negative pressure test result;	0.744 l/s per m² at 20Pa
Variation between +ve and –ve results;	2.55%
Average result;	0.716 l/s per m² at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 89 (HOW-031)	
Positive pressure test result;	0.786 l/s per m² at 20Pa
Negative pressure test result;	0.753 l/s per m² at 20Pa
Variation between +ve and –ve results;	4.20%
Average result;	0.770 l/s per m² at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 90 (HOW-029)	
Positive pressure test result;	0.856 l/s per m² at 20Pa
Negative pressure test result;	0.828 l/s per m² at 20Pa
Variation between +ve and –ve results;	3.27%
Average result;	0.842 l/s per m² at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	

Test Results Continued

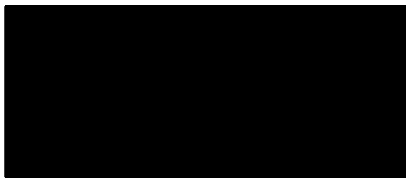
Bed 91 (HOW-026)	
Positive pressure test result;	0.994 l/s per m² at 20Pa
Negative pressure test result;	0.994 l/s per m² at 20Pa
Variation between +ve and –ve results;	0%
Average result;	0.994 l/s per m² at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 92 (HOW-024)	
Positive pressure test result;	0.947 l/s per m² at 20Pa
Negative pressure test result;	0.903 l/s per m² at 20Pa
Variation between +ve and –ve results;	4.64%
Average result;	0.925 l/s per m² at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 93 (HOW-021)	
Positive pressure test result;	0.750 l/s per m3 at 20Pa
Negative pressure test result;	0.739 l/s per m3 at 20Pa
Variation between +ve and –ve results;	1.47%
Average result;	0.744 l/s per m² at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 94 (HOW-020)	
Positive pressure test result;	0.750 l/s per m² at 20Pa
Negative pressure test result;	0.742 l/s per m² at 20Pa
Variation between +ve and –ve results;	1.07%
Average result;	0.746 l/s per m² at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 95 (HOW-017)	
Positive pressure test result;	0.756 l/s per m3 at 20Pa
Negative pressure test result;	0.783 l/s per m3 at 20Pa
Variation between +ve and –ve results;	3.45%
Average result;	0.770 l/s per m3 at 20Pa
Test results comply with the required criteria laid down in HBN 04 Supplement 1	

Test Results Continued

Bed 96 (HOW-015)	
Positive pressure test result;	**0.961 l/s per m² at 20Pa**
Negative pressure test result;	**0.919 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**4.37%**
Average result;	**0.940 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 97 (HOW-012)	
Positive pressure test result;	**0.939 l/s per m² at 20Pa**
Negative pressure test result;	**0.947 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**0.84%**
Average result;	**0.943 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 98 (HOW-011)	
Positive pressure test result;	**0.930 l/s per m3 at 20Pa**
Negative pressure test result;	**0.956 l/s per m3 at 20Pa**
Variation between +ve and –ve results;	**2.72%**
Average result;	**0.943 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	
Bed 99 (HOW-009)	
Positive pressure test result;	**0.792 l/s per m² at 20Pa**
Negative pressure test result;	**0.806 l/s per m² at 20Pa**
Variation between +ve and –ve results;	**1.61%**
Average result;	**0.799 l/s per m² at 20Pa**
Test results comply with the required criteria laid down in HBN 04 Supplement 1	

I trust that the above results are self explanatory, but please do not hesitate to contact me if you should have any queries.

Yours sincerely



Stuart B Borland BSc BArch RIAS
Director
Building Science Division
RSK Environment Limited

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ISSUED BY: IAN MCKENZIE

DATE: 7TH OCTOBER 2015

PRESENTATION BY: AD

APPROVED BY: KAREN GAVIN

DATE: 19TH OCTOBER 2015

QEUH – WARD 4B

VENTILATION REPORT

JOB No. 5902 OCTOBER 2015

MERCURY ENGINEERING & BUILDING SERVICES LTD.
MERCURY HOUSE
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VENTILATION REPORT

INDEX

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VENTILATION REPORT

AHU 63 SUPPLY (4TH FLOOR HAEMATOLOGY)

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Commissioning Services Ltd
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CONTRACT: NSGH, ADULT & CHILDRENS HOSPITAL – PLANTROOM 31

SYSTEM: 31 – AHU 63 SUPPLY (4TH FLOOR HAEMATOLOGY)

	AIR SYSTEMS PRE COMMISSIONING SHEET	✓	X	N/A
1.	Check AHU for damage and that all the components are secure	✓		
2.	Check the transit straps have been removed, if applicable	✓		
3.	Check pulleys are secure, tight, aligned and belts are correctly tensioned, if applicable	✓		
4.	Check with the controls engineer that the system is available to run and that plant rotation is correct	✓		
5.	Check all ductwork/air terminals are fitted and that air regulating dampers are open	✓		
6.	Check louvres are fitted and clear from obstructions, if applicable	✓		
7.	Check fire dampers are open, if applicable	✓		
8.	Check the motor overloads are suitable and set			✓
9.	Check VAV or CAV boxes are installed correctly and ready for use.			✓
10.	Check the floor plenums are complete, if applicable			✓
11.	Complete commissioning test sheets.	✓		

COMMENTS:

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AHU TEST SHEET

SYSTEM: 31 – AHU 63 SUPPLY (4TH FLOOR HAEMATOLOGY)

AHU											
AHU Manufacturer			Barkell		Fan Size			355			
Fan Manufacturer			Comefri		AHU Serial No			OP1B3043173			
Fan Type			Centrifugal		AHU Model N°.			NTHZ 355 R			
			Design		Test					% Design	
Air Volume		(L/S)	2800		2426					87	
External Static Pressure		(Pa)	2616		Inlet	356	Outlet	663	Total	1019	
Fan Rotational Speed		(R.P.M)	3850		3089						
Filter Test Data	Pre Filter	(Pa)	Inlet	*	Outlet	*			ΔP	55	
	Sec Filter	(Pa)	Inlet	*	Outlet	*			ΔP	120	

MOTOR				
Manufacturer	TEC	Output kW	11.0	
Serial N°	1411-0923253	Motor Full Load Current	19.8	Amps
Voltage	400	Motor Running Current	15.0	Amps
	Design	Test		
Rotational Speed.	2930	2574		

DRIVE DETAILS								
Motor Pulley/Shaft Size	(mmØ)	180 X 2	38	Motor Pulley Taper Lock Size	2012			
Fan Pulley/Shaft Size	(mmØ)	150 X 4	50	Fan Pulley Taper Lock Size	2517			
Belt Type/Size		XPZ	975	N°. Of Belts	4			
Shaft Centres mm		270		Adjustment	-	30	+ 20	mm
Variable Speed Drive		Yes		Set Point	44 Hz			

STANDBY PLANT							
Test Air Volume	2426	Inlet Pressure	*	Motor Rotational Speed	2574	Motor Running Current	
% Design	87	Outlet Pressure	*	Fan Rotational Speed	3089	15.0	Amps
Variable Speed Drive			Yes	Set Point	44 Hz		

Comments.

Motor 2 Serial No. 1411-0923253

Motor & Fan Pulley = SPZ

Control static pressure set point = 663 Pa

* Filter pressures taken from magnehelic gauges.

Main Volume = TH1 - 1348 l/s + TH2 – 1078 l/s = 2426 l/s

Instrument Used (Ref N°.) HV05/1, HV05/4 & HV05/5

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 3 of 10

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DUCT VOLUME TEST SHEET

SYSTEM: 31 – AHU 63 SUPPLY (4TH FLOOR HAEMATOLOGY)

VELOCITY PROFILE (taken facing air flow) TEST HOLE LOCATION: LEVEL 4 RISER T3

Test Hole Ref		Duct Dia (mm)		Duct Size (mm)		Duct Area		Design Air Volume		Design Air Velocity	
				Width x Height		M2		L/S		M/S	
TH1				500	500	0.2500		1040		4.16	
5.90	5.80	5.10									
5.50	5.70	5.10									
5.30	5.50	5.20									
5.10	5.50	5.00									
Velocity Sub Totals											
21.80	22.50	20.40									

Total Velocity	Number of Readings	Average Velocity	Measured Air Volume	% Design	Static Pressure
M/S		M/S	L/S		Pa
64.7	12	5.39	1348	130	365

Remarks: Test hole serves Branch A

Instrument Used: HV05/1

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 4 of 10

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DUCT VOLUME TEST SHEET

SYSTEM: 31 – AHU 63 SUPPLY (4TH FLOOR HAEMATOLOGY)

VELOCITY PROFILE (taken facing air flow) TEST HOLE LOCATION: LEVEL 4 RISER T3

Test Hole Ref		Duct Dia (mm)		Duct Size (mm)		Duct Area		Design Air Volume		Design Air Velocity	
				Width x Height		M2		L/S		M/S	
TH2				700	350	0.2450		900		3.67	
6.00	4.80	4.50	7.10								
6.00	3.70	3.00	5.90								
5.50	3.50	2.90	4.50								
Velocity Sub Totals											
17.50	12.00	10.20	13.10								

Total Velocity	Number of Readings	Average Velocity	Measured Air Volume	% Design	Static Pressure
M/S		M/S	L/S		Pa
52.8	12	4.40	1078	120	376

Remarks: Test Hole serves Branch B

Instrument Used: HV05/1

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 5 of 10

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GRILLE TEST SHEET

SYSTEM: 31 – AHU 63 SUPPLY (4TH FLOOR HAEMATOLOGY)

VELOCITY PROFILE (taken facing air flow) — TEST HOLE LOCATION: CEILING VOID

Test Hole Ref	Duct Dia (mm)	Duct Size (mm)	Duct Area	Design Air Volume	Design Air Velocity
		Width x Height	M2	L/S	M/S
TH3	200		0.0314	80	2.55
Velocity Sub Totals					

Total Velocity	Number of Readings	Average Velocity	Measured Air Volume	% Design	Static Pressure
M/S		M/S	L/S		Pa

Remarks: NOT REQUIRED - DIRECT BALOMETER VOLUMES USED.

Instrument Used: -

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 6 of 10

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GRILLE TEST SHEET

SYSTEM: 31 – AHU 63 SUPPLY (4TH FLOOR HAEMATOLOGY)

Design Data		Initial Test Data		Final Test & Regulation Data		
Terminal or Ref No	Design Air Volume l/s	Balometer Initial Air Volume l/s	Balometer Final Air Volume l/s	Balometer Factor	Balometer Final Air Volume l/s	% Design
BRANCH A						
512-HG005	80	57	91	*	*	*
512-HG004	80	53	97	*	*	*
512-HG003	80	47	92	*	*	*
512-HG002	80	56	95	*	*	*
512-HG001	80	61	105	*	*	*
513-HG009	80	82	84	*	*	*
513-HG010	80	95	83	*	*	*
513-HG011	80	94	87	*	*	*
513-HG016	80	81	83	*	*	*
513-HG015	80	86	84	*	*	*
513-HG014	80	77	106	*	*	*
513-HG013	80	93	100	*	*	*
513-HG012	80	105	91	*	*	*

Remarks: *Pressurised room, therefore direct Balometer readings recorded and used as final reading. Room volumes set to control room differential pressures.

Instrument Used: HV03/15

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 7 of 10

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GRILLE TEST SHEET

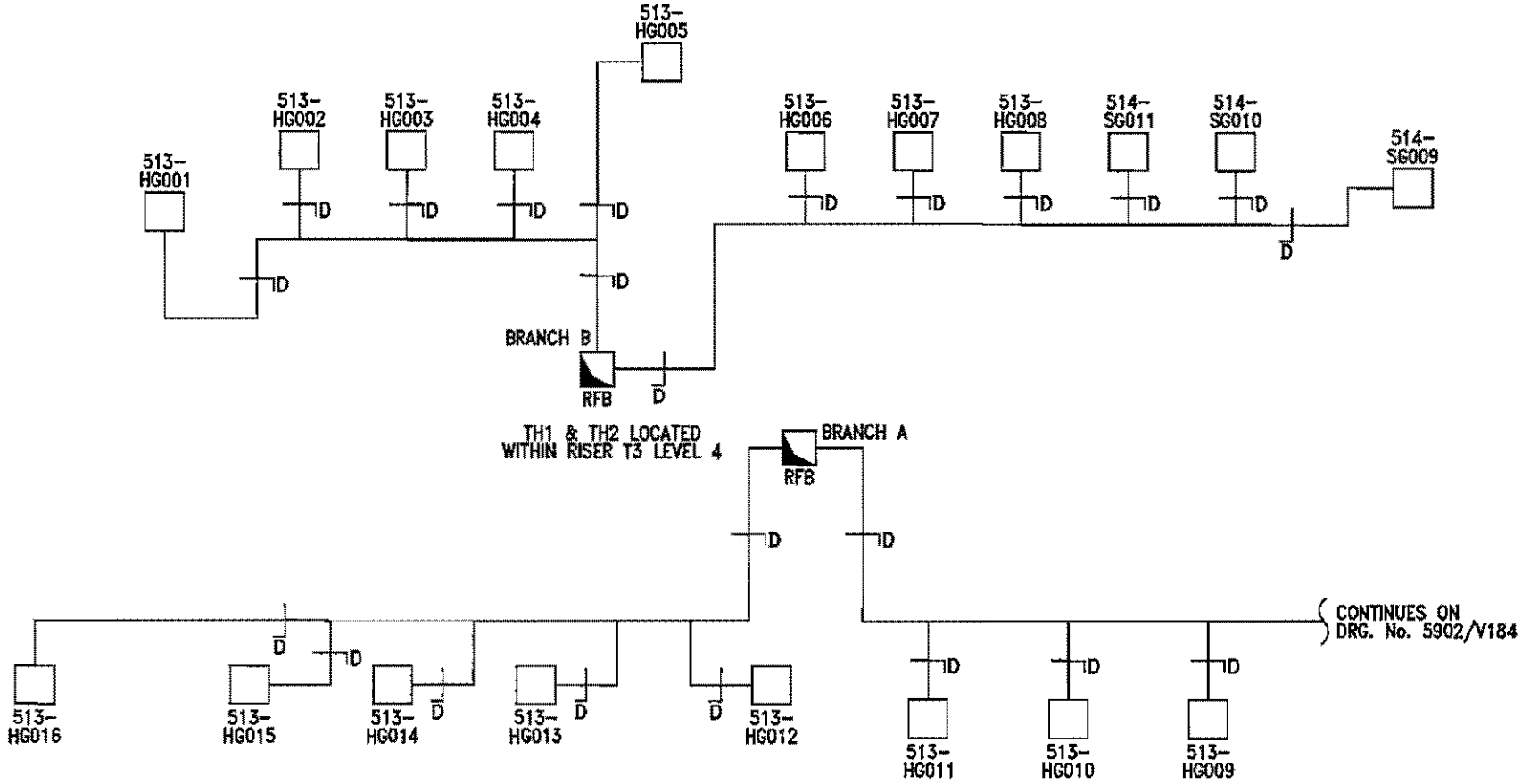
SYSTEM: 31 – AHU 63 SUPPLY (4TH FLOOR HAEMATOLOGY)

Design Data		Initial Test Data		Final Test & Regulation Data		
Terminal or Ref No	Design Air Volume l/s	Balometer Initial Air Volume l/s	Balometer Final Air Volume l/s	Balometer Factor	Balometer Final Air Volume l/s	% Design
BRANCH B						
513-HG001	100	127	103	*	*	*
513-HG002	80	68	96	*	*	*
513-HG003	80	79	98	*	*	*
513-HG004	80	72	99	*	*	*
513-HG005	80	120	83	*	*	*
514-SG009	80	84	82	*	*	*
514-SG010	80	68	82	*	*	*
514-SG011	80	72	99	*	*	*
513-HG008	80	70	90	*	*	*
513-HG007	80	80	98	*	*	*
513-HG006	80	92	100	*	*	*

Remarks: Pressurised room, therefore direct Balometer readings recorded and used as final reading. Room volumes set to control room differential pressures.

Instrument Used: HV03/15

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 8 of 10



FOURTH FLOOR

SHEET: 9 OF 10

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CLIENT:
MERCURY ENGINEERING UK

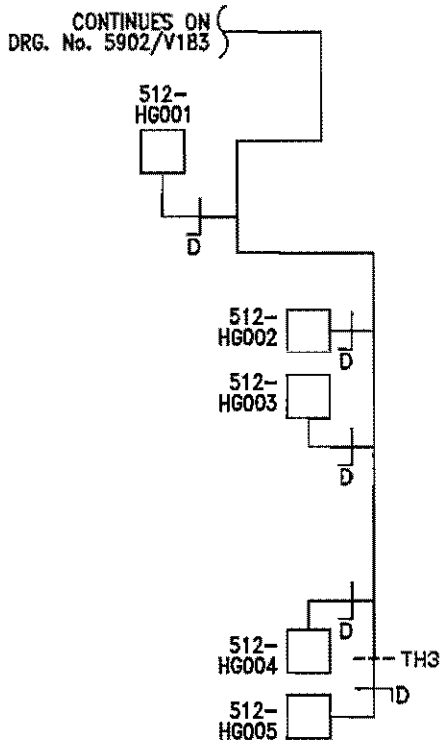
TITLE:
SCHEMATIC LAYOUT OF

31-AHU 63 SUPPLY
4TH FLOOR HAEMATOLOGY

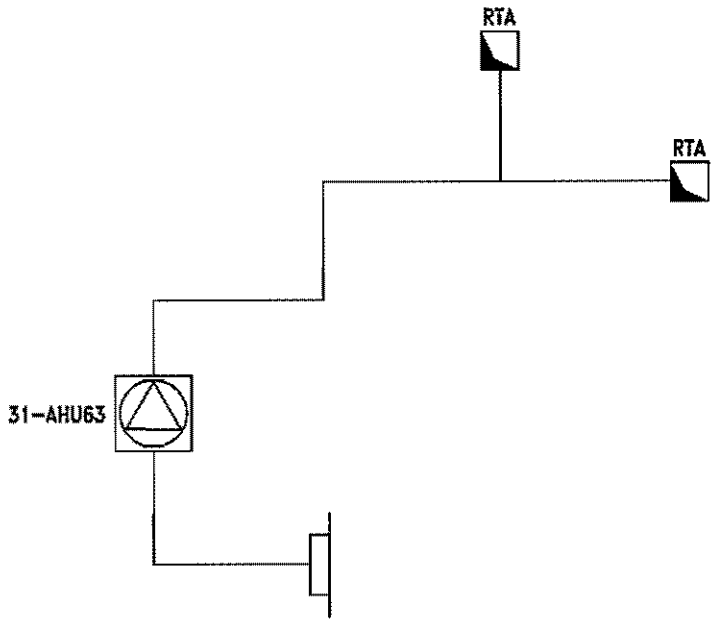
DRAWN: KL/SM

DATE: 01/07/15

DRG. No.: 5902/V183



FOURTH FLOOR



PLANTROOM 31

SHEET: 10 OF 10

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TITLE:
SCHEMATIC LAYOUT OF

31-AHU 63 SUPPLY
4TH FLOOR HAEMATOLOGY

DRAWN:
KL/SM

DATE:
01/07/15

DRG. No.:
5902/V184

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VENTILATION REPORT

AHU 63 EXTRACT (4TH FLOOR HAEMATOLOGY)

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CONTRACT: NSGH, ADULT & CHILDRENS HOSPITAL – PLANTROOM 31

SYSTEM: 31 – AHU 63 EXTRACT (4TH FLOOR HAEMOTOLOGY)

	AIR SYSTEMS PRE COMMISSIONING SHEET	✓	X	N/A
1.	Check AHU for damage and that all the components are secure	✓		
2.	Check the transit straps have been removed, if applicable	✓		
3.	Check pulleys are secure, tight, aligned and belts are correctly tensioned, if applicable	✓		
4.	Check with the controls engineer that the system is available to run and that plant rotation is correct	✓		
5.	Check all ductwork/air terminals are fitted and that air regulating dampers are open	✓		
6.	Check louvres are fitted and clear from obstructions, if applicable	✓		
7.	Check fire dampers are open, if applicable	✓		
8.	Check the motor overloads are suitable and set			✓
9.	Check VAV or CAV boxes are installed correctly and ready for use.			✓
10.	Check the floor plenums are complete, if applicable			✓
11.	Complete commissioning test sheets.	✓		

COMMENTS:

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AHU TEST SHEET

SYSTEM: 31 – AHU 63 EXTRACT (4TH FLOOR HAEMOTOLOGY)

AHU										
AHU Manufacturer			Barkell		Fan Size			355		
Fan Manufacturer			Comefri		AHU Serial No			OP1B3043173		
Fan Type			Centrifugal		AHU Model N°.			NTHZ 355 R		
			Design		Test				% Design	
Air Volume	(L/S)		1391		965				69	
External Static Pressure	(Pa)		535		Inlet	170	Outlet	28	Total	198
Fan Rotational Speed	(R.P.M)		1900		1907					
Filter Test Data	Pre Filter (Pa)	Inlet	*		Outlet	*			ΔP	15
	Sec Filter (Pa)	Inlet	N/A		Outlet	N/A			ΔP	N/A

MOTOR				
Manufacturer	TEC	Output kW	2.2	
Serial N°	1305-0984906	Motor Full Load Current	8.51	Amps
Voltage	400	Motor Running Current	2.5	Amps
	Design	Test		
Rotational Speed.	1445	1445		

DRIVE DETAILS						
Motor Pulley/Shaft Size (mmØ)	132 x 1	28	Motor Pulley Taper Lock Size	1610		
Fan Pulley/Shaft Size (mmØ)	100 x 2	40	Fan Pulley Taper Lock Size	1610		
Belt Type/Size	XPA	932	N°. Of Belts	2		
Shaft Centres mm	280		Adjustment	-	40	+ 20 mm
Variable Speed Drive	Yes		Set Point	30 Hz		

STANDBY PLANT							
Test Air Volume	965	Inlet Pressure	*	Motor Rotational Speed	1445	Motor Running Current	
% Design	69	Outlet Pressure	*	Fan Rotational Speed	1907	2.5	Amps
Variable Speed Drive			Yes	Set Point	30 Hz		

Comments.

Motor 2 Serial No. 1305-098491

Motor & Fan Pulley = SPA

* Filter pressures taken from magnehelic gauges.

Instrument Used (Ref N°.) HV05/1, HV05/4 & HV05/5

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 3 of 9

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DUCT VOLUME TEST SHEET

SYSTEM: 31 – AHU 63 EXTRACT (4TH FLOOR HAEMOTOLOGY)

VELOCITY PROFILE (taken facing air flow) — TEST HOLE LOCATION: LEVEL 4 RISER T4

Test Hole Ref		Duct Dia (mm)		Duct Size (mm)		Duct Area		Design Air Volume		Design Air Velocity	
				Width x Height		M2		L/S		M/S	
Main TH				700	450	0.3150		1391		4.42	
3.70	3.40	3.60	3.80								
3.40	3.20	3.20	3.30								
3.50	2.70	2.40	2.80								
3.40	2.40	2.10	2.10								
Velocity Sub Totals											
14.00	11.70	11.30	12.00								

Total Velocity	Number of Readings	Average Velocity	Measured Air Volume	% Design	Static Pressure
M/S		M/S	L/S		Pa
49	16	3.06	965	69	114

Remarks:

Instrument Used: HV05/1

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 4 of 9

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CONTRACT: NSGH, ADULT & CHILDRENS HOSPITAL – PLANTROOM 31

DUCT VOLUME TEST SHEET

SYSTEM: 31 – AHU 63 EXTRACT (4TH FLOOR HAEMOTOLOGY)

VELOCITY PROFILE (taken facing air flow) TEST HOLE LOCATION: CEILING VOID

Test Hole Ref	Duct Dia (mm)	Duct Size (mm)	Duct Area	Design Air Volume	Design Air Velocity
		Width x Height	M2	L/S	M/S
TH1	160		0.0201	50	2.49
Velocity Sub Totals					

Total Velocity	Number of Readings	Average Velocity	Measured Air Volume	% Design	Static Pressure
M/S		M/S	L/S		Pa

Remarks: NOT REQUIRED - DIRECT BALOMETER VOLUMES USED.

Instrument Used: -

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 5 of 9

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EST: 1975

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CONTRACT: NSGH, ADULT & CHILDRENS HOSPITAL – PLANTROOM 31

GRILLE TEST SHEET

SYSTEM: 31 – AHU 63 EXTRACT (4TH FLOOR HAEMOTOLOGY)

Design Data		Initial Test Data		Final Test & Regulation Data		
Terminal or Ref No	Design Air Volume l/s	Balometer Initial Air Volume l/s	Balometer Final Air Volume l/s	Balometer Factor	Balometer Final Air Volume l/s	% Design
514-TEG003	30	24	31	*	*	*
514-TEG002	30	34	30	*	*	*
514-TEG001	30	31	30	*	*	*
513-TEG008	30	26	31	*	*	*
513-TEG006	30	40	30	*	*	*
513-TEG007	30	40	31	*	*	*
513-TEG005	30	53	30	*	*	*
513-TEG004	30	53	30	*	*	*
513-TEG001	70	64	57	1.18	67.26	96
513-TEG003	50	28	40	1.18	47.20	94
513-TEG002	50	44	40	1.18	47.20	94
513-TEG011	40	75	32	1.18	37.76	94
513-TEG009	62	150	50	1.18	59.00	95
513-TEG010	59	173	48	1.18	56.64	96

Remarks: *Pressurised room, therefore direct Balometer readings recorded and used as final reading. Room volumes set to control room differential pressures.

Instrument Used: HV05/15

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 6 of 9

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CONTRACT: NSGH, ADULT & CHILDRENS HOSPITAL – PLANTROOM 31

GRILLE TEST SHEET

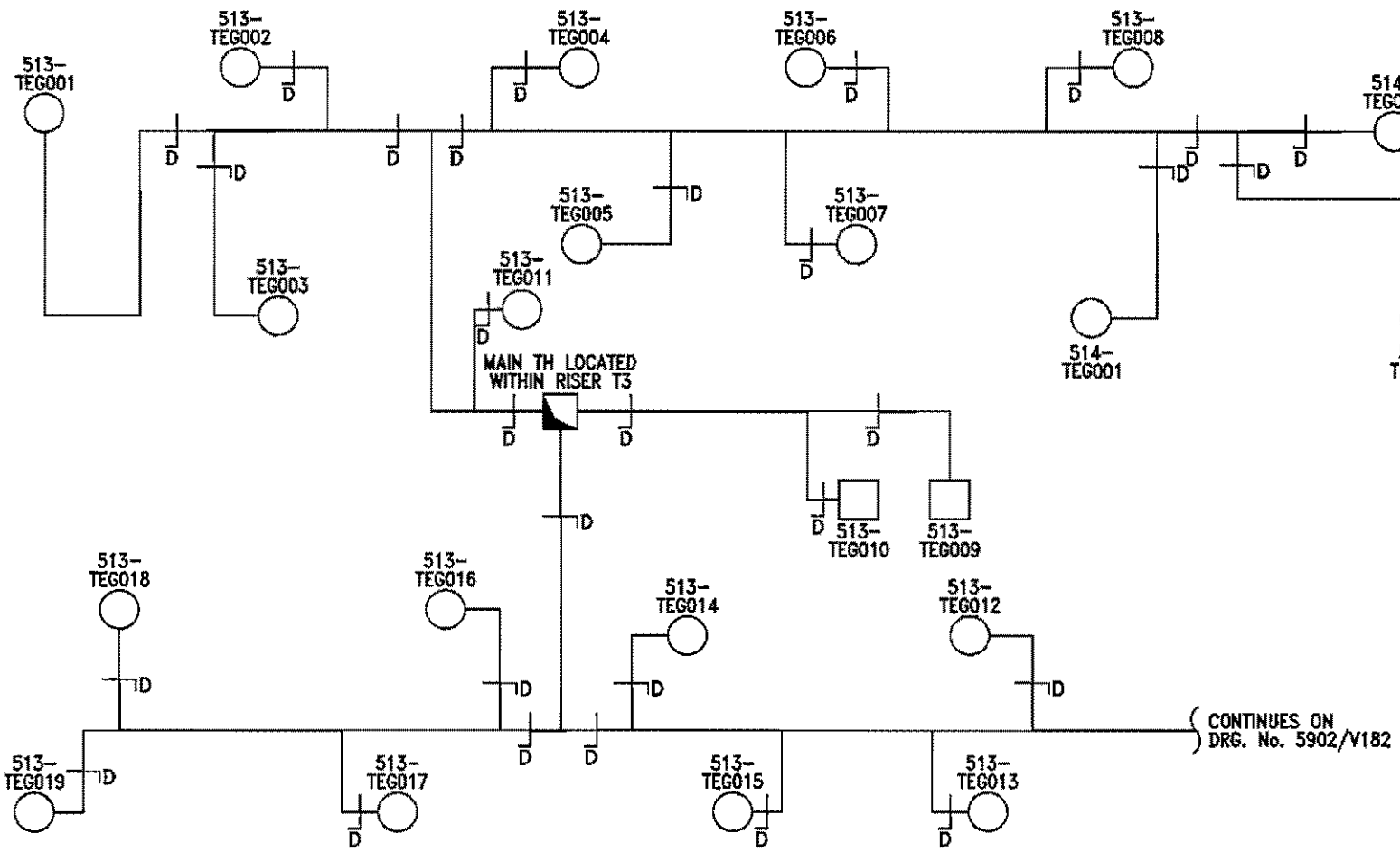
SYSTEM: 31 – AHU 63 EXTRACT (4TH FLOOR HAEMOTOLOGY)

Design Data		Initial Test Data		Final Test & Regulation Data		
Terminal or Ref No	Design Air Volume l/s	Balometer Initial Air Volume l/s	Balometer Final Air Volume l/s	Balometer Factor	Balometer Final Air Volume l/s	% Design
512-TEG006	30	24	30	*	*	*
512-TEG005	30	23	30	*	*	*
512-TEG002	30	26	31	*	*	*
512-TEG003	30	29	30	*	*	*
512-TEG004	30	24	30	*	*	*
512-TEG001	30	29	29	*	*	*
513-TEG012	30	40	30	*	*	*
513-TEG013	30	42	32	*	*	*
513-TEG015	30	42	28	*	*	*
513-TEG014	30	46	30	*	*	*
513-TEG019	30	32	30	*	*	*
513-TEG018	30	44	30	*	*	*
513-TEG017	30	53	31	*	*	*
513-TEG016	30	44	30	*	*	*

Remarks: *Pressurised room, therefore direct Balometer readings recorded and used as final reading. Room volumes set to control room differential pressures.

Instrument Used: HV05/15

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 7 of 9



FOURTH FLOOR

SHEET: 8 OF 9

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CONTRACT:
NSGH, ADULT & CHILDREN'S HOSPITAL - PLANTROOM 31

CLIENT:
MERCURY ENGINEERING UK

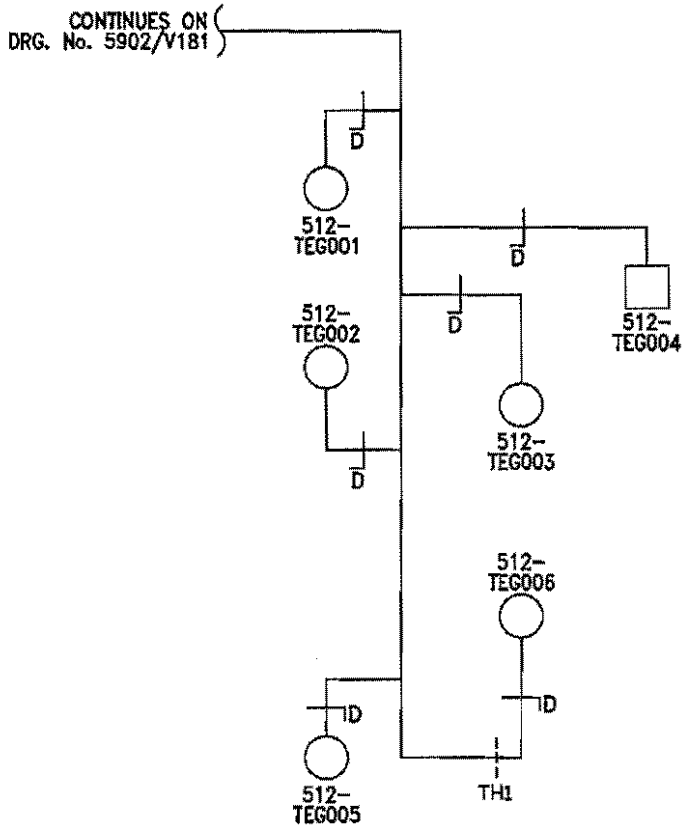
TITLE:
SCHEMATIC LAYOUT OF

31-AHU 63 EXTRACT
4TH FLOOR HAEMATOLOGY

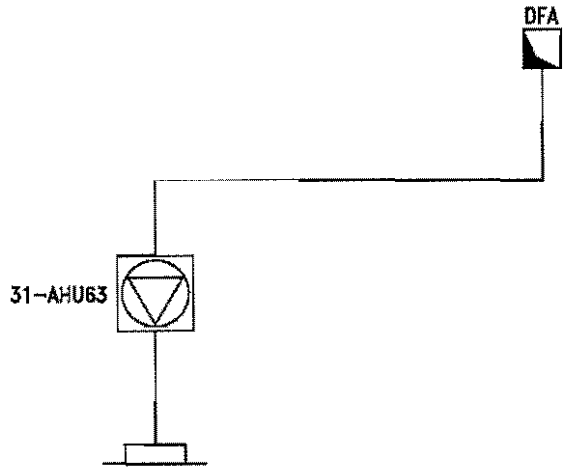
DRAWN: KL/SM

DATE: 01/07/15

DRG. No.: 5902/V181



FOURTH FLOOR



PLANTROOM 31

SHEET: 9 OF 9

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MERCURY ENGINEERING UK

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31-AHU 63 EXTRACT
4TH FLOOR HAEMATOLOGY

DRAWN: KL/SM

DATE: 01/07/15

DRG. No.: 5902/V182

QEUH – WARD 4B

VENTILATION REPORT

31-63/EF01 (4TH FLOOR HAEMATOLOGY)

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CONTRACT: NSGH, ADULT & CHILDRENS HOSPITAL – PLANTROOM 31

SYSTEM: 31 – 63/EF01 (4TH FLOOR HAEMATOLOGY)

	AIR SYSTEMS PRE COMMISSIONING SHEET	✓	X	N/A
1.	Check Fan for damage and that all the components are secure	✓		
2.	Check the transit straps have been removed, if applicable	✓		
3.	Check pulleys are secure, tight, aligned and belts are correctly tensioned, if applicable			✓
4.	Check with the controls engineer that the system is available to run and that plant rotation is correct	✓		
5.	Check all ductwork/air terminals are fitted and that air regulating dampers are open	✓		
6.	Check louvres are fitted and clear from obstructions, if applicable	✓		
7.	Check fire dampers are open, if applicable	✓		
8.	Check the motor overloads are suitable and set			✓
9.	Check VAV or CAV boxes are installed correctly and ready for use.			✓
10.	Check the floor plenums are complete, if applicable			✓
11.	Complete commissioning test sheets.	✓		

COMMENTS

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CONTRACT: NSGH, ADULT & CHILDRENS HOSPITAL – PLANTROOM 31

DIRECT DRIVE FAN TEST SHEET **SYSTEM: 31 – 63/EF01 (4TH FLOOR HAEMATOLOGY)**

FAN									
AHU Manufacturer		Not Applicable		Fan Size		Not Stated			
Fan Manufacturer		Sandometal		Fan Serial No		1304370-313			
Fan Type		Plug		Fan Model N°.		ESDM1/1			
		Design		Test				% Design	
Air Volume	(L/S)	699		1011				145	
External Static Pressure	(Pa)	325		Inlet	241	Outlet	68	Total	309
Filter Test Data	Pre Filter (Pa)	Inlet	N/A	Outlet	N/A			ΔP	N/A
	Sec Filter (Pa)	Inlet	N/A	Outlet	N/A			ΔP	N/A

MOTOR				
Manufacturer	Ziehl-Abegg	Output kW	1.1	
Serial N°	13010169	Motor Full Load Current	2.53	Amps
Voltage	230	Motor Running Current	1.66	Amps
	Design	Test		
Rotational Speed R.P.M	1430	1158		

DRIVE DETAILS			
Variable Speed Drive	Yes	Set Point	70 Hz (Max 86 Hz)

Comments: N/A – Not Applicable

System volume set to control corridor pressure from pressurised rooms.

Instrument Used (Ref N°.) HV05/1, HV05/4 & HV05/5

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 3 of 7

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DUCT VOLUME TEST SHEET

SYSTEM: 31 – 63/EF01 (4TH FLOOR HAEMATOLOGY)

VELOCITY PROFILE (taken facing air flow)

Test Hole Ref		Duct Dia (mm)		Duct Size (mm)		Duct Area		Design Air Volume		Design Air Velocity	
				Width	x Height	M2		L/S		M/S	
Main TH				500	350	0.1750		699		3.99	
5.90	6.00	5.60									
5.80	5.70	5.80									
5.70	5.70	5.70									
5.80	5.80	5.80									

Velocity Sub Totals

23.20	23.20	22.90									

Total Velocity	Number of Readings	Average Velocity	Measured Air Volume	% Design	Static Pressure
M/S		M/S	L/S		Pa
69.3	12	5.78	1011	145	196

Remarks:

Instrument Used: HV12/1

Date: 7/10/15 | Engineer: Ian McKenzie & Daniel Kane | Sheet 4 of 7

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DUCT VOLUME TEST SHEET SYSTEM: 31 – 63/EF01 (4TH FLOOR HAEMATOLOGY)

VELOCITY PROFILE (taken facing air flow)

Test Hole Ref		Duct Dia (mm)		Duct Size (mm)		Duct Area		Design Air Volume		Design Air Velocity	
				Width x Height		M2		L/S		M/S	
TH1		250				0.0491		90		1.83	
1.70	1.70										
1.90	1.90										
1.90	2.00										
1.90	1.90										
Velocity Sub Totals											
7.40	7.50										

Total Velocity	Number of Readings	Average Velocity	Measured Air Volume	% Design	Static Pressure
M/S		M/S	L/S		Pa
14.9	8	1.86	91	102	11

Remarks: Test Volume 91l/s ÷ Balometer Volume 79l/s = 1.15 Factor.

Instrument Used: HV05/1

Date: 7/10/15 | Engineer: Ian McKenzie & Daniel Kane | Sheet 5 of 7

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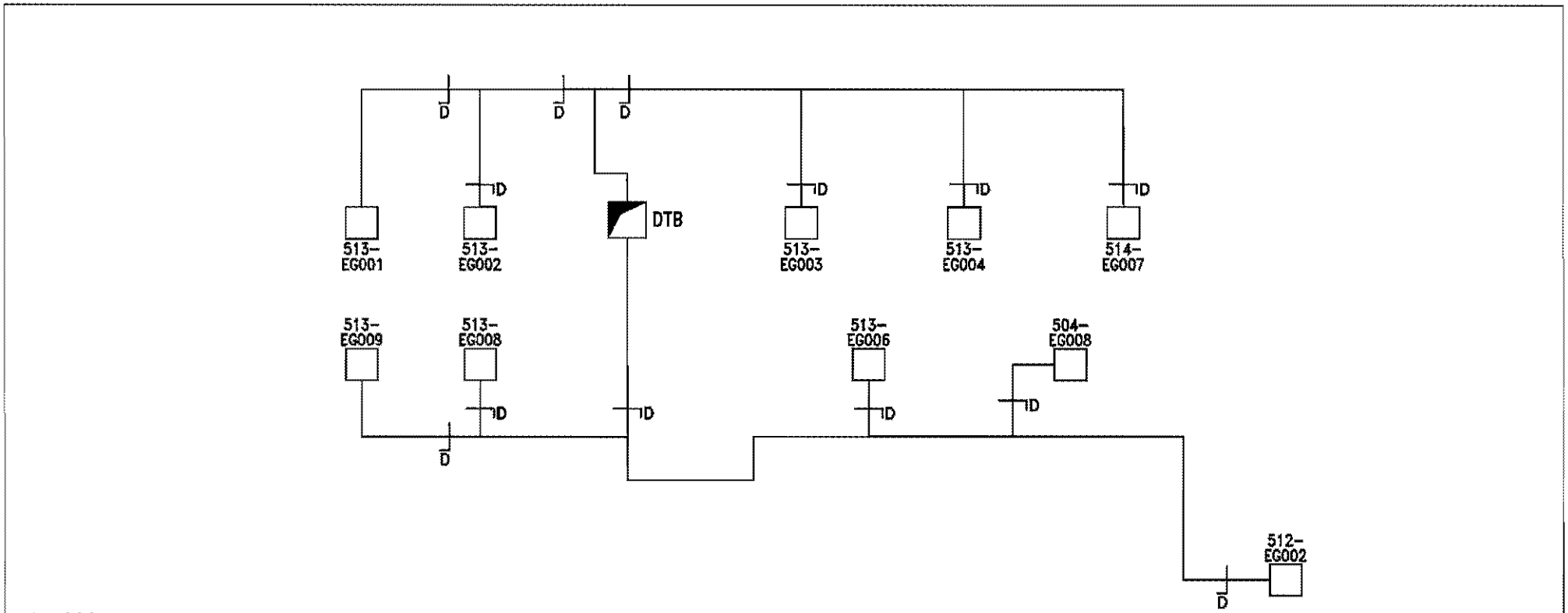
GRILLE TEST SHEET **SYSTEM: 31 – 63/EF01 (4TH FLOOR HAEMATOLOGY)**

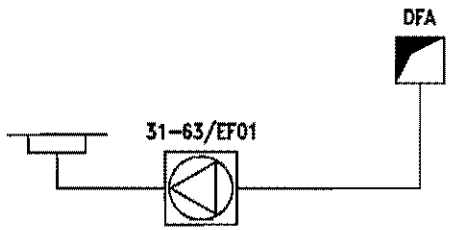
Design Data		Initial Test Data		Final Test & Regulation Data		
Terminal or Ref No	Design Air Volume l/s	Balometer Initial Air Volume l/s	Balometer Final Air Volume l/s	Balometer Factor	Balometer Final Air Volume l/s	% Design
512-EG002	90	94	79	1.15	90.85	101
514-EG008	75	93	68	1.15	78.20	104
513-EG006	75	86	70	1.15	80.50	107
513-EG008	75	136	81	1.15	93.15	124
513-EG009	75	120	100	1.15	115.00	153
514-EG007	77	24	88	1.15	101.20	131
513-EG004	63	24	92	1.15	105.80	168
513-EG003	55	33	91	1.15	104.65	190
513-EG002	54	53	91	1.15	104.65	194
513-EG001	60	33	106	1.15	121.90	203

Remarks:

Instrument Used: HV05/15

Date: 7/10/15	Engineer: Ian McKenzie & Daniel Kane	Sheet 6 of 7





SHEET: 7 OF 7

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CONTRACT:
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CLIENT:
MERCURY ENGINEERING UK

TITLE:
SCHEMATIC LAYOUT OF

31-63/EF01 4TH FLOOR HAEMATOLOGY

DRAWN: KL/SM

DATE: 18/12/14

DRG. No.: 5902/V[illegible]9

A49756324

QEUH – WARD 4B

VENTILATION REPORT

AHU 63 ROOM PRESSURES, SUPPLY & EXTRACT VOLUMES

New South Glasgow Hospital

31AHU63 - Level 4 - 4B Wards – Room Pressures, Supply & Extract Air Volumes

Room Bed Ref.:	Room Door Ref.:	Room to Corridor Pressure Set Pa		Minimum Supply Design Volume l/s	Supply Grille Volume l/s	Extract Grille Volumes l/s
		Micro-manometer Reading Pa	Room Digital Display Pa			
76	HOW190	7.0	7.0	80	91	30
77	HOW193	7.0	7.0	80	97	30
78	HOW195	7.1	7.0	80	92	31
79	HOW198	7.7	7.1	80	95	30
80 XL	HOW202	6.9	7.1	100	105	30
81	HOW050	6.9	7.0	80	84	29
82	HOW053	6.8	6.8	80	83	30
83	HOW055	7.1	6.6	80	87	32
84	HOW058	7.8	7.7	80	83	28
85	HOW059	7.7	7.1	80	84	30
86	HOW062	7.1	7.2	80	106	31
87	HOW064	7.4	7.6	80	100	30
88	HOW067	7.9	7.8	80	91	30
89 XL	HOW031	7.0	7.1	100	103	33
90	HOW029	7.6	7.8	80	96	30
91	HOW026	7.5	7.6	80	98	33
92	HOW024	7.8	7.9	80	99	30
93	HOW021	7.1	7.2	80	83	30
94	HOW020	7.7	7.6	80	82	31
95	HOW017	7.5	7.8	80	82	30
96	HOW015	7.1	7.2	80	99	31
97	HOW012	6.2	6.7	80	90	30
98	HOW011	6.9	7.2	80	98	30
99 XL	HOW099	6.3	6.4	100	100	31

Room Pressures to be set between 5Pa and 10Pa target pressure 7Pa ± 1Pa

Comments:

Above readings were finalised and witnessed by BM's Julie Miller 6th October 2015.

NB: Door seals have been trimmed to achieve room to corridor differential pressures and the required minimum air change rate (standard size rooms air volume design minimum 80l/s and the 3 larger rooms at a minimum air volume 100l/s.

31AHU63 Supply set at 44Hz
31AHU63 Extract set at 30Hz
31-63EF01 Corridor extract set at 70Hz (Set to control room corridor pressure)

Ward 4B corridor pressure is set to external corridors at approximately +10Pa.

Room pressure alarms/information;

1) High room pressure set at 15Pa
2) Low room pressure alarm set at 5Pa
3) Door open or out of specification alarm is set for a 2 minute period before alarming.
4) Room pressure alarms can be silenced from the button on the digital display set at each room door entry (on the stainless steel plate).

Report compiled and finalised by Ian McKenzie (H&V)
8th October 2015

QEUH – WARD 4B

VENTILATION REPORT

AHU 63 SUPPLY FILTER INTEGRITY TEST

31AHU63 Supply – Level 4 - 4B Wards – HEPA Filter Integrity Test Report

Room Bed Ref.:	*Room Door Ref.:*	*HEPA Filter S/N:*	*Upstream Aerosol Concentration Pre Scan*	*Maximum Ratio % Penetration*	*Recorded Downstream Concentration Ratio %*	*% Upstream Aerosol Concentration Post Scan*	*Pass/Fail*
76	HOW190	007000-35157	62mg/m³	≤0.01%	0.0011%	109%	Pass
77	HOW193	006997-35157	59mg/m³	≤0.01%	0.0004%	111%	Pass
78	HOW195	006991-35157	71mg/m³	≤0.01%	0.0014%	97%	Pass
79	HOW198	007002-35157	76mg/m³	≤0.01%	0.0006%	102%	Pass
80	HOW202	007012-35157	63mg/m³	≤0.01%	0.0034%	92%	Pass
81	HOW050	007009-35157	62mg/m³	≤0.01%	0.0054%	98%	Pass
82	HOW053	007014-35157	51mg/m³	≤0.01%	0.0014%	108%	Pass
83	HOW055	006996-35157	35mg/m³	≤0.01%	0.0042%	105%	Pass
84	HOW058	007001-35157	53mg/m³	≤0.01%	0.0006%	101%	Pass
85	HOW059	007007-35157	66mg/m³	≤0.01%	0.0014%	103%	Pass
86	HOW062	006995-35157	67mg/m³	≤0.01%	0.0002%	104%	Pass
87	HOW064	006998-35157	55mg/m³	≤0.01%	0.0006%	104%	Pass
88	HOW067	006993-35157	60mg/m³	≤0.01%	0.0010%	100%	Pass
89	HOW031	007003-35157	75mg/m³	≤0.01%	0.0011%	102%	Pass
90	HOW029	006999-35157	70mg/m³	≤0.01%	0.0009%	101%	Pass
91	HOW026	007006-35157	72mg/m³	≤0.01%	0.0007%	98%	Pass
92	HOW024	007013-35157	57mg/m³	≤0.01%	0.0002%	111%	Pass
93	HOW021	006992-35157	17mg/m³	≤0.01%	0.0012%	96%	Pass
94	HOW020	007011-35157	52mg/m³	≤0.01%	0.0008%	110%	Pass
95	HOW017	007008-35157	75mg/m³	≤0.01%	0.0005%	106%	Pass
96	HOW015	007010-35157	47mg/m³	≤0.01%	0.0009%	96%	Pass
97	HOW012	007004-35157	42mg/m³	≤0.01%	0.0021%	104%	Pass
98	HOW011	007005-35157	44mg/m³	≤0.01%	0.0023%	98%	Pass
99	HOW099	006944-35157	43mg/m³	≤0.01%	0.0007%	109%	Pass

New South Glasgow Hospital

31AHU63 Supply – Level 4 - 4B Wards – HEPA Filter Integrity Test Report

Test Instruments Used	*Serial No.*	*Calibration Due*
Photometer	TDA-2G	March 2016
Aerosol Generator	ATI Aerosol Generator	March 2016

RESULTS (Enter Pass / Fail) *Results and test conditions are compliant with BS EN ISO 14644-3*	*PASS*

	COMPLETED BY:	*WITNESSED BY*
PRINT:	Ian McKenzie	
SIGNATURE:	[redacted]	
DATE:	8th October 2015	

QEUH – WARD 4B

VENTILATION REPORT

CALIBRATION CERTIFICATES

OptiCal Sciences

CERTIFICATE OF COMPLIANCE AEROSOL GENERATOR

No G/26262

The Standards used have been calibrated by internal and external procedures traceable to National Standards.
This Aerosol Generator has been tested with Shell Ondina EL Oil.

Date of Calibration: 16-Mar-15		Model	Serial No
Customer	H & V Commissioning Services	Vicount 1300	1025732
Address	Kilknowe Office		
	16 Barrmill Road		
	Galston, Ayrshire		
	KA4 8HH		
Service Report No 26262			

STANDARDS USED

INSTRUMENT DESCRIPTION	MANUFACTURER	SERIAL No	LAST RECAL	CERT NO
Photometer	Air Techniques	12076	23-Jan-15	26127
Airflow Meter	Kanomax Climomaster	440952	4-Jul-14	640820
Airflow HLF Bench	Gelman Sciences	9436-89	18-Sep-14	25629
Electrical Safety Tester	MicroPAT+	78491386	20-Mar-14	337772
Aerosol Diluter	Air Techniques	11645	3-Dec-14	25929

AEROSOL OUTPUT CONCENTRATION RESULTS

Inlet Bottle Pressure (PSI)	Oil Flow Valve	Heater Block Temperature (°C)	HLF Bench Airflow (L/min)	Upstream Concentration (µg/L)
10	-	316	14,375.9	45
20	-	316	14,375.9	130
30	-	316	14,375.9	200
40	-	316	14,375.9	280
50	-	316	14,375.9	350

ELECTRICAL SAFETY TEST RESULTS

Test No: 213	
Test Mode: Class one	
Visual: Pass	
Earth Test: 0.06 Ω	
Insulation Test: ^19.9 MΩ	
Load Test: 0.00 KVA	
Leakage Test: 00.1 mA	
FLOW RATE	
ATI TDA-5B	N/A LPM

CALCULATED RESULTS

Generator Output (g/min) = Upstream Concentration (µg/L) x HLF Bench Airflow (L/min) / 1,000,000

Pressure	Output (g/min)	Pressure	Output (g/min)
10 psi	0.65	50 psi	5.03
20 psi	1.87		
30 psi	2.88		
40 psi	4.03		

Out Of Limit Errors As Found. Comments: None

Next Calibration Due 16-Mar-16 | Engineer A.KERR [redacted]

OptiCal Sciences Limited
Envirotest House
Anglia Way, Moulton Park Industrial Estate, Northampton NN3 6JA
Telephone: 0844 334 0100 Fax: 0844 334 0101 Email: info@optical-sciences.co.uk
Visit our Website at www.optical-sciences.co.uk

DATE: 16-Mar-15

OptiCal Sciences

SERVICE REPORT

CUSTOMER H & V Commissioning Services
ADDRESS Kilknowe Office
16 Barrmill Road
Galston, Ayrshire
KA4 8HH
CONTACT Angela Daly
PURCHASE ORDER NO 4778/IS/AC
OSL ORDER REF 23048

ENGINEER Adam Kerr
HOURS as per quote
TRAVELLING TIME
OTHER EXPENSES

WORK REQUIRED Repair / Service / output
CALIBRATION CERT. ISSUED 26262
MODEL LV1300
SERIAL NO 1025732

☐ CONTRACT ☐ WARRANTY ☒ CUSTOMER A/C OTHER

On inspection of instrument blowing fuses and failing portable appliance test

Fault traced to heater elements failing

Replaced 2 x heater elements - OK

Portable appliances test carried out, See electrical safety results

Using LAF Bench, 1000:1 diluter and Ref Photometer, recorded output concentration

Calculate output g/min

Checked normal working functions of instrument - OK

PART NO.	QTY.	DESCRIPTION	ELECTRICAL SAFETY TEST RESULTS
	2	Heater elements	Visual: pass
			E. Continuity: 0.06Ω
			Fuse Rating: -
			Insulation: >19.9 MΩ
			Run Test: 0.00 KVA
			Flash: N/A
FOR OFFICE USE ONLY:	T =	L =	Test No: 213

ENGINEER SIGNATURE [redacted]

SERVICE REPORT No 26262

OptiCal Sciences Limited
Envirotest House
Anglia Way, Moulton Park Industrial Estate, Northampton NN3 6JA
Telephone: 0844 334 0100 Fax: 0844 334 0101 Email: info@optical-sciences.co.uk
Visit our Website at www.optical-sciences.co.uk

ISO 9001

QSF19
03/05/2010

CERTIFICATE OF CALIBRATION

Issued By IRC Ltd

Date of Issue 27 August 2015

Certificate Number
205772

Instrument Repairs & Calibration
7 Howard Court Industrial Estate
East Kilbride, G74 4QZ
Tel: 01355 264120 Fax: 01355 264150
www.instrument-repairs.com

Approved Signatory
[redacted]

☐ F. Sllo ☐ N. Anderson ☐ K. Low ☑ C. Moore ☐ A. Rae

Customer : H&V Commissioning Services Ltd
Killknowe Offices, 16 Barrmill Road
Galston KA4 8HY

Date Received : 20 August 2015

Instrument -

System ID :	IRC02093	Job Number :	R70380-1
Description :	Micromanometer	Ref. Number :	HV5-01
Manufacturer :	DPM	Site :	
Model Number :	TT470S	Location :	
Serial Number :	7471		
Procedure Version :	774		

Environmental Conditions

Temperature :	23°C +/- 2°C	Mains Voltage :	230V +/- 10V
Relative Humidity :	50% +/- 20%	Mains Frequency :	50Hz +/- 1Hz

Comments

The instrument stabilised in the laboratory for 4 hours prior to calibration.
Results at the time of test carry no long term stability of the Instrument.
This certificate records the ON RECEIPT calibration status.
Recalibration period 52 weeks by customer request.

Traceability Information

Instrument description	*Serial number*	*Certificate number*	*Cal. Date*	*Cal. Period*
Mensor CP6000	610020	N18686&7 N18673	19/04/2013	156

Calibrated By : C. Moore **Date of Calibration : 27 August 2015**

This is to certify that the above instrument was fully calibrated. Work carried out was in accordance with procedures laid down in BS EN ISO/IEC 17025:2005.
The accuracies of the standards used are traceable to National Standards,via UKAS approved laboratories.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number
205772

Test Title	Tolerance	Applied Value	Reading	Pass/Fail
Pascal				
	100fa	0.00pa	0.0pa	Pass
	200fa	20.00pa	20.1pa	Pass
	400fa	40.00pa	40.1pa	Pass
	600fa	60.00pa	59.9pa	Pass
Kilopascals				
0.500kpa	5pa	0.5kpa	0.50kpa	Pass
1.00kpa	20pa	1.000kpa	1.00kpa	Pass
2.00kpa	30pa	2.000kpa	2.00kpa	Pass
3.00kpa	40pa	3.000kpa	3.00kpa	Pass
4.00kpa	50pa	4.000kpa	4.00kpa	Pass
5.00kpa	60pa	5.000kpa	5.00kpa	Pass
)0kpa	70pa	6.000kpa	6.00kpa	Pass

End of results

Uncertainties

Pressure TE69 15 - 1000mBar +/- 0.04% of reading

CERTIFICATE OF CALIBRATION

Issued By IRC Ltd

Date of Issue 22 September 2015

Certificate Number
206411

Page 1 of 2 Pages

Instrument Repairs & Calibration
7 Howard Court Industrial Estate
East Kilbride, G74 4QZ
Tel: 01355 264120 Fax: 01355 264150
www.instrument-repairs.com

Approved Signatory
[redacted]

☐ N. Anderson ☐ K. Low ☑ C. Moore ☐ A.Rae

Customer : H&V Commissioning Services Ltd
Kilknowe Offices, 16 Barrmill Road
Galston KA4 8HY

Date Received : 15 September 2015

Instrument -

System ID :	IRC02515	Job Number : R70680-2	
Description :	Clamp Meter	Ref. Number : HV5-4	
Manufacturer :	Ideal	Site :	
Model Number :	61-768	Location :	
Serial Number :	051102797	Last Certificate Number : 192495	
Procedure Version :	1.01	Last Calibration Date : 09/05/2014	

Environmental Conditions

Temperature :	23°C +/- 2°C	Mains Voltage :	230V +/- 10V
Relative Humidity :	50% +/- 20%	Mains Frequency :	50Hz +/- 1Hz

Comments

The instrument stabilised in the laboratory for 4 hours prior to calibration.
Results at the time of test carry no long term stability of the instrument.
This certificate records the ON RECEIPT calibration status.
Recalibration period 52 weeks by customer request.

Traceability Information

Instrument description	*Serial number*	*Certificate number*	*Cal. Date*	*Cal. Period*
5500 Multifunction Calibrator	6305020	048278	05/11/2014	52

Calibrated By : C. Moore **Date of Calibration :** 22 September 2015

CERTIFICATE OF CALIBRATION

Certificate Number
206411

Test Title	Tolerance	Applied Value	Reading	Pass/Fail
DC Voltage				
4V D.C. Range	21.5mV	3.900 0V	3.900V	Pass
40V D.C. Range	215mV	39.000V	38.98V	Pass
400V D.C. Range	2.2V	390.00V	389.8V	Pass
1000V D.C. Range	7V	1 000.00V	1 000V	Pass
AC Voltage				
4V A.C. @ 50Hz	54.8mV	3.900 0V	3.905V	Pass
40V A.C. @ 50Hz	548mV	39.000V	39.02V	Pass
400V A.C. @ 50Hz	5.5V	390.00V	390.2V	Pass
750V A.C. @ 50Hz	19.3V	750.00V	750V	Pass
DC Current				
100.0A D.C. Range	1.5A	100.00A	99.6A	Pass
200.0A D.C. Range	3.5A	200.00A	199.7A	Pass
400.0A D.C. Range	5A	300.00A	298.7A	Pass
400.0A D.C. Range	6.4A	390.00A	388.8A	Pass
600A D.C. Range	7.3A	450.00A	448A	Pass
600A D.C. Range	13.3A	550.00A	547A	Pass
AC Current				
400.0A A.C. @ 50Hz	2.7A	100.00A	99.6A	Pass
400.0A A.C. @ 50Hz	4.4A	200.00A	200.0A	Pass
400.0A A.C. @ 50Hz	6.1A	300.00A	300.2A	Pass
400.0A A.C. @ 50Hz	7.6A	390.00A	390.2A	Pass
600A A.C. @ 50Hz	23.5A	450.00A	448A	Pass
600A A.C. @ 50Hz	26.5A	550.00A	548A	Pass
Resistance				
400Ω Range	1.4Ω	100.00Ω	100.0Ω	Pass
4kΩ Range	14Ω	1.000 0kΩ	1.000kΩ	Pass
40kΩ Range	140Ω	10.000kΩ	9.98kΩ	Pass
400kΩ Range	1.4kΩ	100.00kΩ	99.8kΩ	Pass
4MΩ Range	94kΩ	1.000 0MΩ	0.998MΩ	Pass

End of results.

Uncertainties

DC Voltage	+/- 12ppm +1 LSD
AC Voltage	0 to 1000V 0.01% +/- 1digit
DC Current	0 to 10A 0.008% +/- 1 digit
AC Current	0 to 1000A 0.2% +/- 2 Digits
Resistance	0 to 10M 0.005% +/- 1 Digit

CERTIFICATE OF CALIBRATION

Issued By IRC Ltd

Date of Issue 22 September 2015

Certificate Number
206403

Page 1 of 2 Pages

Instrument Repairs & Calibration
7 Howard Court Industrial Estate
East Kilbride, G74 4QZ
Tel: 01355 264120 Fax: 01355 264150
www.instrument-repairs.com

Approved Signatory

[redacted]

☐ N. Anderson ☐ K. Low ☑ C. Moore ☐ A.Rae

Customer : H&V Commissioning Services Ltd
Kilknowe Offices, 16 Barrmill Road
Galston KA4 8HY

Date Received : 15 September 2015

Instrument -

System ID :	IRC02517	Job Number : R70680-3	
Description :	Digital Tachometer	Ref. Number : HV5-5	
Manufacturer :	Standard	Site :	
Model Number :	ST-6236B	Location :	
Serial Number :	06111857	Last Certificate Number : 192491	
Procedure Version :	688	Last Calibration Date : 09/05/2014	

Environmental Conditions

Temperature :	23°C +/- 2°C	Mains Voltage :	230V +/- 10V
Relative Humidity :	50% +/- 20%	Mains Frequency :	50Hz +/- 1Hz

Comments

The instrument stabilised in the laboratory for 4 hours prior to calibration.
Results at the time of test carry no long term stability of the instrument.
This certificate records the ON RECEIPT calibration status.
Recalibration period 52 weeks by customer request.

Traceability Information

Instrument description	*Serial number*	*Certificate number*	*Cal. Date*	*Cal. Period*
5500 Multifunction Calibrator	6305020	048278	05/11/2014	52

Calibrated By : C. Moore **Date of Calibration :** 22 September 2015

This is to certify that the above instrument was fully calibrated. Work carried out was in accordance with procedures laid down in BS EN ISO/IEC 17025:2005.
The accuracies of the standards used are traceable to National Standards, via UKAS approved laboratories.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%.

CERTIFICATE OF CALIBRATION

Certificate Number
206403

Test Title	Tolerance	Applied Value	Reading	Pass/Fail
RPM Measured				
	1.5RPM	1 000.0RPM	1 000RPM	Pass
	2RPM	2 000.0RPM	2 000RPM	Pass
	2.5RPM	3 000.0RPM	3 000RPM	Pass
	3RPM	4 000.0RPM	3 999RPM	Pass
	3.5RPM	5 000.0RPM	4 999RPM	Pass
	6RPM	10 000.0RPM	10 000RPM	Pass

End of results

Uncertainties

AC Voltage	0 to 1000V 0.01% +/- 1digit
Frequency	0.1ppm ± 1digit

OptiCal Sciences

CERTIFICATE OF CALIBRATION

CALIBRATION SUMMARY

UK01-26273

The instrument under test was calibrated against standards which are either traceable to National Standards or are derived by approved ratio techniques. Any number of factors may cause the instrument to drift out of calibration before the calibration interval has expired.

Prepared For:	H & V Commissioning Services Limited Kilknowe Office 16 Barrmill Road Galston Ayrshire, KA4 8HH
Service Report No.:	UK01- 26273
Make:	ATI
Model:	TDA-2G
Serial No.:	14086
Date of Calibration:	17-Mar-15
Calibration Due Date:	17-Mar-16
Calibration Procedure:	OSL-10015

The instrument complies with the specification at the measured points.

Comments:
None

Calibration Performed By: S. Wakefield

Date:

Signature: [redacted]

OptiCal Sciences

CERTIFICATE OF CALIBRATION

UK01-26273

STANDARDS TRACEABILITY

Statement of Traceability
The Instrument Standards used have been calibrated by an external laboratory, and are traceable to National Standards. The calibration below has been performed to meet the requirements of ISO-10012:2003. The photometer has been calibrated for use with ISO 14644-3

Instrument Standards				
Description	Manufacturer	Serial No.	Last Recal.	Cert. No.
Digital Voltmeter	Robin	910000537	13-Feb-15	351759
Airflow Meter	TSI	40450819003	20-May-14	N/A
Pico-Ampere Source	Keithley	80964	14-Oct-14	TERISO_633508
Reference Photometer	ATI	13487	19-Nov-14	25908
Aerosol Dilutor 1000:1	ATI	13940	4-Mar-15	26275

CALIBRATION TEST DATA

System Voltages			
Location	As Found	As Left	Tolerance
J9-1	5.09 V	5.09 V	+5.0 ± 0.1 V
J9-5	15.0 V	15.0 V	+15.0 ± 0.45V
J9-6	-15.03 V	-15.03 V	-15.0 ± 0.45V

Flow Rate Verification/Calibration			
Expected	As Found	As Left	Tolerance
28.3 LPM	29.1 LPM	28.3 LPM	28.3 ±2.8 LPM

Calibration Results				
Test	Expected	As Found	As Left	Tolerance
Straylight	<0.007	0.0019	0.0013	N/A
100% Setting	100 µg/L	90 µg/L	100 µg/L	±10%
Internal Reference Settings	DOP = (Total Finevestan A80B)			

Calibration Performed By: S. Wakefield

Date: 17-Mar-15

Signature: [redacted]

OptiCal Sciences

CERTIFICATE OF CALIBRATION

UK01-26273

Amplifier Linearity			
Photometer Reading	As Found	As Left	Tolerance
0.001%	0.80	0.80	$0.80 \pm 0.04 \times 10^{-10}$
0.01%	0.80	0.80	$0.80 \pm 0.04 \times 10^{-9}$
0.10%	0.80	0.80	$0.80 \pm 0.04 \times 10^{-8}$
1.0%	0.80	0.80	$0.80 \pm 0.04 \times 10^{-7}$
10%	0.76	0.76	$0.80 \pm 0.04 \times 10^{-6}$
100%	0.80	0.80	$0.80 \pm 0.04 \times 10^{-5}$

Comparison Results	
Reference Reading (µg/L)	U.U.T. Reading (µg/L)
100	100
10	10
1	1
0.1	0.1
0.01	0.01
0.001	0.001

Temperature & Humidity During Calibration	
Temperature	Humidity
24 °C	32 %RH

Condition of Calibration, As Found:			Condition, As Left:
☒ In Tolerance	☐ Out of Tolerance	☐ Inoperable	☒ In Tolerance

Maintenance Performed			
☒ Rework Scattering Chamber	☒ Align Optics	☐ Replace Absolute Filter	☒ Leak Test
☐ Replace Smoke Chamber	☒ Test Scanning Probe	☐ Replace Exhaust Filter	☐ Hours Hours Run
☐ Replace/Clean Tubing	☒ Test Electrical Connections	☐ Replace Gaskets	☐ X.XX Firmware Version
☐ Clean Valve	☒ Perform Voltage Measurements	☒ Tighten Loose Hardware	☒ Final Test

Calibration Performed By: S. Wakefield

Date: 17 Mar 15

Signature: [redacted]

DATE: 17-Mar-15

OptiCal Sciences

SERVICE REPORT

CUSTOMER H & V Commissioning Services Limited
ADDRESS Kilknowe Office
16 Barrmill Road
Galston
Ayrshire, KA4 8HH
CONTACT Angela Daly
PURCHASE ORDER NO 4787/IS/AC
OSL ORDER REF 23042

ENGINEER S.Wakefield
HOURS As Quote
TRAVELLING TIME N/A
OTHER EXPENSES N/A

WORK REQUIRED Repair and Recalibration
CALIBRATION CERT. ISSUED 26273
MODEL ATI TDA-2G
SERIAL NO 14086

☐ CONTRACT ☐ WARRANTY ☒ CUSTOMER A/C OTHER

Replaced Selector valve knob. Checked Power supplies and reset flow to 1.0 CFM

Stripped, cleaned and realigned optics.

Calibrated using Lab Standard Photometer, Picoamp Source and 1000:1 Diluter.

Reset internal reference to 100%. Checked response at various concentrations.

Checked Straylight, Op Amp null point, leak test, operation, and clean down.

PART NO.	QTY.	DESCRIPTION	ELECTRICAL SAFETY TEST RESULTS
10409	1	Selector valve knob	Visual:
			E. Continuity:
			Fuse Rating:
			Insulation:
			Run Test:
			Flash: N/A
FOR OFFICE USE ONLY:	T =	L =	Test No:

ENGINEER SIGNATURE [redacted]

SERVICE REPORT No 26273

OptiCal Sciences Limited
Envirotest House
Anglia Way, Moulton Park Industrial Estate, Northampton NN3 6JA
Telephone: 0844 334 0100 Fax: 0844 334 0101 Email: info@optical-sciences.co.uk
Visit our Website at www.optical-sciences.co.uk

ISO 9001

safecontractor APPROVED

SYSTEM HYGIENICS

SOUTHERN GENERAL HOSPITAL GLASGOW

POST CLEAN REPORT

7th September 2015

SYSTEM HYGIENICS
Chaucer Industrial Estate, Dittons Road, Polegate East Sussex, BN26 6JF
Tel: 01323 481170 Fax: 01323 483061

INDEX

INTRODUCTION

The ventilation ductwork systems have been thoroughly internally cleaned as detailed in this report.

All cleaning has been carried out to B&ES Guide to Good Practice TR19 (2nd Edition) cleanliness verification standards whereby no more than 0.3g dust / m² duct surface may be found using the 15 litre/min Preferred Vacuum Test Method.

We have taken photographs from various locations before and after our works have taken place to demonstrate the hygiene condition of ventilation ductwork systems.

[redacted]

Signed
Date 15th September 2015

Mr. Jeff Gardner
SALES ENGINEER

Email Address: [redacted]

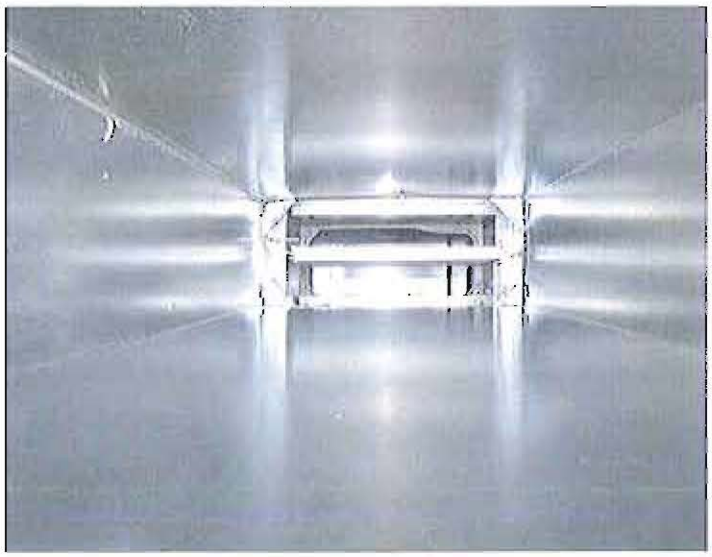
Mobile: [redacted]

PHOTO LOG		
Locations: Location	**Before Clean**	**After Clean**
Level 4 – Supply duct	1	2
Level 4 – Supply duct	3	4
Level 4 – Supply duct	5	6
Level 4 – Supply duct	7	8
Level 4 – Supply duct	9	10
Level 4 – Supply duct	11	12
Level 4 – Supply duct	13	14
AHU 63 – Fresh air intake	15	16
AHU 64 – Filter chamber	17	18
AHU 63 – Fan chamber	19	20

1. Level 4 – Supply duct – Before clean.

2. Level 4 – Supply duct – After clean.

3. Level 4 – Supply duct – Before clean.



4. Level 4 – Supply duct – After clean.

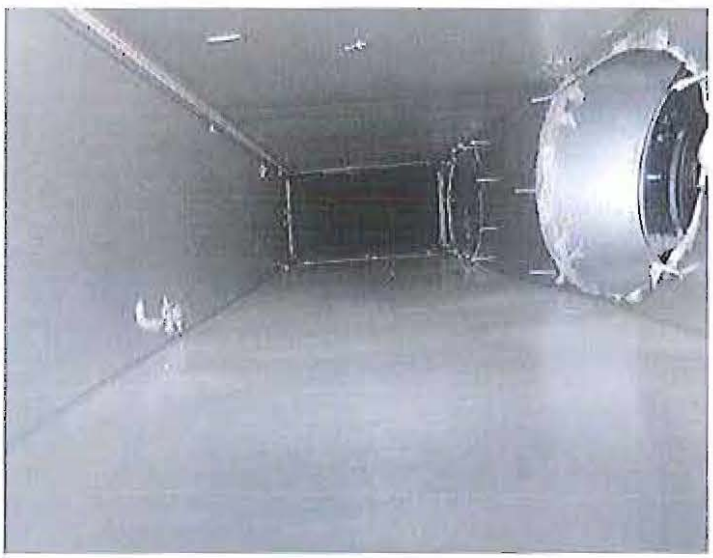
5. Level 4 – Supply duct – Before clean.

6. Level 4 – Supply duct – After clean.

7. Level 4 – Supply duct – Before clean.

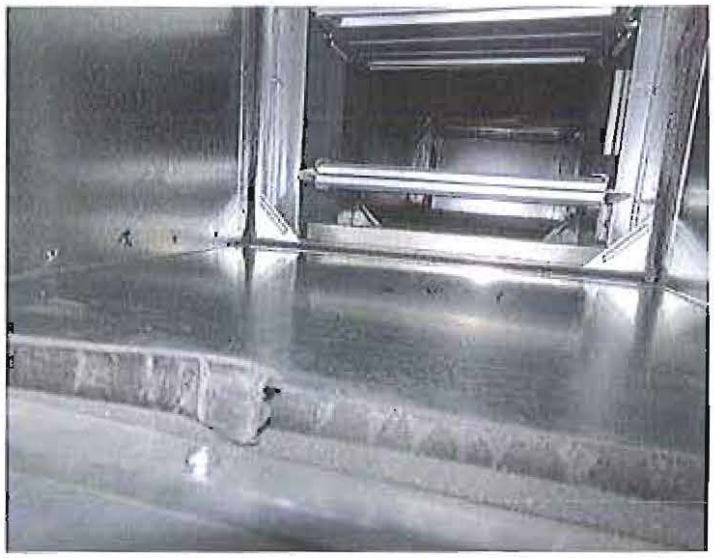
8. Level 4 – Supply duct – After clean.

9. Level 4 – Supply duct – Before Clean.



10. Level 4 – Supply duct – After Clean.

11. Level 4 – Supply duct – Before Clean.



12. Level 4 – Supply duct – After Clean.

13. Level 4 – Supply duct – Before Clean.

14. Level 4 – Supply duct – After Clean.

15. AHU 63 – Fresh air intake – Before Clean.

16. AHU 63 – Fresh air intake – After Clean.

17. AHU 63 – Filter chamber – Before Clean.

18. AHU 63 – Filter chamber – After Clean.

19. AHU 63 – Fan chamber – Before Clean.

20. AHU 63 – Fan chamber – After Clean.

SYS/15/133
Issue no.1

University of Hertfordshire
Hatfield Herts
AL10 9AB

Biodet
Laboratory
Email [redacted]

System Hygienics Ltd
Chaucer Industrial Estate
Dittons Road, Polegate
East Sussex BN26 6JF

Ref: SYS/15/133
Date: 21st September 2015
Log No. 1761

CERTIFICATE OF ANALYSIS

Job No.:
Operator: M. Hickenbottom
Date Sampled: 09-Sep-2015
Date Received: 16-Sep-2015

Filters were weighed to determine the amount of particulate contamination.

Results:

Sample N°	Location	Filter Difference (mg)
1	4th floor Supply Duct	0.0
2	4th floor Supply Duct	0.0
3	4th floor Supply Duct	0.0
4	4th floor Supply Duct	0.1
5	4th floor Supply Duct	0.2
6	4th floor Supply Duct	0.0

[redacted]

I.MOSS 21st September 2015
TECHNICAL MANAGER

CERTIFICATE OF CLEANLINESS

We hereby certify that the Extract & Supply Systems (referred to in the photo log) serving:-

Southern General Hospital
75 Hardgate Road
Glasgow

have been cleaned and completed on 07 September 2015 In accordance with B&ES Guide to Good Practice TR/19 (2nd Edition) standard, whereby no more than 0.3g dust per 1m² internal surfaces did remain. Please refer to legislation set out overleaf and attached laboratory analysis results reference SYS/15/133 dated 21 September 2015

System examined by our representative Mr Mark Hickenbottom.

presented by

SYSTEM HYGIENICS LIMITED
Chaucer Industrial Estate
Dittons Road, Polegate
East Sussex BN26 6JF

Signed [redacted]

24 September 2015

Date

STD78

A49756324

EXCERPTS FROM WORKPLACE (HEALTH, SAFETY AND WELFARE) REGULATIONS 1992

MAINTENANCE OF WORKPLACE, AND OF EQUIPMENT, DEVICES AND SYSTEMS
Regulation 5

(1) The workplace and the equipment, devices and systems to which this regulation applies shall be maintained (including cleaned as appropriate) in an efficient state, in efficient working order and in good repair.

(2) Where appropriate, the equipment, devices and systems to which this regulation applies shall be subject to a suitable system of maintenance.

(3) The equipment, devices and systems to which this regulation applies are:-

(a) Equipment and devices a fault in which is liable to result in a failure to comply with any of these Regulations; and

(b) Mechanical ventilation systems provided pursuant to regulation 6 (whether or not they include equipment or devices within sub-paragraph (a) of this paragraph).

Approved Code of Practice (Regulation 5)

20. The workplace, and the equipment and devices mentioned in these Regulations, should be maintained in an efficient state, in efficient working order and in good repair. 'Efficient' in this context means efficient from the view of health, safety and welfare (not productivity or economy). If a potentially dangerous defect is discovered, the defect should be rectified immediately or steps should be taken to protect anyone who might be put at risk, for example by preventing access until the work can be carried out or the equipment replaced. Where the defect does not pose a danger but makes the equipment unsuitable for use, for example a sanitary convenience with a defective flushing mechanism, it may be taken out of service until it is repaired or replaced, but if this would result in the number of facilities being less than that required by the Regulations, the defect should be rectified without delay.

21. Steps should be taken to ensure that repair and maintenance work is carried out properly.

22. Regulation 5(2) requires a system of maintenance where appropriate, for certain equipment and devices and for ventilation systems. A suitable system of maintenance involves ensuring that:

(a) regular maintenance (including, as necessary, inspections, testing, adjustment, lubrication and cleaning) is carried out at suitable intervals;

(b) any potentially dangerous defects are remedied, and that access to defective equipment is prevented in the meantime;

(c) regular maintenance and remedial work is carried out properly; and

(d) a suitable record is kept to ensure that the system is properly implemented and to assist in validating maintenance programmes.

VENTILATION
Regulation 6

(1) Effective and suitable provision shall be made to ensure that every enclosed workplace is ventilated by a sufficient quantity of fresh or purified air.

(2) Any plant used for the purpose of complying with paragraph (1) shall include an effective device to give visible or audible warning of any failure of the plant where necessary for reasons of health or safety.

(3) This Regulation shall not apply to any enclosed workplace or part of a workplace which is subject to the provision of:-

(a) section 30 of the Factories Act 1961;

(b) regulations 49 to 52 of the Shipbuilding and Ship-Repairing Regulations 1960;

(c) regulation 21 of the Construction (General Provisions) Regulations 1961;

(d) regulation 18 of the Docks Regulations 1988.

Approved Code of Practice (Regulation 6)

32. In the case of mechanical ventilation systems which recirculate air, including air -conditioning systems, recirculated air should be adequately filtered to remove impurities. To avoid air becoming unhealthy, purified air should have some fresh air added to it before being recirculated. Systems should therefore be designed with fresh air inlets which should be kept open.

33. Mechanical ventilation systems (including air-conditioning systems) should be regularly and properly cleaned, tested and maintained to ensure that they are kept clean and free from anything which may contaminate the air.

34. The requirement of regulation 6(2) for a device to give warning of breakdown applies only 'where necessary for reasons of health or safety'. It will not apply in most workplaces. It will, however, apply to 'dilution ventilation' systems used to reduce concentration of dust or fumes in the atmosphere, and to any other situation where a breakdown in the ventilation system would be likely to result in harm to workers.

35. Regulation 6 covers general workplace ventilation, not local exhaust ventilation for controlling employees' exposure to asbestos, lead, ionising radiations or other substances hazardous to health. There are other health and safety regulations and approved codes of practice on the control of such substances.

EXCERPTS FROM HVCA GUIDE TO GOOD PRACTICE TR19 'Cleanliness of Ventilation Systems'

Section 9 - Verification of Cleanliness

9.1 The primary method of assessment is visual. For cleaned system verification the surface should be visibly clean and capable of meeting the level of cleanliness specified.

9.2 Verification where specified on general ventilation systems, should be by means of a vacuum test (VT), as described in Appendix D, based on the recommendations of the US National Air Duct Cleaners Association (NADCA) ACR 2005. A system will be considered acceptably cleaned if, following a VT, a result of not more than 0.75g/m² is achieved. This is equivalent to 0.75mg/100cm² as per ACR 2005.

9.3 It should be noted that verification should take place immediately after cleaning to avoid any possibility of post-clean interference. The client should be given the opportunity to witness testing of ductwork surfaces.

Section 5.2
A testing procedure is defined in this guide which may be used to establish whether or not it would be appropriate to clean a mechanical ventilation system. This provides one reasonable practicable way of satisfying the Regulation and ACOPs relevant to the cleanliness of ventilation systems.

Section 5.5
The owner or operator should select the type(s) of test(s) and frequency to be included within their testing regime to suit the particular requirements of the building served by the ventilation system. The regime should be reviewed regularly (eg. annually), to take into account any changes in the building use, legislation and/or health and safety guidance.

Section A8
The specification should include a definition of the method of verifying the effectiveness of the treatment including the number and type of microbiological samples to be taken and their analysis eg. in-house or third-party laboratory.

System Hygienics Ltd recommends that the system mentioned in our Certificate of Cleanliness is cleaned on at least an annual basis in accordance with the above Loss Prevention Council recommendations.

A specific Risk Assessment, taking account of the likely rate of grease accumulation and other factors, should be carried out to establish the required inspection and cleaning frequency.

Schneider Electric

Commissioning Site Report

Project Title:	New South Glasgow Hospital
Project No:	N1.00566
Client:	MEL
Location:	Ward 4B
Panel Ref:	N/A
Snag List Ref:	1
System Name:	StruxureWare
Engineer:	Gary Palmieri
Date:	06/10/2015

WORK CARRIED OUT

The 24 rooms, numbered 76 to 99, each have a CMR V-Sensors installed in the ceiling outside the room with a wall mounted pressure display in the corridor. There is also a HMI (Touchscreen) display at the Nurse Station.

Each of the 24 no. sensors and displays had their wiring checked. They were then powered up and then the pressure readings checked to the corridor displays and the HMI at the Nurse Station. All units were confirmed as operating and reading correctly.

The operation of the Pressure Alarms, on each room, were checked and the Alarms confirmed at the corridor displays and the HMI at the Nurse Station. Each Alarm was acknowledged/silenced from the corridor display or the HMI.

The pressure readings displayed were confirmed by the H&V Engineers on site during the commissioning.

Signature: [redacted]

Functional Design Specification

New South Glasgow Hospital – Adult & Childrens

Ward 4B Nurse Station Pressure Monitoring

(See Appendix for Associated Systems)

Control Panel Type:	Ward 4B Nurse Station Pressure Monitoring Panel
Document No:	ME-XX-04-DC-S660-134
Document Revision:	R01
Revision Date:	13/10/2015

Associated Plant Ref:	**Associated Plant Description:**
31AHU63	AHU Type 41 Functional Design Specification

For Commissioning Use Only:	
Plantroom Zones	
Commissioning Date:	
Engineers Name:	
Engineers Signature:	

Revision History

Revision	Date	Author	Checked by	Comments
R01	13/10/2015	CR		Record

CMR AIR MANAGEMENT

ISSUE No: R01

DATE: 13th October 2015

PROJECT: Ward 4b Hospital Ward Pressure Monitoring

Prepared for: Schneider Electric

AIRFLOW AND PRESSURE CONTROLS

INDEX

Prepared by: Justin Congrave

Mobile: [redacted]

E-mail: jcongrave[redacted]

System Description

The area consists of 24No. Rooms which require pressure monitoring.

A V-Sensor Air Pressure Monitor will be mounted in the ceiling local to each room. A Blue PVC Tube will be connected to an Air Probe Plate on the ceiling/wall of the reference area, and a Red PVC Tube will be connected to an Air Probe Plate on the ceiling/wall of the room. A local DIS-125 Alarm Display Plate will be mounted on the wall to provide a pressure readout and audible / visual alarm, and be connected to the V-Sensor using Lapp DeviceNET Thin Cable. The V-Sensor will be wired to a Modbus Tap (Power / Communication Junction Box) using the same Lapp DeviceNET Thin Cable. The 24No. Modbus Taps will be connected together using DeviceNET Thick Cable, which will be taken back to the Nurse Station Panel.

The Nurse Station Panel will be a Stainless Steel surface mount box housing a 230Vac - 24Vdc power supply, which will feed the V-Sensors and a 7" Colour HMI. The Modbus RTU from the V-Sensors shall be read in and provide a display of the measured Room Pressures. Each differential pressure value will be displayed in Pa (Pascals) and sit within a Box which shall be Green when Healthy, changing to Flashing Red if in Alarm. When in Alarm the HMI will have a common Audible Alarm Sounder which may be silenced by pressing the Mute Button on the touch screen. When muted the Red Box will cease flashing and become static, before returning to static Green when the fault is rectified. This functionality essentially replicates that of the V-Sensor / DIS-125 Alarm Display Plate, so that any alarm can be acknowledged locally or at the Nurse Station.

The V-Sensor has integral adjustments to allow the setting of both high and low pressure alarms, along with delay timers to prevent nuisance alarms when the areas are being accessed during normal activities.

The proposed system is an instantaneous display only, and does not offer any data retention.

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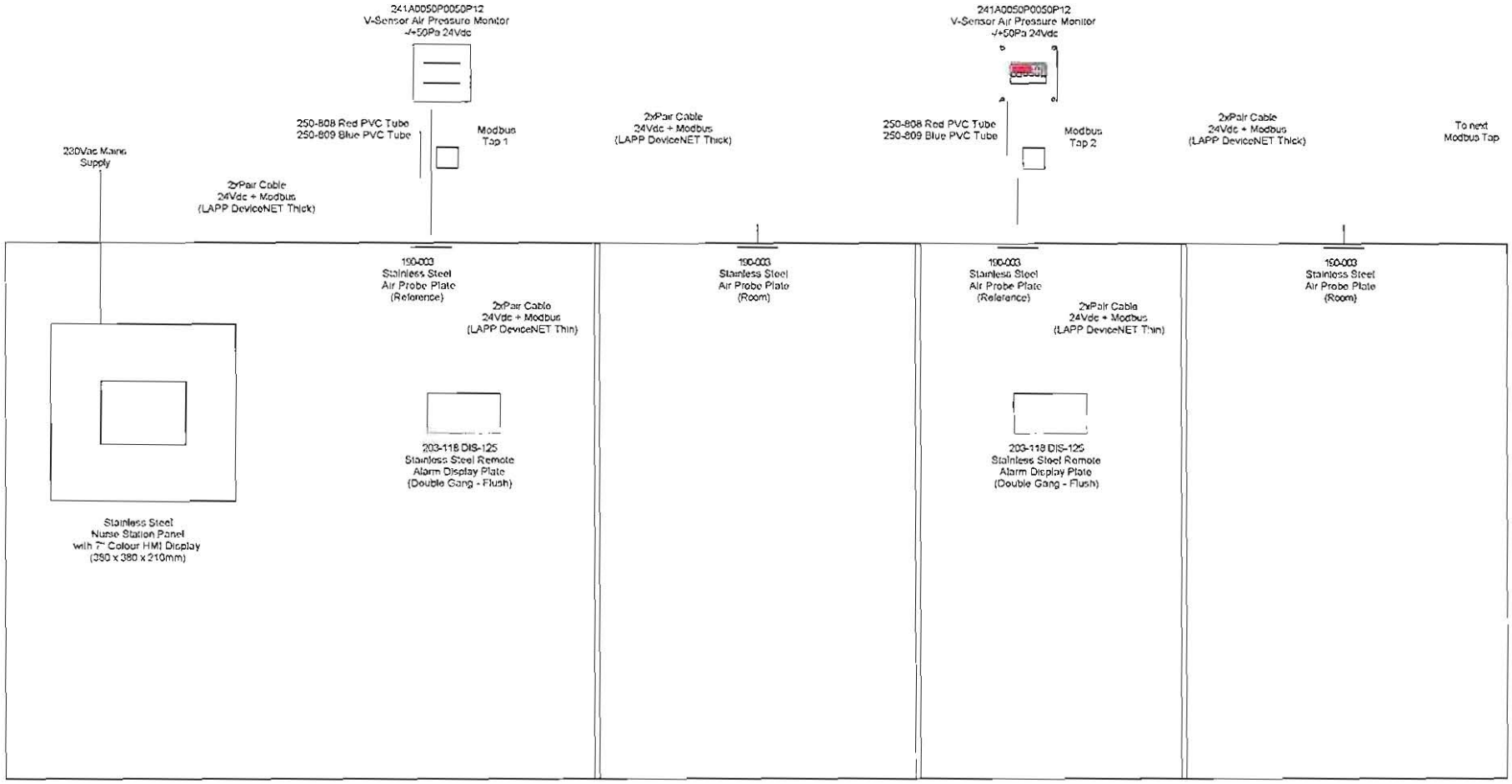
HOSPITAL PRESSURE MONITORING SCHEMATIC



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Functional Design Specification

New South Glasgow Hospital – Adult & Childrens

Ward 4B Nurse Station Pressure Monitoring Instructions

(See Appendix for Associated Systems)

Control Panel Type:	Ward 4B Nurse Station Pressure Monitoring
Document No:	ME-XX-04-DC-S660-135
Document Revision:	R01
Revision Date:	14/10/2015

Associated Plant Ref:	**Associated Plant Description:**
31AHU63	AHU Type 41 Functional Design Specification

For Commissioning Use Only:	
Plantroom Zones	
Commissioning Date:	
Engineers Name:	
Engineers Signature:	

Revision History

Revision	Date	Author	Checked by	Comments
R01	14/10/2015	CR		Record

QEUH Ward 4b Room Pressure Monitoring Panel Operating Instructions

NORMAL OPERATION

The main screen on the HMI shows 24 boxes which display the pressures for each room. If the condition of the room is healthy, the border of the box will be green.

If a room goes into alarm, the border for the pressure display for that room will flash red and the HMI alarm will sound. The alarm can be muted by pressing the box which is flashing. The border will then stop flashing and will show steady red until the room comes out of alarm. Pressing the button in the lower left corner of the screen will mute all alarms. The alarm sounder in the display plate outside the room will be muted when the alarm is muted from the panel.

The main screen is the only screen used for normal operation. It is possible to swipe the display left or right to show other screens but these will be locked unless a higher level user is logged in. If a user swipes to a different screen then they will need to swipe back to the normal screen.

ADVANCED OPERATION

Normally there is no user logged in and muting of alarms is the only function available. To access higher level functions, an Engineer or Administrator will need to be logged in. In practice it is unlikely that access to higher level functions will ever be needed.

Users

Engineers can mute alarms, change alarm settings and exit or restart the application. An Engineer [redacted] with a password [redacted] was configured at the factory.

Administrators can, in addition, create other users. An Administrator [redacted] with a password [redacted] was configured at the factory.

To login, press the Login button and then enter the password. The username is not entered and is determined from the password. If the login was successful, the name of the user will be displayed briefly. Automatic logout will occur after a few minutes.

Alarm Settings

The alarm thresholds and timer may be changed by an Engineer or Administrator. These settings are stored in the sensors but can be modified using the HMI. On the main screen, touching a pressure box to the left or right of its central point will open a window showing the alarm thresholds in Pa and the alarm time in seconds. The settings can be changed on this screen. It is recommended to close the alarm settings screen then open it again to make sure the sensor has been updated with the changes.

Restarting the HMI

The HMI can be restarted by pressing the CMR logo. Open and close Control Panel and then press the Launch Application button.

User Administration

Administrators can create, modify and delete users by pressing the Admin button. This opens the Administration screen. Operation is self explanatory. **It is important not to delete the only administrator.** If there are no administrators left then it will be impossible to do any further user administration.

Rev No	...sion Note	Date	Signature	Checked

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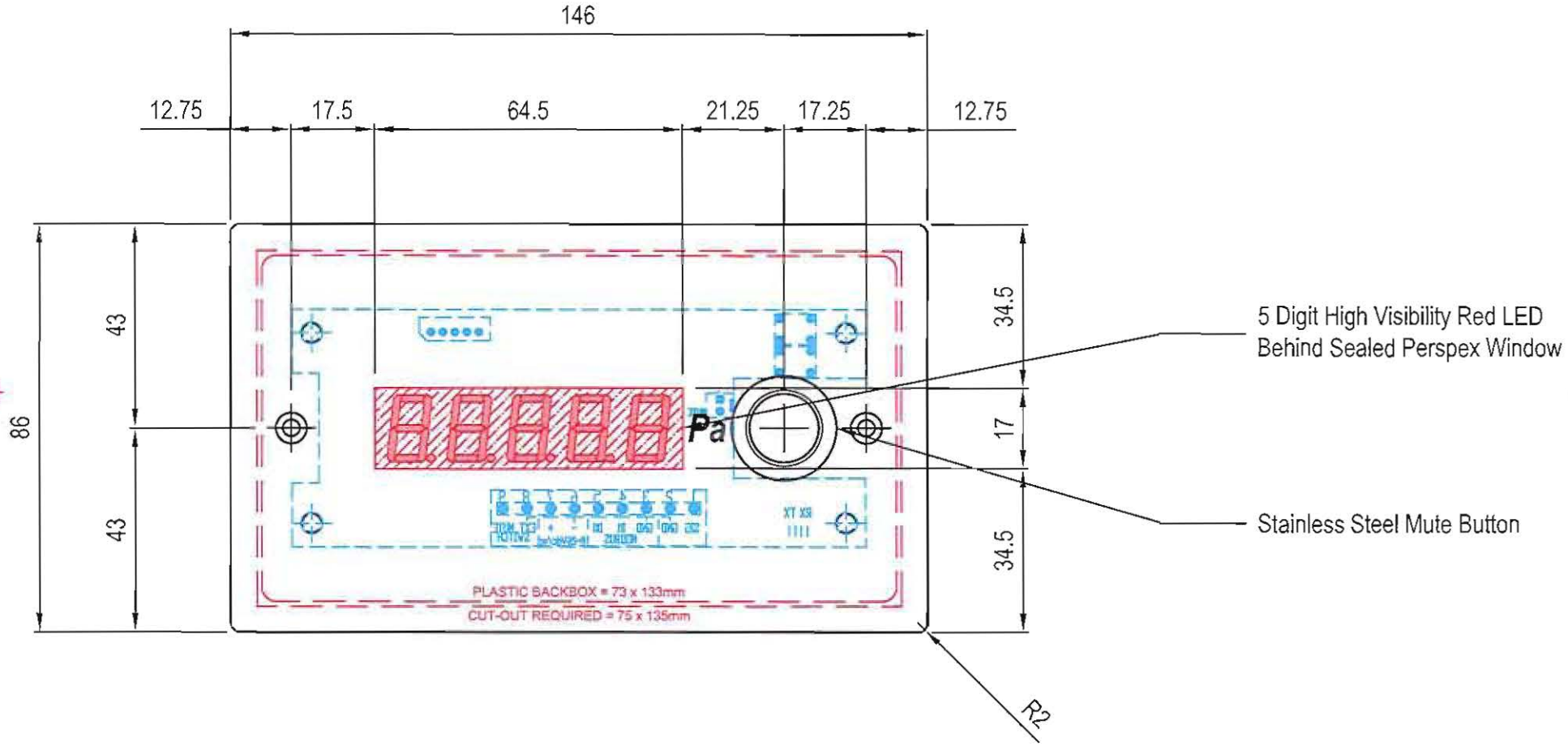
IF IN DOUBT - ASK



ORG TITLE:			PROJECT:	MATERIAL:			FINISH:			DIMENSIONS:
Remote Digital LED Alarm Indicator			DIGITAL SENSORS	2.0mm THK 316L STAINLESS STEEL			STAIN BRUSHED - 320G OPTISHEEN			mm
DRG No:	REV:	PART No:	ORIGINAL REF:	SCALE:	SHEET:	SIZE:	Designed by:	Checked by:	Drawn by:	Date:
M-359_1	A	203-045	203-040 / 203-116	NTS	1 of 1	A4	J.C.	-	J.C.	20/12/06

V-SENSOR AIR PRESSURE AIR VOLUME

- Ultra low pressure and volume measurement
- Traceable Calibration Certificate Is Included
- High accuracy and repeatability
- Linear pressure or air volume output
- Both measurement and PID control output
- Two modbus for monitoring and remote display
- One alarm relay, buzzer and LED Indicators
- Auto Zero and overload protection is standard
- Operator keyboard display for all functions
- Two Modbus rtu, 0..10V and 4..20mA outputs
- IP65 enclosure with easy mount wall bracket
- 24 month warranty
- 30 Years field application experience

V-SENSOR Wall Mount with Keyboard and LED display

GENERAL

The V-Sensor is a wall mount ultra low pressure transmitter which provides 0..10V and 4..20mA as well as Modbus communication over the selected range . The display can be adjusted via the keyboard to show the measured value in Pa, hPa, kPa, m/s, l/s, m3/s, m3/h and ACR (air change rate).

A PID control output can be selected, but still having one output for monitoring the pressure or volume.

The pressure ranges can be adjusted via the keyboard, but the base range is factory calibrated and certified i.e. 10, 25, 50, 100, 250 and going up to 7500 Pa. All ranges can be adjusted to +/- ie. -/+25Pa.

Power supply 24Vdc/ac non-Isolated or 24,110 and 230Vac Isolated are available as standard.

CMR TRANSDUCER

The transducer is manufactured by CMR with high precision engineered components. The principle is the measurement of the displacement of the diaphragm by means of a push and pull variable reluctance circuit which is not effected by humidity and hence it can be used in any industrial or commercial environment. There are no mechanical connections to any of the sensing coils and the diaphragm.

CMR Transducer

Extremely low pressures can be measured with excellent repeatability and minimal hysteresis. The diaphragm displacement is so small that no air volume is required to measure the air pressure which means measurement tubing can be connected in excess of 200m throughout the building without losing accuracy or measurement speed.

The zero drift is minimized by the measuring copper coils which are matched to provide excellent self compensation. One coil measures positive and the other negative drift and therefore balances any excessive drift between two tolerance limits in its life cycle. The CMR Transducer has a proven field track record of over 30 years. All CMR Sensors are temperature compensated in a computerised climate chamber.

CMR Climate Chamber

KEYBOARD DISPLAY

A combined keyboard and LED Display is fitted into the lid and is connected to the V-Sensor board with a plug-in ribbon cable. All parameters can be accessed via the key pad. The display can also be programmed to switch off after a time and by touching a key to light up again. Normally it is always on.

PARAMETER CONFIGURATION

The duct width and height can be entered as well as the density and (mf) magnification (K) factors to scale Fan Inlet Rings, Flowgrids, Veloprobes, Oval Flowprobes, Venturis or any other velocity pressure producing probes. The volume can be linearized over 8 points to provide extremely high accuracy in measurement.

The range can be changed from -10 Pa to 30 Pa or -20 to 120 Pa. The output signals can be changed to i.e. 2..10V, 1..5V or 5..19mA. The V-Sensor has a configurable Volt Free alarm output relay.

The auto zero function is built in, which is of great advantage at very low velocity pressure measurement i.e. 0.3 Pa to have an accurate base point at all times. The auto zero can be turned off where it is not required.

The overload protection can be switched on and is ideal to protect the low pressure diaphragm. It is active whenever the sensor is powered up.

One of the outputs can be configured to be a PID control to drive fan inverters or modulating dampers and the other can be used for the actual pressure or air volume measurement for the BMS or PLC system. The set point can be sent from the BMS via modbus.

The signals can be individually smoothed. The control output can be fast but the measurement output can be dampened.

A calibration mode can be selected so that all of the parameters remain the same as commissioned and only the base sensor shall be calibrated and displayed in Pa.

MODBUS rtu COMMUNICATION

The modbus communication can be used to read and write all parameters by the remote Host which can be the BMS , PLC or PC.

REMOTE ALARM DISPLAY

A remote display DIS110 without alarm or DIS125 with alarm and mute button can be connected via Modbus if the modbus is not used for the BMS. The alarm button has green and red Led light rings to show healthy or alarm status. A buzzer is also fitted. A separate power supply can be wired to the display.

Remote Display Plate

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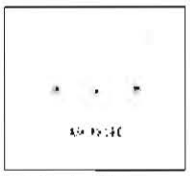
V-SENSOR PRESSURE APPLICATIONS

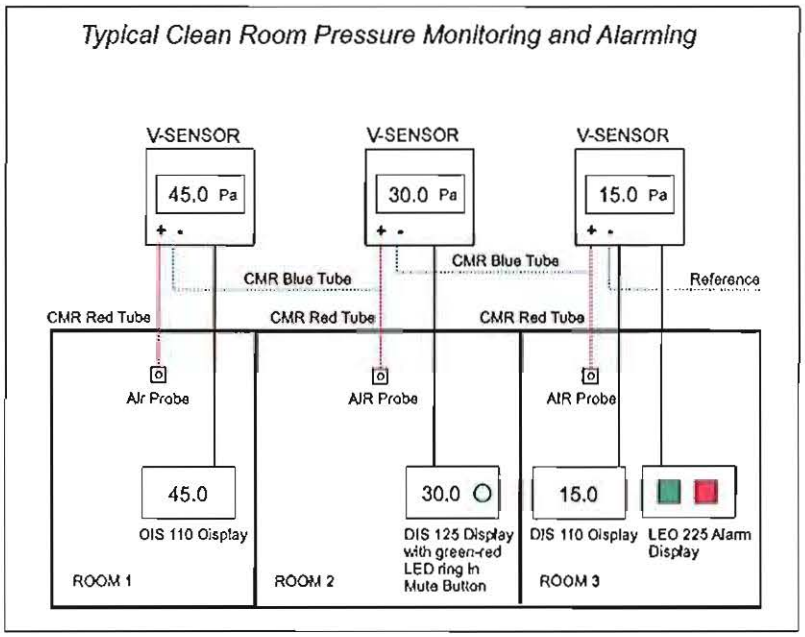
ROOM PRESSURE MEASUREMENT WITH CMR V-SENSORS

Tubes + Fittings

Ceiling Air Probe

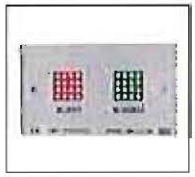


Air Probe Plate



DIS 110 Display

DIS 125 Display



LED 225 Display

The above schematic shows a typical clean room. The room pressures are measured in cascades starting in Room 3 from e reference such as a plant room or eny other stable location, then measuring ecross to room 2 end finally across to Room 1.

Eech room has an air probe plate fitted to the ceiling. The air probes are connected to the V-Sensors with red end blue CMR PVC Tubing.

The CMR PVC tubing can be run up to 200m from the room to the P-Sensor without losing accuracy of the measurement.

Remote LED display plates are fitted for the operators to see the actual room pressure in Room 1 and 2. Room 2 has elso a local illuminated alarm green and red led built as ring into the mute button end a buzzer. Room 3 has only a modbus alarm led indicator plate.

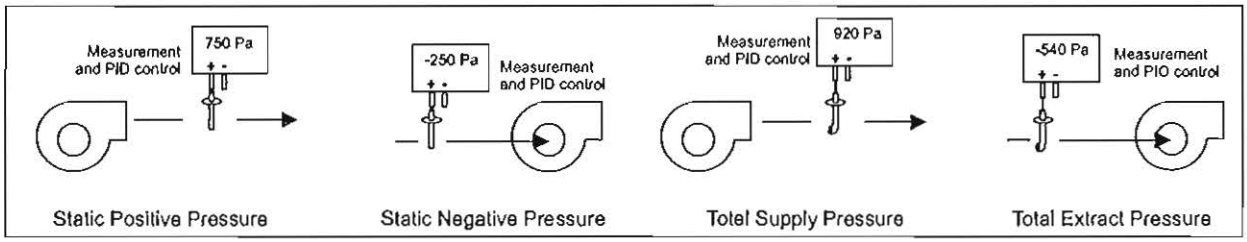
The V-Sensor is a true Low Differential Air Pressure Transmitter and can be used for static pressure, vacuum pressure end differential pressure measurements in positive or negative areas.

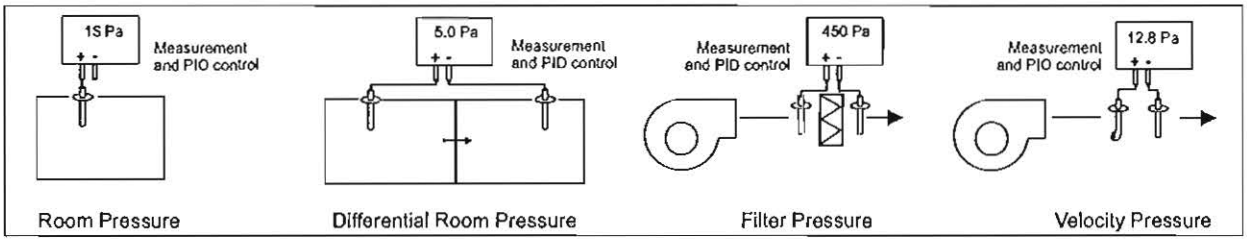
The operator keyboard with LED display is fitted into the lid as standard and shall display the actual pressure. All parameters can be adjusted without opening the lid.

The Pressure measurement can be transmitted via modbus rtu or analogue signals 0..10V or 4..20mA to the SCADA, BMS or Industrial PLC systems for long term monitoring.

All future calibretion can be done using the calibration mode. Celibration Certificates traceable to National and International Standards (UKAS) are supplied as standard with ell V- Sensors.

TYPICAL PRESSURE APPLICATIONS





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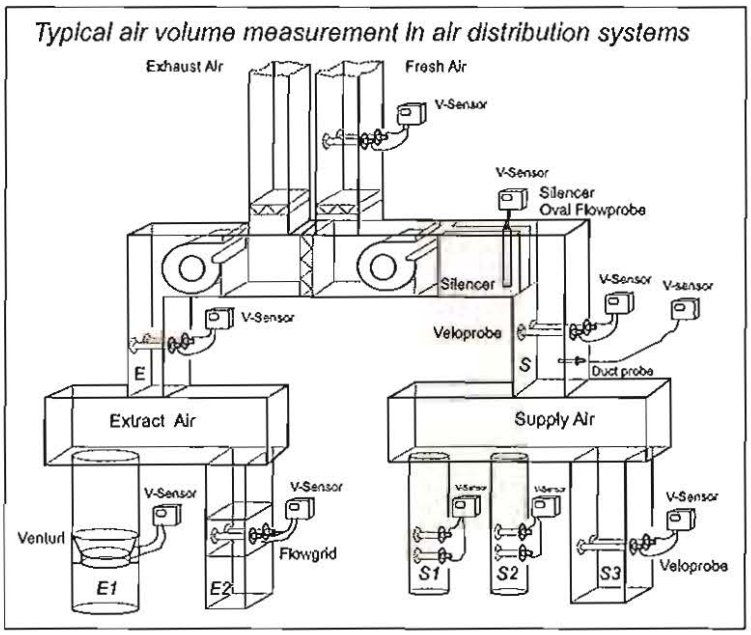
V-SENSOR AIR VOLUME APPLICATIONS

VELOCITY PRESSURE AND AIR VOLUME MEASUREMENT WITH CMR V-SENSORS

FGG Flowgrid

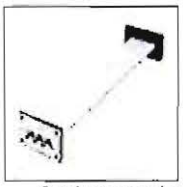
VVM Venturi

PVC Tube Fittings



CMR Veloprobes

Duct Probes



Oval Flowprobe

The CMR V-Sensor is an ultra low high precision Velocity Pressure Transmitter which has been designed to accurately measure air volumes in Ventilation Ducts . The built in Square Root Extraction and Magnification Factor Scaling makes the V-Sensor an extremely versatile measurement instrument.

It can display the actual volume in m3/s. Other Units such as m3/h, litres/s or ACR (Air change rate) can be selected via the keyboard. Any Imperial measurement units i.e. CFM are available on request .

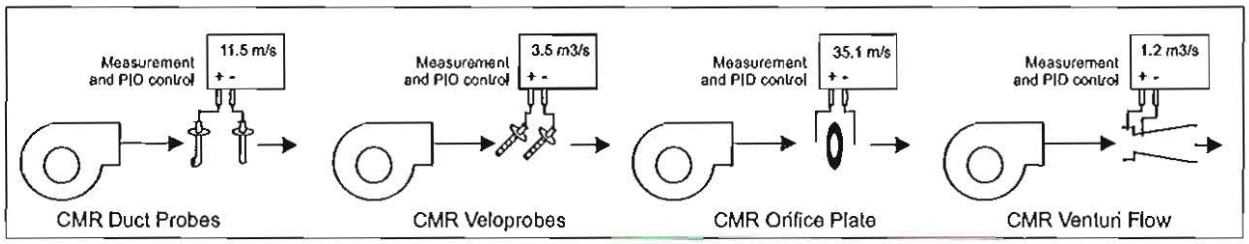
The CMR PVC tubing can be run up to 200m from the sensing station to the V-Sensor without losing the accuracy of the measurement.

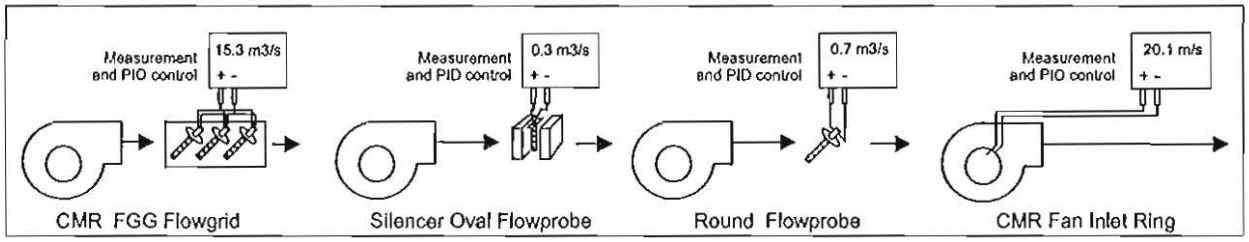
The V-Sensor is used for monitoring and also controlling Volume Flow in Commercial or Process Applications and is designed to be connected to any CMR Veloprobes, Duct Probes, Flowgrids, Venturis and Fan Inlet Rings. It can also be used with any existing or custom made duct Flow Measurement Device.

The measured values can be transmitted to remote display plates, SCADA, BMS control systems or Industrial PLCs through the output signals of 0..10V, 4...20mA, modbus 1 and 2.

Calibration Certificates traceable to National and International Standards (UKAS) are supplied with all V-Sensors.

TYPICAL CMR AIR VOLUME MEASUREMENT APPLICATIONS





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V-SENSOR VELOPROBE MEASUREMENT

GENERAL
The drawing shows a typical application for CMR Veloprobes and V-Sensors.

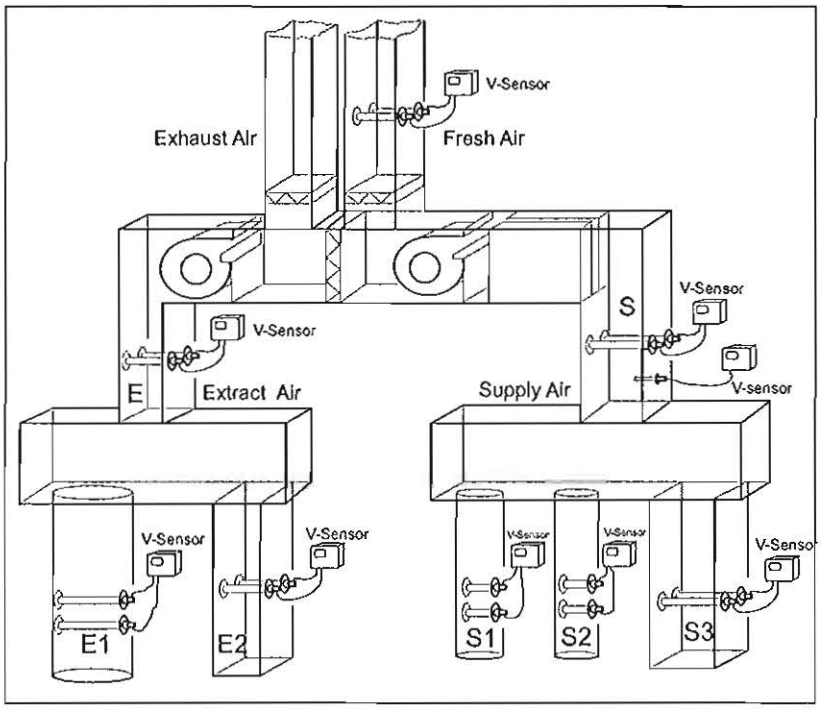
The supply air duct can either be fitted with one central Veloprobe or individual Veloprobes on each of its branches.

In many cases, the positions of the Veloprobes are very much dictated by the design of the building. The CMR Veloprobe can be fitted in almost any position in order to provide accurate measurements.

In a single supply and extract duct application, the V-Sensor measures the building's actual total supply and return volumes. As both V-Sensors are calibrated to provide a linear air volume signal, tracking of supply and extract air is now made easy.

The duct height, width or diameter, density and magnification ('K' factors) can be entered in the V-Sensor via the keyboard very easily and only the measurement range for 0..10V or 4..20mA must be given to the BMS at final commissioning.

For multiple duct applications, the total supply and extract air volume is derived by adding all air volumes from the individual ducts.



Example of Volume adding: S = E ± an offset for positive or negative building pressure
S1 + S2 + S3 = E1 + E2 ± offset or S = E1 + E2 ± offset - etc

V -Sensor - scaling in m/s only.

Adjust the Impact Veloprobe (red) to face the Airflow and end adjust the Static Veloprobe (blue) to approx. 180° away from the airflow.

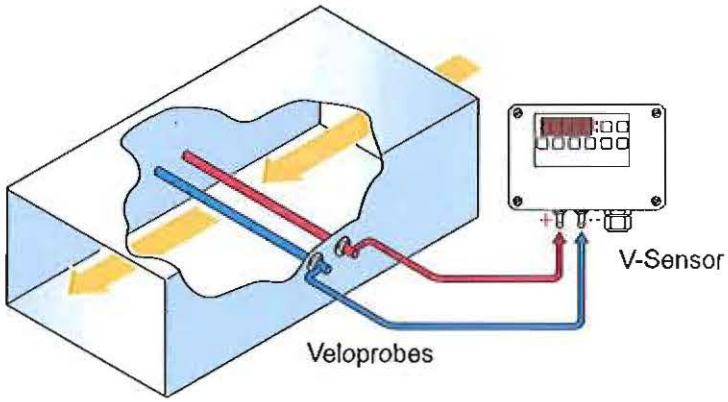
Scaling of the duct height and width is done in the BMS
Use the keyboard and adjust the display to m/s. Adjust the height and width to 1 and adjust the (mf) to 2.000. Press the very left hand key briefly and the sensor range is displayed for a short time, which is the renge at 10V in m/s. If the range of tha sensor is 100Pa then it should display 9.128 m/s.
Take a Pitot Tube reading in the duct and if the velocity is not equal to the display then adjust the magnification factor until it is equal then press the range key again to get the new range in m/s.

V-Sensor - scaling in m3/s - m3/h - l/s - ACR air change rate

Adjust the Impact Veloprobe (red) to faca the Airflow and and adjust the Static Veloprobe (blue) to approx. 180° away from the airflow.

Scaling the range for the BMS
Use the keyboard end anter the duct height and width or simply enter the width of a round duct and keep the height at 0. Adjust the magnification factor (mf) to 2.000. Use the display key and select m3/s, m3/h, l/s or ACR (Air Change Rete) and adjust the decimal places. When pressing the left hand key the sensor range shall be displayed in the selected units at 10V. Take a Pitot Tube reading in the duct and if the volume is not equal to the display then adjust the magnification factor until it is equal then press the range key again to get the new range.

V-Sensor air volume measurement with Veloprobes in Duct



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V-SENSOR KEYBOARD FUNCTIONS

FUNCTIONS (Use Operator Manual for full Instructions)

The V-Sensor LED-Keyboard has been designed to simplify installation and commissioning. The only time the lid must be opened is for wiring during installation. Thereafter every control function can be accessed via the keyboard, even the calibration can be carried out utilising this functionality.

ZERO KEY

When pressing the zero key for 1 seconds, the V-Sensor shall perform a zero which means the pressure is taken off the sensor internally and the diaphragm is relaxed to zero.

PASSWORD

The keyboard can be password protected so that only the display can be operated, but no adjustments can be made.

RANGE KEY

Pressing the range key very quickly once will display the sensor range i.e. if it shows 100, this means the range of the sensor has been configured to 0-100Pa for 10V/20mA output. By pressing the range key for 1 seconds it enters the configuration menu:

S	Software Version	1.5
Ad	Network Address	1-254 (0 Denotes Modbus Display)
AZ	Auto Zero	on - off
P	Positive Range	i.e. + 25
n	Negative Range	i.e. - 25
Opp	Over Pressure	1(on) 0(off)
F	Zero Offset	
t	Set Point	
Sn	Modbus smoothing	d or o
Adj	Internal / External	I or E
Azt	Auto Zero time interval	1-99 h
FF	Modbus float format	0-3

OUTPUT KEY

Pressing the output key very quickly once will display the sensor output configuration i.e. lin or root, which means the sensor measures pressure or airflow. By pressing the output key for 1 seconds the configuration menu can be reached:

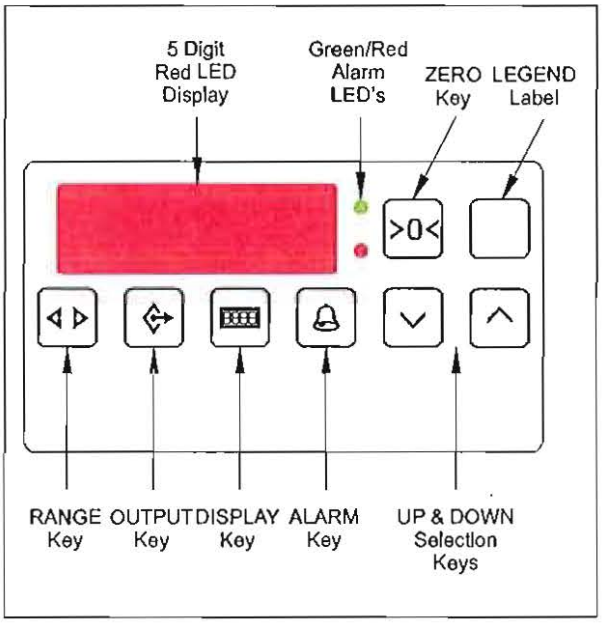
So	Output Smoothing	0-99
Lin	Output mode	linear pressure
root	Output mode	square root
e	Output scaling	F, L or Fac
F	Mag Factor	0-99.99
_	Duct width	0-9999mm
I	Duct height	0-9999mm
d	Air Density Factor	0-9.99kg/m3
r	Room Size	0-9999m3
s	Small Value Shut off	0-99.99%
o	Output Re-Scaling	
bFl	Bi-Directional Flow	0 or 1

DISPLAY KEY

Pressing the display key very quickly once will display the measurement units. i.e. Pa, hPa, kPa etc, and is the units the sensor has been configured to i.e. Pa. By pressing the display key for 1 seconds it enters the configuration menu:

Sd	Display Smoothing	0-99
Pa	Pascals	
hpa	hecta Pascals	
3pa	kPa	
nnps	metres per second	
lps	litres per second	
nn3s	cubic metres per second	
nn3h	cubic metres per hour	
acr	Air Change Rate per hour	
dp	Decimal Place	0-4
pos	Display polarity (+)	
neg	Display polarity (-)	
Led	Display Activation	1 or t
L2b	Leading Zero Blanking	1-4

V-SENSOR STANDARD LED KEYBOARD



ALARM KEY

Pressing the alarm key quickly shall mute the alarm as the V-Sensor has an alarm buzzer built in.

By pressing the alarm key for 1 seconds it enters the configuration menu:

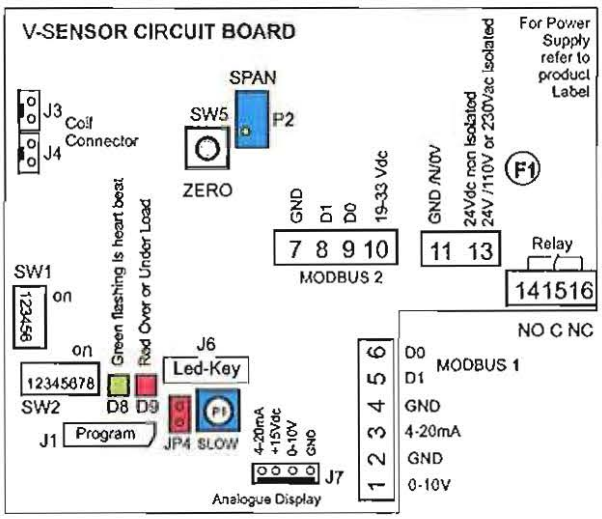
L	Low Alarm	
H	High Alarm	
t	Alarm timer 1	0-999
t.	Alarm timer 2	0-999
u.	Units	dU (Display Units) or Per (%)
af	Alarm Function	0-2
Sr	Self Reset	0-1
rb	Remote Buzzer	-, 0, 1 or P
rA	Remote Alarm Indication	-, 0, F or LH
rt	Re-alarm timer	0-999 minutes
tU	Alarm timer units	s or h

UP - DOWN KEY

The up and down keys are used to select the various parameters

OUTPUT SIGNAL

0-10V and 4-20mA are also available on J7.



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V-SENSOR ORDER DESCRIPTION

GENERAL
CMR manufactures the V-Sensors to suit many low pressure and volume measurement applications. Because of the variety of pressure ranges, output signals and power supplies it has been necessary to design an easy to use selection table for anybody to make up a V-Sensor specification to satisfy a requirement. On the V-Sensor Selection Table you will find all specifications available with the associated ordering code.

V- SENSOR BASE PART NUMBER
The V-Sensor Part Number starts with a base part number of the type of sensor. Code '24' which is a V-Sensor in a standard ABS enclosure.
The Part Number therefore starts with '24'.

V-SENSOR ISSUE No
The V-Sensor will have a version number to identify the model.
The Code is '1 for version 1'.
The Part Number extends to '241'

TUBE CONNECTORS
6 mm barbed nipples to fit CMR PVC Tube are fitted as standard into the ABS box. They have the Code 'A'.
4 mm barbed nipples to suit the CMR SiliconeTube are also available as Code 'B'.
The example has 6 mm barbed nipples which is standard.
The Part Number therefore extends to '241A'.

NEGATIVE PRESSURE RANGE
The Negative Range is specified as (-). If the application requires to measure a negative pressure against a reference, i.e. a room has to be at negative pressure compared with the corridor then the room has to be connected to the Red or (+) nipple. The blue (-) nipple shall be connected to the reference in this case the corridor.

The negative room pressure shall suck on the red (+) nipple and the V-Sensor produces an output signal equivalent of the negative pressure measured.
In the Example we have chosen - 25 which has the Code '0025'.
The Part Number extends to '241A0025'.

If the V-Sensor must only measure in the positive Range i.e 0-25 then the Negative Renge will always be selected as 0 and the Code is always '0000'.

PRESSURE UNITS
The negative pressure and the positive pressure range must be expressed in units i.e. Pa or kPa. The CMR transducers are in Pascals (Pa) as standard.
In the example Pa was selected with Code 'P'.
The Part Number extends '241A0025P'

POSITIVE PRESSURE RANGE
To measure Positive Pressure against a reference it is necessary to select a positive range i.e. +25. The Code is '0025' This means the V-Sensor selected above can measure from - 25 Pa to 0 and from 0 to +25 Pa. The output Voltage would therefore be 5V or 12mA at 0 Pa.
The Part Number extends to '241A0025P0025'

LABEL UNITS
As the V-Sensor has a fixed label next to the LED display, i.e. Pa, kPe, hPa, mB etc. It is necessary to specify the label when selecting the part number as this is all part of the validation of the instrument.
In the example Code'P' for Pa was selected.
The Part Number extends to '241A0025P0025P'

OUTPUT SIGNAL
The Industry Standards for Output Signals are 0-10V or 4-20mA, but other signals can be adjusted via the keyboard by the operator.

If 0-10V is the Output Signal for -25 Pa to + 25 Pa then 5 V is 0 Pa. From 5V to 0V the V-Sensor measures from 0 Pa to - 25 Pa i.e.(-)12.5 Pa would be 2.5V.
From 5V to 10V the V-Sensor would measure positive Pressure from 0 Pa to + 25 Pa i.e. +12.5 Pa would be 7.5V.
It is standard to use equal ranges -25 Pa to +25 Pa rather then -25 Pa to + 50 Pa but the V-Sensor can be adjusted via the keyboard to provide this off-set.

In the Example, we have selected Dual (0-10V & 4-20mA) which has the Code '1'.
The Part Number extends to '241A0025P0025P1'

POWER SUPPLY
CMR can supply 24Vdc/24Vac Non-Isolated which does not have an isolation transformer, and is also suitable for 3-Wire connection. Most common is the 24Vac Isolated. 110Vac and 230Vac are less used, but also selectable. In the example we have selected 24Vac Isolated which has the Code '3'.
The Part Number extends to '241A0025P0025P13'.

FINAL PART NUMBER
The Part Number to order is '241A0025P0025P13'

Now try and select your own V-Sensor using the V-Sensor Order Selection Table.

V-SENSOR ORDER SELECTION TABLE

The Selection Table has been prepared to make ordering easy. Each column contains a number of different options which are available and a Part Number can be established by you depending on a specific requirement.

The Example Part Number 241A0025P0025P13 which is printed above the Selection Table and identified as being a V-Sensor with ABS enclosure, having an LED Display and Keyboard, with an Issue No 1, with 6mm barbed tube connectors, a Negative Pressure Range of -25, Range Units In Pa (Pascals) and a Positive Range of +25, labelled In Pa (Pascals) with Dual Output Signals of 0-10V & 4-20mA,which would mean in this case
0 Pa is 5V & 12mA. The Power Supply is 24Vac.

The V-Sensor would be supplied with a 5 digit LED-Keyboard / Display mounted internally into the Lid and the Measured Units are Pa (Pescals). The Decimal Point is user adjusted to 1 on the keyboard which indicates from -25.0 Pa to +25.0 Pa It comes with a traceable Calibration Certificate to national and international Standards (UKAS).

24	1	A	0025	P	0025	P	1	3
V-Sensor	Issue	Nipple	Negative	Range	Positive	Label	Output	Power
Part No.	No	Size	Range	Units	Range	Units	Signal	Supply
Base = 24	Issue = 1	6mm = A	0000	Pa = P	0000	Pa = P	Dual = 1	24Vdc = 2
		4mm = B	0010		0010	kPa = K		24 Vac = 3
			0025		0025	mB = B		110 Vac = 4
			0030		0030	hPA = H		230 Vac = 5
			0050		0050	m/s = V		
			0060		0060	m3/s = Q		
			0100		0100	m3/h = M		
			0120		0120	l/s = L		
			0125		0125	ACR = A		
			0150		0150			
			0200		0200			
			0250		0250			
			0500		0500			
			0750		0750			
			1000		1000			
			1250		1250			
			1500		1500			
			2000		2000			
			2500		2500			
			5000		5000			
			7500		7500			

HOW TO ORDER

EXAMPLE
A wall mount pressure transmitter is required of the Type V-Sensor
An LED complete with Keyboard is required as standard with an Issue No 1.
The tube connections must be 6mm for CMR PVC Tube
The negative pressure range must be -100 Pa
The measured units must be in Pascals (Pa)
The positive pressure range must be +100Pa
The units on the LED display must in Pa as well as on the Product label.
The output signal must be Dual (0-10V & 4-20mA)
The power supply must be 24Vdc non-Isolated

Call CMR for assistance at any time

The part Number for this V-Sensor is 24 1 A 0100 P 0100 P 1 2

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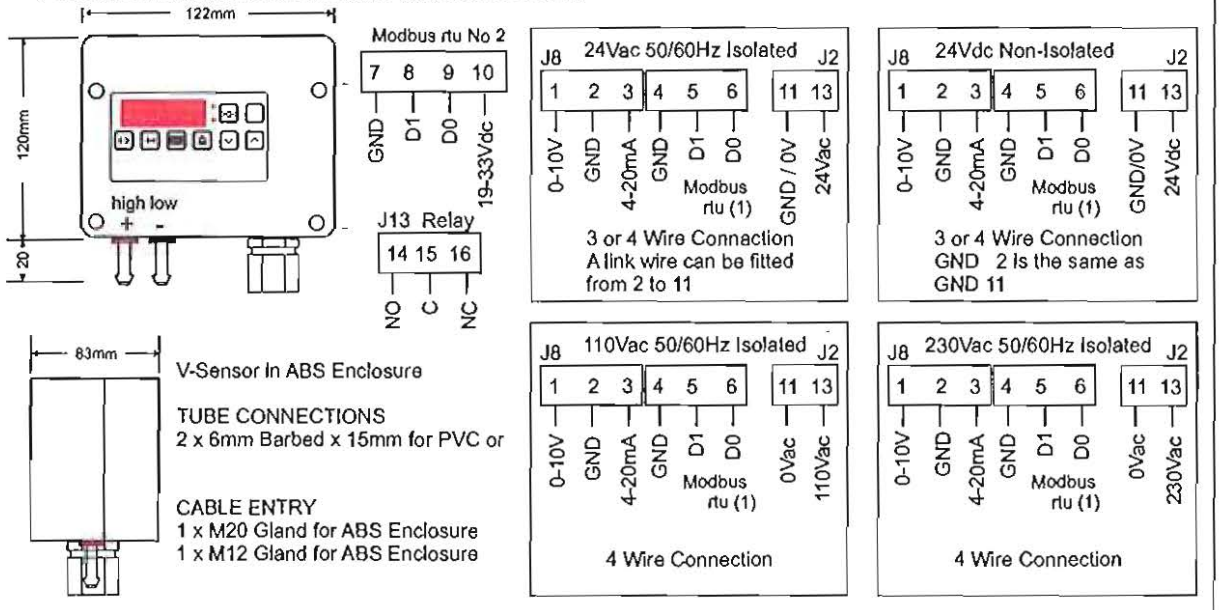
mail sales@cmr-controls.com

V-SENSOR TECHNICAL SPECIFICATION

Measurement Range	Any Range from 0-25Pa or -/+25Pa up to 0-7500Pa or -/+7500Pa
Overload Capacity	Ranges 25Pa - 150Pa up to max 1200Pa if over pressure protection is off.
	Ranges from 200Pa - 7500Pa up to max 10 times of range if over pressure protection is off.
Media	Non corrosive gases such as Air, N2, O2, Co2, N2O and Inert gases
Diaphragm Unit	Beryllium Copper suitable for high concentration of Formaldehyde - Stainless Steel on request.
AC Power Supplies	24 Vac 50/60Hz 198mA. Internal Fuse 300mA Auto-Reset.
Transformer Isolated	110Vac 50/60Hz 40mA. Fuse 315mA Wickmann.
	230Vac 50/60Hz 20mA. Fuse 315mA Wickmann.
DC Power Supplies	24 Vdc (19 to 31Vdc) smoothed 118mA Internal Fuse 300mA Auto-Reset.
Voltage Output Signal	0-10V (0 to100% of Range) RL = 5kOhm min. Other output signals (e.g. 2-10V) or PID loop control is programmable via the keyboard.
Current Output Signal	4-20mA (0 to100% of Range) RL = 500 Ohm max. (0-20mA) or PID control is programmable via keyboard
Relay Output 1A 24Vdc	One Alarm changer over volt free contact is user programmable
2 x Modbus rtu Connection	2 x Output Signal, Alarm Status, Alarm Thresholds and Alarm Timers are all readable as Modbus rtu Commands. Modbus register assignments to read and write are available in user manual.
Hysteresis/Repeatability	0.1% Typical of Full Scale.
Linearity (Accuracy)	+/- 0.25% of Full scale = > 100 Pa and 0.25Pa < 100Pa.
Zero Drift	0.05%K (+10°C to +50°C) - Automatically corrected to 0.0 if Auto-Zero function is enabled.
Operating Temperature	-10°C to +70°C.
Mounting Position	Vertical.
Weight	0.6 kg in ABS Housing.
Electrical Connections	ABS Housing: 1 x M20 Gland and 1 x M12 Gland and internal removable Screw Terminals.
Air Tube Connections	ABS Housing: Positive and Negative Pressure Barbed Nipple 6mm OD x 15mm long for CMR PVC Tube
	Alternatively Barbed Nipple 4mm OD x 15mm long for silicone tube on special request.
Enclosure	Plastic (ABS) Light Grey (RAL7035) - Protection IP65.
	EN61326-1 EMC - EN61010-1 SAFETY.
Calibration Certificate	Supplied with Certificate traceable to national and International Standards (UKAS).

V-SENSOR DIMENSIONS AND CONNECTIONS



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BED 81
BED 80
BED 79
BED 78
BED 77
BED 76
ATRIUM VOID

NOTES
1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL CONTRACT DOCUMENTATION

-Room Pressure Panel
-Pressure Sensor
RPD-XX -Room Pressure Display

AS BUILT DRAWING

NHS
Brookfield MULTIPLEX BM

NEW SOUTH GLASGOW HOSPITALS (NSGH) PROJECT

FOURTH FLOOR PLAN
HIGH RENAL INPATIENTS & DAY UNIT
LIGHTING LAYOUT
ZONE E

Job No	Drawn	Checked	Approved
GB1 6008	KM	JF	BR
Status		Date	Scale @ A0
AS BUILT		22.10.15	1:50

Discipline	Area	Level	Type	Drawing No	Revision	No.
M E	ZE	04	PL	600	512	Z1

A49756324

BED 89
BED 90
BED 91
BED 92
BED 93
BED 94
BED 95
BED 96
BED 88
BED 87
BED 86
BED 85
BED 84
BED 83
BED 82
BED 81
BED 89

NOTES

-Room Pressure Panel

-Pressure Sensor

-Room Pressure Display

AS BUILT DRAWING

NEW SOUTH GLASGOW HOSPITALS
(NSGH) PROJECT

FOURTH FLOOR PLAN
NSGH HAEMO-ONCOLOGY
LAYOUT OF PRESSURE INDICATORS
ZONE E

Job No. SB10008	Drawn RM	Checked JF	Approved BR
Status AS BUILT		Date 22.10.15	Scale @ A3 1:50

Originator	Zone	Level	Type	Role	Number	Sheet Number	Rev
WE	ZE	04	PL	660	513	Z1	

A49756324

BED 94
BED 95
BED 96
BED 97
BED 98
BED 99
BED 83
BED 82
BED 81
BED 80
BED 79
BED 78
BED 77
ATRIUM VOID

NOTES

-Room Pressure Panel
-Pressure Sensor
RPD-XX -Room Pressure Display

AS BUILT DRAWING

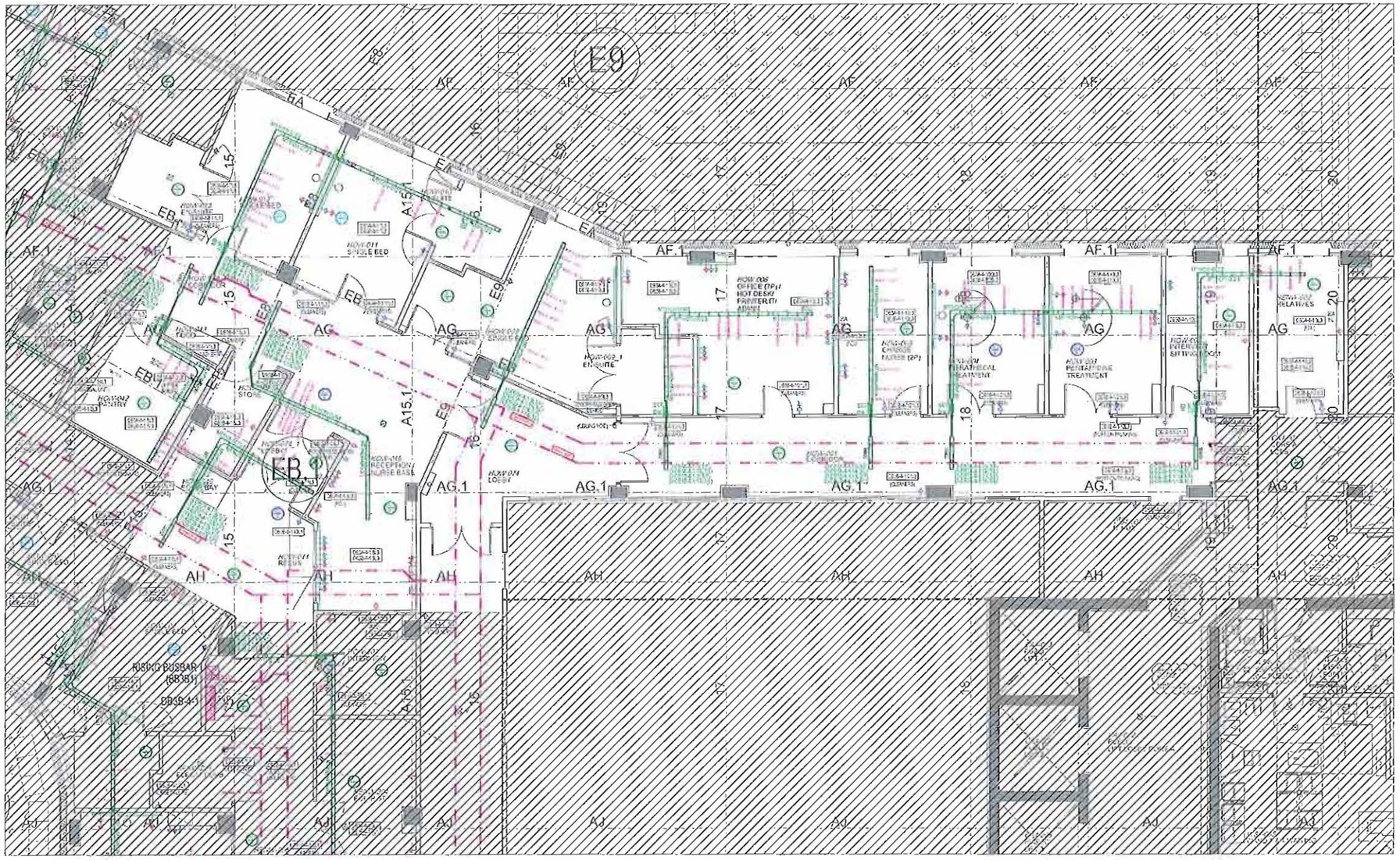
NEW SOUTH GLASGOW HOSPITALS (NSGH) PROJECT

FOURTH FLOOR PLAN
NSGH HAEMO-ONCOLOGY
LAYOUT OF ROOM PRESSURE INDICATORS
ZONE E

GB1.6008	AM	JF	BR
AS BUILT		22.10.15	1:50

ME | ZE | 04 | PL | 660 | 514 | Z1

A49756324



AS BUILT DRAWING

NHS

Brookfield MULTIPLEX BM

NEW SOUTH GLASGOW HOSPITALS (NSGH) PROJECT

FOURTH FLOOR PLAN
NSGH RADIOLOGY
AS BUILT MODULAR SMALL POWER LAYOUT
ZONE E

GB1 0008	AM	BR	04
AS BUILT		22/10/15	1:50

1E	ZE	04	PLW	531	514	Z1

A49756324

Brookfield MULTIPLEX BM

Client Training & Familiarisation Register

System Description	Ward 4b Room Differential Pressure Monitoring System
Nature of Training	Detailed training – Estates Team
Date	20th October 2015 @ 3pm

I hereby confirm that I have received training on the aforementioned systems

NAME:	SIGNATURE:	Site
WILLIAM BLACK	[redacted]	
BILL MURRAY		
THOMAS FEENEY		
STEPHEN CORRIE		QUEH
M WARD		" "
G. HARVEY		"
D BRATTEY		"
A GOODS		"
J. GILMORE		"
C. MCGECHNIE		"
S THOMSON		" "
R. FREER		"

Topics: Room Differential Pressure Monitoring System
Handout: Functional Description Documents – System Description & Operational Instructions

Brookfield MULTIPLEX | BM

Client Training & Familiarisation Register

System Description	Ward 4b Room Differential Pressure Monitoring System
Nature of Training	Detailed training – Users
Date	20th October 2015 @ 4pm

I hereby confirm that I have received training on the aforementioned systems

NAME:	SIGNATURE:	Site
Allyson McArdle	[redacted]	
HELEN HUNTER		
Terri Brand		
FRANCES ADIE		WOSCC DS/139
MARY McAULEY		BEARSDEN WOSCC HAEM.
Marie McLAUGHLIN		
Grant McQuade		
Mhairi Cameron		
PETER MOIR		

Topics: Room Differential Pressure Monitoring System
Handout: Functional Description Documents – System Description & Operational Instructions

Wednesday 27 May 2015
at 1.30 pm

Room ADM 2.16B, Conference Room, Level 2, New Victoria ACH

PRESENT

Chair	TW	Infection Control Manager
Tom Walsh		
Professor Craig Williams	CW	Co-ordinating ICD
Lynn Pritchard	LP	Lead Infection Control Nurse, South East
Ann Kerr	AK	Lead Nurse, Surveillance
Clare Mitchell	CM	Lead Infection Control Nurse, South West
Kate Hamilton	KH	Lead Infection Control Nurse, North East
Joan Higgins	JH	Lead Infection Control Nurse, Clyde
Susie Dodd	SD	Lead Infection Control Nurse, North West
Pamela Joannidis	PJ	Nurse Consultant, Infection Control
Dr Pauline Wright	PW	ICD, South
Dr Linda Bagrade	LB	ICD, Clyde
Dr Teresa Inkster	TI	ICD, North
Dr Christine Peters	CP	ICD, South
Dr Aleks Marek	AM	ST4

In Attendance
Ann Lang (Minutes) PA Infection Control

Apologies Received
Dr Alison Balfour Sandra McNamee Professor Andrew Smith

Item	Action

1. Welcome & Apologies

Tom welcomed everyone to today's meeting. Apologies were received from the above mentioned.

2. Minutes of SMT Meeting held on 29 April 2015

The minutes of the previous SMT meeting held on 29 April 2015 were accepted as with the following amendments:-

Page 2, South West, 1st para – should read coolers instead of heaters.

Page 2, last para – should read "....external company had to be brought in to provide water based coolers. Joan advised that in RAH they have to bring in portable units every year to cool the area of ICU".

Page 3, North West, 3rd bullet – should read "She said the CVC compliance in real was better with a recent CVC sweep scoring of 100%.

Page 4, Item 3, last sentence – insert rescreening instead of screening.

Page 8, Item 21, 2nd bullet – should read " Alison stated that with regards to air sampling this has been centralised since February 2015".

Actions C/F

- Tom to raise at the next AICC meeting the issue regarding the ventilation in the labour suite.
- Pamela to issue the notes of the last CPE Group meeting.

Item	Action

Actions Update

- It was agreed that the decolonisation regimen in the MRSA Policy should be for 5 days.

STANDING ITEMS

3. Matters Arising

There were no matters arising that were not on the agenda.

4. Sector Update

i) Geographical Sector Update (encl)

The IC Sector Updates were distributed with agenda.

- **Clyde (Joan Higgins)**
  - Joan reported 3 SABs in Ward 27 at RAH were identified in April and two were PVC related. She said they are working with staff and have carried out education.
  - 3 HAI Clostridium difficile cases were identified in Ward 26 at RAH in March.
  - Ward 10 at RAH was closed with 3 patients and 1 staff with confirmed norovirus.

- **North East (Kate Hamilton)**
  - Kate reported 2 SABs in RDU at Stobhill for April with a further 3 identified for May. An environmental audit was carried out which scored Gold. Discussions are ongoing with the Senior Charge Nurse and Kate said they are speaking to the Practice Development Nurse.
  - With wards moving Kate reported that the team are quite busy.

- **North West (Susie Dodd)**
  - Susie reported that the SPC chart for GGH was breached as they received one more CDI case after the last SMT. Two typing results were received with different strains. Susie stated that antimicrobial have reviewed the cases and they are waiting on the results.
  - There has been a number of SABs with 3 of them line related. Susie responded that the number of SABs have decreased since Renal Unit has moved to SGUH.
  - 4 wards were closed in April with 2 wards closed twice.
  - In Ward 7C there was a severe CDI case.
  - A patient in ITU died with confirmed Influenza A (H1N1).
  - 1 patient with confirmed scabies was identified in Arran ward and a further 2 possible cases.
  - In the Western Susie reported that there was a flooding from the top roof and wards had to be decanted.
  - All wards in the main are of the Western Infirmary have closed and Susie advised that this leaves the Outpatients Department at the Western.

    Tom thanked Susie for acting up as Lead Nurse for the North West Sector.

- **South East (Lynn Pritchard)**
  - Lynn reported 1 SAB case at the Victoria Infirmary.
  - In April Lynn advised that 5 wards had closed with one ward confirmed norovirus.
  - The Victoria Infirmary and Mansion House Unit have both closed and Lynn commented that Kate has now taken over Victoria ACH.
  - Tom also thanked Lynn for covering the South East site as Lead Nurse.

Item		Action
	South West (Clare Mitchell) • Clare reported 8 SABS with 4 of them in NICU, although there has not been a SAB in the last three weeks. An outbreak meeting took place and actions are in progress. Stefan is carrying out hand hygiene sessions. Craig asked if there had been a change in practice. Kate commented that in PRM there were not a lot of cases that were line related and no cases had been reported since middle March. Craig suggested checking the headsets as this had been a change at SGH. Kate agreed to check the headsets at PRM.	KH
5.	**HAIRT Report** Nil to update.	
6.	**Q&P HAI Report** A copy of the report for May was distributed with the agenda and noted.	
7.	**IPC Work Plan** The IPC Work Plan for April was distributed with the agenda and Pamela provided an update. She reported that the work plan reflects the terminology in the new HAI standards. A couple of items are still to be finalised e.g. waiting on government recommendations in relation to the Vale of Leven Inquiry and awaiting the CEL regarding surveillance. Tom reported that he spoke to Abigail Mullings regarding the outstanding items and she advised that there is no update at present. Additions to the workplan include new business for reporting in terms of new structure and the CAAS standards. The National Advisory Group has disbanded and Tom advised that this is now the HAI Task Force and includes an ICN, ICM and ICD.	
8.	**Sub-Groups/ Short Life Working Groups Update:**	
i)	**Water Safety Group** Pamela provided an update on the Water Safety Group. She said that the Policy and Scheme of Delegation and the SOP for Pseudomonas had been approved at the last BICC meeting and Craig asked for these documents to be forwarded to SMT. Craig also commented that Estates staff should be working to the Policy and should refer to this if carrying out testing. With regards to possible water testing and drinking water samples being taken Craig asked to be informed of any areas that are carrying these out.	
ii)	**Theatre Maintenance & Management Group** There have been no meetings since the last SMT.	
iii)	**Infection Control Policy Group** Pamela reported that there were four policies that were approved at the last BICC meeting which included Hand Hygiene, Scabies, MRSA and CDI. The Policy group met last week and reviewed the Chicken Pox Policy, Occupational Related Illness Policy, Tuberculosis Policy and the Last Offices SOP.	
iv)	**Education Group/OLM Workstream** Lynn advised that the work of the Education group is ongoing and the last OLM meeting was cancelled.	

Item	Action
v) Decontamination Group The next meeting of the Decontamination Group is scheduled for the beginning of June. Kate advised that she met with Craig and they have looked at the terms of reference and these will be part of the HAI standards.	
vi) Person Centred Care Joan updated the group and advised that communication for patients with one failed case of MRSA and on their second treatment will receive daily communication on their treatment. Kate mentioned that her team have this as part of their weekly visit. Joan stated that they looked at the weekly visits and if a patient was given a PVC they would receive an information leaflet and feedback would be given to the nurse in charge. With the implementation of the new audit Joan reported that the focus group for SCNs regarding audits will be put on hold until the new audit is finalised. An application for funding was put into the Appeals Society for a competition for staff on staff knowledge in relation to Standard Infection Control Precautions and in relation to PVC/CVC management. Joan said that the prize would be an Ipad Air and the successful participant will be chosen at random for each competition. Joan reported that SureWash asked if we would like to trial a unit of theirs for a month but Joan commented that cost is £1,000 per month to rent. Kate suggested ordering one unit for the Infection Control week to have this as a feature. Tom said he could maybe fund this internally for 2-3 weeks. In relation to SICPs Pamela advised that Joan is to take the first member of the public to look at the SICPs audit and this will start next week.	
vii) CPE Group – CPE Screen SLWG The short life working group sits on the national group and ensure the group are aware of discussions nationally. Craig reported that discussion should take place with a patient with possible notification of CPE. He said a flag should come up on ICNET if the patient is possible for CPE and a screen has been done. As this is a high risk Craig stated that we need to define high risk and any positive patients should be in isolation for 14 days. Craig advised that there could be approximately 100 possible cases per month or a maximum of 400 a month across all sectors. Kate discussed a case where [redacted] when he came into hospital but staff were not sure why they were doing this and what CPE stood for. Pamela suggested that we agree what should be done by the IPCT if a patient is a high risk case. Joan asked if there was any policy guidance or information leaflet and Pamela advised that there are no final copies of documentation from the national group. Pamela and Craig agreed to meet to discuss this and put XPs on ICNET if a patient was found to be positive. Pamela reported that HPS felt that boards should take local ownership in relation to communication with staff and patients. Lynn suggested contacting Golden Jubilee. Pamela recommended that the group be reformed and wait on guidance from the national group.	**PJ/CW**

Item	Action
9. Project Update:	
i) ICNET Update Ann reported that an IT meeting took place last week. She said that HPS are keen for us to do the user acceptance testing on ICNET but Ann said that we have made a corporate decision to delay testing as we are focusing our attention on IPCAT. With regards to training for ICDs on ICNET Ann asked when they would like this carried out and Craig suggested adding this to an ICD meeting. Ann asked the ICDs to let her know what they want the training to focus on. Ann advised that she has received a few requests from microbiologists to access ICNET. As Elaine McCormick, Nitish Khanna and Tony Speekenbrink have access to the system it was agreed to limit the access to them.	**ICDs**
ii) MRSA Screening / KPIs For our last submission from January – March Ann reported that our rate was 80%. Ann asked sectors to remind their staff to send in their data for quarter two for April – June. She said due to the new structure being implemented there could be a duplication of wards.	
iii) SAB HEAT Target With regards to SABs Ann reported that for Quarter 1 there were 27 SABs and Ann stated that the Data Team monitor cdiff and SAB daily. For this month there are 41 SABs and last month Ann reported that there were 36 SABs and we still have a number of unknown SABs. Craig commented that the number of cases have increased across Scotland. Ann said that she is hopeful the new audit tool sweep will raise awareness of PVC and mentioned that there are still education issues. Kate advised that smart sites are being used for needle devices and sometimes do not fit on. Craig suggested looking into this and Kate agreed to speak to Practice Development and said that she will ask at the weekly visit next week. With regards to CDI Ann reported that there have been 26 cases so far for this month and she is hoping that we meet the HEAT Target for CDI. For surgical site infections in the new HAIRT Ann reported that there have been 4 neck of femur cases and 3 knee SSIs which have been in separate hospitals. Kate stated that the ESAB form will need to change in light of the redesign of the hospital. Ann informed that the cross Directorate SAB group has now amalgamated into the Acute Infection Control Committee.	**KH**
iv) IPCAT Pamela reported that all tablets have been distributed to the sectors and IPCAT went live on 25th May. She said that the teams are carrying out mock audits and the training for SCNs will need to be arranged especially at new SGUH. After this the Data Team will take up the training. Ann advised that there is an IT issue as the process for the audit is not saving. Eugene Smythe is the lead for testing and Ann said that we are going to ask Eugene how he would like to be notified of any problems and Pamela agreed to take this forward. Pamela advised that domestics have changed the names of their areas to match with what infection control has.	**PJ**

Item		Action
v)	**Transmission Based Precautions** The report on Transmission Based Precautions has been submitted to HPS and Pamela reported that our own addendum to this is due for renewal in July. Craig advised that the group is to be stood down and Tom said that he will issue the email he received. Craig stated that action needs to be taken with regards to the masks and who needs to be trained e.g. A&E staff. He said that we are not changing existing practice but protecting the patient whereby wearing a mask may be detrimental to their health. An improvement group are to be put together to take actions forward and provide an update to BICC.	**TW**
vi)	**New Build – Adult Hospital / Children's Hospital** Adult Hospital Craig advised that the BMT rooms are to be checked for full validation. Children's Hospital In the new hospital Craig said that the BMT rooms are to be checked here also. With regards to dust monitoring Pamela reported that she has discussed how to move an immunocompromised patient in a high risk area. She said that we will need to get methods of work from Brookefield so that when work is ongoing a patient can come in from another area. She said that this has been raised with Mary Anne Kane.	
10.	**Finance Report** Tom reported that he has not yet received an updated report from Finance for 2015/16.	
11.	**On The Move** With regards to office accommodation Tom advised that the central team at the Western Infirmary will move to Yorkhill in November and staff will receive a letter from HR to confirm this. He said that he is still unsure of where the staff at GGH will be moving to. As the bed numbers at GGH have increased Tom asked for Sandra to be notified if there is a resource implication. He said that he will try and seek clarification on the location of the team. Mearnskirk will now come under the remit of Anne Harkness and this will come under Clare's team at the South. In relation to 7 day working in main sites Tom reported that this has been costed but labs do not have any data on the number of approximate results for a weekend. He said that he has not received national guidance on what 24/7 cover means. Tom reported that he has been asked to lead on the new CDI intelligence (centre for data intelligence and innovation) which means that Sandra, Craig and Pamela will lead on more Infection Prevention and Control work. Ann advised that at her team meeting she was asked about permits and if staff can park in a permit holder area. Pamela and Sandra to check this with the On the Move Group.	**SMcN / PJ**

Item		Action
	Teresa stated that with the output for the Western moving to Yorkhill we may need to look at additional resource in the north.	
12.	**Clinical Governance Related Guidance** Copies of the latest Clinical Governance Related Guidance notes were issued with the agenda. Craig suggested reading the article regarding "Managing risks during the transition period to new ISO connectors for medical devices".	
	INFECTION CONTROL GOVERNANCE	
13.	**IC Official Responses (Complaints / FOIs / PQs / Legal Enquiries)** Nil to update.	
	COMMUNICATIONS/ FEEDBACK	
14.	**Events/ Representation Feedback** Nil to update.	
15.	**Core and Divisional Team Brief** Copies of the latest Briefs have been issued.	
	NEW BUSINESS/ AGENDA ITEMS	
16.	**New Business**	
i)	**Online Infection Prevention and Control Policy Manual** An SBAR was written up regarding non access to the online Infection Prevention and Control Policy Manual. Pamela reported that Kerry and Pauline were working on this to rectify it. She said if there were any further problems with access to the website to contact Pauline Hamilton.	
ii)	**Visitors of Patients with Norovirus** Joan reported that she had an issue at IRH where a patient was put in a single room with [redacted]. She said it was raised at the Lead Nurse meeting and Sandra suggested raising this at SMT to ask if we should restrict visitors when patients have [redacted]. Kate stated that if a ward was closed they would stop open visiting and restrict visitors to night time visiting only. Tom recommended that if there were three wards closed in a hospital to restrict visitors. Susie commented that the sign on the door for the isolation of a patient does not reflect what is in the policy. Lynn suggested developing a different poster/sign for the door or entrance to the door for visitors. Pamela to ask the Patient Forum on their thoughts of this new sign.	**PJ**
iii)	**VOL Inquiry Report** Tom advised that he and Sandra are working on an update on the recommendations for the VOL Inquiry Report and when this is finalised he will send this to SMT.	
iv)	**HEI Standards Evidence** The Lead Nurses met last week to discuss the information required for our portfolio of evidence for HEI. Pamela confirmed that HEI are happy to receive links to our policies and the deadline for the return of information is 12th June 2015.	

Item		Action
	ITEMS FOR NOTING	
17.	Meetings Update:	
i)	Lead Nurse Meeting At the last Lead Nurse meeting Pamela said they discussed the Priority for Isolation Protocol. She said that Joyce Brown is happy with the document and will forward this to AICC. Craig asked for this to be sent to the microbiologists. Pamela reported that we have received the word version of the HAI Scribe from HFS and will send this out. She said that a review of the IPC Risk Assessment Tool was carried out and the Influenza Outbreak Trigger Tool was discussed. MRSA screening was also discussed at the meeting and Pamela said they discussed if a patient was negative for three years that they would not rescreen the patient. Kate to find out how many patients were positive in the last three years. Craig advised that if a patient has a tag and the patient answers yes to the MRSA question they should be screened. He suggested finding out the number of patients with a tag. Pamela agreed to arrange to have a list of core questions and will write down what the Lead Nurses do.	**PJ** **KH** **PJ**
ii)	<u>ICD Meeting</u> At the ICD meeting Craig said they discussed the new structure and ICD cover for sites. As the ICD for the South covers GGH as well Craig advised that Teresa will cover Renal, Pauline and Christine will cover the rest of the site and he will cover Maternity and Paeds. Tom suggested at the next Lab meeting to raise the issue of ICD cover at GGH with the increased number of beds there. The issue of attendance at meetings was discussed and how to prevent duplication of attending Clinical Governance and sector meetings. Tom and Craig to speak to David Stewart regarding governance meetings and if Infection Control could be identified as an agenda item at the start of a meeting. The ICDs will cover the following areas:- • Regional – Teresa • Clyde – Linda • Paeds and Maternity – Craig • South – Christine / Pauline The Water Policy that was tabled at the last BICC meeting was also discussed.	
iii)	<u>Board Infection Control Committee</u> Copies of the previous minutes and the agenda for the latest meeting were distributed with the papers.	
iv)	<u>Acute Infection Control Committee</u> Copies of the previous minutes and the agenda for the latest meeting were distributed with the papers.	

Item	Action
v) Partnership Infection Control Support Group Copies of the previous minutes and the agenda for the latest meeting were distributed with the papers.	
18. Review of Actions and Decisions • Kate to check the headsets at PRM. • Pamela and Craig to meet to discuss putting XPs on ICNET for CPE. • ICDs to let Ann know what they want to focus on for the ICNET training. • Kate to speak to Practice Development regarding the smart sites used for needle devices. • In relation to IPCAT Pamela to check with Eugene how he wishes to be informed of any problems. • Sandra/Pamela to check with the On the Move Group regarding staff parking at new sites e.g. Yorkhill. • Pamela to ask the Patient Forum on their thoughts of a new sign for the door regarding patients in isolation. • Pamela to issue the HAI Scribe word document from HFS. • Kate to find out how many patients were positive with MRSA in the last three years and Pamela agreed to arrange to have a list of core questions and to write down what the Lead Nurses.	
19. Items Agreed ▪ The decolonisation regimen in the MRSA Policy should be for 5 days.	
20. Any Other Competent Business • Pamela reported that an engineer has been authorised for water testing. He suggested to have a checklist for Pseudomonas and recommended that for high risk areas there should already be an audit - a SOP checklist for the use of water for all wards listed in the Board Water Policy. It was agreed at this group that the only other areas that required an audit were areas where there have been two patients with positive blood cultures in the previous year. • With regards to a patient with VHF moving to the new hospital Christine said the she will do a walkround of the area to look at PPE etc. with Pauline. She said that high risk samples for patients will go to the new SGUH. • The registration for Cleanliness Champions has changed and Ann advised that the Data Team will no longer be registering staff and this has been put on as a Hot Topic on Staffnet. • Linda advised that she and Lynn are to attend a meeting at the Vale of Leven regarding legionella. She said they received high level positives for legionella in the shower in the surgical day bed unit but this is classed as low risk. It was agreed that as this area is low risk they will continue with remedial actions. Linda stated that the hand wash basin in the corridor of the oncology ward is not being used by patients and the advice is to remove the basin. Pamela confirmed that there is an email in the system asking Estates to remove this basin and to stop testing. It was agreed to raise this issue at the next Water Group meeting.	**CW/PJ**

Item	Action

21. Date and time of next meeting

The next meeting is scheduled for Wednesday 24 June 2015 at 1.30pm, ADM2.16B Conference Room, Level 2, New Victoria ACH.

The dates for future meetings have been arranged as undernoted:

Date (2015)		Time	Venue
29	July	1.30pm – 3.30pm	ADM 2.16B Conference Room, New Vic ACH
26	August	1.30pm – 3.30pm	Conference Room, Management Building, SGH
30	September	1.30pm – 3.30pm	ADM 2.16B Conference Room, New Vic ACH
28	October	1.30pm – 3.30pm	ADM 2.16B Conference Room, New Vic ACH
25	November	1.30pm – 3.30pm	Room L0/A/010, New Lab Block, SGH
16	December	1.30pm – 3.30pm	ADM 2.16B Conference Room, New Vic ACH

Wednesday 24 June 2015
at 1.30 pm

Room ADM 2.16B, Conference Room, Level 2, New Victoria ACH

PRESENT

Chair

Tom Walsh	TW	Infection Control Manager
Sandra McNamee	SMcN	Associate Nurse Director
Lynn Pritchard	LP	Lead Infection Control Nurse, West & Partnerships
Ann Kerr	AK	Lead Nurse, Surveillance
Joan Higgins	JH	Lead Infection Control Nurse, Clyde
Jenna Gillies	JG	Microbiology Trainee
Gillian Bowskill	GB	Senior Infection Control Nurse, South
Pamela Joannidis	PJ	Nurse Consultant, Infection Control
Dr Pauline Wright	PW	ICD, South
Dr Linda Bagrade	LB	ICD, Clyde
Dr Teresa Inkster	TI	ICD, North
Dr Christine Peters	CP	ICD, South
Dr Aleks Marek	AM	ST4

In Attendance

Ann Lang	(Minutes) PA Infection Control

Apologies Received

Dr Alison Balfour Professor Craig Williams Kate Hamilton Clare Mitchell

Item	Action

1. Welcome & Apologies

Tom welcomed everyone to today's meeting. Apologies were received from the above mentioned.

2. Minutes of SMT Meeting held on 27 May 2015

The minutes of the previous SMT meeting held on 27 May 2015 were accepted with the following amendments:-

Page 3, last sentence – should read "Pamela recommended that the group meet again and wait for guidance from the national group".

Page 5, 3rd para – delete last sentence.

Page 9, item 20, 2nd bulletpoint – should read "With regards to a patient with VHF moving to the new hospital Christine said she will do a walkround of the hospital with Pauline".

Actions C/F

- In relation to SABs Kate to check the headsets at PRM.
- Sandra/Pamela to check with the On the Move Group regarding staff parking at new sites e.g. Yorkhill.

Item	Action
Actions Update • Craig to let Ann Kerr know when to organise ICNET training for ICDs. • Kate to find out how many patients were positive with MRSA in the last three years and Pamela agreed to arrange to have a list of core questions for the Lead Nurses. This will be discussed at the next Lead Nurse meeting.	
STANDING ITEMS	
3. Matters Arising There were no matters arising that were not on the agenda.	
4. Sector Update	
i) Geographical Sector Update (encl) The IC Sector Updates were distributed with agenda.	
• **Clyde (Joan Higgins)** • Joan reported 4 SABs for the month of May. • 5 CDIs were reported with 4 of these cases severe CDIs. • 3 wards were closed in RAH with 2 of these confirmed as norovirus and the other one was presumed norovirus.	
• **North (Gillian Bowskill)** • Gillian reported 7 SABs in total and 4 of these cases are for RDU at Stobhill and she said they are all different SPA types. A hand hygiene audit was carried out and the score for this was 95%. • Teresa reported that [redacted]. On reviewing the case she said the patient had no travel history, contacts were all negative and staff screened were also negative. She said there were a number of occupational health issues with no link practitioner on site and nobody could stand in to assist. Sandra agreed to speak to Rona Wall in the first instance and raise this at the next BICC meeting. • Gillian commented that the SAB reported in the Mat Assessment Unit at PRM was a deep SSI following a c-section. She said a meeting will be convened to discuss this with the PRM clinical team.	**SMcN**
• **West & Partnerships (Lynn Pritchard)** • Lynn reported that there has been an increased number of Parainfluenza 3 in ward B7. A hand hygiene audit was carried out with a score of 85%, education was carried out and isolation was emphasised.	
South (Lynn Pritchard) • As Lynn has been covering this site she provided an update. She said that a ward was closed with three patients with suspected gastroenteritis. Sandra commented that she received many phone calls as to why a ward in the new hospital was closed. Craig suggested maybe updating our policy to review actions in relation to single room accommodation. It was also noted that this ward only has one sluice. Pamela agreed to look at the policy and bring back some suggestions to SMT.	**SMcN**

Item		Action
	Christine pointed out that they need to be able to make a judgement to close a ward as she had an issue where the SCN was not happy and raised this with the out of hours medic. Sandra suggested policy should be referred to.	
	She said that she will raise the issue regarding the number of domestics on wards and the standard of cleaning with the local teams.	SMcN

5. HAIRT Report

A copy of the report for June was distributed with the agenda.

Tom advised that the SSI rates for hip arthroplasty procedures were above the national average but Ann reported that they have come back down in quarter one.

The SPCs for the next report will be updated and Sandra said that they are looking to maybe remove the site SPC charts. Ann stated that hospital level SPC charts will include Regional wards and old directorate SPC charts will be invalid now.

6. Q&P HAI Report

The Quality and Performance Committee is now called the Acute Services Committee and Tom commented that there was no report to update on.

7. IPC Work Plan

The IPC Work Plan for June was distributed with the agenda and Pamela provided an update.

She reported that there are three items that have scored red and these include an SOP to describe what HAI audit information should be displayed. She said this is part of the HAI Communication Strategy and this has been issued to committees for comments. Other items include a policy to describe the role and responsibilities of clinical staff in relation to providing HAI information to patients. Also to develop a strategy to describe how IPC policies will be audited.

8. Sub-Groups/ Short Life Working Groups Update:

i) Water Safety Group

Pamela provided an update on the Water Safety Group. She said the issue of testing for legionella is ongoing and Craig and Tom are to meet with Mary Anne Kane and Alan Gallacher to discuss this. Christine asked who is required to sit on the Water Sector groups as neither Pauline nor her attends any meetings or receives any results. Joan commented that she and Linda receive the results for information only and Linda stated that if there is a high count of legionella she is not sure what they should do. Pamela responded that there is a section in the policy describing this. Once in sectors Sandra advised that the Lead Nurse and Infection Control Doctor will attend the Clinical Governance Groups and could raise this issue at this meeting.

Pamela commented that each sector will have a written scheme and she agreed to draft a document of what Infection Control should do within sectors. She also said that she will forward the new Water Systems Policy to the ICDs and will arrange a meeting to discuss this with the ICDs. **PJ** **PJ**

ii) Theatre Maintenance & Management Group

There have been no meetings since the last SMT.

Item		Action
iii)	**Infection Control Policy Group** Pamela reported that four policies have been issued to the committee for comments and they include Chickenpox, TB, Occupational Related Illness and the Last Offices SOP. Pauline asked if we need an Infection Control PVL Policy and was informed that we do not as we have adopted the Public Health policy. Linda recommended calling this a SOP instead of a Policy. Sandra advised that HPS are working with Health Protection Network regarding this and this document is in draft and has not been finalised. Pauline asked what to do if they receive a call to say a patient has PVL and Craig informed that Public Health is the owner of this document. Tom suggested to have a SOP for inpatients with PVL and asked if the Policy Group could look at this.	**PJ**
iv)	**Education Group/OLM Workstream** A teleconference was held with NES and Sandra reported that NES plan to review the course in the new two years with a course in which staff can choose modules. As some staff are still going through the programme the Data Team will assist with the administration for this until staff pass the course. Lynn said that Mental Health are not on the matrix and Sandra suggested that they have their own matrix. It was agreed that Lynn will look at this for Mental Health. It was agreed to delete OLM Workstream from the agenda.	**LP**
v)	**Decontamination Group** The meeting of the Decontamination Group has not met recently.	
vi)	**Person Centred Care** Nil to update.	
vii)	**CPE Group** The CPE Group met and Pamela advised that she and Craig met with clinical users to roll this out to ICUs and screening for CPE in ICUs will go live from 1st September. Joan recommended that lab guidance is issued as the ICT will have to educate clinical teams and write protocols for them.	
9.	**Project Update:**	
i)	**ICNET Update** Ann provided an update and advised that user acceptance testing on ICNET had been suspended. She said there have been issues with the system being down and the Data Team are to look at the average length of time the system is down. A copy of the XP document was circulated and another meeting of the IT Group is to be set up. Ann stated that the ICNET documentation audit tool will be at the back of the document for the teams.	
ii)	**MRSA Screening / KPIs** For the last quarter Ann reported that we were 93% compliance and our overall compliance is 66% which is an increase from last quarter which was 64% and compliance with CRA is 93%. She said a document detailing the compliance rates will go to AICC.	

Item	Action

iii) SAB HEAT Target

With regards to SABs and CDI Ann reported that the national report is due to be issued on 30th June but will be embargoed until 7th July.

As of today Ann reported that GGC has 105 SABs for quarter 2 and stated that for quarter 1 there were 102 cases in total. She said 53.3% of the overall SABs are HAIs. For the month of June Ann said that there are 23 SAB cases and of these 12 are confirmed HAIs. In relation to the HAIs 5 out of 9 cases are IV access devices.

The number of CDI cases for quarter 1 was 110 cases and for quarter 2 Ann advised that we have 102 cases so far. She said that regarding CRTs being issued to be careful as there are no directorates now and these should be sector based.

iv) IPCAT

Pamela reported that there have been software issues with the new audit plan and this is being addressed.

v) Transmission Based Precautions

The Transmission Based Precautions document has been circulated and Pamela reported that no comments have been received from HPS or the national group.

vi) New Build – Adult Hospital / Children's Hospital

Adult Hospital

Christine advised that work is in progress regarding the room available in A&E for a possible VHF case.

She also reported that we are trying to get information regarding the design and validation for the hepa filter extracts in the BMT rooms.

Children's Hospital

In Schiehallion Tom reported that there is concern as there is fungus in one of the rooms and Infection Control have not seen the validation reports for these rooms.

Christine asked where the best place was to put a high risk patient as there are rooms on different floors. She was informed that Ian Powrie has the details for every room in the hospital but as rooms have been renumbered it is difficult to keep track of. She said that she is trying to get a list of what rooms are available and the filters in them.

Tom advised that a meeting has been arranged with Ian Powrie and Craig for 7th July. Teresa said that she is concerned that the validation reports have been done but have not been signed off by Infection Control. If there are any issues after the meeting Tom stated that he will raise these with David Stewart.

10. Finance Report

Tom reported that he has not yet received an updated report from Finance recently.

Item		Action
11.	**On The Move** With regards to office accommodation Tom advised that the central team at the Western Infirmary will move to Yorkhill in November and Sandra advised that she is looking for alternative accommodation for the ICNs at GGH. Joan commented that parking permits requires a director to sign these off and advised that they will be doing more travelling after taking over Vale of Leven Hospital.	
12.	**Clinical Governance Related Guidance** There were no updates available for the meeting.	
	INFECTION CONTROL GOVERNANCE	
13.	**IC Official Responses (Complaints / FOIs / PQs / Legal Enquiries)** Nil to update.	
	COMMUNICATIONS/ FEEDBACK	
14.	**Events/ Representation Feedback** Nil to update.	
15.	**Core and Divisional Team Brief** Copies of the latest Briefs have been issued.	
	NEW BUSINESS/ AGENDA ITEMS	
16.	**New Business**	
i)	**Ward Closures at SGUH** As discussed earlier in the meeting.	
ii)	**VOL Action Plan** A copy of the updated Action Plan is out for consultation to the Area Clinical Forum and no comments have been received. Once finalised Sandra said that she will issue this to SMT.	
iii)	**HEI Evidence** A link to the documents for the HEI self assessment was issued with the agenda.	
iv)	**HAI Communication Strategy** A copy of the HAI Communication Strategy has been issued to the committee for comments and for final approval at BICC in July.	
	ITEMS FOR NOTING	
17.	Meetings Update:	
i)	Lead Nurse Meeting At the last Lead Nurse meeting Pamela said they discussed NMC revalidation and NES e-portfolio. Ann reported that we have been asked to participate in a data collection exercise with The Copyright Licensing Agency Limited. They contacted us to complete an audit for 6 weeks to detail what articles we photocopy or share. This requires 10 members of staff from our teams at GRI, IRH & RAH to complete the details and 3 of whom need to be nominated to complete the short questionnaire.	

Item	Action

i) Lead Nurse Meeting
At the last Lead Nurse meeting Pamela said they discussed NMC revalidation and NES e-portfolio.

ii) ICD Meeting
At the ICD meeting Craig said they discussed CPE screening.

iii) Board Infection Control Committee
There have been no meetings since the last SMT meeting.

iv) Acute Infection Control Committee
There have been no meetings since the last SMT meeting.

v) Partnership Infection Control Support Group
There have been no meetings since the last SMT meeting.

18. Review of Actions and Decisions

- Sandra to speak to Rona Wall regarding the advice sought from occupational health. She will also raise this at the BICC meeting.
- With regards to the new hospital Pamela to look at the policy for closing a ward at the new hospital.
- Sandra to raise the issue regarding the input of domestic staff at the new hospital.
- Pamela to draft what Infection Control should do with high counts of legionella.
- A meeting to be arranged with the ICDs to discuss the new Water Systems Safety Policy.
- The Policy Group to look at drafting a SOP for an inpatient with PVL.
- Lynn to look at a matrix regarding education for Mental Health.

19. Items Agreed

- Nil to update.

20. Any Other Competent Business

- Sandra reported that the number of ecoli bacteremia cases in May were 108 cases. She said that Craig forwarded comments on a consultant document and said that to do enhanced surveillance on this had been objected to at national level.
- Tom said to keep the IC Network ongoing boards would need to fund this themselves.
- Aleks advised that they had their first positive Mycobacterium Bacteria sample in cardia bypass machines at Golden Jubilee. She said it is the same team that looked after the machines in Yorkhill and Christine said that Golden Jubilee were asked to sample the machines. Maleks was informed that Ian Kennedy is the board co-ordinator regarding testing.

Item	Action

21. Date and time of next meeting

The next meeting is scheduled for Wednesday 29 July 2015 at 1.30pm, ADM2.16A Conference Room, Level 2, New Victoria ACH.

The dates for future meetings have been arranged as undernoted:

Date (2015)		Time	Venue
26	August	1.30pm – 3.30pm	Conference Room, Management Building, SGH
30	September	1.30pm – 3.30pm	ADM 2.16B Conference Room, New Vic ACH
28	October	1.30pm – 3.30pm	ADM 2.16B Conference Room, New Vic ACH
25	November	1.30pm – 3.30pm	Room L0/A/010, New Lab Block, SGH
16	December	1.30pm – 3.30pm	ADM 2.16B Conference Room, New Vic ACH

From: Armstrong, Jennifer
Sent: 08 August 2021 19:38
To: Shariff, Imran
Subject: FW: BMT Briefing
Attachments: BMT Briefing Note 06 July.docx

Ward 4b

From: Walsh, Tom
Sent: 06 July 2015 21:57
To: Armstrong, Jennifer [redacted]
Subject: Fw: BMT Briefing

Dear Jennifer

This is a reflection of the meetings I attended today.

Perhaps we could discuss again tomorrow?

Thanks

Tom

We will prepare a report
Sent from my BlackBerry 10 smartphone.

From: Williams, Craig [redacted]
Sent: Monday, 6 July 2015 21:36
To: Walsh, Tom
Subject: Fw: BMT Briefing

Sent from my BlackBerry 10 smartphone on the EE network.

From: Jenkins, Gary [redacted]
Sent: Monday, 6 July 2015 5:44 PM
To: Archibald, Grant; Stewart, David
Cc: Williams, Craig
Subject: BMT Briefing

Grant / David,

Please find attached briefing note with regard to the discussion today and BMT issues.
The preferred clinical view from the BMT Consultants and ICDs, taking account of the balance of risk, is to transfer the service back to the Beatson on Wednesday.
I have cancelled my leave tomorrow and will come in to take this forward.

Regards
Gary

Gary Jenkins

Director: Regional Services Directorate
[redacted]

Briefing & Overview
Bone Marrow Transplant Service, Ward 4b
Queen Elizabeth University Hospital

The Bone Marrow Transplant (BMT) service transferred from the Beatson West of Scotland Cancer Centre on 06 June 2015.

As part of routine infection control measures for BMT, it was agreed to reintroduce the routine air sample testing in line with the frequency applied at the Beatson.

On 30 June, I was contacted by the Clinical Service Manager to notify me that Microbiology and Infection Control had received the results of the air samples. The air sample measurements were in excess of the recommended standards for a BMT Unit. At a meeting on 01 July, the ICD reported that only 1 of the 24 rooms met the specification; the other rooms has reading in excess of 5000 against an acceptable normal air particle count of 1000 for a BMT area.

It was also noted that the pentamadine treatment room should have negative air pressure however this did not appear to be in place. Dr Peters, ICD, reported that she has asked for copies of the commissioning and validation data but this had not yet been provided to her. The same data has been requested for Theatres, HDU, lobbied rooms and hepa-filter areas and will be provided to Anne and Kevin for the rest of the sites.

With regard to BMT, it was agreed that a potential solution would be to increase the air flow and ventilation to ward 4b. The aim of this being to increase the pascal measurement to between 5–10, and increase the air exchanges in the room to 12 per hour. Accordingly on the evening of 01 July the ventilation system was increased to maximum capacity. A number of other measures were also agreed:

- Move to ensure that the door and room seals are adequately air tight
- Increase the cleaning schedules to twice daily
- Introduce prophylaxis porzaconazole to allograft patients (anti-fungal medication)
- Re sample the ward to assess if an improvement had been achieved.

It was agreed that it would be sensible to await the outcome of the re-sampling exercise prior to making any decision about alternative accommodation for the patients.

The group reconvened on 03 July to assess progress from the above.

It was reported that the air exchange rate being achieved was around 6 per hour, still lower than the desired 12. The pascal measurement from the rooms to the corridor was around 5; the lower end of the accepted range. The ICD reported that whilst there had been an improvement in the particle count across 9 rooms, the remainder remained non compliant and out with the accepted normal standard. The ICD also reported that there had been some fungal growth from environmental swabs taken in the unit.

Following clinical debate, it was agreed that on the balance of risk, it would be safer to transfer the patients back to the Beatson West of Scotland Cancer Centre until such times as a permanent solution could be implemented to ward 4b. However, as an evaluation of the Beatson would need to undertaken, the balance of risk suggested that it would be safer to leave the patients at QEUH over the weekend until an assessment of the Beatson could be undertaken on 06 July.

Dr Craig Williams (Lead Infection Control Doctor) returned from leave on 06 and attended the review meetings on 1100 & 1500. Dr Williams concurred with his ICD colleagues and BMT Consultants that it would be clinically appropriate to transfer the patients back to the Beatson until the environmental issues could be resolved.

Dr Williams requested the validation and commissioning results for the BMT Unit and a further engineering view on the hepa-filtration and ventilation issues. Dr Williams briefly reviewed the clinical specification for the unit and stated that it seemed fine from his interpretation. Peter Moir agreed to develop a programme of work and financial plan related to rectifying the function of the unit.

It is proposed for clinical safety, pending ambulance availability and other infrastructure support, that BMT patients and acute leukaemia patients will transfer from the Queen Elizabeth University Hospital on 8th July back to the Beatson West of Scotland Cancer Centre.

This will affect 18 patients

A communication plan will be put in place with patients and their families, press and other stakeholders. It is planned to tell the patients tomorrow once the infrastructure is in place.

Gary Jenkins
Director: Regional Services
06 July 2015

From: Hood, John
Sent: 07 July 2015 12:12
To: Jones, Brian; Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20); Peters, Christine
Subject: FW: BMT SGUH

Follow Up Flag: Follow Up
Flag Status: Completed

Categories: Green Category

FYI

From: Williams, Craig
Sent: 07 July 2015 11:47
To: Hood, John
Subject: RE: BMT SGUH

Dear John

Thanks for the helpful comments, I think the gist of this is that these rooms were not built to the spec and as you clearly say they should have been to the same spec as the Beatson

Craig

From: Hood, John
Sent: 07 July 2015 11:40
To: Williams, Craig; Inkster, Teresa (NHSmail); Jones, Brian; Peters, Christine; Jenkins, Gary; Walsh, Tom
Subject: FW: BMT SGUH
Importance: High

Please find my annotated comments.
John H

From: Williams, Craig
Sent: 07 July 2015 10:35
To: Inkster, Teresa (NHSmail); Hood, John; Jones, Brian; Peters, Christine; Jenkins, Gary
Cc: Walsh, Tom
Subject: BMT SGUH

Dear All

Attached is a draft of a document to clarify the original building requirements and briefly describes the building and validation process. Is everyone content that if the building is provided to the original specification it will provide a safe environment for patients. Comments by 1130 please

Craig

From: Jenkins, Gary
Sent: 24 July 2015 08:44
To: Williams, Craig; Powrie, Ian; Parker, Anne; Moir, Peter; Campbell, Myra
Cc: Morrison, Anne
Subject: RE: BMT specification

Craig / Ian,

I think we should share this with Peter, Anne, Myra in the first instance and seek their views today.
I have copied them into this correspondence.

Regards
Gary

(If we need to try and meet today to discuss, I am happy that we do so)

From: Williams, Craig
Sent: 23 July 2015 16:49
To: Powrie, Ian; Jenkins, Gary
Subject: Fw: BMT specification

Dear Ian and Gary

This is the feedback from Peter Hoffman at Colindale. The main points as I see them are around the retention of tiles in the ensuite and the smoke testing. Ian should we take HFS advice around this.

I think we also need to be clear with Ann Parker that although the airflow will be from room to corridor and the corridor will be at positive pressure to the rest of the hospital that this is not a protected area as such.

How do you want to take this forward

Best wishes

Craig

Sent from my BlackBerry 10 smartphone on the EE network.

From: Peter Hoffman [redacted]
Sent: Thursday, 23 July 2015 4:33 PM
To: Williams, Craig
Subject: RE: BMT specification

Dear Craig,

Comments on the proposal

The proposal refers to a 5-10 pascal "differential pressure". It does not specify a) differential between which two areas and) the direction of that differential. The differential should be between the patient room and the corridor and the patient room should be at positive pressure to the corridor. This should be firmly established. (I have come

across situations where the value of the pressure differential was being measured precisely; that it was in the wrong direction did not seem to matter).

Room ceiling. I understand that an MF ceiling is a suspended solid, sealed ceiling. This would prevent the majority of air leaks and is acceptable. Please confirm I have understood the realities of an "MF ceiling".

Ensuite ceiling – it is proposed to keep the existing tiled ceiling but silicon seal around the tiles. This is a low QA approach – the tiles will get removed if access to services above are needed and the sealant will be replaced with low assurance of an adequate seal - the people doing it will probably not understand the significance. It would be better to have the same as the main room ceiling.

The lighting diffusers used are "IP" (ingress protection) rated so will be a barrier to airflow. They will be silicon sealed in – suspect this is as good as can be expected.

The air handling unit (AHU) is to be upgraded – general principals only, precise details not given. There seems no need to change the AHU filters and terminal HEPA filters. No problem to do this but be aware that, if they are, the setup will be operating at its very best when it is first activated and the normal range of performance will be below this to varying extents.

Filter blockage is assessed using the pressure differential across the filter. How will this be monitored? Ideally it would be measured electronically and fed in to a building management system ("BMS") which would alarm when a filter is approaching its maximum pressure differential value. Details of the proposed approach would help.

The use of mechanical micromanometer gauges (generically called magnahelic) to monitor room-corridor pressures is proposed. These would need to be read and recorded regularly e.g. once a shift or daily. If magnahelic are used, they should have a scale both above and below zero (e.g. -30 to +30 pascals). A better approach may be to use electronic micromanometers such that there is a local display but also an audible alarm at the nurses' station (not via the BMS – it may be a day or two before this is acted on) when out of specified range. This would not need the reading & recording that a magnahelic would and should be considered. Electronic micromanometers should have a short (5 minute?) alarm delay such that the do not sound every time a door is opened (the pressure would go to zero), but only when there is a real problem.

I am not sure there is a need to silicon seal the hatches in the ceiling. As such sealing is unlikely to be reliably maintained, the ventilation should be capable of keeping the rooms reliably positive pressure provided the hatches are well-fitting.

Has it been confirmed that patient room windows are sealed? Which windows elsewhere in the whole unit are sealed?

Commissioning & validation

Taking AHU swabs is pointless.

How will the gauges be "calibrated" If this just adjusting the zero point with the doors open, it is not calibration.

Pressures ward corridor to non-ward areas – Is this a protected area? How is it protected? Is this intended to say this area is safe for patients? Not sure what's going on here.

There should be witnessed observation of smoke flow through a variety of gaps in each room – pipe and cable entry points, around the room door etc. The smoke should flow outwards to all adjacent areas.

That is all that immediately occurs to me looking through the document. The document is rather basic so maybe I have assumed things where that assumption was not the same on the part of the project team or contractors.

It would be good to get this seen by someone in HPS. I can advise but have no remit to approve.

Regards,
Peter

From: Williams, Craig [redacted]
Sent: 23 July 2015 11:05
To: Peter Hoffman
Subject: BMT specification

Dear Peter

Many thanks again for your help with this. As discussed I have attached a specification for the rebuild of the BMT unit. The unit will house patients undergoing bone marrow transplantation and with acute leukeamia. The team will have access to pressurised lobbied side rooms, bulit to HBN0401 elsewhere in the hospital should their use be necessary.

Best wishes

Craig

Prof Craig Williams
Consultant Microbiologist Royal Hospital for Children, Glasgow
Lead Infection Control Doctor, NHSGGC
Professor of HAI, UWS

t. [redacted]
w. www.uws.ac.uk/hai

From: Jenkins, Gary
Sent: 23 July 2015 10:25
To: Parker, Anne; Morrison, Anne; Meehan, Laura; Campbell, Myra; Moir, Peter; Williams, Craig; Hunter, William; McClintock, Wendy; Campbell, Myra; Powrie, Ian; McArdle, Agnes; McLaughlin, Marie; Walsh, Tom; McQuaker, Grant
Cc: MacDonald, Marion; Dunlop, David; Dodds, David; Harkness, Anne; Kane, Mary Anne; Stewart, David; Archibald, Grant
Subject: BMT SERVICE: QEUH

Dear All,

I should like to provide the following update from the meeting held yesterday.

From a haematology perspective, the service is content with the work programme. However we still need Infection Control sign-off on the issues noted at point 1 below if we are to allow the work to progress as planned on Monday 27th July. Could I ask Craig and Tom to review this please as a priority.

1. Infection Control / Microbiology Issues
   - HAI Scribe documentation needs to be completed (Ian Powrie / Peter Moir / Clare Mitchell / Jackie Barmanory)
   - Confirmation the programme of works outlined in the email from Peter Moir on Friday 17th are appropriate from an Infection Control and Microbiology perspective (Craig Williams)
   - Confirmation from Peter Hoffman (external ICD / Microbiologist) that the revised programme is acceptable for a BMT Unit (Craig Williams)
   - Confirmation that the air exchanges and negative air flow measurements for the Pentamadine room are appropriate – you will note there is no proposed change and the area appears to be working following assessment (Craig Williams / Ian Powrie)
   - Confirmation that the non digital pressure gauges are acceptable – please note these are not digital as per the initial recommendation, however they are exactly the same as the rest of QEUH (Craig Williams)

2. Ward Logistical Issues
   - Confirmation received from Wendy McClintock that there is adequate interim storage to service the retained 10 Haematology beds
   - The Seminar Room on level 4 should be booked out for the duration of the works to act as an interim holding area for deliveries / surplus goods (Wendy McClintock)
   - We agreed that the zoned area, as per the model described by Peter, is operationally viable and allows the existing ward to function as normal whilst the contractors are on site

3. Estates / Facilities Issues
   - Additional storage for beds and lockers to be identified (Billy Hunter)
   - The route of access from the lab block up to the ward can be managed around the AGV schedules (Billy Hunter / Peter Moir)
   - Brookfield method statement to be sent to Billy Hunter for review (Peter Moir)

4. Ward / Service Issues that need to be planned
   - The maintenance schedule is once per annum for each room, taking approximately 2 days. This will result in 48 'lost' days related to planned activities. Consideration should be given as to how this will be accommodated – i.e. planned downtime and method of 'tenting off' the physical environment (Myra Campbell / Alison McCardle / Laura Meehan / Marie McLaughlin)
   - A contingency model should be developed for unplanned issues, i.e. emergency access. I suggested that it would be useful to liaise with renal and see if there is an opportunity to utilise the two lobby rooms if required (Myra Campbell / Margaret McLucas / Gus McKillop / Laura Meehan)

As discussed, the scheduled works will last for 11 weeks, thereafter a period of testing will be undertaken (2-3 days) prior to the service to transfer back to QEUH.

Regards
Gary

From: Jenkins, Gary
Sent: 17 July 2015 14:38
To: Parker, Anne; Morrison, Anne; Meehan, Laura; Campbell, Myra; Moir, Peter; Williams, Craig
Cc: MacDonald, Marion; Dunlop, David; Dodds, David
Subject: BMT SERVICE: QEUH

Dear Colleagues,

Thank you for your time today to discuss the above.

I should like to confirm the content of our discussion and the acceptance of the BMT clinical team and ICD in relation to the agreed amendments:

- We discussed that the recent series of testing has confirmed that we can achieve 7-9 pa to the individual patient rooms. It was agreed that this is well within the acceptable standards for the unit and that Craig Williams will contact a colleague in England for external assurance that this is wholly acceptable for a BMT service.
- We agreed that the design of a plaster board sealed ceiling would be acceptable as this modification achieves the desired output stated above.
- We accept that the maintenance programme for the HEPA filters is acceptable and we will work with Ian Powrie and colleagues going forward in relation to the six monthly engineering checks and HEPA filter changes.
- We received confirmation that the walls and ceiling finishes are anti-fungal as required for the unit.
- We agreed that the retrofit of monitoring gauges for air pressure is welcomed and that this will provide additional reassurance to colleagues on a day to day basis.
- We have identified that there is no issue with patients who require transfer into the critical care facilities at the QEUH.
- We are content that the drainage in the two shower rooms has been dealt with to obviate against water stagnation.
- We noted that the pentamadine room will operate with negative pressure to enable air exchanges.

In relation to progressing the works, I outlined that it is estimated that the programme will be completed within an 11 week timeframe. The clinical teams accepted that the current interim arrangements are acceptable (i.e. retaining BMT in B8 / B9) for this timeframe.

We discussed two other components:

- To limit the general footfall through BMT in the future, we will map alternative routes to the other ward areas on the 4th floor and introduce additional signage.
- Ian Powire, Peter Moir and Craig Williams will assess how to zone off the 10 remaining Haematology beds whilst the remedial work is being undertaken. Craig indicated that he acknowledged that Brookfield remain the key contractors for the remedial works but reminded colleagues of the need for HAI scribe assessment as the work is being undertaken in a live hospital environment.

Regards,
Gary

Gary Jenkins
Director: Regional Services Directorate
NHS Greater Glasgow & Clyde

[redacted]

Minutes of the
NHS GREATER GLASGOW AND CLYDE
BOARD INFECTION CONTROL COMMITTEE
held on
Monday 27th July 2015 at 12.00noon in
Conference Room, Southern General Hospital

Present:

Dr Jennifer Armstrong (Chair)	Board Medical Director
Professor Craig Williams	Co-ordinating ICD
Ms Sandra McNamee	Associate Nurse Director, Infection Control
Mr Kenneth Fleming	Head of Health and Safety
Mr Donald Sime	Employee Director
Dr Andrew Seaton	Consultant Physician
Dr David Stewart	Lead Director, Acute Medical Services
Ms Jacqueline Shookhye-Dickson	Heath Protection Nurse Specialist, PHPU
Rona Wall	Occupational Health Service Manager
Andy Bell	Project Manager, Facilities

In Attendance
Ann Lang (minutes)

Apologies received:
Tom Walsh Dr Iain Kennedy Pamela Joannidis Ms Suzanne Clark
Ms Liz McGovern

Item		Action
1.	**Welcome and Apologies** Apologies were received from the above mentioned.	
2.	**Minutes of the meeting held on 18 May 2015** The minutes of the previous meeting were agreed as an accurate record.	
3.	**Matters arising** <u>Antimicrobial Stewardship</u> Dr Seaton advised that there has been no progress as funds are not available to support this and modules will be issued from NES through the nursing network.	
4.	**Standing Agenda Items**	
	4.1 HAI Reporting Template (HAIRT) June 2015 The June 2015 HAIRT was distributed with the agenda. In the report Sandra McNamee reported that SSI rates for hip arthroplasty procedures remain above the national average. She said that analysis of the six infections found no commonality and no issues were identified at Cowlairs and Inverclyde Decontamination Units.	
	4.2 Q&P HAI Report – No Update There was no Q&P report for this committee. As this is now the Acute Services Committee Sandra McNamee advised that discussions are ongoing with Dr Armstrong regarding the information to include for this committee.	

Item		Action
4.3	**IPC Work Plan 2015/16** A copy of the IPC Work Plan for 2015/16 was distributed with the agenda and Sandra McNamee provided an update to the committee. In the recommendations from the Vale of Leven Inquiry Report she stated that we should have a HAI Communications Strategy and Audit Plan and SOP which has been provided to the committee for approval. The Lead ICN is to meet with the Lead Nurse in theatres to ensure that NHSGGC is compliant with elements of the HEI theatre audit tool in preparation for any inspections. As of 1st July 2015 a dedicated Infection Prevention and Control team are based at GGH to cover this site and the partnership areas. Sandra reported that new SPCs have been prepared in light of the new ward moves to the Queen Elizabeth University Hospital. She said this will be the first month of the monthly reports for sectors, Regional and Woman and Children will remain as before. In relation to the CAAS standards Sandra said that work with the link nurses has commenced for the process to start in September. There are several standards linked to IPC and the IPCNs are supporting the pilot wards at the moment.	
4.4	**Policies** Sandra McNamee updated the group on the following policies and SOPs and said that they had been issued for comments and modified as requested. <u>Chickenpox Policy</u> A copy of the above policy was distributed with the agenda and the committee approved this policy. <u>Occupational Related Illness Policy</u> Sandra reported that she met with Rona Wall and asked her to refresh Occupational Health representation at this committee as Dr Henderson has retired. She said that she will send the policy to Rona Wall and the committee agreed to approve this policy once Rona had a chance to look this over and any changes suggested made. <u>Tuberculosis Policy</u> A copy of the above policy was distributed with the agenda and approved. <u>Last Offices – SOP</u> A copy of the above SOP was distributed with the agenda and approved. <u>IPC HAI Communications Strategy</u> Sandra report that the terminology for the new communications strategy has been updated and includes Health and Social Care Partnerships. This document was approved by the committee. <u>IPC Audit Tool (IPCAT) – SOP</u> A copy of the new SOP Audit Plan was distributed with the agenda. Sandra stated that we require to evidence what the process is regarding audits and how often to do this. She said she is hoping that this audit tool will link with the FM tool in due course. The committee approved the SOP.	**SMcN**

Item		Action
4.5	**New Build Project** Professor Williams reported that the patients that were in the Bone Marrow Transplant Units in the new hospital have been relocated to the Beatson. He advised that the unit was not built to the correct specification and Brookefield have agreed to fund the rebuild for this area and the timeframe for this is 12 weeks. He said that all of the ID rooms have been built to specification and there is no risk to ID patients. With the demolition of the surgical block in September and the dust particles Professor Williams said there is concern regarding immune compromised patients being treated at the new hospital. He said that an alternative route will be identified for these patients so that they are entering the hospital at the furthest point away from the demolition. The decontamination room for a possible VHF patient was discussed and Professor Williams advised that there is no need for special containment and the room that has been identified is suitable. The isolation of rooms and the ward closure in the new hospital were discussed. Sandra McNamee advised that there is an appendix to the Outbreak Policy which is in draft and will be submitted to AICC and said that a ward could be kept open if there were dedicated nursing staff but that this could be operationally difficult. In the ward that did close Sandra pointed out that there is only one sluice in all wards in the Queen Elizabeth University Hospital. Dr Seaton commented that the availability of hand get in IDU was not good as this is situated between two rooms. Sandra advised that she will ask an Infection Control Nurse to look at this area as a matter of urgency. She said that Clare Mitchell and the Lead Nurse are on site and looking at areas where to place information.	**SMcN**
5.	**Exception Reports and Updates**	
5.1	**vCJD Group** As Dr Kennedy was unable to attend the meeting there was no update.	
5.2	**Antimicrobial Utilisation Committee** Dr Seaton reported that he provided an update of AUC at the last BICC meeting. The next AUC meeting is scheduled for 11th August 2015.	
5.3	**Acute Infection Control Committee (AICC)** The minutes of the Acute Infection Control Committee held in May were distributed with the agenda and noted. Also issued was a copy of the agenda for the last meeting in July as the minutes were not available as yet. Dr Stewart advised that SABs and the insertion of PVC lines were discussed.	
5.4	**Partnership Infection Control Support Group (PICSG)** The minutes of the Partnership Infection Control Support Group held in May were noted. Also issued was a copy of the agenda for the last meeting in July as the minutes were not available. Sandra McNamee advised that previously in acute a FM audit (SCART) was undertaken and also carried out in Partnerships in 2008. Mary Anne Kane is looking to undertake another audit and there is debate whether this should be done in Mental Health areas. Mari Brannigan is looking for clarification from David Pace on this.	

Item		Action
5.5	**Recent Outbreaks/Incidents** Sandra McNamee reported that a patient in the Burns Unit at GRI was identified with a toxigenic strain of diphtheria in her wound and this was reported to HPS. As the patient was an outpatient PHPU were involved in community contacts and all family were screened and tested negative. Dr Armstrong noted another SAB case has been identified in the Renal Unit at Stobhill. Sandra advised that there have been 5 cases to date during a 6 – 8 week period. An action plan is progressing and Marion MacDonald is working on this. She said that most seem to be connected to central lines and the focus will be on line care in this unit. Dr Armstrong asked for this to be put on the agenda for the next AICC meeting. Sandra also advised that this will be included in the directorate report for Regional Services which is issued to the Director, Chief Nurse and Chief of Medicine. Dr Armstrong asked Dr Stewart to take this forward and meet to discuss any additional interventions.	**DS**
5.6	**CPE Screening** Discussion took place regarding the introduction of CPE screening. Professor Williams advised that this is part of the NAD documentation and a plan is already in place to support the high risk units and will be replicated in other areas. He said that this will be triggered by a lab result that a screen has been taken, but the ultimate result can take two weeks to process. Education sessions will be carried out and the plan is to start this in ITUs from September. It was agreed that an update be provided at the next BICC meeting.	**CW**
6.	**New Business / Documents Received**	
6.1	**HAI Annual Report** A copy of the HAI Annual Report was distributed with the agenda. Professor Williams reported that enhanced e coli bacteraemia surveillance is to start in 2016. Dr Seaton advised that with regard to comoxiclav prescribing there is an indication of increasing resistance and stated that we need to focus on more promotion of quinolone.	
6.2	**HPS CDI and SAB Reports (Q1 Jan-Mar 2015)** Sandra McNamee updated the group on the latest figures for SAB and CDI for the quarter from January – March 2015. She said that with regards to SABs NHSGGC reported 27.1 SAB cases, with all boards to achieve a rate of 24 cases or lower by 31st March 2015. For CDI cases NHSGGC reported 24.6 cases per 100,000 OCBDs which remains below the national average of 27.1 cases. The estimated figures for the number of SABs for quarter 2 are 116 cases and for CDIs the estimated figure is 108 cases. Sandra commented that SABs continue to be a significant challenge to meet the target. Dr Seaton stated that vascular access is difficult to do at the new hospital and patients had to be sent to GGH to put lines in. Sandra advised that she will contact Karen McGugan to see if there has been an increase in the number of requests. Dr Stewart also advised that he will discuss this with Rachel Green and will raise this at the next AICC meeting. Dr Armstrong commented that last year the number of SAB cases related to renal patients and now it appears to be vascular access. Dr Stewart advised that the work in renal is ongoing and he will discuss this with George Welsh. Professor Williams stated that the number of SAB cases for this quarter relate to renal and neonatal patients and said that he will look at the epidemiology.	**SMcN** **DS** **DS** **CW**

Item		Action
6.3	**HAI Standards** All evidence was submitted for the HAI self assessment which was amended to reflect the outcomes of the new HAI standards. Sandra McNamee reported that theatres are being prepared for possible inspections by Healthcare Improvement Scotland.	
6.4	**Vale of Leven Hospital Inquiry Report** A link to the Vale of Leven Hospital Inquiry Report was included with the agenda. Dr Armstrong asked if we need an overall group to look at all the issues. Sandra McNamee reported that the recommendations maps to our Action Plan apart for the Link Nurses but they will be part of the CAAS Standards. Dr Armstrong stated that we need to formally record that work is ongoing and to document that we have looked at all aspects. She asked if Tom Walsh and Sandra McNamee can carry out a gap analysis and link to the recommendations of what we have completed. This can then be forwarded to BICC or the Board Clinical Governance Forum.	**TW/ SMcN**
6.5	**HAI Inspection Methodology** A copy of the HEI letter dated 10th July was distributed with the agenda. This details changes in the methodology and timescales from HEI regarding their inspections to sites. Sandra McNamee advised that there are new audit tools including PVC, CVC, Public Partner and Antimicrobial Prescribing tools. The new changes take effect from October 2015.	
6.6	**Mandatory HAI Requirements** The Scottish Government issued a letter regarding Healthcare Associated Infection (HAI) and Antimicrobial Resistance (AMR) Policy Requirements and the mandatory requirements that require to be adopted and implemented in all NHS healthcare settings. The committee discussed all the points raised in the letter and Sandra McNamee reported that in relation to Ecoli surveillance this will start from 2016. She said this will be additional work for the team as there are approximately 300 cases per quarter and the team will need to speak to medical staff to discuss these to determine a source. This may have a significant impact on what the IPCT were able to deliver. Sandra McNamee commented that the CAUTI bundle is in place apart from SGH and that this would be the intervention put in place to reduce CAUTI. HPS did a pilot study and almost 60% were community acquired so not amenable to intervention. Dr Armstrong asked if we need to take this away to look at and provide a response to the Scottish Government. Professor Williams suggested to bring back any points that are not embedded to BICC. Dr Armstrong recommended that that we bring back to the committee what surveillance cannot be done. Sandra McNamee advised that the National Point Prevalence Survey is due to be carried out next year again. She said this means that some staff are away from their duties for three months to collect this information. Dr Seaton said his team also had to suspend mandatory work to carry out the point prevalence survey. With regards to the National Infection Prevention and Control Manual Professor Williams advised that all NHS Boards are required to demonstrate that they have adopted, implemented and monitor compliance of the manual.	

Item	Action
He said that we have an addendum to the Transmission Based Precautions Policy and Dr Armstrong said to make sure that we have an audit trail through BICC and have it noted that this has been discussed with clinical groups. She said we should map this to a single document to be presented to BICC, Acute Services Committee and the Associate Medical Directorate meeting.	**CW**
In the letter Sandra McNamee advised that it states that we should not have policy documents as we should be working to the Infection Prevention and Control manual and suggested transferring our policy documents to SOPs (Standard Operating Procedure). She said this can be done when each policy is due for renewal and the policy can be changed to a SOP. Dr Armstrong stated that in the Vale of Leven Report it states that boards are responsible for two yearly policies. She proposed that this be raised with HPS to seek clarity on the planned update of the national manual and Sandra McNamee agreed to write to HPS.	**SMcN**
Sandra stated that the letter also states that all NHS Boards are required to report all HIIAT Green reporting items to HPS from April 2016. She said this will generate another report and will be a significant change to the Outbreak Policy.	
In relation to HAI Scribe Sandra McNamee reported that teams should be advised that minimum bed space should not be less than 3.6m wide.	

7. Update from Public Health Protection Unit

Jacqueline Shookye-Dickson provided an update for the committee and said she will forward a copy of the document to the group.

- A number of nursing homes have closed due to norovirus and influenza and 12 wards have been closed since May.
- There is ongoing high incidence of mumps cases with approximately 44-55 cases per month. Staff have been encouraged to ensure they are immunised.
- There is also a high incidence of whooping cough with 14-16 cases per month and Jackie advised that every few years there is an upsurge.
- The increase in diagnoses of HIV in people who inject drugs continues. 24 cases have been reported to date which is a significant increase from previous years. Dr Seaton reported that community testing is being carried out on drug users and said that they are finding patients coming in with abscesses. He said the prevalence in drug users is very high.
- An immunisation programme against meningitis B will be introduced from 1st September 2015, with babies born from 1st July 2015 eligible.

8. Review of Actions

- Sandra McNamee to send Rona Wall a copy of the Occupational Related Illness Policy for her approval.
- In relation to the availability of hand gel in IDU Sandra McNamee to ask an Infection Control Nurse to look at this area.
- Dr Stewart to raise at AICC the number of SAB cases in the Renal Unit and to discuss this with George Welch.
- Professor Williams to provide an update regarding CPE screening.
- Sandra McNamee to contact Karen McGugan to ask if the number of requests have increased for vascular access.
- Dr Stewart to discuss vascular access with Rachel Green.
- Professor Williams to look at the epidemiology relating to the number of SAB cases.

Item	Action
• Tom Walsh and Sandra McNamee to carry out a gap analysis to link to the recommendations in the Vale of Leven Action Plan that is provided to the Scottish Government. • Professor Williams to provide a one page document in relation to the addendum we have for Transmissions Based Precautions. • Sandra McNamee to write to HPS for clarity regarding changing policies to SOPs. **9. AOCB** No other business was discussed. **10. Date and Time of Next Meeting** The next meeting has been arranged for Monday 5 October at 12 noon and will be held in the Conference Room, Southern General Hospital.	

2015 Meeting Dates

Date (2015)			Time	Venue
Monday	5	October	12noon – 2pm	Conference Room, Southern General Hospital
Monday	30	November	12noon – 2pm	Conference Room, Southern General Hospital

Action Number	Description	Owner	Timescale	Comments
1	Collate all information on the design and sign off process pre PMI 228 and CE #10675.	Heather Griffin	By 29/01/16	
2	Provide reports and commissioning test certificates for completed works & covered by CE # 10675.	David Ramsey	By 29/01/16	
3	Provide report on design process for the additional works instructed under CE #18133 and commissioning certification.	Peter Moir	By 29/01/16	
4	Provide commission certificates for air permeability tests instructed under CE # 16807.	Peter Moir / David Ramsey	By 29/01/16	
5	Review of reasons why Hepa filters were not fitted in PICU and to establish cost, feasibility of retro fitting and timescale.	Peter Moir / Ian Powrie	By 29/01/16	**David Hall Note:** Hepa filters were not included within the ERs for isolation rooms which were understood to be for source protection rather than protective. The flexibility to add in the Hepa's was part of the design
6	Review document " Facilities for the Treatment of Adults with Haematological Malignancies – 'Levels of Care' and published by BCSH Haemato-Oncology Task Force 2009 (Note: Date for Review November 2014) is the current recommendation for BMT operations. This may require consultation with HPS & HFS. Consideration to be given to the implications of delivering a built environment to meet Level 3 definitions and requirements on completion of the above review.	Craig Williams / Jennifer Armstrong Project Team	ASAP On receipt of review outcome	

7	Provide briefing data and sign off process for the Adults Theatres.	Heather Griffin	By 29/01/16	
8	Provide commission data and certificates for Adults Theatres to confirm specification compliance.	Peter Moir / David Ramsey	By 29/01/16	
9	Establish if the proposed increase of extract in the en-suite rooms in the Schiehallion ward is a betterment over the original specification for the rooms.	Peter Moir / Ian Powrie	By 29/01/16	
10	Forward E mail requesting that a request was made to the Project Team to provide increased extract in the en-suite rooms in the Schiehallion rooms.	Craig Williams / Jennifer Armstrong	By 29/01/16	
11	Provide bacteriology test benchmark results and certificates for the Beatson and former Schiehallion Wards. Compare to results in QUEH.	Craig Williams	By 29/01/16	
Notes				
1	RHC: Currie & Brown (DH) confirm that the Isolation Rooms, Theatres and Schiehallion room designs are compliant with building regulations and the relevant SHTM's and SHPN 04 Supplement 1.			

David Loudon

Director of Facilities & Capital Planning

27th January 2016

From: Peters, Christine
Sent: 07 July 2015 12:22
To: Williams Craig (NHS GREATER GLASGOW & CLYDE - SGA20)
Cc: Jones, Brian; Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20); Hood, John; Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20)
Subject: RE: BMT SGUH

Categories: Green Category

Craig,

The validation data will be critical.

I will be away from tomorrow with 4 weeks annual leave. Teresa will be covering until Pauline gets back on Monday , therefore any actions to be taken on the back of the legionella results will need to be taken forward by them.

Regards,

[redacted]
Dr Christine Peters
Consultant Microbiologist
Southern General Hospital
GGC
Ex [redacted]
Mobile: [redacted]

From: Williams, Craig
Sent: 07 July 2015 12:07
To: Peters, Christine
Subject: RE: BMT SGUH

Dear Christine

I agree looking at the results it seems to be room sealing that might be the main problem but in the absence of any validation data it is difficult to be sure. Ian Powrie now apparently has a spreadsheet so we should be seeing something today which should give us some idea on how the ventilation is performing. He is also suppposed to be getting in touch with you about legionella.

Best wishes

Craig

From: Peters, Christine
Sent: 07 July 2015 12:03
To: Williams, Craig
Cc: Hood, John; Inkster, Teresa (NHSmail); Jones, Brian; Jenkins, Gary
Subject: RE: BMT SGUH

Hi Craig,

I agree that 5-10 is the best target range, just need to be clear where this is referenced to.

The issues are complex and requesting sealed rooms only makes sense if a concurrent positive pressure is maintained.

Regards,

Christine

From: Williams, Craig
Sent: 07 July 2015 11:48
To: Peters, Christine
Cc: Inkster, Teresa (NHSmail)
Subject: RE: BMT SGUH

Dear Christine

Thanks for the comments, the detials will be picked up during future discussions probably through the group that Anne Harkness is about to set up. The key point of the document is to establish that we requesetd sealed rooms. I take the point about the pressue differential and CDC but having discussed this with Peter Hoffmann he is of the view that a reliable 5kPa pressure differential is the key thing so I left the 5-10 in place

Craig

From: Peters, Christine
Sent: 07 July 2015 11:25
To: Jenkins, Gary; Williams, Craig; Inkster, Teresa (NHSmail); Hood, John; Jones, Brian
Cc: Walsh, Tom
Subject: RE: BMT SGUH

Hi All,
We have only had 20 minutes to look at this document. We would rather have a full scale discussion round a table as the issues are so enormous and we all seem to have different pieces of information at our disposal.

Regards,

Teresa Inkster and Christine Peters Joint signed

From: Jenkins, Gary
Sent: 07 July 2015 10:58
To: Williams, Craig; Inkster, Teresa (NHSmail); Hood, John; Jones, Brian; Peters, Christine
Cc: Walsh, Tom
Subject: RE: BMT SGUH

Craig,

We should also mention that there is no negative pressure in the pentamadine room.
The other issue in your bullet point, air exchanges at >12 – it stated yes, should it not state no as this has not yet been achieved?

I have also gone through this with Anne Parker, Myra Campbell, Laura Meehan and Alison McCardle; they are all comfortable with it.

Thanks

Gary

From: Williams, Craig
Sent: 07 July 2015 10:35
To: Inkster, Teresa (NHSmail); Hood, John; Jones, Brian; Peters, Christine; Jenkins, Gary
Cc: Walsh, Tom
Subject: BMT SGUH

Dear All

Attached is a draft of a document to clarify the original building requirements and briefly describes the building and validation process. Is everyone content that if the building is provided to the original specification it will provide a safe environment for patients. Comments by 1130 please

Craig

NHS Greater Glasgow and Clyde

Infection Prevention and Control Work Plan 2014/2015

(This document supports the implementation of the NHS Board IPC Programme 2014/15)

Approval

NHS Greater Glasgow & Clyde Board Infection Control Manager

NHS Greater Glasgow & Clyde Board Infection Control Committee

Submitted to:

NHS Greater Glasgow & Clyde Acute Infection Control Committee

NHS Greater Glasgow & Clyde Partnerships Infection Control Support Group

CONTENTS

1. NEW INITIATIVES / PROJECTS - 2014 / 15

Topic	Actions	Critical Dependency(s)	Lead	Bi-monthly Update October	Implementation Date
Undertake surveillance and quality improvement programmes in addition to the mandatory requirements of HDL (2006)38	Review available data, quality assure against existing available data and if possible plan strategies to survey all services for SSI.	ICNet functionality ?HDL from SGHD re additional mandatory requirements	Surveillance Co-ordinator and Lead Nurse Surveillance (Ann Kerr)	Two systems running during July and August. Once testing is complete additional surveillance projects will be developed.	July 2014 Currently exploring other types of surgical procedures to include in the project.
IPCT Service Evaluation	IPCT will conduct a survey of SCN / SN / HCA to determine areas for improvement.	None	Lead Nurse IPC Clyde and Person Centred Care (Joan Higgins)	Complete	Results sent to IPC SMT June 2014
Measure compliance / knowledge of policies	Nationally influence the development of an audit tool to enable SCNs to measure compliance with Standard Infection Control Precautions.	Development of LanQip. Possible nursing IT developments CAAS.	ANDIPC (IPC only) (Sandra McNamee)	Version 2 LanQip was launched in August 2014.	TBC
Develop new Infection Prevention Control Audit based on clinical priorities	Audit Group will develop an IPC Audit based on compliance with SICPs, MRSA KPI, CVC / PVC / CAUTI Bundles.	None	Lead Nurse IPC South West / Audit Group (Clare Mitchell)	No. Suspended until March 2015.	June 2015
Explore IT solutions regarding the reporting of the results from the IPC Audit	IT Project Board will explore options for collecting information from the IPC Audit. This will include the selection of appropriate hardware to support local IPCTs.	Available IT systems / finance	ANDIPC and LN Surveillance (Sandra McNamee, Ann Kerr)	No. Suspended until March 2015.	June 2015

Topic	Actions	Critical Dependency(s)	Lead	Bi-monthly Update September	Implementation Date
South Glasgow Hospitals (Adult)	• Board Hand Hygiene Co-ordinator working with Project Team to decide location of gel and HH dispensers and posters for staff (7000 + rooms). • Location of PPE dispensers. Team at SGH to assist project team with this. • Pseudomonas risk assessment for critical care and haemato-oncology areas to be completed. • IPCT requested meeting to discuss the move of the BMTU and the CDU to the new build as this was not in the original specification. • IPCT North West to participate in the group reviewing systems for transferring equipment to new-SGH. • Attend the Generic Ward Operational Group.	Releasing time from other HH commitments IPCT resource None Project Team to facilitate IPCT resource None	ANDIPC Lead Nurse IPC South West NCIPC NCIPC / Co-ordinating ICD / ICM / ANDIPC Lead Nurse IPC North West NCIPC	*Pseudomonas* risk assessment completed by NCIPC. Hand hygiene work ongoing. Project directed work with Project Team also ongoing. IPCT requested meeting with Project Team and Directorate regarding these unplanned moves. All groups where attendance has been requested are being attended.	Dependant on new build handover.
South Glasgow Hospitals (Children)	• Board Hand Hygiene Co-ordinator working with Project Team to determine locations for hand hygiene products (as above). • NCIPC working with Project Team to determine allocation of 'Danicentres' throughout new build for the provision of disposable PPE.	IPCT resource	NCIPC	Initial assessment complete. At point of installation IPCT required to allocate exact position of AHR dispensers and Danicentres'.	Dependant on new build handover.
	• Review of 'infected patient' pathway from ED to AAU and onward.	IPCT resource	NCIPC	Completed.	
	• Review of specialised service adjacencies in ward bed configuration.	IPCT resource	NCIPC	Ongoing input / attendance by NCIPC at Operational Group.	
	• Review of ventilation standards in lobbied single rooms (both hospitals)	IPCT resource	NCIPC	Ongoing review of ventilation.	
	• Pseudomonas risk assessment for critical care and haemato-oncology areas to be completed (as above)	IPCT resource	NCIPC	Risk assessment will be undertaken annually.	

Topic	Actions	Critical Dependency(s)	Lead	Bi-monthly Update September	Implementation Date
On the Move	• Attend Corporate Team On the Move Group. • Submit data on staff who are currently on sites that will migrate to the new-SGH. • Try and secure accommodation for staff who will need to migrate but who do not need to be located in South Glasgow Hospitals. • Service review complete. • OD day being organised for October 2014.	None	ANDIPC	**Yes**	
Ebola Preparedness	• Participate in development of training materials with Health Protection Scotland. • Plan prepared to provide training to all EDs and the Communicable Diseases Units. • Evaluate and recommend list of PPE. • Participate in the PHPU Steering Group.	IPCT nursing resource for training	NCIPC	**No**	October/November 2014

2. CORE PROGRAMMES OF WORK

A) Surveillance and Continuous Quality Improvement

Topic	Actions	Lead	Report / Update Available
To reduce MRSA / MSSA bacteraemia (SABs) to 24 cases per 100,000 occupied bed days by 31 March 2015 (HEAT)	Prepare monthly reports based on information from the enhanced surveillance of SABs.	Clinical Project Manager (Ann Kerr)	Monthly Acute and quarterly Directorate reports issued.
	Align outcome data from team to information collected by SPSP where possible. Support interventions from this information.	IPC Data Team / QIFs	Ongoing.
	Continue cross-directorate SAB Steering Group Meetings.	Clinical Project Manager (Ann Kerr)	Meetings to occur bi-monthly. Minutes available.
	IPCT to carry out enhanced surveillance of all reported SABs.	IPCTs	Ongoing. Output informs monthly Acute and quarterly Directorate Reports issued.
	IPCT to continue to support and update educational sessions around venepuncture and line management. Promote NES Aseptic Technique modules as learning resource.	IPCTs / Education (Lynn Pritchard)	Ongoing. Reports on numbers undertaking are available on request.
	Information from the updated Clinical Review Tool will be included in the Directorate SAB Reports. Returns will be included in the Directorate Monthly Reports.	Clinical Project Manager (Ann Kerr)	Monthly Acute and quarterly Directorate Reports issued.
	IPCTs will carry out audits of clinical practice in relation to the managements of PVC / CVC when a SAB is associated with an invasive device and as part of the IPC Audit.	IPCTs	Results will be included in the Monthly Directorate Reports.
	Report progress against target to NHS Board via the bi-monthly HAIRT and Quality & Performance Report.	ICM (Tom Walsh)	Every two months to BICC and Q&P.
	QIFs will target areas for improvement based on information collected.	QIFs / Clinical Project Manager (Ann Kerr)	
To reduce the incidence of C. *difficile* to 32 cases per 100,000 occupied bed days in ages 15 and over by 31 March 2015 (HEAT)	Monitor both HAI and non-HAI cases and produce and return to clinical areas SPC charts in relation to HAI *C. difficile*.	IPC Data Management / IPCTs (Ann Kerr)	Ongoing. Reported monthly to Wards and Directorates. Reported monthly to Nurse Director for Partnerships.
	Support the Antimicrobial Management Team in promoting antimicrobial policies which limit broad spectrum antibiotic agents implicated in *C. difficile*, MRSA and other similar infections.	ICDs	Ongoing. ICDs attend Antimicrobial Utilisation Committee.
	Support clinical teams in the management and reporting of *C. difficile* cases to reduce the risk of onward transmission.	IPCTs	Ongoing.

Topic	Actions	Lead	Report / Update Available
Undertake surveillance and quality improvement programmes which are compliant with national requirements	NHSGGC continue to comply with HDL (2006)38.	Surveillance Co-ordinator / IPC Data Management (Ann Kerr)	Ongoing. Quarterly SSI Reports issued to clinicians.
Alert Organism / Communicable Disease Surveillance	IPCTs will continue to collect data on all alert organisms or communicable diseases referred to them to detect trends and identify areas for action.	IPCTs	Ongoing. Data supports the update of SPCCs which are issued monthly.
Ensure delivery of IT work plan and utilise IT systems for continuous improvement	IPC Lead Surveillance Nurse will deliver actions outlined in Project Plan and act on recommendations from IPCT to develop or utilise existing IT systems.	IPCTs / IPC Lead Surveillance Nurse (Ann Kerr)	IPC Lead Surveillance Nurse to report to IPC SMT monthly on progress.

B) Education

Topic	Actions	Lead	Report/ Update Available
To ensure that IPCTs have access to education and training as appropriate	Continue to support and promote the education of the IPCT workforce by linking with Practice Development, Learning & Education within NHSGGC, and nationally with NHS Education for Scotland.	Education (Lynn Pritchard)	Ongoing
Ensure that staff in Primary Care have access to training on local decontamination	Support NES online / local decontamination training for staff.	IPCTs	Ongoing
To ensure that the workforce has access to education as per ICP Education Strategy	Continue to support and promote the IPC Modules on learnPro.	Education (Lynn Pritchard)	Ongoing
To ensure managers have access to IPC training records	Ensure members of the IPCT log training / education sessions on Oracle in order to provide clinical staff with up-to-date records of training.	ANDIPC (Sandra McNamee)	Ongoing
Ensure that training is provided and aligned to NHSGGC policies in relation to the management of invasive devices	Review existing presentations and ensure that they accurately reflect and include the key elements in the revised CVC / PVC Policy.	Education (Lynn Pritchard)	July 2014

C) Policies

Topic	Actions	Lead	Report/ Update Available
To maintain and enhance the NHSGGC Infection Prevention and Control of Infection Policy Manual	There will be a planned programme for the review / updating of all policies as per QIS HAI Standards.	IPC Policy Group (Pamela Joannidis)	Ongoing
	Develop new policies as required based on the requirements of the organisation and in response to new legislation, guidance or emerging pathogens.	IPC Policy Group (Pamela Joannidis)	Ongoing
	Place IPC policies on the IPC website and promote this site.	IPC Policy Group (Pamela Joannidis)	Ongoing
Implement the National Infection Prevention and Control Manual as available	Review contents and prepare addendums as required, as per Policy / SOP.	IPC Policy Group (Pamela Joannidis)	As available
Ensure that updated or newly developed IPC Policies and Standard Operating Procedures are fit for purpose and meet / complement other organisational objectives	Ensure consultation by implementing the IPC SOP Procedure for the Development and Approval of IPC Policies, SOPs and Patient Information in NHSGGC.	ANDIPC (Sandra McNamee)	Ongoing

D) Decontamination

Topic	Actions	Lead	Report/ Update Available
CJD	Review the Advisory Committee on Dangerous Pathogens (ACDP) Guidance on "transmissible spongiform encephalopathy agents: safe working and the prevention of infection", and make recommendations to the parts of the organisation to which issues within this applies.	CJD Group (PHPU Lead tbc)	Ongoing. CJD is a standing item on the BICC Agenda.
Central Decontamination Unit	Support the central decontamination unit by attending quarterly decontamination meetings at Cowlairs Decontamination Unit and provide education as required / requested.	Decontamination Group (Kate Hamilton / Dr Sarah Whitehead)	Ongoing. Included in Facilities update to BICC.
Central Decontamination Units	Carry out an IPC Environmental Audit on all units managed by CDU.	IPCTs	Ongoing. Reports will be included in Directorate re-posts
IPC Decontamination Group (Sub-Group of BICC)	IPCT will chair and support the work of this group and give advice as requested by clinical services and liaise with HPS / HFS. Work being carried out to establish decontamination page on NHSGGC IC Website and the introduction of internal safety action notices.	ICDs (Dr Sarah Whitehead / Dr Alison Balfour)	Ongoing. Decontamination Group reports to BICC / AICC / PICSG as appropriate.

E) Clinical Governance & Patient Safety (SPSP and SPSI)

Topic	Actions	Lead	Report/ Update Available
To comply with the principles outlined in the QIS Clinical Governance and Risk Management Standards	The IPC service will have structures and processes in place to identify, manage and communicate risks throughout the organisation.	ICM (Tom Walsh)	Risk Register developed and submitted to BICC for approval. Highest rated risks are submitted to the Corporate Risk Register.
	IPCTs will continue to assist clinical teams to complete the Root Cause Analysis tool for severe cases of CDI, and log onto Datix any severe case or case where it appears as a factor on the patient's death certificate.	IPCTs / Clinical Teams NHSGGC	Datix is reviewed within the directorate specific clinical governance systems. Overview given by Risk Manager to AICC / BICC.
To comply with the principles outlined in the QIS Infection Control Standards	Produce an Annual Report based on the IPC Programme for approval by the BICC and the NHSGGC Quality & Performance Committee.	ICM (Tom Walsh)	May 2015
To comply with the requirements of the SGHD in relation to the HAIRT Report	Populate the NHS SGHD bi-monthly HAIRT Report for presentation to the NHS Board and the NHSGGC Quality and Performance Committee.	ICM (Tom Walsh)	The HAIRT is published on the NHSGGC website bi-monthly. Presented to NHSGGC Board and Quality and Performance Committee (summary).
To ensure that the IPCT are supporting staff to apply IPC Policies and SOPs in relation to invasive devices management and SICPs to promote patient safety.	The IPC Audit will be undertaken as a minimum every 12 months in all wards and Clinical Departments, or more frequently as indicated by results, i.e. RED or AMBER score.	IPCTs	Reports returned to SCNs and Lead Nurses. Score reported in Directorate Monthly Reports.
To ensure that evidence based practice in relation to infection prevention and control is promoted by IPCTs in NHSGGC	The IPCTs in NHSGGC will participate in the SPSP and SPSI as required.	SPSP (Joan Higgins / Karon Cormack)	Ongoing
	Data will be shared between IPCTs and SPSP / SPSI where appropriate.	IC Data Management (Ann Kerr)	Ongoing
To comply with the requirements of the SGHD in relation to the HAI Report Card	Populate the HAI Report Card.	IC Data Management (Ann Kerr)	Ongoing. Reports posted on NHSGGC website each month.

F) Healthcare Hygiene, Cleaning Services and the Built Environment

Topic	Actions	Lead	Report/ Update Available
To comply with national guidance on cleanliness standards and provide patients and visitors with a clean hospital environment	To ensure compliance with national monitoring of standards by participating in the peer and public review of cleaning services.	IPCTs (Elisabeth Sutherland)	Ongoing
	IPCT participate in the site Facilities Groups.	IPCTs	Ongoing. Minutes from these groups are submitted to the Facilities Clinical Governance Committee.
	Participate in the training of public reviewers.	Patient Experience (Pamela Joannidis)	Ongoing
To ensure that NHSGGC premises are designed and built to facilitate the prevention and control of infection	Co-ordinating ICD jointly chairs with GM Facilities, the NHSGGC Water Group. This group reviews guidance with regards to the control of Legionella and *Pseudomonas*.	CICD / Facilities (Craig Williams / Mary Anne Kane)	Water Group meets bi-monthly. This group reports to BICC and Facilities Clinical Governance Committee.
	Ensure that all advice in relation to new builds complies with HFS Building Notes and Guidance Documents.	IPCTs	Ongoing
	Ensure that PPM and validation of theatres is ongoing.	S&A / CICD (Craig Williams)	Ventilation Group meets quarterly and reports to AICC.

G) Hand Hygiene

Topic	Actions	Lead	Report/ Update Available
Continue to involve the public and patients in compliance in relation to hand hygiene	Participate in Patient Experience events as requested.	**LHBC** (Stefan Morton)	**Ongoing**
	Educate and support members of the public to participate in local monitoring of hand hygiene compliance	**LHBC** (Stefan Morton)	**Ongoing**
	Continue to update the IPC website with regards to Hand Hygiene initiatives and information.	**LHBC** (Stefan Morton)	**Ongoing**
Promote a zero tolerance approach to HH compliance in NHSGGC as per CEL(2009)5	To continue to support staff to undertake local hand hygiene audits based on SPSP methodology which will now include information on technique as well as opportunity.	**LHBC** (Stefan Morton)	**Ongoing**
Provide assurance that NHSGGC continue to support continuous improvement in relation to HH	Prepare an assurance plan for Health Protection Scotland and NHSGGC.	**LHBC** (Stefan Morton)	**Update September 2014**

H) Person Centred Care (PCC) / Patient Experience

Topic	Actions	Lead	Report/Update Available
To ensure that systems and processes are in place to secure public involvement in issues related to HAI and that these systems are linked to the NHSGGC Patient Experience Framework	Map all Patient Experience (PE) activity to the Participation Standards documented in a log of activity reviewed at Acute Operating Division (AOD) PE Steering Group.	**Patient Experience** (Pamela Joannidis)	**Ongoing**
	A representative from the IPCT will attend the AOD PE Steering Group.	**Patient Experience** (Pamela Joannidis)	**Ongoing**
	Patient information will continue to be developed and updated as necessary.	**Patient Experience** (Pamela Joannidis)	**Ongoing**
	A member of the IPCT will visit every patient who has been identified with an alert organism or communicable disease and if able will give the patient verbal and written information.	**Person Centred Care** (Joan Higgins)	**Ongoing**
Monitoring of the National Cleaning Services Specification	Members from the IPCT will continue to participate in the Monitoring Framework for Cleaning Services PPI Review Support Group.	**IPCTs** (Pamela Joannidis)	**Ongoing**
NHS QIS Standards of HAI	Support public partners who attend the BICC and PICSG.	**Patient Experience** (Pamela Joannidis / Sandra McNamee)	**Ongoing**

I) Inspectorate Directorate / Quality Improvement Scotland HAI Standard

Topic	Actions	Lead	Report/ Update Available
Comply with NHS QIS HAI Standards and populate the online portfolio of evidence to demonstrate compliance with the standards	Review and update relevant evidence as it is updated or developed in response to the HEI action plan following each visit.	**HEI Leads (AICC)** (Rory Farrelly)	**Report on the progress of action plans is a standing item on the AICC agenda.**
	Co-ordinate and post the evidence submitted by other departments within NHSGGC.	**ICM** (Tom Walsh)	**Ongoing**
Participate in the NHSGGC Corporate HEI Inspection	Participate in the Acute Operating Division Corporate HEI inspection audits.	**IPCTs**	**Ongoing**

J) Scrutiny

Topic	Actions	Lead	Report/ Update Available
Comply with IPC Elements of the Health Improvement Scotland (HIS) Annual Scrutiny & Inspection Plan	Map IPCT information against that required in the new plan and address any defic iencies or points of clarity required.	TBC	TBC

K) MRSA KPIs

Topic	Actions	Lead	Report/ Update Available
Support staff to comply with CNO (2013)1 and complete the MRSA Clinical Risk Assessment	Nursing admission document will include MRSA CRA.	IPC Lead Surveillance Nurse (Ann Kerr)	Results included in monthly Directorate Reports.
	IPC Audit compliance with MRSA Screening national target through local collation and upload to HPS Portal.	IPCTs / IPC Lead Surveillance Nurse / IPC Data Team	Results included in monthly Directorate Reports.
	IPCTs / QIFs will promote and support staff to complete and comply with CNO (2013)1.	IPCTs / QIFs	N/A

L) On the Move

Topic	Actions	Lead	Report/ Update Available
Plan services to meet the needs of the Clinical Services Review and the integration of Health and Social Care.	Convene a group with all relevant stakeholders (IPCT, SMT, LN, HR) to ensure that staff are kept informed and supported during any changes which arise due to organisational change.	**ICM**	**As required**

3. GLOSSARY

ACDP	**Advisory Committee on Dangerous Pathogens**
AMT	**Antimicrobial Management Team**
AOD	**Acute Operating Division**
Alert organism alert condition	Any of a number of organisms or infections that could indicate, or cause, outbreaks of infection in the hospital or community.
Bacteraemia	Infection in the blood. Also known as Blood Stream Infection (BSI).
BICC	**Board Infection Control Committee**
CDAD	***Clostridium difficile*** Associated Disease
CDI	***Clostridium difficile*** Infection
CEL	**Chief Executive Letter** issued by Scottish Government Health Directorates (SGHD)
CMO	**Chief Medical Officer**
CVC	**Central Vascular Catheter**
C. difficile	***Clostridium difficile*** also referred to as ***C. diff*** (or ***C-diff***) is a Gram-positive spore-forming anaerobic bacteria. C. *difficile* is the commonest cause of gastro-intestinal infection in hospitals. It causes two conditions; antibiotic associated diarrhoea and the more severe and occasionally life-threatening pseudomembranous colitis. Control of the organism can be problematic due to the formation of spores and difficulty in removing them. Patients who have had antibiotics within the last eight weeks are most at risk of acquisition of the organism.
Cleanliness Champion	**Cleanliness Champion** A Ministerial led initiative to offer a specific education programme to HCWs. http://www.scotland.gov.uk/Topics/Health/NHS-Scotland/19529/19322
Code of Practice	**Code of Practice.** The NHS Scotland Code of Practice for the Local Management of Hygiene and Healthcare Associated Infection issued 2004 contains the components that must be complied with by all NHS HCWs in Scotland. http://www.scotland.gov.uk/Publications/2004/05/19315/36624
GRO	**General Registers Office**
HAI	Originally used to mean hospital acquired infection, the official 'Scottish Government' term is now **Healthcare Associated Infection**. These are considered to be infections that were not incubating prior to contact with a healthcare facility or undergoing a health-care intervention. It must be noted that HAI infection is not always an avoidable infection.
HAI SCRIBE &HBN 30	Scottish Health Facilities Note 30: version 3. Infection Control in Built Environment: Design and Planning.
HCW	**Healthcare Worker**
HDL	**Health Department Letter**
HEAT Target	**Health Efficiency and Access to Treatment**. Targets set by the Scottish Government.
HH	**Hand Hygiene**
HPS	**Health Protection Scotland**
IPCN/T/O/D/M	**Infection Control Nurse / Team / Officer / Doctor / Manager**
ICP	**Infection Control Programme**
KPI	**Key Performance Indicator**
LHBC	**Local Health Board Co-ordinator** (Hand Hygiene)
MRSA	**Meticillin resistant *Staphylococcus aureus.*** A *Staphylococcus aureus* resistant to first line antibiotics; most commonly known as a hospital acquired organism.
MSSA	**Meticillin Sensitive *Staphylococcus aureus***
PCAT	**Primary Care Audit Tool**
PHPU	**Public Health Protection Unit**
PVC	**Peripheral Vascular Catheter**
QIS	**Quality Improvement Scotland**
SAB	***Staphylococcus aureus* bacteraemia**
SIRN	**Scottish Infection Research Network**
SOP	**Standard Operating Procedure**
SPC	**Statistical Process Control Charts**
SPSP	**Scottish Patient Safety Programme**
VRE	**Vancomycin resistant enterococcus** - an alert organism. A common organism that can be inherently resistant to Vancomycin but can also acquire (and transfer resistance) to other organisms. Has caused outbreaks reported in the literature in a variety of high-risk settings, eg renal or bone marrow transplant units.

NHS GREATER GLASGOW AND CLYDE - ACUTE SERVICES DIVISION

DRAFT Minutes of Meeting of the **Acute Control of Infection Committee** held on **Monday 6 July 2015**, at 10.00 am, in the Conference Room, Management Building, Southern General Hospital, Glasgow.

Present

Prof Craig Williams	Lead Infection Control Doctor
Ms E Love	Head of Nursing, W&C
Mrs A Kerr	Lead Nurse Surveillance IPC
Ms Y Gourlay	Lead Pharmacist, AMT
Ms Karen Cormack	Head of Clinical Risk
Mrs L Thomson	Lead Nurse AMU & Cardiology GRI
Ms P Joannidis	Nurse Consultant Infection Prevention & Control
Ms A Harkness	Director, South Sector
Mrs M MacDonald	Chief Nurse Regional Services
Mrs C McKay	Lead Nurse Clyde
Dr L Bagrade	Consultant Microbiologist ICD Clyde
Ms K Hamilton	Lead Nurse North IPC
Mrs J Higgins	Lead Nurse Clyde IPC
Ms L McCaig	Senior Charge Nurse Diagnostics
Dr I Kennedy	Consultant Public Health
Ms J Barmanroy	Senior Infection Control Nurse South Sector
Dr C Peters	Consultant Clinical Microbiologist South Sector
Mr T Walsh	Infection Control Manager
Dr D Stewart (Chair)	Lead Director, Acute Medical Services

In Attendance

Mr T Sim	Corporate Administration Officer

Apologies

Ms K McGuigan	Lead Nurse, Imaging, Diagnostics
Ms S McNamee	ADN Infection Control
Mrs J Brown	Chief Nurse Clyde Sector
Ms K McGuigan	Lead Nurse, Imaging, Diagnostics
Dr J Beattie	Associate Medical Director W&C
Mr J Stuart	Chief Nurse North Sector
Ms E. Burt	Chief Nurse South Sector
Dr T Inkster	Consultant Microbiologist Diagnostics
Mrs M A Kane	Interim Director Facilities

Item **Action**

1) **Welcome and Apologies**

Apologies for absence were recorded as noted above. Dr Stewart welcomed new members to the meeting.

2) **Minute of Previous Meeting**

The minutes of the meeting of the group held on 12 May 2015 were agreed as an accurate record subject to the following corrections.

Page 2 Item 8 Ms Cormack advised of the change from Infection Control Bulletin to Clinical Risk Bulletin.

3) **Matters Arising**

All matters arising were covered in the agenda.

a) **Clinical Risk Update**

A presentation was provided by Ms Cormack who covered Infection Control Incidents in the time period April- June 2015.

Ms Cormack began by reporting the Infection Control Incidents by sub-category and advised that there was 1 CJD related incident during the above period. There were also 3 Inability to Isolate and 1 SAB incident. Ms Cormack took members through the approval status of incidents highlighting both those awaiting review and those currently being reviewed. Patient Outcome details were provided and Ms Cormack advised that there were 5 deaths during the period 4 CDI and 1 SAB death. There were some differences in CDI data and Ms Cormack advised that some incidents had been wrongly coded. Infection Control have also noticed that there has been an increase (39%) in severe CDI cases in Apr 2013- March 2014 and April 2014- March 2014. However Ms Cormack reported that there is an overall reduction in CDI cases over the same period, with fewer total numbers, but more severe cases.

b) **National Infection Prevention and Control Manual- Publication of Chapter 2 Transmission based Precautions**

Professor Williams provided a verbal update on this item and advised members that there was a meeting on 13 July 2015 to discuss draft amendments to existing protocols. Ms Joannidis also advised that the Policy was due for review in July 2015. Ms Joannidis asked for approval to extend the review date until end of September 2015 to allow for further review of the TBP report.

4) **Monthly Enhanced Surveillance of SAB Reports- April 2015 & May 2015**

Mrs Kerr reported on the April and May figures and advised that there were 36 cases identified in April and 46 in May. Around 52%-56% of HAI SABs were Hospital Acquired Infections. Mrs Kerr further reported that between 33%-46% of HAI SABS were attributed to a vascular access device. There is ongoing work to ensure compliance with the HEAT target. There were issues in May around the increased incidence which was attributed to the Renal Discharge Unit at Stobhill Hospital and there are actions being taken to address this. Ms Joannidis advised that there was a new audit tool around PVC and CVC with a better educational focus around practice.

Dr Stewart thanked Mrs Kerr for her update and asked members to consider the previous campaign to discourage the use of PVC and if this might be re-engaged.

5) **Quarterly Reports on the Surveillance of C Diff/SAB**

a) Mrs Kerr provided a verbal update and advised on the following;

SABs-Quarter 4- (October- December 2014) there were 93 patient cases which equated to a rate of 25.1 cases per 100,000 acute occupied bed days (AOBDs).This is above the national HEAT target of 24 cases per AOBDs. The Scottish rate was 30.4.

CDI- Quarter 4- (October- December 2014) there were 114 patient cases in ages 15 years and above, which equated to a rate of 33.3 cases per 100,000 total occupied bed days (OBDs). This is above the national HEAT target of 32 cases per 100,000 OBDs.
The Scottish rate was 35.4.

Mrs Kerr advised that the figures for Q1 January- March 2015 were embargoed until 7 July 2015. However there was an increase in SABs with 102 patient cases with a rate of 27.1 cases per 100,000 AOBDs (Scotland 29.7). There was a statistically significant decrease in our yearly trends in MSSA and total SABs (year end March 2015).
In terms of CDI Mrs Kerr reported that there were 87 patient cases in ages 15 years and above with a rate of 24.6 cases per 100,000 OBDs (Scotland 27.1) This was NHSGG&C's third lowest reporting quarter Mrs Kerr advised.

b) **Revised Healthcare Associated Infection (HAI) Standards: Health care Environment Inspectorate and Self- Assessment.**

Ms Joannidis provided a verbal update and reported to members that NHSGG&C submitted against nine Standards and that there had been feedback to date. Ms Joannidis also advised that there was a link available to view what had been submitted.

c) **HAI Annual Report 2014.**

The Health Associated Infection (HAI) Annual Report was received and noted by members.

d) **IPC HAI Communications Strategy**

Ms Joannidis provided a verbal update on the Communications Strategy and advised that it had been circulated for comment and would be sent to the BICC later in July for approval

e) **IPC Audit Tool SOP**

The Audit Tool SOP has been circulated for comment Ms Joannidis advised and would also be presented at the BICC meeting on 27 July 2015 for approval.

6) **Draft Policies for Noting**

The following Policies were provided to members for noting:

- Tuberculosis Policy
- Chickenpox Policy
- Occupational Related Illness Policy
- SOP Last Offices

7) **Standing Items**

a) **Bi Monthly HAIRT Report June 201%**

Mr Walsh provided members with an update on the Key Healthcare Associated Infection Headlines for June 2015 (HAIRT). The report was received and noted. Mr Walsh advised members on some key headlines and advised that NHSGG&C successfully achieved the 2013 *Clostridium difficile* HEAT target of less that 39 cases per 100,000 occupied bed days in the over 65 age group. In the year ending December 2014 NHSGG&C had a statistically significant decrease in MSSA and total *Staphylococcus aureus* bacteraemias in comparison with the previous year.

Mr Walsh further advised that for the last available quarter (October- December 2014) the SSI rates for Caesarean section and knee arthroplasty procedure categories are below the national average; while repair of neck of femur procedures match the national average and SSI rates for hip arthroplasty procures remain above the national average.

b) **HEIS**

This item was noted by members

c) **Infection Control Implementation Plan**

Members received and noted the Infection Control Implementation Plan presented by Ms Joannidis who reported on key initiatives projects within the plan. The SOP to describe what HAI audit information should be displayed in wards and what should be public facing information was circulated for evaluation. Ms Joannidis further advised that there is ongoing work with IPC and theatre users to ensure that NHSGG&C is compliant and prepared for HEI theatre inspections.

There was some discussion around the 1109 single rooms within the new South Glasgow University Hospitals and the implications for IPC. Both Ms Joannidis and Mr Walsh were cognisant of concerns and agreed to review the implementation plan to ensure this was captured. **PJ/TW**

d) **Sector Reports/Exceptions/Updates**

The Infection Prevention and Control Sector Reports presented by Mr Walsh for April and May 2015 were received and noted by members. Mr Walsh advised members that each of the three sectors Lead IPC Nurses would provide an update on their sectors at Acute Infection Control Committee meetings.

e) **Minutes of Board Infection Control Committee March 2015**

The minutes of the Board Infection Control Committee meeting on 30 March 2015 were noted by members. Mr Walsh drew member's attention to point 4.2 and advised the Q&P committee no longer exists and has been replaced by the Acute Services Committee.

f) **CJD**

Dr Kennedy provided members with a verbal update and advised that NHSGG&C have until October 2015 to implement guidance on the use of re-usable instruments.

g) **AMT Report**

The AMT report provided by Ms Gourlay was received and noted by members. Ms Gourlay began by reporting on the SAPG Prescribing Target Downstream Medical Wards to May 2015 and advised members that the recording of Indication continues above the 95% target. Prescribing of antibiotics varies around the 95% target, with the recording of duration for oral antibiotic therapy improving, but still below the 95% target. Ms Gourlay further advised that these targets will be replaced by the new SAPG target in June 2015. **YG**

Ms Gourlay provided further information on the SAPG target for Surgical receiving wards and for Colorectal and Plastic Surgery. In particular Ms Gourlay drew member's attention to the improvement in the use of single dose therapy within the SAPG Target for Plastic Surgery where compliance with policy has changed from 40% in September 2014 to 90% in March to May 2015.

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h) **Theatre Maintenance/Validation**

Professor Williams advised that there were no particular issues to report and Ms Hamilton confirmed that all Theatres were up and running. Dr Peters advised that there were some issues with ventilation within a couple of areas and in particular within one room at the new SGUH. There was discussion around HEPA filters and the need to ensure that air pressures were correct, as Dr Peters had reported that there were some issues around slightly positive air pressure.

Dr Peters and Professor Williams advised that a meeting had been arranged later in the day with Gary Jenkins, Director of Regional Services to discuss these issues.

i) **Decontamination**

Professor Williams reported that the drafted new terms and conditions would by reported at the new meeting in September 2015. **CW**

8) **AOCB**

Dr Kennedy advised on three separate issues:

- Botulisim- There had been one further case recently, and as the case was within 6 weeks of the previous case, it will be classed as belong to the outbreak.

- Mycrobacterium chimera and cardiac bypass- The manufacturer's Field Safety Notice has been issued, and Dr Kennedy, Professor Williams and Mr Walsh would be meeting to discus the next steps.

- Diptheria- There has been a case of cutaneous diphtheria in a patient attending a plastics clinic at Glasgow Royal Infirmary. Dr Kennedt advised that this is the first toxigenic diphtheria in Scotland since 2007.

10) **Date of Next Meeting**

Monday 7 September 2015 at 10.00am, Conference Room, Management Building, Southern General Hospital

From: Kane, Mary Anne [redacted]
Sent: 15 June 2018 10:40
To: STORRAR, Ian (NHS NATIONAL SERVICES SCOTLAND); RANKIN, Annette (NHS NATIONAL SERVICES SCOTLAND); Powrie Ian (NHS GREATER GLASGOW & CLYDE); alan.gallacher[redacted]
Subject: Responses from DR Craig Williams ICD re Commissioning
Attachments: Tom WQ.docx

Please see attached some responses received from Dr Williams re his involvement as ICD in commissioning of the QEUH/RHC
Mary Anne

- Were you involved in the design of the water system at QEUH/RHC in your role as Lead ICD ?

No

- Were you involved as Lead ICD with the sign off of the water systems at QEUH/ RHC at handover ?

No

- Did you review the water test results for the hospitals as part of the project hand over process ?

Yes along with Ian Powrie we reviewed a spreadsheet of results

- Was the methodology for sampling and disinfection discussed with you as ICD ?

Yes Ian and I observed the methods used by the contractor to sample outlets and they were appropriate

- Do you recollect any issue with the water system at the point of handover /commissioning ?

My recollection is that there were a few high counts in the QUEH tower in a relatively small number of outlets, these were treated and retested and were clear.

NHS National Services Scotland

Scottish Health Facilities Note 30: Version 3

Infection control in the built environment: Design and planning

Health Facilities Scotland

A49756324

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Version 3

Infection Control in the Built Environment: Design and Planning

Health Facilities Scotland

June 2007

A49756324

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1. Scope

1.1 This document is a revision of Scottish Health Facilities Note 30 (SHFN 30): 'Infection Control in the built environment: design and planning' which was published in 2002. The need for a revised document has become increasingly apparent in light of the determined focus being applied to reducing Healthcare Associated Infections (HAIs). This focus has highlighted the need for initial, rigorous examination of proposals for new build healthcare facilities, extensions to healthcare facilities, and refurbishment of healthcare facilities in relation to prevention and control of infection. Having highlighted the need for a rigorous examination of proposals in relation to new healthcare facilities, good practice also requires an ongoing audit of existing healthcare facilities.

1.2 SHFN 30 is intended to guide and stimulate thinking on the planning and execution of new construction and refurbishment works in all types of healthcare facilities.

1.3 The document is aimed at all those involved in the provision of new or refurbished facilities and aims to ensure that prevention and control of infection issues are identified, analysed and planned for at the earliest stage of a project.

1.4 Project team members and contributors from various disciplines will take different points from the document and it is the ensuing debate and analysis which will improve the quality of the delivered facility.

1.5 SHFN 30 should also be seen as a reference guide, for use in conjunction with the HAI System for the Control of Risk of Infection in the Built Environment (HAI-SCRIBE), which is concurrently being developed for use within NHSScotland. HAI-SCRIBE aims to reduce infection hazards through the development of a prevention and control of infection questionnaire using a number of scenarios within the built healthcare environment.

These scenarios are:

- the proposed site for development of a healthcare facility;
- the design and planning stage of the proposed healthcare facility;
- the construction and refurbishment stage of the healthcare facility;
- the ongoing maintenance of the healthcare facility.

1.6 Although HAI-SCRIBE is intended mainly for new build and refurbishment of healthcare facilities, the question set relating to ongoing maintenance should also be applied to all existing healthcare facilities. Continual maintenance of existing healthcare buildings is important in ensuring that there is no deterioration of existing healthcare facilities. The built environment includes existing buildings used for healthcare purposes and new build projects, and the intention is to apply HAI-SCRIBE from design and planning through to occupation and operation of the facility.

2. Introduction

2.1 In recent years there has been an increase in concern about the risks to health from receiving treatment and care in healthcare facilities. The Report of a Joint Scottish Executive Health Department and NHSScotland Working Group (Carey Group 2001) states that studies have found:

- an estimated 9% of hospital patients acquire an infection during their stay;
- risks are not only present in hospitals but also in primary healthcare and social care settings;
- there is a risk of vCJD, the human form of BSE, being spread from person to person by surgical instruments.

Furthermore, a report by Walker (2001) estimates that the total cost to Scotland of HAI is approximately £186 million per annum.

2.2 Advances in technical and therapeutic methodologies are among the range of factors which present further challenges in relation to control of infection. Organisms with antimicrobial resistance have become a major public health threat, making infection occurring within healthcare premises increasingly difficult to treat. Infection originating in hospitals and other healthcare facilities is now recognised as a serious and widespread problem. Although standards of hygiene in healthcare facilities and standards of personal hygiene have been identified as likely sources of infection and infection spread, it can also be said that the design, planning, construction, refurbishment and ongoing maintenance of the healthcare facility also have an important role to play in the control of infection. The physical environment has to assist, not hinder, good practice.

Origins

2.3 Healthcare Associated Infection (HAI) is a priority issue for NHSScotland. A major programme of work to improve the prevention and control of HAI across NHSScotland was laid out in the Ministerial HAI Action Plan, HDL(2002)82. Under the Chairmanship of the Chief Medical Officer (CMO), the HAI Task Force is now carrying out the programme of work highlighted by the Action Plan. Part of the HAI Task Force 3-year programme of work involves producing guidance on updating the physical environment for older buildings and reviewing the current guidance relating to prevention and control of infection in the built environment; the HAI Task Force Groups 6 & 8 have been charged with undertaking this work. These groups have been combined and are led by Health Facilities Scotland.

Background

2.4 Healthcare Associated Infection (HAI) can be described as infection that is acquired during a visit or is related to a stay in a healthcare facility. In recent years there has been an increase in concern surrounding the risks to health from receiving treatment and care in healthcare facilities. Incidences of HAI are

now recognised as a serious and widespread problem, although the true extent of healthcare associated infection is difficult to quantify.

2.5 As part of the national HAI strategy, an HAI prevalence survey will be undertaken to provide data on the overall burden and costs of HAI to Scotland. This survey is being progressed by the HAI Task Force, through Health Protection Scotland (HPS). The Pilot Survey started in May 2005.

2.6 HAI is significant medically because of the associated mortality and morbidity. This is highlighted by the fact that approximately 1 in 10 patients acquire an infection as a result of receiving treatment and care in healthcare facilities (Plowman et al, 1999). It is also important economically, with one estimate suggesting that the annual cost to NHSScotland due to HAI may be as high as £186 million with the loss of 380,000 bed days (Walker, 2001). Furthermore, research findings show that at least 20% of HAIs are preventable (Harbarth, 2003). Control of HAI is therefore a major concern, and the high incidence of HAI is seen as evidence of poor quality of healthcare delivery, which leads inevitably to avoidable costs (WHO, 2002). It has been estimated that the compensation cost from clinical negligence resulting in HAI is £4 million per annum and non-conformance with recommendations and guidelines of all kinds accounts for 32% of United Kingdom NHS compensation costs (Wanless, 2001).

2.7 The Report of a Joint Scottish Executive Health Department and NHSScotland Working Group in April 2002 states that HAI can affect patients, staff and others in all healthcare settings, not just in hospitals. Potential consequences to health as a result of HAI may be wide ranging including hospital admission, prolonged stay, absence from work, increased costs to the NHS, the individual and/or families, and emotional distress to the latter.

2.8 The most common types of HAIs are urinary tract infection, surgical site infection, and lower respiratory tract infections such as pneumonia, which account for an estimated 92% of all HAIs. Figure 1 adapted from Ayliffe (1992) shows the routes of transmission for Healthcare Associated Infections.

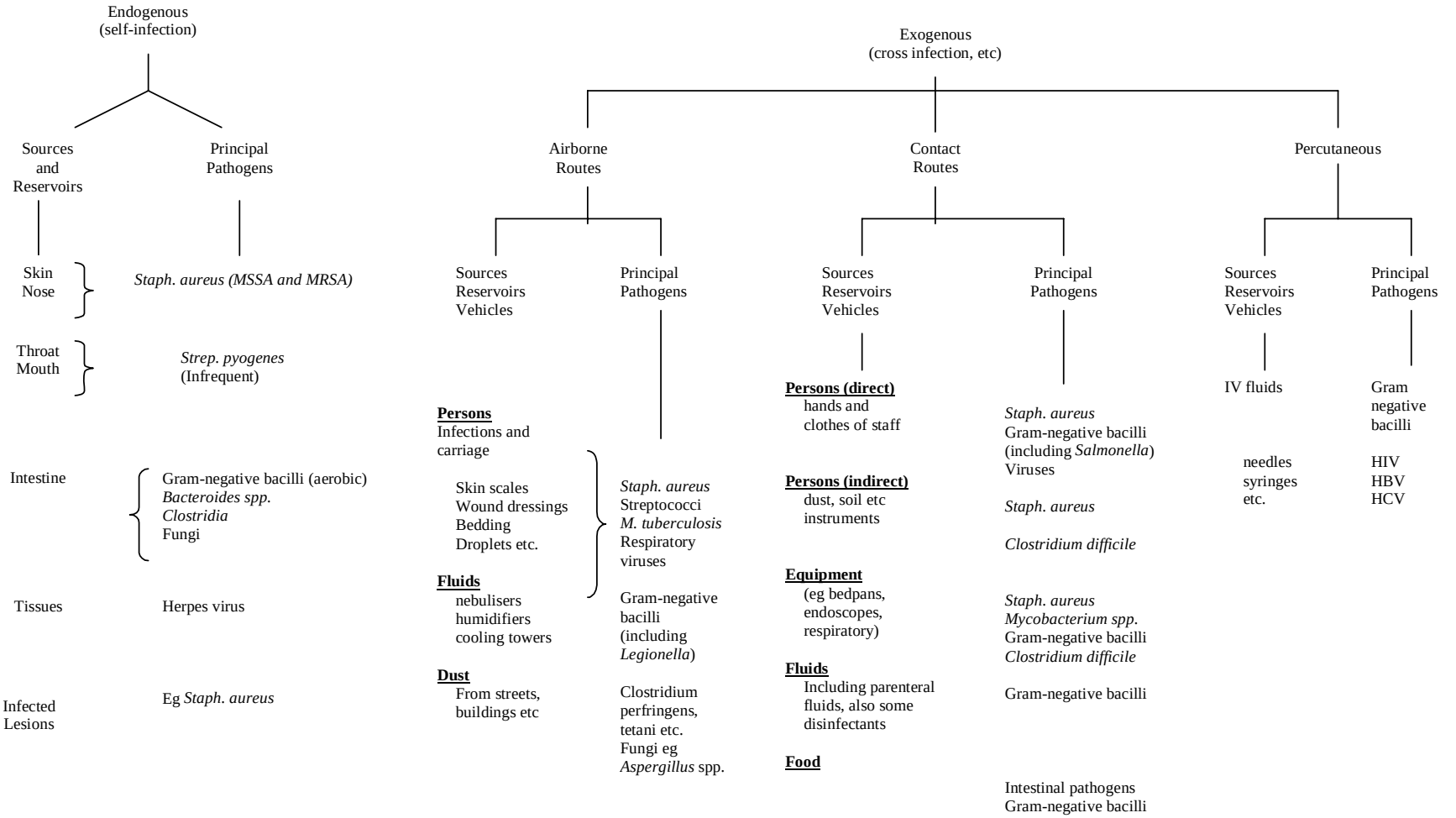

Figure 1: Roots of transmission adapted from Ayliffe (1992)

Purpose of this document

2.9 This guidance document should not be seen as being an infection control manual or a comprehensive guide to the principles underpinning the global issues surrounding prevention and control of infection. It should be seen as guidance which highlights the prevention and control of infection issues associated with site development, design and planning, construction and refurbishment and on-going maintenance of the healthcare facility.

2.10 The document's principal aim is to provide information on the prevention and control of infection, and on the prevention of cross-infection and cross contamination in healthcare facilities, to those responsible for the planning, design and maintenance of such facilities. It is imperative that those involved in these processes have a sound knowledge of prevention and control of infection in the built environment. This document can provide an insight to the key factors within the built environment which can impact on the control of infection. However, further knowledge may be gained by training in HAI which is available from a variety of sources from basic induction training to specialist post graduate level courses such as 'Controlling the risk from Healthcare Associated Infection in healthcare environments' module which is provided by Glasgow Caledonian University as part of the MSc Healthcare Property and Facilities Management. It is therefore intended as a first point of reference on prevention and control of infection for healthcare estates and facilities managers, architects, builders, engineers, surveyors, health planners and Infection Control Teams working on healthcare estate new build and refurbishment projects. It will also be useful as a guide for best practice in existing healthcare facilities.

2.11 Throughout the various sections of the document there are a number of key themes which are repeated. These are:

- Project Team;
- Importance of education;
- Risk management;
- Legislative issues.

2.12 These themes are discussed in Sections 3-6 of this document, in order to give an indication of why they are important in relation to the prevention and control of infection within the built healthcare environment.

2.13 Sections 7-13 refer to the processes involved in the development and maintenance of the healthcare facility. These sections highlight how the key issues fit into the processes involved in the development and maintenance of the healthcare facility.

The built environment and quality of care

2.14 HAI is a complex issue involving the whole patient journey and the many different elements of treatment and care provision, however, it is clear that the built environment plays a key role in the prevention and control of HAI.

2.15 Developing solutions to this serious problem requires a clear understanding of how the commissioning, planning, design, procurement, construction and operation and maintenance of healthcare properties can contribute to the prevention and control of HAI. The absence of a holistic approach to the management of these stages of development and maintenance of healthcare facilities may compromise prevention and control of infection. Although there is a need to improve the evidence base in some areas, much of the knowledge surrounding the control of HAI has been published in standards, journals and guidelines. Much of the solution to the existing HAI problem lies in the effective dissemination and implementation of existing knowledge to all involved, in a logical, accessible form.

3. The Project Team

3.1 Healthcare Associated Infection (HAI) is a complex issue involving the many different elements of patient care and provision. Due to its multi-factorial nature there is a need to develop a holistic approach to combating the spread of infection within the built environment. To achieve this, knowledge from a wide variety of sources is needed including Infection Control Specialists, Architects, Facilities Managers and Engineers.

3.2 A comprehensive approach to planning needs to include consultation with, and participation of, appropriate specialists from its inception through to post-project evaluation.

Management of the Project

3.3 The Scottish Executive Health Department's, Scottish Capital Investment Manual (SCIM) sets out the organisational structure of the Project within NHSScotland, a summary of which can be described as follows:

NHS Board internal organisation

i. **NHS Board** - monitor cost and progress of all capital investment projects at regular meetings. If problems are identified, it needs to be satisfied that appropriate steps are being taken;

ii. **Chief Executive Officer** – accountable to NHS Board. May be only person with total responsibility for project and any other related activities. Responsible for management of all major capital schemes at all stages of the process from inception to post project evaluation;

iii. **Project Board** - comprising senior staff within the NHS Board who have an interest in the project and whose activities will be affected by the project, e.g. staff from clinical areas such as infection control;

iv. **Project Director** - responsible for overall project management. Managing the NHS Boards interest in the Project. Evaluating competence of and appointing Consultants and Contractors who will undertake design and construction activity and act as point of contract in dealings with Contractors;

v. **Professional Adviser** - experienced in construction and design, especially of healthcare facilities;

vi. **User Panel** - representatives of each of the relevant service departments, in each case authorised to define their department's needs and to review and agree how those needs are to be met.

External resources:

i. **Project Manager** – NHS Boards rarely have capacity in-house to develop and manage all aspects of the project, therefore it is usually necessary to appoint external Advisors and Consultants. The Project Manager's role is to provide a single point of responsibility for the project brief and design. They also oversee the day to day progress of the project;

ii. **Other Consultants** – this includes Design Consultants, M & E Engineers and Architects. They are managed by the Project Manager, appointed by the Project Director. However, their responsibility will be to, and their contracts with, the NHS Board.

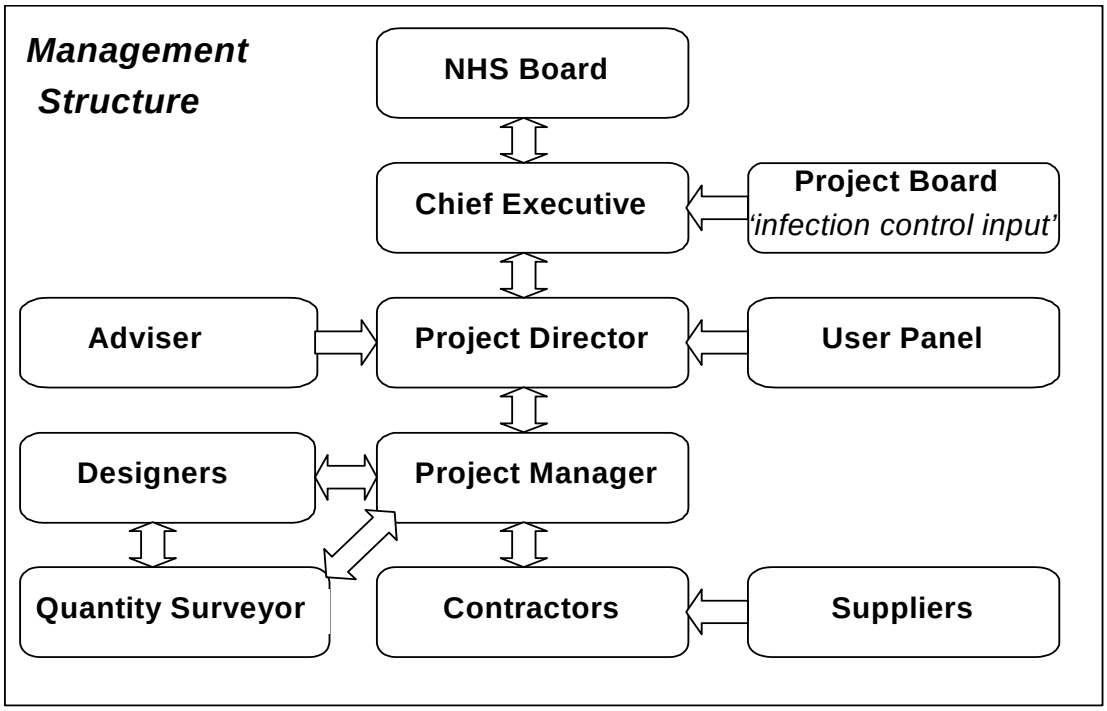

Table 1: Highlighting the management structure of the key players involved in the development of the healthcare facility

Importance of experience and understanding of prevention and control of infection in the Project Team

3.4 Due to its multi-factorial nature, knowledge and understanding of HAI is not only necessary for Infection Control Specialists. There is a necessity for all staff involved in the procurement, design, construction and maintenance of the healthcare facility to be appropriately educated in prevention and control of infection. Training on prevention and control of infection of these groups is available from a variety of sources ranging from basic induction training (NHS Education for Scotland's Mandatory HAI Induction Training Framework and NHS Education for Scotland's Cleanliness Champions Programme), to more specialist training at Post-Graduate level.

3.5 Prevention and control of Healthcare Associated Infection is significantly increasing in profile within NHSScotland. The Ministerial Action Plan

'Preventing infections acquired while receiving healthcare' HDL(2002)82 sets out an Action Plan which is being undertaken by the HAI Task Force. Within the Action Plan there is reference to the promotion of good prevention and control of infection practice in wards, clinical settings and support services, emphasising that the work environment should be conducive to good prevention and control of infection practice and that environment and equipment standards must be maintained.

3.6 There are a variety of measures which contribute to the prevention of infection. However, despite every best effort, not all infections are preventable. Resources must be directed towards minimising the risk where infection can be prevented and facility design plays an important role in achieving this.

Importance of Infection Control input

3.7 Any project to build or refurbish healthcare facilities requires the involvement of a multi-disciplinary team from planning to completion and must include input from Infection Control Specialists throughout the project. The importance of a clean, safe environment should not be under-estimated, as it will help ensure that:

- health and safety needs in terms of limiting the risk of infection of the occupants, healthcare workers and building contractors, are met during the project;
- the building design features will minimise the risk of transmission of infection;
- important design issues are considered at the project planning stage to avoid costly modification at a later stage.

3.8 Infection Control staff provide expertise and advice on the prevention and control of infection and as such play a pivotal role in ensuring other members of the Project Team are appropriately informed of any prevention and control of infection issues which may arise when:

- an initial site is being considered for development;
- the healthcare facility is being designed;
- the healthcare facility is being constructed or undergoing refurbishment;
- the healthcare facility is operational.

Examples of issues to be considered by the Project Team

3.9 Any disturbance of the environment caused by maintenance, demolition, construction and renovation presents a risk of infection to the occupants including:

- exposure to airborne micro-organisms such as *Aspergillus* spp;
- water entry and absorption into building materials leading to increased microbial contamination;

- access for insect pests and vermin;
- increased traffic through the facility;
- dust and debris in patient care areas and local/central decontamination units.

3.10 It is important to consider certain issues before construction work commences including:

- the type and extent of construction or renovation work;
- the likelihood of contamination to adjacent patient care areas;
- the impact on traffic for supplies e.g. sterile stock storage and delivery;
- the air flow and pressure differentials in the area (differentials may be varied by external wind strength and direction);
- the susceptibility of the occupants to infection e.g. through respiratory problems, immuno-compromised or intensive care patients;
- requirements for extra cleaning facilities.

3.11 Suitable efficient barriers may be required for dust control where work is to be carried out near patient areas. Examples of work include:

- demolition of walls, plaster and ceilings;
- removal of flooring, carpets, windows and doors;
- routine maintenance activities;
- any work with water which may aerosolise water droplets in high risk areas;
- exposure of ceiling voids;
- repairing water damage.

3.12 Transmission of micro-organisms with potential to cause infection requires three main elements:

- a susceptible host;
- reservoir of an infectious agent;
- an environment which allows the infection agent to colonise and possibly cause an infection in the susceptible host.

3.13 The risk of infection increases when micro-organisms exist in sufficient numbers in the environment and have the means of transmission to a susceptible host.

3.14 Implementation of effective prevention and control of infection measures reduce the risk of transmission by promoting an environment where risk of interaction between organism and susceptible host is minimised and this can be achieved by:

- proper design and maintenance of ventilation systems;

- designs which minimise accumulation of liquids in the airstream;
- designs which facilitate cleaning and good housekeeping;
- provision, where appropriate, of negative pressure ventilation;
- provision of adequate hand-hygiene facilities;
- provision, where appropriate, of adequate decontamination facilities.

3.15 Standard precautions should be adopted at all times in the healthcare setting but on occasion, additional transmission based precautions such as isolation are required to protect other patients, particularly those who are susceptible, staff and visitors. In any care setting, provision for the following in building design will assist in reducing the risk of infection:

- easy access to hand-hygiene facilities;
- suitable ventilation;
- adequate space for storage and ease of movement for patients and staff;
- surfaces, furnishing and fittings which will minimise dust accumulation;
- surfaces, furnishing and fittings which can withstand recommended decontamination processes and which are cleanable;
- secure and prompt waste and laundry disposal.

Selection of multi-disciplinary team of specialists

3.16 There are a variety of contract agreements with regards to the Project Team involved in the development of the healthcare facility. Each facility should apply the type which is most suitable to them. Ideally, the Project Team will include specialists such as those described in paragraph 3.22. Project Team members should have the appropriate authority to make and action decisions with regard to infection prevention and control.

Assembling the Project Team

3.17 The Project Team should be assembled as soon as possible to ensure that an accurate design brief is developed. Regular meetings with stakeholders referred to in paragraph 3.22 to discuss design, tendering, build and commissioning will ensure the facility is functionally suitable and fit for purpose. Regular communication during the construction and commissioning stages should also ensure that prevention and control of infection risks are highlighted and subsequently eliminated or mitigated.

Selection of consultants

3.18 The main source of guidance for procurement of healthcare facilities in Scotland is PROCODE, produced by Health Facilities Scotland. PROCODE gives guidance on the selection of consultants and is designed to compliment the Scottish Capital Investment Manual (SCIM).

3.19 Every consideration should be given to the quality of composition of the Design Team, including client representatives. Selection of Design Teams entirely, or primarily, on cost is contrary to public sector procurement requirements which demand a best value approach. The quality of the Design Team, including knowledge and understanding of healthcare associated infection, should be a key criteria in the selection of the Design Team. The design brief and/or output specification are critical in achieving a high quality environment.

Roles and responsibilities

3.20 Communication between all parties is paramount in order to ensure that prevention and control of infection risks are highlighted and then either eliminated or managed. The quality of the healthcare facility design and the subsequent tendering and construction phase will be enhanced if all potential risks and interactions with other services are fully examined and discussed as early in the process as practicable. This can be achieved if there is frequent communication and continuous co-operation between the Design Team and the successful Contractor during each stage of the healthcare facility development. Such participation can ensure that prevention and control of infection issues can be controlled promptly and effectively.

3.21 Demonstration of the decision making process e.g. minutes or project evaluation and records of significant decisions should be kept.

Representatives on Project Team

3.22 To ensure all infection issues are highlighted, input is needed from a wide variety of sources. The following list highlights some of the groups which need to be represented; each member of the Project Team must be competent in their designated area.

a) **Project Director**

Responsible for creation and management of the Project Team for delivery of a system which minimises infection in both the construction of operation of the facility.

b) **Client/Department representative**

To represent ward, department or work area. Required to represent end users to ensure the facility will be functionally suitable and fit for purpose.

c) **Infection Control Specialists - representatives from the Infection Control Team**

To ensure prevention and control of infection issues are considered at the planning stage, particularly where work may impact on existing services during the construction phase. Incorporate best practice into the final design and to review post occupancy.

Infection Control may also advise on cleaning and decontamination regimes to be operated post occupancy and to give input in areas such as storage space requirements or clean/dirty workflows.

d) **Design Team (to include Architects, Services Consultants, Planning Supervisor and Clerks of Works)**

To seek the advice of all the relevant professionals and incorporate their views into the final design of the healthcare facility. The Planning Supervisor, in accordance with the Construction, Design and Management Regulations (CDM), has the responsibility to review the Contractor's proposed project programme and advise the Client whether the works can commence. Throughout the project, the Contractor should provide method statements for discussion with the Planning Supervisor and Design Team before any significant elements of work are undertaken, records of which must be kept.

e) **Facilities services**

Depending on the management arrangements, the following functions may need to be represented. This list is not exhaustive and other groups should be consulted as needed.

i. Infection Control Manager;
ii. Domestic;
iii. Waste;
iv. Estates;
v. Catering;
vi. Portering;
vii. Security;
viii. Fire;
ix. Procurement;
x. Sterile services;
xi. Linen and laundry services

Information from these can be used to inform the Design Team and to amend existing schedules before and during the construction phase.

f) **Contractor**

To work with the Design Team to provide a manageable programme of works, ensuring that views of stakeholders and risks identified by the various stakeholders are effectively managed. This is subject to review by the Planning Supervisor (see paragraph 3.22 d) above – Design Team).

4. Importance of education

4.1 Due to HAIs multi-factorial nature, education is not only necessary for Infection Control Specialists. There is a necessity that staff involved in the procurement, design, construction and maintenance of the healthcare facility should be appropriately educated in prevention and control of infection and should be able to demonstrate their knowledge and understanding of the area.

4.2 The nature of the issue means that both the clinical and non-clinical environment are affected. An environment which is designed to be fit for purpose, which limits the risk of infection spread by incorporating facilities, design features and fabrics that facilitates the promotion of standard precautions e.g. hand-hygiene, cleaning, disinfection, decontamination, patient isolation/segregation and waste disposal facilities is therefore essential.

4.3 Training on prevention and control of infection for these groups of staff is available from a variety of sources, and ranges from basic mandatory induction training to more specialist training at Post-Graduate level. An HAI module aimed specifically at these groups of staff has been incorporated into Glasgow Caledonian University's MSc Healthcare Property and Facilities Management. The module is also available outwith the MSc as a continuing professional development course.

4.4 One of the key priorities outlined in the Ministerial Action Plan 'Preventing infections acquired while receiving healthcare' HDL(2002)82, was the introduction of mandatory induction training on HAI for healthcare workers. Based on the principle that the greater number of healthcare workers with direct or indirect patient contact who have an understanding of the Standard Infection Control Precautions, the greater the chance of promoting high personal standards and behaviours, and reducing the prevalence of HAI within NHSScotland.

4.5 NHS Education for Scotland (NES) has developed a multidisciplinary prevention and control of infection educational programme entitled 'The Cleanliness Champion'. The programme is designed for staff with direct patient contact, and introduces the concept of standard precautions being applied at all levels of care to protect patients and staff from infection risk. Further information on training on HAI can be found at www.nes-hai.info/.

5. Risk management

5.1 Risk management involves three stages:

1. Identifying risk.
2. Assessing risk.
3. Managing the identified risk by elimination or by using controls to reduce the severity of risk.

Identifying risk

5.2 The time taken to plan or refurbish a healthcare facility can vary from a relatively short period in the case of urgent renovation, to as long as three or four years for a major capital build project. It is therefore important that Infection Control Teams are notified of capital bids or contracts given to Architects at the earliest opportunity. The Infection Control Team need to be involved in the first planning meetings. Most meetings thereafter will require some input from them.

5.3 To avoid mistakes and pitfalls the Project Team must consider issues including:

- How will the product, equipment, room or clinic be used?
- What possible solutions are available?
- What are the budgetary limitations?
- Which prevention and control of infection principles or external regulations apply?
- What does the evidence suggest in relation to the specific context?
- What are the laws governing the project?
- What are the standards and guidelines from architectural and engineering bodies, government departments and accrediting agencies?
- Which product or design best balances the infection control requirements with employee and patient safety and satisfaction, and cost constraints? (Carter and Barr, 1997.)

Common pitfalls

5.4 Common pitfalls arise from a number of pressures, for example, the pressure to choose the cheapest products or design. As many authors have argued, the best products or designs may be more expensive initially but in the long term they will probably realise cost benefits as they may prevent outbreaks, or they may last longer and require less maintenance and be more durable.

Common errors

5.5 Common errors in design and construction (adapted from Carter and Barr, 1997) due to inept or non-existent risk management include:

- air intakes placed too close to exhausts or other mistakes in the placement of air intakes;
- incorrect air turnover and airflow patterns;
- air-handling systems which function only during the week or on particular days of the week;
- ventilation systems which are not fully commissioned;
- negative air-pressure rooms being omitted from large, new inpatient buildings;
- carpet placed where vinyl should be used;
- aerators on taps (also avoid swan-neck outlets where possible);
- sinks located in inaccessible places;
- patient rooms or treatment rooms which do not have sinks in which healthcare workers and visitors can wash their hands;
- doors too narrow to allow beds and equipment to be moved in and out of rooms;
- inadequate space to allow safe use of medical devices and equipment.

5.6 Carter and Barr reported these errors they had encountered during construction projects in their practice of prevention and control of infection. They recommended that Infection Control personnel inspect the construction site frequently to make sure the workers are following the correct guidance.

Assessing risk

5.7 Outbreaks of infection have been related to the design, plan, layout, function and/or finish of the built environment (Cotterill et al, 1996; Kumari et al, 1998). Thus, risk assessment is a fundamental imperative in the planning and design stages of a healthcare facility, yet it is often overlooked or compromised throughout the lifecycle of the project. Disseminating good specialist knowledge and involving Infection Control Teams throughout all phases of construction and renovation projects will reduce risks. Failure to properly assess prevention and control of infection risk can lead to expensive redesign later and expose the patient and healthcare worker to prevention and control of infection hazards.

Managing the risk

5.8 Part of the Infection Control Team's role is to help non-clinical professionals to understand the main principles of how infection is spread in the context of the built environment.

5.9 When evaluating the spread of infection and its control, three aspects should be considered:

- source;
- mode of transmission; and
- susceptible recipient.

These principles should be applied to all stages of the development of the healthcare facility.

Source

5.10 Building professionals must be convinced about the risks associated with construction projects, and that the environment can be a reservoir for potentially infectious agents. The source is the person, animal, object or substance from which an infectious agent is transmitted to a host. The immediate healthcare environment can be a potential reservoir of micro-organisms and source of infection or contamination, therefore, Designers and Planners need to consider eliminating potential sources of infection by practising good design, for example:

- storage facilities;
- choice of materials, avoiding unnecessary surfaces that may become reservoirs for infectious agents;
- ensuring materials and surfaces can be cleaned and maintained.

5.11 It has been reported (Rampling et al, 2001) that antibiotic-resistant bacteria, such as meticillin-resistant *Staphylococcus aureus* (MRSA), may survive and persist in the environment leading to recurrent outbreaks.

5.12 Attention to prevention of airborne infection by the use of ventilation in specialised areas and correct engineering and mechanical services contribute greatly to reducing potential reservoirs of infection in the built environment.

5.13 Elimination of other environmental sources of infection, for example pests, litter, insects, birds, small mammals and waste, should be considered at the outset of a project and reviewed throughout. Common pests include rats, mice, ants, cockroaches, pigeons and flies. All carry micro-organisms on their bodies and in their droppings. Healthcare facility hygiene is dependent on controlling pests.

Mode of transmission

5.14 A basic understanding of modes of transmission of infection assists in promoting joint responsibility for prevention and control of infection. Micro-organisms can be transmitted in three main ways:

- **direct** transmission involving direct transfer of micro-organisms to the skin or mucous membranes by direct contact;

- **indirect** transmission involving an intermediate stage between the source of infection and the individual, for example infected food, water or vector-borne transmission by insects;
- **airborne** transmission involving inhalation of aerosols containing micro-organisms, for example legionnaires disease or tuberculosis.

5.15 Environmental dispersal of micro-organisms during construction, resulting in HAIs, should also be emphasised to non-clinical members of the Project Teams.

5.16 There is a need to assess the infection risks during construction and how construction activity itself may be a mechanism for dissemination of infection; for example, environmental airborne contaminants and infectious agents are closely related to water and moist conditions which feature prominently in construction activity.

Susceptible recipient

5.17 Preventing transmission of infectious agents to vulnerable patient populations, healthcare workers and visitors is an important component of prevention and control of infection programmes.

5.18 Outbreaks of infection, affecting immuno-compromised patients, have been reported, and construction professionals need to understand the concept of the at-risk patient. Some groups of patients are especially susceptible to certain infectious agents to which they may be exposed in the healthcare construction environment.

Conclusion

5.19 The integration of prevention and control of infection risk management and construction is in its infancy. It represents a significant change in the management of healthcare facilities design and planning which will take time to develop to a level at which the greatest benefits can be achieved. Just as important then is the need to carry out research in the area of risk management, prevention and control of infection and the built environment to produce sound irrefutable evidence on which to base further risk management strategies.

Important

- always consult the Infection Control Team at an early stage:
  - whenever refitting or refurbishment is planned;
  - whenever major capital bids are planned;
- do not wait until patients are ready to move in;
- do not wait until fixtures, fittings and furnishings have been purchased;
- do not let cost or space consideration override reason;
- most advice will be commonsense but not always popular financially.

6. Legislative issues

Health and safety

6.1 Due to the complexity of the process of developing a new healthcare facility, there is a great scope for errors and omissions which can affect the delivered facility in terms of its ability to contribute to, or at least limit the spread of infection.

6.2 HAI is a health and safety issue and the actions or omissions of those involved in the provision or operation of the facility could become evidence in any legal action stemming from an infection. For this reason it is essential that, as with other considerations of professional competence, all those involved in the commissioning, procurement, design and planning and construction refurbishment or ongoing maintenance are able to demonstrate that appropriate expertise was in place and advice sought.

6.3 A number of pieces of legislation put the primary responsibility for the safety of the facility, including HAI, on the employer, usually the NHS Board. In construction procurement the 'employer' sets the resource, assesses the competence of the Design Team and evaluates the output. This means the employer should lead on setting the quality culture that will deliver a safe environment.

Health and Safety legislation and prevention and control of infection

6.4 It is important to remember that many of the recommendations in this guidance, while evidence based, may also be required by Health and Safety law in respect of controlling the risk of infection to staff and patients. This needs to be taken into account during the process of planning, designing and maintaining healthcare premises, as this will clearly influence the final outcome. The following outlines some of the key features of relevant legislation which impinge on the control of infection. Other relevant legislation may also be applicable.

Health and Safety at Work etc Act 1974

6.5 The duties of employers under the Health and Safety at Work etc Act 1974, including protecting the health, safety and welfare of employees, extends to patients and others who may be affected by any work – this includes control of infection measures.

The Provision and Use of Work Equipment Regulations (PUWER) 1998

6.6 Anyone involved in the supply of equipment, plant or machinery for use at work has to make sure that, as far as is reasonably practicable, it is safe and does not cause any risk to health when used at work.

For example:

- equipment should be made of materials that can easily be cleaned and which do not support microbial growth;
- plant or equipment which needs regular cleaning should be easy to access and easy to dismantle.

The Construction (Design and Management) Regulations 1994 (CDM) (as amended 2000)

6.7 These Regulations require that health and safety is taken into account and managed throughout all stages of a project, from conception, design and planning through to site work and subsequent maintenance and repair of the structure. These Regulations apply to most common building, civil engineering and engineering construction work (including demolition, dismantling and refurbishment).

6.8 The NHS Board has Client responsibilities under these Regulations; it has to pass relevant reasonably available information about health and safety matters which relate to the project to those who are responsible for planning the project.

6.9 The CDM Regulations state that Planning Supervisors have responsibility to review the Contractor's proposed project programme and advise the Client whether the works can commence.

The CDM Regulations also state that Designers should:

- ensure that when they design for construction they assess the foreseeable health and safety risks during construction as well as the eventual maintenance and cleaning of the facility in the balance with other design considerations such as aesthetics and cost. This can be achieved by applying the normal hierarchy of risk control;
- identify all the hazards inherent in carrying out the construction work and, where possible, alter the design to avoid them. If the hazards cannot be removed by changing the design, then the risks will need to be controlled and the designer should provide information about the remaining risks.

The Control of Substances Hazardous to Health (COSHH) Regulations 1999

6.10 COSHH provides a framework for controlling the risks from most hazardous substances, including biological agents, which can contribute to the risk of infection.

6.11 COSHH requires that employers assess the risk from all infectious agents to both their employees and others who may be affected by their work, for example patients. The assessment needs to be suitable and sufficient and must cover the steps that need to be taken to meet the requirements of the rest of the Regulations. This means that the assessment should also review the use of control strategies, the maintenance and use of control measures such as air

handling systems and air filtration, health surveillance requirements and, perhaps most importantly, information, instruction and training for employees.

6.13 There are a number of general measures in COSHH relating to the control of exposure to biological agents which must be applied in the light of the results of the assessment. Other procedural/management control measures must also be applied if employers are to fully meet their duties under COSHH including:

- keeping as low as practicable the number of employees exposed or likely to be exposed to biological agents;
- designing work processes and engineering control measures so as to prevent or minimise the release of biological agents into the place of work;
- displaying a biohazard sign and other relevant warning signs;
- drawing up plans to deal with accidents involving biological agents;
- specifying appropriate decontamination and disinfection procedures;
- instituting means for the safe collection, storage and disposal of contaminated waste, including the use of secure and identifiable containers, after suitable treatment where appropriate;
- making arrangements for the safe handling and transport of biological agents, or materials that may contain such agents, within the workplace;
- specifying procedures for taking, handling and processing samples that may contain biological agents;
- providing collective protection measures and, where exposure cannot be adequately controlled by other means, individual protection measures including, in particular, the supply of appropriate protective clothing or other special clothing;
- where appropriate, making available effective vaccines for those employees who are not already immune to the biological agent to which they are exposed or liable to be exposed;
- instituting hygiene measures compatible with the aim of preventing or reducing the accidental transfer or release of a biological agent from the workplace including in particular, the provision of appropriate and adequate washing and toilet facilities and the prohibition of eating, drinking, smoking and application of cosmetics in working areas where there is a risk of contamination by biological agents.

6.14 'Appropriate' in relation to clothing and hygiene measures means appropriate for the risks involved and the conditions at the workplace where exposure to the risk may occur.

7. Procurement and construction process

Overview

7.1 The procurement and construction of a healthcare facility is a highly complicated process and requires input from a wide variety of sources. During the procurement and construction process, reference should be made to existing guidance relating to the procurement and construction of healthcare facilities such as that contained in the Scottish Executive Health Department's Scottish Capital Investment Manual (SCIM).

7.2 Infection Control Specialist input is essential in relation to procurement at the design and planning stage of a project. There is a case for stipulating that Architects and Designers for healthcare projects should be able to demonstrate their knowledge and understanding of prevention and control of infection.

7.3 The specification of building materials, especially surface finishes, healthcare facility equipment etc should take account of the input from the Infection Control Specialist.

7.4 The Scottish Capital Investment Manual (SCIM) comprises a number of guidance booklets covering the following areas:

- Overview;
- Project Organisation and Management;
- Private Finance Guide;
- Business Case Guide;
- Management of Construction Projects;
- Commissioning a Healthcare Facility;
- Information Management and Technology Guide;
- Post Project Evaluation.

7.5 Other sources of information which should be consulted include Health Facilities Scotland procurement guidance PROCODE which provides an insight into the contracting aspects of health building projects, including the implementation of national policy and EU directives. PROCODE provides guidance on a wide range of procurement issues including the appointment of Works Contractors and Consultants and the use of various forms of contract.

7.6 Prevention and control of infection issues associated with procurement and construction need to be given appropriate priority and consideration. Recommendations and the incorporation of recommendations should be documented. It is therefore essential that the advice of Infection Control Specialists should be sought as a routine feature of the procurement and construction process and HAI-SCRIBE should be applied at the appropriate stages of procurement and construction. The involvement of Infection Control

Specialists and the application of HAI-SCRIBE is not restricted to certain levels of project expenditure but rather is applicable to all procurement and construction processes.

7.7 Health and safety considerations are an important feature at this stage and at least some of the health and safety considerations will influence final outcome in terms of prevention and control of infection. The duty of employers to protect employees also extends to patients and others who may be affected by inappropriate prevention and control of infection measures.

8. Evaluation of site for development

8.1 Due to the complexity of the management of HAI, especially in relation to the built environment, input from a wide variety of sources is necessary for success.

Selection of multi-disciplinary team of specialists for implementation of HAI-SCRIBE

8.2 HAI-SCRIBE aims to manage infection risks through the development of a prevention and control of infection questionnaire. The system highlights the need for a multi-disciplinary team of specialists with appropriate skills to ensure its implementation. This is an essential requirement in terms of the evaluation of the site for development. Inappropriate decisions, or a less than rigorous investigation of the site, may well result in infection problems being identified at a later stage when it may be very difficult or indeed impossible to remedy the situation. Remediation of the situation may also prove expensive and investment at this stage may pay dividends over the life of the facility.

8.3 The multi-disciplinary team of specialists may include, amongst others:

- an Architect;
- a Building Services Engineer;
- an Infection Control Specialist with experience/knowledge of the built environment;
- a Risk Manager;
- an Estates/Facilities Manager.

Record of decision-making

8.4 A record of significant decision-making should be maintained. Such a record is evidence of 'due diligence' and helps to ensure that prevention and control of infection issues are implemented. Good practice requires implementation of a risk management system such as HAI-SCRIBE, this being an accurate record of the process of hazard assessment and risk management. Signing off by the Infection Control Specialist at each stage of the development, including this stage of the evaluation of the site, should be considered an essential step.

Pollution/contamination

8.5 Pollution from external sources can contribute to the spread of infection within the built environment (e.g. ingress of *Aspergillus* spores or *Legionella* bacteria during earthworks). Limitation of external pollution can go some way to controlling the spread of infection within the built environment.

8.6 HAI-SCRIBE highlights in its question sets, the potential for infection risk when consideration is being given to a proposed site for development. Research into the history of the area being proposed for development, together with a rigorous

examination of existing industries and businesses, will highlight any potential for infection risk and the measures which may be appropriate to manage the infection risk. Failure to be rigorous in relation to the historical research of the area and the examination of existing industries in the area may result in infection risks not being identified until it is too late to effectively manage them. Specialist external advice is likely to be necessary.

8.7 There are other pollution/contamination issues which may also need to be identified and addressed, even if these are not infection risks e.g. land contaminated by chemicals, asbestos etc.

Topography of site

8.8 When considering the topography of the proposed site for development, issues such as the prevailing wind direction and the associated prevention and control of infection issues need consideration.

8.9 For example, the positioning of the healthcare development in relation to cooling towers in the area and the potential infection risk from entrainment of vapour plumes containing *legionella.*

Implication of choosing natural ventilation

8.10 Adequate ventilation in healthcare facilities is essential for fresh air supply, odour dilution and the removal of airborne contamination.

8.11 In relation to evaluation of a site for development, consideration should be given to how the foreseeable conditions of the site will affect the performance of the ventilation system chosen.

8.12 In areas where the functioning of the ventilation system is critical to the minimisation of HAI risks, a mechanical ventilation system is most likely to be appropriate. The possibility for contaminants to be introduced in the fresh air supply from sources such as earthworks or cooling towers should be considered.

8.13 Where ‘natural’ ventilation is considered, this falls into two broad categories; controlled and uncontrolled. Uncontrolled ‘natural’ ventilation is most frequently seen as opening windows. Its performance is not predictable and as such, it is inappropriate as a strategy for ventilation in areas where controlled conditions are required. Uncontrolled natural ventilation allows contaminants such as fungal spores to be introduced to the ventilated space in untreated air when windows are open. Conversely, when windows are closed, dilution of contaminants in the ventilated space will be greatly reduced.

8.14 Between these two extremes is controlled natural ventilation where the ventilation, whilst not provided through a conventional ducted ventilation system, is designed, engineered and maintained to provide predictable performance.

8.15 As such a system is likely to be more affected than a mechanical system by external influences such as weather conditions, its design will require specialist knowledge. This type of system may involve filtration of incoming air but will not generally involve other air treatment such as heating. The motive force for the air will often be the buoyancy of air at room temperature, however, this entails relatively low pressure differentials which will constrain the type of filtration used.

8.16 Although air-conditioning may seem a straight-forward solution to the control of the environment, it is expensive to run and not environmentally sustainable on a large scale. Within the working life of buildings being built now, restrictions in Carbon Dioxide emissions allowances are likely to preclude the routine use of air-conditioning. For this reason, sites which necessitate sealed, air-conditioned buildings should be avoided.

Impact of activities in the surrounding environment

8.17 Activities occurring in the surrounding environment can contribute to the spread of infection. For example, there may be construction/demolition works programmed in the neighbourhood which may present a risk e.g. fungal contamination arising from earthworks. Measures to limit these risks should be implemented.

Constraints of developing on a pre-determined site

8.18 In some cases the use of a particular site is unavoidable and in this case, steps must be taken to minimise any adverse conditions inherent on the site. HAI-SCRIBE highlights in its question sets the potential for infection risk arising from restraints on the development of a pre-determined site. For example, will lack of space limit the proposed development and any future expansion of the facility (e.g. to increase single room provision) and might this create or increase a risk of infection? Will the proposed development impact on the surrounding area in any way which may lead to restrictions being applied to the operation of the proposed facility which may in turn present potential for infection risk (e.g. storage and collection arrangements for healthcare waste).

Strategic planning

8.19 Infection Control Specialist input is essential at the strategic planning stage. It is never too early to have prevention and control of infection input.

8.20 To allow Infection Control Specialists to effectively participate in the planning process for both renovation and new-build projects, it is necessary for them to understand the process from its inception to completion.

8.21 A comprehensive approach to planning needs to include consultation with the appropriate specialists from inception through to post-project evaluation. The Project Team should include specialists as described in paragraph 3.20 of Section 3.

9. Design and planning stage

9.1 At the design and planning stage, it is crucial that hazards associated with infection risk should be identified and assessed, and measures taken to manage these risks. It is essential to 'design in' at the design and planning stage, measures which will eliminate or minimise the impact of identified hazards and effectively manage the risk of infection. Reference should be made to the question sets contained within HAI-SCRIBE.

Strategic planning and the role of prevention and control of infection

9.2 In the 'National Overview for Improving Clinical Care in Scotland: Healthcare Associated Infection (HAI); Infection Control', NHS Quality Improvement Scotland (QIS) prescribes that prevention and control of infection are considered as part of all service development activity. In the USA, the current authority for construction, design for federal and healthcare providers is the 2001 edition of 'Guidelines for Design and Construction of Hospital and Healthcare Facilities' published by the American Institute of Architects/Academy of Architecture for Health (2001) with assistance from the US Department of Health and Human Services; http://www.aia.org/aah_gd_hospcons The latest version strongly supports prevention and control of infection input at early planning and design stages.

9.3 For Infection Control Teams to effectively participate in the planning process for both renovation and new-build, it is necessary for them to understand the process from its inception to completion.

9.4 Where significant refurbishment is being considered, or the use of an existing patient facility is being planned, Infection Control Specialist input is essential at the strategic planning stage. It is never too early to have prevention and control of infection input.

9.5 To allow Infection Control Specialists to effectively participate in the planning process for both renovation and new-build projects, it is necessary for them to understand the process from its inception to completion.

9.6 The organisation of the Project Team involved in Strategic Planning is given in paragraph 3.22 of Section 3.

The planning process

9.7 The planning process, although refurbishment work may be different, is comprised of the following stages:

- the concept/feasibility study;
- sketch plans;
- the preparation of a business case to support the viability of the project;

- project funding;
- the design stage;
- project monitoring;
- commissioning the facility;
- post-project evaluation.

Table 2 highlights the infection control input required at each stage.

9.8 Its aim is to prompt those with overall responsibility for managing capital schemes or Private Finance Initiative/Public Private Partnerships (PFI/PPP) to include prevention and control of infection advice at the right time in order to prevent costly mistakes.

These points are expanded upon in more detail below.

Concept/feasibility study

9.9 The planning process starts with the identification of a 'need' by the users. The development of this need will involve feasibility studies to enable a design brief or output specification to be developed. The Infection Control Team should review operational policies and procedures at this stage and there may be 1/200 designs to give a broad overview of the scheme. The Infection Control Team needs to consider:

- the effect additional beds or departments will make to policies such as waste disposal, linen and catering, etc.;
- the effect of extra theatres on decontamination services, workflow, etc.;
- additional specialised areas that will probably require extra infection control and laboratory input as well as specialist advice which may not be available in-house e.g. bed space and size of departments, etc., plus engineering services needs such as ultra-clean ventilation, showers baths, etc.

Further details on this process can be found in Table 2.

Space planning

9.10 There are a number of issues in terms of design and layout which could contribute to the risk of transmission of micro-organisms. For example, the design of the ventilation system needs to inhibit contamination spread rather than contribute to it. The internal and external routes identified for removal of dirty laundry, waste food, healthcare waste, similarly need to be planned so as to inhibit rather than encourage contamination.

9.11 There should be adequate space within the healthcare facility for storage of consumables, for example, there should be adequate storage in theatres for small orthopaedic implants.

9.12 The location of departments, theatres, wards and rooms needs to take account of good prevention and control of infection practice and ensure that workflows are designed to inhibit infection spread.

9.13 It is very important that the design and layout of the healthcare facility should inhibit the spread of infection. Reference should be made to HAI-SCRIBE and its question sets in relation to this.

9.14 Workflow systems should facilitate travel from clean to dirty to clean but never back again to clean. This principle is important in terms of limiting infection spread.

9.15 Correct workflow systems must be maintained throughout the building project. Input from Infection Control Specialists is essential at the planning stage of the project, requiring close collaboration between Infection Control Specialists and the Design Team. This is especially important in the planning of specialised units, for example, theatres and critical care.

9.16 Most healthcare departments have clean-to-dirty area flow systems. Workflow is a basic element of good prevention and control of infection practice and this needs to be reflected when the built environment is being planned.

Sketch plans

9.17 The remaining 1/200 designs will be available at this stage and the Infection Control Team needs to give a broad view of prevention and control of infection issues such as:

- missing rooms;
- wards without ancillary areas.

Additional considerations at this point will include:

- storage;
- ancillary areas;
- single rooms;
- isolation rooms;
- changing facilities;
- lifts;
- pneumatic delivery systems.

The business case

Outline business case

9.18 The preparation of a business case is the process that supports NHS Board submissions for funding of new capital projects. A business case must convincingly demonstrate that the project is economically sound, is financially

viable (affordable to the NHS Board and purchasers) and will be well managed. In addition, a business case for any investment should show that it will benefit patients. An overview of the capital investment process is given in the Scottish Capital Investment Manual (SCIM).

9.19 The involvement and support of a wide range of managers and staff is vital to the success of the business case, both to determine the requirement and scope of the investment and also to participate in subsequent stages of planning. It is important therefore at this stage to identify and involve key people who have a direct interest in the end product. This will include members of the Infection Control Team along with other leading clinicians, nursing managers and departmental heads. Specifically at this stage, Infection Control Teams need to:

- establish the goals of prevention and control of infection. What prevention and control of infection risks are especially important for each specific context;
- agree the agenda for prevention and control of infection design and planning;
- communicate prevention and control of infection imperatives throughout the course of the project, but especially at the initial stages;
- monitor the progress of the building/refurbishment project in relation to compliance with infection control specifications;
- determine available resources that can be used and recognise the cost benefits of not cutting corners on prevention and control of infection issues.

9.20 Normally the input from the Project Team should be managed by the Project Director. For larger and more complex schemes, a Project Manager reporting to the Project Director may be appointed to conduct the detailed work and manage the Project Team.

Issues to be addressed by the Infection Control Team

9.21 The Infection Control Team must ensure that prevention and control of infection implications are not compromised by reducing or overcrowding in clinical areas. The issues frequently addressed will include costs and space constraints which will impact on areas such as:

- storage and equipment cleaning areas;
- ventilation;
- hand hygiene facilities;
- furnishing;
- appropriate finishes;
- isolation rooms/rooms used to segregate patients;
- specific products with infectious implications;
- applicable regulations;

- domestic services room.

Detail planning

9.22 It is at this stage, when the outline business case is presented, that the 1/50 designs will be available. There will probably be two stages to the consultation process:

1. Early on in this period the Infection Control Team will need to discuss location of rooms for correct workflow/prevention and control of infection practice, i.e. wards, theatres and patient passage through out-patients or primary care facilities, etc.
2. Later there will be a need to discuss the finer details such as where fixtures and fittings are located, what type of flooring, cupboards or storage systems are to be used, and ventilation in theatres, etc.

9.23 The Infection Control Team will also need to think about the prevention and control of infection issues around:

- workflow;
- hand-wash basins: types, numbers and location;
- fixtures/fittings/flooring;
- wastewater and sewage/body fluid disposal;
- ventilation;
- heating and lighting;
- water systems;
- suction/medical gases;
- storage systems;
- ward kitchens/pantry.

9.24 The business case process should highlight the variables that drive the facility's requirements with regard to prevention and control of infection. This is not always an easy task in the initial stages of a project. Table 4 gives a range of initial ideas.

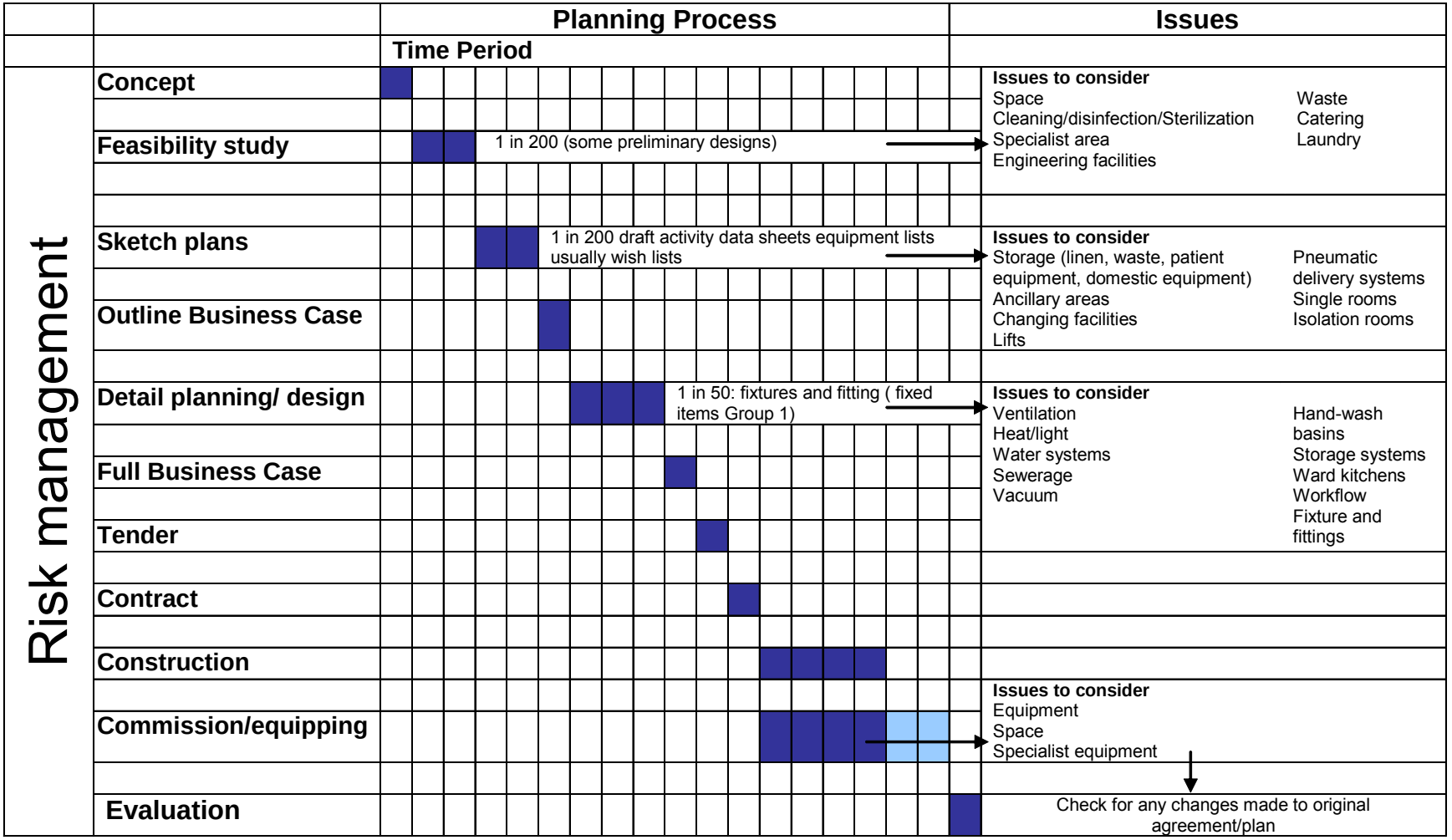

Table 2: Project Development Chart

Typical Stages of Infection Control Input

1. **Concept/feasibility study:** Infection Control Team should review operational policies and procedures, e.g. 1/200 plans.

   Adding beds to ward area may mean extra sluice or side rooms.

   Adding extra theatres will need a review of decontamination services for instruments.

   Additional specialised areas will need extra prevention and control of infection input.

2. **Sketch plans:** at this stage, the Infection Control Team needs to give a broad view of prevention and control of infection issues e.g. rooms missing, wards without ancillary areas such as disposal rooms or dirty utility.

3. **Detail planning/design:** (1/50 designs – early period)

   There is a need to finalise locations of rooms for correct workflows/prevention and control of infection practice, i.e. wards, theatres.

4. **Detail planning/design:** (1/50 designs – later period)

   Need to discuss finer details within rooms: location and type of fixtures and fittings, e.g. hand-wash basins/types of basins; airflows in theatres, flooring.

5. **Construction:** the Infection Control Team will need input here, particularly if the new build is attached to an existing healthcare building, to prevent risks to patients.

6. **Equipment:** decisions on equipment should be made as an ongoing process, but it is at this stage that it will be seen that previous equipment 'wish-lists' may not fit the rooms/departments or are now outdated. It is important that Infection Control Teams have input during this period (especially if it is a PFI/PPP build).

7. **Commission/equipping:** Infection Control Teams must have input during this stage if costly and dangerous mistakes are to be avoided.

8. **Evaluation:** this is an important stage in which lessons learnt can be highlighted for future projects, both within NHS Boards and throughout NHSScotland. Post-project evaluation is mandatory and results should be available to other Boards.

Table 3: The Key Stages of the Planning Process and examples of Infection Control input

Accommodation areas/internal environment/general services	Examples: Key issues and areas to be considered
Accommodation areas	
Bed areas: • Single-bed rooms	En-suite facilities.
• 4-bedded bays versus 6-bedded bays	• Doors on bays • En-suite facilities
Dirty utility/clean utility	Standardisation of rooms/ choice of equipment e.g. bed pan vs macerator. Space.
Workflow/layout	Standard ward area versus specialised area.
Bed Planning	Elective. Emergency.
Linen services and facilities	Internal laundry versus commercial laundry.
Catering/kitchen areas	Furnishing, fixtures and fittings plus workflow crucial for HACCP. Commercial systems e.g. cook-chill versus in-house systems.
ITU/HDU	Single rooms versus 4/6 bed bays.
Handwash basins	1 to 2 versus 1 to 4 versus 1 to 6 dependent on room types. Facilities to ensure compliance with hand hygiene guidance: sinks, taps, soap, gloves, aprons. Easily accessible for staff use.
Staff change areas/storage of uniforms	Type of uniform provided will dictate, i.e. 'greens' versus classic.
Decontamination facilities. CDU/LDU	Operational policy dictated by choice of decontamination strategy
Equipment	Bed/mattresses. Purchase versus hire. Endoscopes/instruments. Cleaning/disinfection requirement. Patient specific. Enough equipment available.
Priority areas	
• Critical care • UCV Theatres • Hydrotherapy • Mortuaries • SCBUs and maternity • Renal units • Oncology • Neurology • Paediatrics • Decontamination units • Pharmacy aseptic dispensary	Every specialist area will have different requirements and infection control issues so cannot be planned as standard departments.
Internal Environment	
Ventilation	Single rooms, bays, theatres, pacing rooms, treatment rooms, internal sanitary areas. Negative and positive pressure isolation rooms.
Heating/ventilation	Dust-free options, i.e. hidden heat panels versus radiators.
Lighting	Quantity. The use of sealed units.
Furnishings, fittings and artwork	Walls/floors/ceilings – hygiene versus aesthetics.
Water	Deadlegs. Water turnover. Appropriate temperature for hot and cold systems. Water coolers/fountains.
General services	
Disposal of waste	In-house versus commercial. Storage.
Communications	IT systems (timely information on pathology, etc, operational policies, infection control policies, procedures and training).
Emergency plans	Water storage if water cut off/heating/medical gases and vacuum/suction/emergency generator, ventilation, etc.

Table 4: Infection control issues to consider in the Capital Planning Process. (Note: this is not an exhaustive list)

(Shaded boxes include examples of issues related to prevention and control of infection which might need to be considered.)
1. Set the strategic context: • where are we now? • where do we want to be? • is it affordable?
• in-patient/day cases; • single room issues;
2. Define objectives and benefit criteria:
• facilities for patients with antibiotic resistant infections; • cost benefits of preventing healthcare associated infection.
3. Generate options.
4. Measure the benefits.
5. Identify/quantify costs.
6. Assess sensitivity to risk.
7. Identify the preferred option.
8. Present the outline business case.
9. Develop the preferred option: full business case.

Table 5: Typical steps in the business case process.

The HAI implications associated with using private finance

Dealing with HAI in PFI/PPP Projects

9.25 The Scottish Executive Health Department encourages the consideration of the strengths of the private sector and the use of privately raised capital. There are essentially two broad criteria against which all schemes are assessed: 'value for money' and 'assumption of risk'. NHS Boards are expected to explore the private finance alternative whenever a capital investment scheme is being considered. The goals of PFI/PPP are to:

- achieve objectives and deliver services more effectively;
- use public money more efficiently;
- respond positively to private sector ideas;
- increase competition.

Key factors in PFI/PPP

9.26 The contract between the NHS and the private sector supplier is critical and it is important that the service representatives/key stakeholders, and particularly in this instance, the Infection Control Team are clear about the options available and the evidence to back up any decisions they advise on. The Infection Control Team will need to make sure that certain criteria are embedded into the contract in such a way that important decisions on design or build do not go ahead without being 'signed off' by them. They should ensure that they have:

- access to all relevant and up-to-date plans and information on operational policies;
- access to any meetings deemed relevant to them or timely minutes from those meetings that they cannot attend;
- access to sites and departments as building work progresses, e.g. environmental rounds with checklists based on project objectives;
- regular communication between both internal Project Manager and the PFI/PPP team;
- involvement in decision making for any category of equipment the PFI/PPP team will purchase;
- involvement in any contracts for support services such as catering, cleaning, linen, decontamination unit, etc., that the PFI/PPP team may be providing;
- access to certain high risk areas for any microbiological testing deemed necessary, e.g. theatres, isolation/segregation rooms, pharmacy and decontamination unit, clean rooms;
- responsibility for HAI and actions to be taken, such as testing and remedial works, and that these terms are clearly specified in the contract.

Design stage

9.27 It is at the design stage that Infection Control Teams will need to follow up any input they have had in the initial brief. Sketch plans should be available to them to explain how the brief fulfils their requirements at the 1/200 and 1/50 plan stages of the project. Suggestions for improvement in operability are encouraged at this stage. (For an approximate time-scale, see Table 2.)

9.28 Consideration should also be given to the impact on existing local facilities, e.g. ventilation, water supplies, etc.

Design and structure issues

9.29 The Infection Control Team will need to consider:

- if the facility is designed to support prevention and control of infection practice;

- design, number and type of isolation rooms (i.e. source or protective environments);
- heating, ventilation, and air-conditioning systems including filtration;
- mechanical systems involving water supply and plumbing;
- number, type and placement of hand-hygiene fixtures, clinical sinks, dispensers for soap, alcohol hand-rub, paper towels, and lotion;
- sharps disposal unit placement;
- accommodation for Personal Protective Equipment;
- surfaces: ceiling tiles, walls, counters, floor covering and furnishings;
- utility rooms: soiled, clean, holding, workrooms;
- storage of movable and modular equipment;
- clinical waste;
- linen (clean)/laundry (used);
- storage of used medical devices prior to transfer to CDU and storage for sterile medical devices.

Adapted from Bartley (2000).

9.30 Equipment schedules for Groups 2 and 3 based on room data sheets/layouts are prepared at this stage. (Further information can be found in Appendix 1.) Items available for transfer should also be identified which will allow schedules for new equipment to be prepared and costed and considered for compatibility with existing equipment. This is an important area for input by the Infection Control Team if costly mistakes are not to be made. (Further information can be found in Appendix 1.)

9.31 The purchase of equipment for Groups 2 to 4 will not normally take place until the operational commissioning period. However, it is important during the construction and equipment supply stage that there is involvement by the Infection Control Team in discussion of Group 2 equipment. Some Group 2 equipment may require to be fitted by the main Contractor and all may have significant design implications. This will ensure that this equipment is compatible with prevention and control of infection needs and also that proper inspection and testing can be agreed. (Further information can be found in Appendix 1.)

9.32 Technical commissioning of the building, services and equipment should include any areas that require inspection and testing to demonstrate compliance with prevention and control of infection standards, i.e. theatres, hydrotherapy pools, isolation/segregation rooms and clean rooms in pharmacy and Central Decontamination Units (CDUs). There is a legal requirement for compliance in CDUs and pharmacies.

9.33 Commissioning of the building services is frequently curtailed to meet deadlines or put in the hands of inadequately qualified or experienced personnel. This is

invariably to the detriment of user satisfaction, operational efficiency, HAI risk and running costs and should be avoided at all costs.

Tender/contract

9.34 The Infection Control Team should help review the tenders/contracts to assess the competence in relation to the technical nature of the build.

Monitoring the project

Construction (new build)

9.35 If the project is a new-build, monitoring will not normally be required by the Infection Control Team until the healthcare premises are at a stage when site visits can be arranged. Although Infection Control input is needed throughout the development of the healthcare facility, at this point it is important for the Infection Control Team to visit the site as soon as possible to familiarise themselves with the layout of the various departments. This will help them to detect any unidentified problems or ones caused by design changes.

Construction (new-build attached to existing site or refurbishment)

9.36 Infection Control Specialists agree that involvement of Infection Control Teams in refurbishment projects is important not only for ensuring that 'designed-in' prevention and control of infection is achieved, but also for assessing the potential risks to patients in existing buildings from dust, dirt and pathogens.

9.37 Measures that may limit the spread of dust, dirt and pathogens during construction include the following:

- undertake work in winter as the risk is lower for *Aspergillus* spp. and other fungal infections;
- clean and vacuum areas under construction and the surrounding areas frequently;
- place adhesive floor strips outside the door to the construction area to trap dust, these should be replaced regularly to remain effective;
- seal windows, doors and roof-space to control dust;
- wet-mop the area just outside the door to the construction area daily or more often if necessary;
- use a high-efficiency particulate air (HEPA) filtered vacuum to clean areas daily or more often if necessary e.g where there is a greater risk of infection spread or a greater need for control of infection;
- transport debris in containers with tightly fitting lids, or cover debris with a wet sheet;
- remove debris as it is created; do not let it accumulate. Use dust extraction equipment where feasible;

- remove debris through a window when construction occurs above the first floor;
- do not haul debris through patient-care areas;
- remove debris after normal work hours through an exit restricted to the construction personnel;
- designate an entrance, a lift and a hallway that the construction workers must use and which are not used by patients, visitors or healthcare workers;
- shampoo carpets when the construction project is completed;
- commission hotel services with regard to cleaning during construction projects.

(Adapted from Carter and Barr, 1997.)

9.38 There is a need to ensure that Infection Control Teams document advice given on building developments and that this advice is followed and recorded. Similarly, Carter and Barr (1997) advise that a daily checklist is maintained during the progress of the construction project (see Table 6 below).

Barriers	
Construction signs posted for the area	Yes/No
Doors properly closed and sealed	Yes/No
Floor area clean, no dust tracked	Yes/No
Air handling	
All windows closed behind barrier	Yes/No
Negative air at barrier entrance	Yes/No
Negative air machine running	Yes/No
Project area	
Debris removed in covered container daily	Yes/No
Trash in appropriate container	Yes/No
Routine cleaning done on job site	Yes/No
Traffic control	
Restricted to construction workers and necessary staff only	Yes/No
All doors and exits free of debris	Yes/No
Dress code	
Appropriate for the area (e.g., Theatres, CDU)	Yes/No
Required to enter	Yes/No
Required to leave	Yes/No

Table 6: Daily construction survey (Carter and Barr, 1997)

Surveillance and monitoring during renovation or construction work

9.39 Routine bacteriological sampling of floors, walls, surfaces and air is rarely indicated (Ayliffe et al, 2000), but there have been several documented outbreaks due to construction work. In 1995 there was widespread contamination of potable water with *Legionella pneumophila* during a period of major construction resulting in two fatal cases of healthcare associated *legionellosis* (Mermel et al., 1995). Multiple outbreaks of healthcare associated *aspergillosis* have also been described, including one specifically attributed to hospital renovation (Flynn et al., 1993). Mermel et al. (1995) suggest that heightened surveillance and preventive measures may be warranted during periods of excavation on hospital grounds or when potable water supplies are otherwise shut down and later depressurised.

9.40 NHS Estates (Wearmouth, 1999) advises:

"*Where vulnerable patients may be placed at risk, it is important that an appropriate risk assessment be carried out with the microbiologist/infection control officer [doctor] at an early stage in advance of any demolition works or disturbance/alterations to the building fabric/ventilation systems.*"

9.41 Since the airborne spores of *Aspergillus* spp. can travel significant distances, this will apply generally to all works in the immediate vicinity or within the boundary of the healthcare site. It is strongly advised that any recommendations by the Microbiologist/Infection Control Doctor should be incorporated into the building or engineering works so as to minimise risk.

9.42 Surveillance and monitoring during renovation or construction work may prove difficult; environmental assessment to detect *Aspergillus* spp. and to confirm epidemiological investigations may not be within the remit of all Infection Control Teams. However, implementation of adequate prevention and control of infection measures during construction are, and have been proven to be, an effective means of protecting highly susceptible or high risk patients from environmental contaminants (Thio *et al*., 2000).

Commissioning/equipping the healthcare facility

9.43 Upon completion of construction, the facility must be brought into use; the complexity of the task involved generally means that a Commissioning Manager and Commissioning Team will be needed. Senior managers, specialist teams and users should be fully involved in the process. The commissioning entails:

- drafting operational procedures;
- establishing baseline and future staffing profiles;
- establishing baseline and future revenue budgets;
- establishing final equipment requirements;
- identifying policy issues for referral to the Commissioning Team or the construction project team;
- identifying staff training needs;

- establishing the occupation programme for each user function, for incorporating into the overall masterplan.

9.44 Members of Infection Control Teams with an understanding of the commissioning process should ensure that they are included in any working groups in which infection prevention and control will have an impact, or in which requirements to modify services may have repercussions on other aspects of the prevention of infection.

9.45 The Infection Control Team may also need to be involved in processes for:

- transfer of facilities;
- phased or staged occupation;
- decorating;
- strategy for equipping;
- selection of equipment;
- storage and subsequent cleaning/disinfection of any furniture or equipment;
- commissioning hotel services for cleaning;
- site visits;
- artwork;
- furnishing and fittings;
- interior finishes and fixtures;
- post-handover period;
- decommissioning of redundant facilities;
- period of handover to operational management.

Post-project evaluation

9.46 The purpose of the post-project evaluation is to improve project appraisal, design, management and implementation. Although post-project evaluation is mandatory, it is a learning process and should not be seen as a means of allocating blame. There are three stages:

1. Project appraisal.
2. Monitoring and evaluation of project.
3. Review of project operations. It is at the third stage when it is useful for the Infection Control Team to be included in the evaluation teams that are reviewing project objectives. The outcomes (activity and its consequences) of the project will not be amenable to evaluation until the facility has been in use for some time.

Successful post project evaluation is aided by independence from the Procurement Team.

9.47 It is important that the project is evaluated in terms of its original objectives, not in light of any new legislation or development. Performance indicators may be used if these can be measured retrospectively. Control of infection related to measurable objectives may include:

- bed turnover;
- re-admission rates;
- incidence of day surgery;
- activity data;
- infection rates;
- patient satisfaction surveys, etc;
- process measures – air sampling, audit.

9.48 Reference should be made to HAI-SCRIBE and its question sets relating to the design and planning stage of any development.

Logistics

9.49 In addition to the issues raised in paragraph 9.10 'Space planning', the design of the healthcare facility must realistically consider the logistics of a functioning facility. It is essential that systems are in place which will inhibit the spread of infection and that resources and personnel are managed so they do not contribute to the risk of infection.

Examples of logistical issues to consider include:

- the delivery and distribution of materials and people via connecting corridors and lifts;
- the collection, transportation and storage pending removal or disposal of waste materials;
- clinical workflows.

9.50 These issues require careful planning and design which recognise the potential for infection spread through the mismanagement of such issues.

Sizing of space

9.51 At the time of writing this document, NHSScotland bed spacing requirements are under review. Bed spacing should be consistent with current guidance provided by Health Facilities Scotland (formerly NHSScotland Property and Environment Forum); Scottish Health Planning Note (SHPN) 04: 'In-patient accommodation: options for choice'.

9.52 There should be sufficient single rooms to prevent the spread of infection both to and from patients as a result of being 'housed' in open ward areas. Boards should audit use of single rooms to promote best use.

9.53 Initial planning and design in new builds needs to include numbers of beds and the appropriate space required between beds in accordance with the type of clinical intervention to be undertaken in the immediate patient environment.

9.54 Multiple beds in a single area should be kept to the minimum number possible, as this will assist in the prevention of cross-infection. Single rooms would appear to be the optimum solution, but other considerations such as cost and staffing levels may create pressure to reduce the proportion of single rooms.

9.55 Design, accessibility and space in patient areas all contribute to ease of cleaning and maintenance.

9.56 Spacing must take into account access to equipment around the bed and access for staff to hand-hygiene facilities. Sufficient space for equipment (e.g. hoists) is a health and safety issue for staff and patients.

9.57 Healthcare facilities must provide enough sanitary facilities and showers/bathrooms to ensure easy access, convenience and independence where possible.

9.58 Toilet facilities should be no more than 12m from the bed area or dayroom.

9.59 The work area around a patient needs to take account of the equipment which is nowadays routinely used in a healthcare facility and the patient space therefore needs to be sufficient to allow easy cleaning of that space and the equipment in it. Greater patient space may also reduce the risks of contact and airborne infection spread although the scientific evidence for this is limited. The design and planning needs to take account of current patient space guidance and the need to accommodate larger patients and patients requiring particular treatments/therapies and associated equipment.

9.60 Mode of transmission of infection should be taken into account when bed space and size of facility are being discussed. This includes direct transmission, indirect transmission via fomites (e.g. door handles, clothing, instruments, kidney dishes etc) and airborne transmission.

9.61 The principle should be to maintain sufficient space for activities to take place and to avoid transmission of organisms either by air or by contact with blood or body fluid or equipment. The exact space needed will vary according to numbers and activity of staff, type of patient, and environmental factors such as ventilation and humidity.

Particular issues for consideration include:

- patient groups;
- transmission of micro-organisms:
  - avoiding cross-infection;
  - the environment and its role in cross infection;
  - shared equipment;

  - movement of patients.
- management of issues:
  - clinical pressures;
  - best use of single rooms;
  - avoiding unnecessary movement of patients between areas.

Bed density

9.62 With an increase in the prevalence of antibiotic–resistant bacteria and immuno-compromised in-patients, there is an increasing need for en-suite single rooms and negative or positive pressure isolation rooms.

9.63 Provision of isolation/single rooms used to segregate patients will help prevent the spread of micro-organisms, especially those transferred by the airborne route or those easily disseminated into the immediate patient environment.

9.64 The provision of adequate space around the bed can significantly improve the quality of the patient's experience and aid the clinical and healing process. Clinicians and carers need adequate space around the bed, arranged in a functionally suitable way, to undertake their work efficiently and safely, making the most effective use of resources. Facilities should also serve the psychological needs of patients and their families providing a place of safety and privacy.

Access for maintenance

9.65 Surfaces should be easy to clean and therefore should be free of internal corners, cracks, crevices etc. which would make cleaning more difficult.

Ducting of services helps to achieve easy cleaning of surfaces but it is important to have sufficient, suitably sited access points for maintenance of the ducted services. The planning and design stage of the project must identify the access points for ducted services and those must be accessible with minimal or no disruption to the building surfaces or to patients.

9.66 Cleaning and maintenance of the ducts themselves must also be easily achieved with minimal infection risk.

9.67 There should be no ducted services where easy access is not available. Access for maintenance must not inhibit the safe efficient normal operation of the ward or department.

Departmental issues

9.68 There are some departments in a healthcare facility where infection risk is higher. These should be situated so as not to further increase the risk of infection.

9.69 For example, inappropriate transferring of cleaning equipment to different areas may be combated by use of colour coded/clearly labelled zoned areas where

movement of domestic staff and equipment is controlled by swipe cards. Departments with susceptible patients should be located and serviced to minimise risk of contamination from departments where patients are an infection risk.

Storage

9.70 Adequate storage should be provided for patients' possessions, sterile supplies, non-sterile supplies or for domestic services equipment and patient care equipment. This can help limit the spread of infection of frequently handled items, minimising contamination. Separate storage areas may be needed depending on the kind of item being stored.

9.71 Inadequate provision of storage facilities can mean that inappropriate sites e.g. corridors and clinical areas, are used for storage of equipment. This can lead to unnecessary contamination both of equipment and, subsequently, from equipment.

9.72 Storage of Personal Protective Equipment (PPE) and ready access to clean PPE is important to encourage its use. There should be appropriate clinical waste bins for disposal of PPE once worn.

Patients

9.73 Lockers and wardrobes are intended for the storage of patients' personal possessions and clothing. They should be made of an impervious material that is easy to clean with no crevices or corners where dust or debris could accumulate, resulting in a reservoir for infectious agents. They should also be sufficiently robust to withstand the prolonged use of recommended decontamination agents. The lockers should be provided with castors to allow easy access for daily cleaning and castors should also be cleaned. Deep cleaning of lockers is required on a routine basis to ensure all surfaces including the underside of the locker are free from spillages. Further guidance can be found in the NHSScotland National Cleaning Specification produced by the HAI Task Force.

Domestic Services Room

9.74 Domestic cleaning equipment and supplies must be stored in separate purpose built areas. There must be a dedicated domestic services room and store for the provision of such must be adhered to (further assistance can be found in SHPN 40: 'Common Activity Spaces'). There should be sufficient space in these areas to allow cleaning equipment to be thoroughly cleaned after use.

The areas are required to have:

- good ventilation;
- adequate space for domestic staff to clean and decontaminate small pieces of equipment and furniture e.g. domestic and clinical waste bins;

- adequately sized rooms to accommodate all activities taking place in the area;
- non-slip safety flooring fitted with coving between the floor and the wall to prevent accumulation of dust and dirt in corners and crevices;
- a large sink with fitted worktops and splashback and a lockable cupboard;
- a separate hand-wash basin fitted with a mixer tap but without a sink plug and fitted with dispensers for soap, alcohol gel, hand towels and handcream;
- foot operated waste bins;
- wall protection around the area where the domestic cleaning equipment is stored;
- adequate provision for the storage of supplies;
- a door stay and door lock.

Linen cupboard

9.75 Each ward should have an area for the storage of clean linen, which in new builds should be purpose designed. The areas used for the storage of clean linen should ensure that linen is not exposed to contaminants.

The areas are required to have:

- good ventilation;
- adequate lighting;
- impervious flooring that is easy to clean and fitted with coving between the floor and the wall to avoid accumulation of dust and dirt in corners and crevices;
- slatted shelving to ensure free flow of air.

9.76 If linen trolleys are used to store linen within the ward area, they should be managed so that:

- they are kept tidy and closed to ensure that linen is not exposed to dust;
- linen bags are not left open or lying on the floor with the potential for exposure to dust, which may potentially carry micro-organisms;
- appropriate procedures are in place to allow cleaning of linen trolleys.

Soiled Linen Storage

9.77 The following types of linen should be segregated at source before sending to the laundry:

- used linen;
- heat labile linen;

- known or suspected infected linen, which should be placed in a water soluble bag before placing it in the linen bag.

9.78 The layout of laundry areas must be designed to ensure that high standards of cleaning can be maintained. Finishes to walls, floors, work surfaces and equipment must be capable of withstanding regular cleaning and the impact of mechanical cleaning equipment. The area should be large enough to allow access for decontamination trolleys.

Equipment Store

9.79 All healthcare premises require a storage area for large pieces of equipment such as beds, mattresses, hoists, wheelchairs and trolleys, which are currently not in use. Ideally this should be an equipment library with centralised storage, cleaning facilities and trained staff.

9.80 This storage area will not only protect the equipment from contamination and dust which may potentially carry micro-organisms, but also allow free access to floors and shelves for cleaning.

9.81 The layout of these areas must be designed to ensure that equipment is stored safely and securely to comply with manual handling requirements. The area should be fitted with good lighting and finishes to walls, floors, work surfaces and doors to protect against foreseeable mechanical damage; equipment must be capable of withstanding regular cleaning.

Waste Disposal

9.82 There are stringent legislative controls and clear working guidelines for the management of healthcare waste. Guidance on which can be found in SHTN 3: 'Management and disposal of clinical waste'. Good design can minimise problems with segregation, storage and disposal. Identification of categories and the means of segregation of clinical and special waste form the key elements of a waste disposal strategy. In addition, compliance with the National Waste Strategy (SEPA) is essential to reduce the volume of waste going to landfill. Consequently the recycling of Domestic Waste should be an integral part of the Healthcare Facilities Waste Management Strategy.

9.83 Space at ward level is needed for suitable waste containers for all types of waste generated, including recyclates.

9.84 Healthcare waste should be securely stored away from unauthorised personnel. Therefore any new developments, or upgrading, must include a secure disposal store at the entrance of each ward or department, or, alternatively, provide a store to service a floor or area to facilitate safe segregation of all types of waste.

Waste Disposal Room

9.85 The waste disposal room is the temporary storage point for all items of supplies and equipment which have to be removed for cleaning, reprocessing or disposal, for example linen, central decontamination unit items, all types of waste and sharps.

9.86 The waste disposal room should be of an adequate size for all activities taking place within the area. Other requirements include:

- good ventilation;
- non-slip safety flooring fitted with coving between the floor and the wall to prevent accumulation of dust and dirt in corners and crevices. The floor must be capable of withstanding regular cleaning and the impact of mechanical floor cleaning;
- a large sink;
- a separate hand-wash basin fitted with a mixer tap but with no sink plug and fitted with dispensers for soap, alcohol gel, hand towels and handcream;
- wall protection on all walls and doors;
- wall finishes which should be impermeable and easily decontaminated;
- double door fitted with protective covering to allow easy access for secure and appropriate waste containers and an access control lock.

Cleaning facilities

9.87 Cleaning schedules must be prepared and in place and these schedules should take account of infection risk. Where building works are being carried out, the cleaning schedule may need to be reassessed. The cleaning schedule should be strictly adhered to and a nominated person should sign off satisfactory completion of the cleaning schedule. The cleaning schedule will identify cleaning which should be carried out after use, daily, weekly, etc.

Cleaning equipment

9.88 This will include:

- a range of equipment which must be in good working order and properly maintained including floor scrubbing machines, polishing machines, vacuum cleaning machines, etc;
- sinks for cleaning equipment which should be exclusively for that purpose and should be large enough to adequately clean the pieces of equipment;
- the provision of large sinks in areas where contaminated wastewater or blood or body fluids are disposed of.

Cleaning agents

9.89 The appropriate cleaning agents must be used. When choosing appropriate cleaning agents, various factors should be considered, for example:

- detergents loosen dirt and grease but do not kill bacteria;
- disinfectants kill bacteria;
- hot water and steam kill bacteria.

Laundry facility

9.90 Laundry facilities, whether ward based or centralised should provide;

- suitable space for laundry machinery;
- suitable storage for used linen and for separation of used and laundered linen;
- storage space which is designed to prevent odours from migrating from storage areas to adjacent areas;
- storage space designed to accommodate trolleys etc used in the transportation of linen;
- appropriate facilities to allow the segregation of used linen, heat labile linen and infected linen, in appropriate containers which are clearly identifiable;
- suitable facilities to allow compliance with hand hygiene practices;
- a laundry policy to ensure infection risks are minimised.

Changing facilities

Patient changing facilities

9.91 The increase in day case patients has increased the number of changing facilities required.

9.92 In areas such as out patients, imaging, day surgery, endoscopy and minor injuries units, it will be necessary to provide changing/storage facilities if clothing has to be removed and kept safe.

9.93 Flooring in these areas should be non–slip, easily cleaned and appropriately wear resistant. All surfaces must be able to withstand regular cleaning with both detergent and disinfectant products. All cubicle/screens must be able to withstand washing procedures at disinfectant temperature i.e. 3 minutes at 71°C or 10 minutes at 65°C.

9.94 All soft furnishings must be covered in an easily cleaned impervious material within all clinical and associated areas. Soft furnishings which are damaged should be removed for repair or disposal. The use of tape for repair is inappropriate. The fire resistance of furnishings and all fabrics must comply with SHTM 87: ‘Textiles and Furniture’. Cleaning processes should be developed to ensure that fire resistance is not compromised.

9.95 Hand-wash basins, sanitary facilities and showers should be provided in these areas.

Staff changing facilities

9.96 Changing facilities should be provided for staff to encourage them to change out of their uniform in the workplace. This is particularly important if the staff member is working in a clinical area or CDU. Facilities should be provided

which allow staff to store their personal possessions safely. Locker sharing can reduce storage requirements.

9.97 Sanitary facilities and showers should be provided for male and female staff in these areas.

9.98 The distance from the working area may affect how often staff use the facilities. However, in the interest of the personal security and safety of staff, staff changing areas should be sited in the main area of the healthcare facility if not very close to (or within) the ward. Changing areas and showers should also be provided for staff who have become contaminated.

9.99 Staff should change from their outdoor clothing into their uniforms in the changing facilities provided.

9.100 By providing staff changing facilities with adequate areas for storage of clothing e.g. lockers, staff will be able to change from their staff uniforms into their outdoor clothing on site. This practice should encourage staff to travel home in their own clothes, not their uniform.

9.101 Staff must have easy access to a hand-wash basin and showering facilities in the event of a spillage, accident or contamination.

9.102 The Watt Group Report (2002) stated that specific guidelines and facilities (washing, showering and cleaning/changing uniforms) should be available in every hospital for the decontamination of staff who become grossly contaminated by blood or body fluids.

Maintenance Staff

9.103 Separate clothing should be provided for maintenance staff to change into when moving between clinical and non-clinical areas. Consideration should also be given to providing changing facilities for maintenance staff, service engineers etc who may have to change into scrub suits and dedicated footwear for work carried out in clean areas.

Uniform changing

9.104 Best practice suggests an area should be provided in staff changing where staff can order clean uniforms. In this area, staff should also be able to collect their laundered uniforms and dispose of soiled uniforms for onward processing at the laundry.

Bed space area

Patient mobility

9.105 Patient mobility is considered vital for aiding recovery and maintaining physical health and hygiene. It is well understood that this helps reduce length of stay and physical complications in the recovery period.

9.106 The provision of sufficient space is essential for nurses and therapists to work, to accommodate wheelchairs and walking aids, and to assist the mobility of patients. Guidance on which can be found in SHPN 04: 'In-patient Accommodation: Options for choice'.

Clinical treatment

9.107 Many of the activities that previously took place in a treatment room now take place at a patient's bedside and therefore additional space is required for equipment and for clinical procedures to take place. It should be noted that treatment rooms may provide a cleaner environment in which less activity takes place during procedures.

Moving and handling

9.108 Moving and handling of patients is a major cause of back injury and other musculo-skeletal disorders amongst staff. To avoid such injury, patients should be moved using equipment designed specifically for the purpose. Sufficient space is therefore required to manoeuvre this equipment around the bed. Manual handling equipment can contribute to the transmission of micro-organisms if not adequately cleaned and stored.

Family support and visiting

9.109 Visits from family and friends are important for the well-being of patients. There should be sufficient space around the bed to allow for seating without disturbing patients in other bed spaces or the flow of nursing care. Adequate toilet facilities should also be in place to limit the risk of infection from visitors using the patient's en-suite facilities. Insufficient seating round the bed space area can lead to prevention and control of infection issues.

The Chief Medical Officer has introduced five tips for the public visiting patients in hospital to help in reducing cross infection. These are:

- think about keeping patients safe before you visit someone in hospital. If you, or someone you live, with has a cold or diarrhoea, or if you feel unwell, try to stay away until you are better;
- wash and dry your hands before visiting a hospital ward, particulary after going to the toilet. If there is alcohol hand gel provided at the ward door or at the bedside, use it;
- ask ward staff for advice before you bring in food or drink for someone you are visiting in hospital;
- if you visit someone in hospital, don't sit on their bed, and keep the number of visitors to a minimum at any one time. Never touch dressings, drips, or other equipment around the bed;
- if you think NHS premises are not as clean as they should be, let the Sister/Charge Nurse know. If you think a healthcare worker has forgotten to wash their hands, remind them about this.

Accessibility for staff

9.110 Poor access around the bed is stressful for staff who have to work, often under pressure, within limited space, entailing more potential for accidents, mistakes and delays. Moving and setting up equipment takes valuable time and this is hindered by limited space. Gaining access to bedhead controls and monitoring equipment also requires sufficient space.

9.111 In multi-bed areas there should be sufficient space around each bed for staff to carry out procedures without disturbing patients in adjacent beds and to provide a degree of auditory privacy. There is now a great deal more activity taking place at, or close to, the bedside which falls into three categories:

- clinical treatment and care;
- personal care;
- support duties including cleaning.

Cleaning

9.112 There needs to be space to allow the easy movement of beds and equipment to facilitate cleaning. Access for cleaning must be considered a key design factor for planners and architects designing new buildings or refurbishments.

Storage

9.113 Adequate space to store equipment away from the bed space is necessary, as inappropriately stored equipment can interfere with cleaning and create a reservoir for micro-organisms.

Fixtures and fittings

9.114 Fixtures and fittings should be easy to clean. Their design needs to take account of cleanability e.g. the surface material, access to all surfaces, etc. Complex dismantling to enable cleaning to be achieved is a disincentive to effective cleaning. Involvement of Domestic Managers in selection of fixtures and fittings is advised.

9.115 Fixtures and fittings should be movable as far as possible to ease cleaning.

Walls

9.116 Smooth, hard, impervious surfaces are recommended in clinical areas as they are easier to clean and bacteria cannot readily adhere to them (Bartley, 2000; Ayliffe et al, 1999). Design should ensure that surfaces are easily accessed, will not be physically affected by detergents and disinfectants and will dry quickly.

Ceilings

9.117 Smooth, hard, impervious surfaces are recommended in theatres and isolation rooms. Caution should be used when considering the use of ceilings to

produce visually appealing areas as they can be difficult or time-consuming to access for cleaning, for example hidden lighting or box-work.

9.118 False ceilings may be associated with accumulation of dust or fungi and can harbour pests. It is therefore essential that buildings are checked on completion to ensure that no unwanted materials from the building works remain and that there is no access for pests (Ayliffe et al, 1999). Ceilings with removable tiles or perforated ceilings can allow dust to fall onto the area below during maintenance work. This type of ceiling should therefore be avoided in isolation rooms, operating theatres and treatment rooms (Ayliffe et al, 1999).

9.119 Pipes and cables running through walls above false ceilings should be sealed so far as is practicable.

Doors

9.120 All bays and single rooms used to segregate patients require doors if they are to be used for cohort nursing or isolation nursing. They should have smooth handles which can be easily cleaned, will not be physically affected by detergents and disinfectants and will dry quickly.

Windows

9.121 Windows, although not directly a prevention and control of infection issue, allow patients in isolation/segregation to feel less shut off from the world and have been shown to add to the therapeutic process where there is pleasant view.

9.122 Glass partitions, instead of solid walls, enable patients to see what is happening in the ward but there will also be a need to allow for patient privacy at times. Double-glazed windows with integral blinds are practical and solve a range of cleaning problems.

9.123 Windows in operating theatres, treatment rooms and isolation/segregation rooms should be fixed and sealed.

9.124 Avoid ledges as in cottage-style windows because this will allow for the accumulation of dust; ledges also require a significant cleaning commitment.

Radiators

9.125 Radiators have been implicated in outbreaks of infection with meticillin resistant *staphylococcus aureus* and are often difficult to clean because they are enclosed in bay windows or in protective covers to prevent burns. They should be smooth, accessible and cleanable.

9.126 Pipework should be contained in a smooth surfaced box that is easy to clean; pipework sited along a wall can become a dust trap and can be impossible to clean.

9.127 Pipes and cables running through walls above false ceilings should be sealed as far as is practicable.

9.128 Radiators should be smooth, accessible and easy to clean. Pipework should be boxed or enclosed with surfaces which are easy to clean.

Work surfaces

9.129 Surfaces should be designed for easy cleaning.

9.130 Surfaces near plumbing fixtures should be smooth, non-porous and water-resistant.

9.131 They should be free of fissures, open joints and crevices that will retain or permit the passage of dirt particles.

9.132 All joints must be sealed (Bartley, 2000).

9.133 Horizontal surfaces can become contaminated therefore regular cleaning is required.

9.134 All surfaces must be able to withstand regular cleaning with both detergent and disinfectant products.

9.135 Surfaces should be designed for easy cleaning, free of fissures, open joints and crevices. Surfaces should withstand regular cleaning with detergents and disinfectants. (Further guidance can be found in the NHSScotland National Cleaning Services Specification produced by the HAI Task Force.)

9.136 Internal corners should be coved. Horizontal surfaces not intended for storage e.g. tops of lockers, should be sloped.

Recommendations

9.137

1. The quality of finishes in all areas should be of a high standard. Guidance on the selection of finishes is provided in several SHTMs, SHPNs and SHBNs.
2. Soft furnishings must be covered in an impervious material within all clinical and associated areas.
3. Flooring should be easily cleaned and appropriately wear-resistant.
4. The use of carpets is not advised within any clinical or associated area. Attractive vinyl flooring materials are available which can provide aesthetic appeal.
5. All joints and crevices should be sealed.
6. Curtains must be able to withstand washing processes at disinfection temperatures.
7. Window blinds should be used with caution; the need for regular cleaning in clinical areas must be considered.
8. All surfaces should be designed for easy cleaning.
9. Smooth, hard, impervious surfaces should be used for walls.

10. All surfaces, fittings, fixtures and furnishings should be designed for easy cleaning and durability.

Equipment

9.138 The selection of equipment which can be easily decontaminated both internally and externally is critical. The use of soft 'difficult to decontaminate' fabrics should be avoided where possible. The design of equipment should also be considered, as intricate design details are often difficult to clean properly.

9.139 Equipment that is in direct contact with patients has been implicated in infection outbreaks (Irwin et al, 1980). Equipment that is within the immediate patient environment has been shown to be a potential source of cross-infection. Fixtures and fittings, if difficult to access or clean on a regular basis, fall into this category and must be included as a potential reservoir of infection when risk assessment is undertaken. Design should ensure that surfaces are easily accessed, will not be physically affected by detergents and disinfectants and will dry quickly.

Cleanability

9.140 Decisions about finishes, design, fixtures and fittings at the planning and procurement stages must take account of their cleanability, i.e. recognition of the importance of finishes etc being cleaned and kept clean. Finishes etc, which are difficult to clean are less likely to be properly cleaned and kept clean.

9.141 The quality of finishes etc in all areas should be of a high standard so that there is ease of cleaning and the fabric of the building stays intact and impervious over its life cycle.

9.142 Particular points to consider include the use of:

- hard flooring in clinical areas;
- flooring which can be easily cleaned and is appropriately wear-resistant;
- coving between the floor and the wall to make cleaning easier;
- limited joints which should be welded or sealed;
- floor finishes, such as vinyl, which are impervious and can be easily cleaned;
- flooring which must be securely anchored. Lifting of the floor can create reservoirs of infection;
- surfaces such as wood, tiles and unsealed joints which should be avoided because they are more difficult to clean;
- flooring of a material which is unaffected by detergents and disinfectants;
- flooring in areas subject to traffic which, when wet, should have high slip resistance;
- carpets, these should not be used in clinical areas.

9.143 The use of dividers or screens that can be manoeuvred on wheels can be of benefit in ITU areas. The use of these dividers requires consideration at the planning stages as extra space is required both for their use between beds and for storage. It is also important that they are easily cleanable.

Electrical supply

9.144 Guidance on the supply of electricity can be found in SHTM 2007: 'Electrical services: supply and distribution'. If the ventilation system is used to control airflows to minimise cross infection, this system should be on a dedicated power supply which is clearly marked and designed to avoid accidental isolation. Where practical, power supplies should be classed as essential.

Electrical power services and sockets

9.145 Sufficient 13-amp switched and shuttered socket outlets should be provided in corridors and in individual rooms to enable domestic cleaning appliances with flexible leads (9 metres long) to operate over the whole department.

9.146 Where possible, socket outlets should be flush-mounted or in trunking systems to prevent the build up of dust.

Ventilation

9.147 In specialised applications such as isolation rooms or decontamination facilities, it is important to be able to monitor the effectiveness of the ventilation systems by means of visual indication such as pressure gauges. Where visual indication is provided, it is essential that the procedures for checking and recording the reading, if necessary, are clearly laid down and staff are adequately trained in the operation of the system and action to be taken in the event of system failure.

9.148 Isolation rooms which have a ventilation system capable of providing either positive or negative pressure within the room are not generally recommended. This is because investigations of failures of such systems have identified lack of staff awareness of the purpose and functioning of the system as key factors.

9.149 Guidance on the use of ventilation systems is given in SHTM 2025: 'Ventilation in Healthcare Premises' and Scottish Hospital Planning Note 13: 'Sterile services department'.

9.150 Consideration should be given to room layouts and the relationships between rooms and should be such that they avoid cross infection. Similarly, so as to avoid cross infection, Domestic Services Room (DSR) and service rooms should be located away from clinical or patient areas and extract outlets should be directed away from air intake vents.

Hot and cold water supplies

9.151 Guidance on hot and cold water supplies can be found in SHTM 2040: 'The control of legionellae in healthcare premises: a code of practice' and SHTM

2027: 'Hot and cold water supplies: storage and mains services'. Guidance on water filtration can be found in SHTN 2: 'Domestic hot and cold water systems for Scottish Healthcare premises'. Safe and effective hot and cold water supplies are paramount in healthcare premises to maintain a safe and comfortable environment for patients and staff, and for treatment at all levels of clinical and surgical care. Water must be supplied at an appropriate temperature and pressure, for example:

- water being supplied to hand-wash basins, baths etc should not cause scalding of the user;
- water being supplied to the DSR and or Pantry should be at a higher temperature however these need to be clearly marked as providing "VERY HOT WATER";
- systems should be designed to ensure continued circulation of water where practical;
- systems should be insulated to avoid heat transfers from hot supplies to cold;
- dead legs in pipework should be avoided;
- consideration should be given to the space and plumbing required for chemical treatment of water systems e.g.
  - compatibility of chlorine dioxide treatment;
  - the necessity for reverse osmosis plant in renal dialysis or sterile supplies units;
- careful consideration should be given to the frequency of use of fixtures especially where infrequent use may result in legionella control problems e.g. showers, sinks, long pipe runs.

9.152 Contamination of the water supply has been recorded as a cause of disease and death in both the public health arena and the hospital setting. It is important, therefore, that drinking water in healthcare settings is safe, readily available to patients and is palatable to encourage drinking. The new EU Drinking Water Directive, which is transposed into UK law by the Water Supply (Water Quality) (Scotland) Regulations 2001, contains new provisions to ensure that the drinking water supply within buildings to which the public has access remains wholesome and is not adversely affected by the domestic plumbing system.

9.153 Access to chilled water, which is plumbed directly off the mains, may be important when patients are feeling unwell, pyrexial or the ambient temperature is high. Patients who are ill become dehydrated and may need to increase their fluid intake.

9.154 A plentiful supply of water for other uses such as personal hygiene, hand hygiene and cleaning of the environment and equipment is also needed. Storage of this water requires careful consideration and can present problems if not dealt with appropriately.

9.155 Systems employed in the storage and conveyance of water for human consumption, and or use, should be designed and installed in order that the growth of harmful organisms, and hence the risk to people, is minimised.

9.156 Systems must incorporate measuring devices to monitor salient parameters accurately and allow trend logging to demonstrate the efficiency and sufficiency of the control measures employed. The number, type and location of the measuring devices should provide data that is representative of the whole system. Whilst it is desirable to increase the availability and access to drinking water and hand hygiene appliances, the provision of such must not encourage the incidence of water within sections of systems which may have a tendency to stagnate. Low flow and no flow of water within systems particularly where temperature variation may occur as a result, must be minimised as far as reasonably practicable to ensure the conditions that will encourage the growth of harmful organisms are avoided as far as possible.

Storage of water and policies for maintenance

9.157 Many organisms, such as species of nontuberculous *Mycobacteria*, *Pseudomonas* and *Legionella*, have been isolated from hospital water systems. Guidance on the control of *Legionella* in water systems can be found in the Health & Safety Executive's approved Guidance Note L8: 'Legionnaire's disease: the control of *Legionella* bacteria in water systems' and SHTM 2040: 'The control of legionellae in healthcare premises - a code of practice'. Problems associated with *Legionella* have been documented in healthcare premises however these problems have been minimised by:

- cleaning water storage tanks;
- maintaining a consistently high temperature in hot water supplies or introducing a form of online disinfection such as chlorine dioxide or ionisation if lower temperature hot water is used to avoid the need for thermostatic mixing valves (see Health & Safety Executive L8, Scottish Health Guidance Note 'Safer' Hot Water and Surface temperatures and SHTM 2040: 'The control of legionellae in healthcare premises - a code of practice');
- regular maintenance of plant;
- removing plumbing dead-legs;
- keeping cold water systems cold;
- minimising water storage.

9.158 In large hospitals, storage tanks are often necessary to ensure adequate supplies of water. Findings of *Aeromonas hydrophila* in seasonal trends by Picard and Goullet (1987) suggests that monitoring the water supply, especially during the summer months, is valuable. They also discuss the importance of keeping storage tanks clean and designing storage facilities to minimise excessive cold water temperatures, which should then reduce the tendency for multiplication of not only *A. hydrophila* but also *Legionella spp*.

9.159 Good practice requires that hot and cold water pipework are separated (i.e. not in the same ducting) to a sufficient margin to avoid heat transfer to the cold water supply. Hot and cold water pipes should not be installed in the same space e.g. voids or ducts where a sufficient margin of separation cannot be provided between pipes to prevent heat transfer. It has also been suggested that there is a need for testing, following a survey of bacteriological quality of water from hospitals by Hunter and Burge (1988).

9.160 Guidance on hot and cold water systems can be found in SHTM 2027: 'Hot and cold water supply, storage and mains services'.

Provision of single room facilities

9.161 With an increase in the incidence of antibiotic-resistant bacteria and immuno-compromised in-patients, there is an increasing need for en-suite single rooms and negative or positive pressure isolation rooms. Single rooms with en-suite facilities allow for easier management of infection than wards. The current trend is for new facilities to have more single rooms than previously with some parts of the UK planning on a basis of at least 50% single rooms. Provision of isolation/single rooms will help prevent the spread of organisms, especially those transferred by the airborne route or those easily disseminated into the immediate patient environment. En-suite single rooms also provide greater privacy and are preferred by many patients.

9.162 Many patients with an infection require physical isolation. However, often patients cannot be isolated because of a shortage of single rooms and isolation rooms. The key to effective isolation on acute general wards is the provision of single rooms with en-suite sanitary facilities. Single rooms reduce the risk of cross-infection for both non-airborne and airborne diseases and help to lower the incidence of HAI. Most patients on acute general wards can be isolated/segregated in single rooms with en-suite facilities. All single rooms in new-build hospitals should have en-suite facilities so that they can, among other reasons, be used to isolate/segregate patients.

9.163 Historically, isolation/segregation in general wards has been provided in single rooms, sometimes without en-suite facilities. Rooms without en-suite facilities often cannot be used to isolate patients effectively.

9.164 Ventilated isolation suites with en-suite facilities can also be provided. They may have a ventilation system that provides a positive pressure in the room to protect the patient from infection, or a negative pressure to prevent a patient from infecting others, or the ventilation may be switchable from positive to negative. These rooms rely on staff being able to assess the type of ventilation required when a patient arrives on the ward and, for switchable systems, knowing how and when to select the correct ventilation mode. Patients can be put at risk if the ventilation mode is not set correctly and as such the provision of isolation rooms which are switchable from positive to negative air pressure is no longer recommended because of the risk to people inside and outside the room in the event of the setting being incorrect.

9.165 There are four main reasons for caring for patients in single rooms:

- patient susceptibility to infection from other sources;
- patient presents an infection risk to others;
- non-medical, for example patient preference;
- clinical but not infection-related.

9.166 In terms of infection control, only patients in the first two categories require isolation. Patients in the latter two categories can be cared for in standard single en-suite rooms used to segregate patients. In order to simplify the use of isolation facilities, two room designs for isolating patients in acute general settings are discussed:

- single room with en-suite facilities;
- enhanced single room with en-suite facilities and ventilated anteroom (isolation suite).

Single room with en-suite facilities

9.167 A single room with en-suite sanitary facilities having extract ventilation is a simple, cost-effective way to provide isolation/segregation and will meet the needs of most patients on general wards. The room does not require any specialist knowledge or action by the nursing staff to operate it. When not being used for isolation the room can be used for general nursing.

Enhanced single room with en-suite facilities and ventilated lobby (isolation suite)

9.168 An enhanced single room with a positive pressure ventilated entry lobby and en-suite facilities with extract ventilation provides both source and protective isolation. The positive pressure lobby ensures that air from the corridor does not enter the isolation room, and that air from the room does not escape into the corridor. This simple design enables the suite to be used for either source or protective isolation without the need for switchable ventilation or special training for staff. It also provides safe isolation/segregation for patients whose condition is unknown.

Advantages

9.169 Both rooms are suitable for caring for patients not in isolation but who require a single room for other reasons. In addition, both room designs are simple in concept, safe in operation, and do not require the nursing staff to have any specialist ventilation knowledge.

9.170 On occasions, it may be necessary to prioritise the use of the available isolation and single rooms used to segregate patients. In such situations, consideration must be given to cohort nursing of patients within small 2/4 bed bays.

9.171 The focus of single/isolation rooms discussed in this part of the document include:

- the role of isolation/single rooms in preventing cross-infection;
- cohort nursing;
- quantity and design;
- negative/positive isolation rooms;
- hand-hygiene facilities;
- sanitary facilities;
- storage of personal protective equipment;
- size and layout;
- visibility/location;
- furnishings and fixtures;
- finishes;
- floors;
- walls;
- ceilings;
- doors;
- windows;
- engineering requirements.

The role of isolation in preventing cross-infection

9.172 The primary aim of prevention and control of infection is to prevent the spread of infection between patients, visitors and staff by the control or containment of potentially pathogenic organisms. Many of these organisms can be controlled by basic prevention and control of infection practices such as hand-hygiene and environmental hygiene, but isolating/segregating the source patient can only effectively contain certain organisms.

9.173 'Negative pressure' isolation rooms are essential for infections transmitted by the airborne route: it has been reported that isolation of infected patients prevents cross-infection in outbreaks of tuberculosis (Louther et al, 1997). For other infections, a patient can be accommodated in a single room which can segregate the patient.

Cohort nursing

9.174 When an index case of infection is followed by several secondary cases, it may be necessary to cohort nurse a group of patients in a bay if insufficient single rooms are available. This can be more easily achieved where wards are divided into small bays (two or four beds per bay) which can be isolated/segregated further by closure of doors at the entrance/exit and which

also have en-suite facilities. When prevention and control of infection guidelines are adhered to, research has demonstrated that cohort nursing can successfully control and contain infection in hospital (Cartmill et al, 1994; Zafar et al, 1998; Green et al, 1998; Karanfil et al, 1992; CDC, 1995, 1997).

9.175 There is currently no definitive guidance on size, ventilation or the equipping of isolation rooms. NHSScotland SHPNs for relevant departments such as wards, theatres and other specialised areas and SHTM 2025: 'Ventilation in healthcare premises', give advice on natural ventilation, general extract ventilation and ventilation for specialised areas.

9.176 Experience has shown that many hospitals find the present allocation of isolation/single rooms inadequate to deal with the increasing numbers of infected and immuno-compromised patients (Langley et al, 1994; Wiggam and Hayward, 2000). Hospitals with 10% of their bed contingent as single rooms often find that this number is inadequate to cope with every infectious patient. Where this is the case, risk assessment needs to be used to inform decisions regarding which patients to nurse in single rooms.

Hand-hygiene facilities

9.177 Hand-hygiene and the use of Personal Protective Equipment (PPE) are key to preventing the spread of infection. Sufficient hand-wash basins must be supplied in a room used to isolate patients (and attached ante-room) and single room. This is in addition to the basin provided for patient wash facilities. Elbow taps for clinical hand-wash basins are preferred and the touch-free control of water flow will further aid the control of infection, although maintenance implications need to be considered.

Sanitary facilities

9.178 Personal hygiene contributes to the prevention of cross-infection and is improved if patients have their own bath or shower, WC and hand-wash basin. Single rooms should therefore be provided with en-suite sanitary facilities. An en-suite single room should also be able to accommodate a hoist for lifting patients.

Size and layout

9.179 Additional facilities may be required for the care and treatment of patients in isolation rooms/single rooms, especially if the isolation is likely to last for some time. The facilities required may include the storage of:

- supplies retained in the room;
- personal clothing and possessions;
- essential domestic cleaning equipment held in en-suite sanitary facilities.

9.180 Where possible, the opportunity should be taken to size the room so that the bed can be placed parallel to the external wall, thereby allowing the patient to enjoy a view of the outside. An intercommunication system, while not essential,

is desirable as this allows the patient verbal contact without compromising their isolation.

Visibility/location

9.181 If patients are to stay in an isolation/single room or bay, it is important that they are able to see staff from their beds. Staff should also be able to see the patient in case of an emergency. This reduces the psychological problems of isolation/segregation. Providing outside views using windows with low sills can also reduce the sense of containment.

Furnishing and fixtures

9.182 In isolation/single rooms/small bays where infectious patients are nursed, it is important that there is enough space to easily clean furnishings and fixtures.

Finishes

9.183 Ledges, recesses and tight angles where dust particles can be trapped should be avoided to allow ease of cleaning. It should be ensured that detergents and disinfectants will not physically affect surfaces and that they will dry quickly.

Floors

9.184 Carpets are not advisable in isolation/single rooms as carpets may prolong the survival of certain micro-organisms.

Walls

9.185 Wall finishes should be impermeable and easily wiped over if necessary.

Ceilings

9.186 These should have homogeneous plastered surface with flush-mounted recessed lights, ventilation grilles and other ceiling fixtures, where possible. Removable ceiling tiles in a grid layout are not advised for isolation rooms.

Doors

9.187 The corridor door to the room should be one and a half leaf and contain a large vision panel. A means of obscuring the vision panel should be included within the door.

9.188 Doors should have smooth handles which can be easily cleaned, will not be physically affected by detergents and disinfectants, and will dry quickly.

Windows

9.189 These will need to be lockable when the specialised ventilation is turned on. Curtains to provide privacy should be controlled within the room.

Engineering requirements for isolation rooms

9.190 Provision of mechanical ventilation systems is important in controlling the required direction of air movement between isolation rooms and the adjacent corridor.

9.191 For negative pressure isolation rooms, there should be a readily visible monitor independent of the air supply/extract system. This is best achieved by monitoring the pressure differential between the patient room and corridor or lobby. This differential should preferably be monitored continuously, i.e. a pressure sensor linked to an alarm at the nurses' station should the pressure drop below a pre-set limit. The alarm should have a built-in delay of a few seconds so that it does not activate every time the door is opened. For negative pressure isolation rooms, there should be an interlock system such that supply ventilation is cut off if the extract ventilation fails. There should be a clear indication to users that the ventilation has failed.

9.192 For isolation rooms with both negative and positive pressure ventilation, the mechanism for switching from one to the other should be lockable. As mentioned previously, it should be noted that this option of having isolation rooms with switchable ventilation is not generally recommended as infections have been transmitted through patients being cared for in a positive pressure room when they should have been in a negative pressure room. Staff should be properly trained on how to use the mechanism. With regard to the en-suite sanitary facility, the extract ventilation should be designed to work in conjunction with the main ventilation system.

9.193 General space/heating requirements can be met by the same method as for 'standard' single rooms. Care should be taken in selection of the heat emitter, as it needs to be easily cleaned and should not have inaccessible corners.

9.194 To reduce dust contamination and ease cleaning, luminaires should be recessed, dust-excluding and fully accessible from below.

9.195 Planned maintenance and monitoring programmes must be established for ventilated rooms to ensure the design criteria is maintained and met at all times. Although it is impossible to give specific maintenance frequencies, each unit must be included in a planned preventative maintenance schedule that includes pressure/air flow monitoring equipment.

Hand-hygiene facilities

Clinical Sinks

9.196 Hand-hygiene is the single most important factor in the prevention of healthcare associated infection (Ayliffe et al, 2000).

9.197 It is known that compliance with hand-hygiene guidelines have led to a significant reduction in the carriage of potential pathogens on the hands and can result in reduction of patient morbidity and mortality from hospital acquired infection (Pittet et al, 2000).

9.198 The absence of conveniently placed sinks often leads to non-compliance with hand hygiene guidelines. Good departmental design, with sufficient, appropriately placed hand-wash basins can increase compliance.

9.199 Thus, the importance of facilities to encourage hand hygiene should be high on the list of priorities when designing and planning new healthcare premises or refurbishment of existing premises is being undertaken.

9.200 This part of the document discusses:

- design;
- sink provision;
- water/taps;
- hand-hygiene dispensers;
- hand drying.

Design

9.201 Sinks in clinical areas must be suitable for that purpose (not of a domestic design). Hotel-style sinks are not appropriate.

9.202 The dimensions of a clinical sink must be large enough to contain splashes and therefore enable the correct hand-hygiene technique to be performed (Bartley, 2000).

9.203 The sides of the sink should be curved to prevent splashing.

9.204 Hand-wash sinks should be sealed to the wall or placed sufficiently far from the wall to allow effective cleaning of all surfaces.

9.205 Waterproofed sink splash-backs should be included to prevent wall damage and allow ease of cleaning (Ayliffe et al, 1999).

9.206 Clinical sinks should not have a plug or a recess capable of taking a plug. A plug is an unnecessary source of infection (especially *Pseudomonas* spp.) and can discourage staff from washing their hands under running water, particularly if mixer taps are not available.

9.207 Overflows are difficult to clean and become contaminated very quickly, serving as reservoirs of bacteria. They should therefore be avoided (SHPN 04: 'In-patient accommodation – options for choice').

Sink provision

9.208 Hand hygiene facilities must be readily available in all clinical areas. There must be sufficient sinks to encourage and assist staff to readily conform to hand hygiene protocols (Boyce et al, 2000; Feather et al, 2000; Carter and Barr, 1997; Dancer, 1999; Department of Health, 2000; Harris et al, 2000; Larson and Killien, 1982; Pittet, 2000). Inconveniently located hand hygiene facilities are

one of the main reasons that healthcare staff do not comply with hand hygiene protocols (Larson and Killien, 1982; Pittet, 2000).

9.209 There is a need to review the numbers and placement of sinks, as well as their dimensions (Kesavan et al, 1998; Bartley, 2000). Guidelines for the appropriate numbers of sinks in clinical areas have been identified (SHPN 04: 'In-patient accommodation - options for choice'). This guidance suggests a minimum of one sink per single room or small ward area and one sink per six beds in a large multi-occupied room. However, to encourage good practice and give reasonable access, it is recommended that there should be:

- ideally, in **intensive care and high dependency units (critical care areas)**, one hand-wash basin at the front of each bed space;
- one sink between four patients in **acute, elderly and long-term care** settings; and
- one sink between six patients in **low-dependency** settings, for example mental health units and learning disability units.

9.210 In **primary care** and **out-patient** settings where clinical procedures or examination of patients/clients is undertaken, then a sink must be close to the procedure, ideally in the same room or in a cubicle section of the room.

Water/taps

9.211 Health and safety regulations (The Workplace [Health, Safety and Welfare] Regulations, 1992) require that both hot and cold running water should be available in areas where employees are expected to wash their hands.

9.212 Hands should always be washed under running water; mixer taps allow this to be practised in safety in healthcare settings where water temperatures are high to combat *Legionella* spp.

9.213 Taps should be elbow, knee or sensor-operated (SHPN 04: 'In-patient accommodation - options for choice') for hand hygiene.

9.214 Taps should be easy to turn on and off without contaminating the hands. Infrared taps are an alternative but these are expensive and can pose problems with cleaning and flushing (Bushell, 2000).

9.215 Taps discharging into a shallow sink or directly into a drain hole can cause splashing which disperses contaminated aerosols. Thus, the tap outlet flow should not point directly into the sink outlet (Ayliffe et al, 2000).

9.216 Swan-neck tap outlets must not be used, as they do not empty after use. Strainers and anti-splash fittings at outlets should not be used as they easily become contaminated with bacteria.

Hand hygiene dispensers

9.217 Skin disinfectants and soaps must be wall-mounted near the sink so that the user can operate the dispenser properly without risking contamination. Soap

dispensers should not be refillable but be of a disposable, single cartridge design.

Alcohol based hand rubs

9.218 Alcohol-based handrubs have an important role, especially when access to hand-wash basins is difficult (Pittet, 2000). Unlike soap dispensers, these do not necessarily have to be placed by sinks. Alcohol based handrubs are a key aid in the prevention and control of infection. It is recognised that these materials are highly flammable and an appropriate fire risk assessment should be carried out with consideration given to the storage of these products. Ingestion of the product by certain patient groups has also been reported. The National Patient Safety Agency in England (2004) has stated that personal dispensers should be used where there is an increased likelihood of patient ingestion. Risk assessment should be carried out on the use of alcohol based handrubs, the location and size of dispensers and the storage and disposal of new stock, giving consideration to the likelihood of ingestion especially in high risk ward areas and clinical units.

Hand drying

9.219 Hand drying is of equal importance in maintaining hand hygiene as wet surfaces can transfer micro-organisms more effectively.

9.220 Paper hand-towels dry hands rapidly and dispensers can be used by several people at once. They are considered to be the lowest risk of cross-infection and are the preferred option in clinical practice areas (Bushell, 2000). The dispensers should be conveniently placed by hand-wash sinks.

9.221 The use of paper towels in rolls should be discouraged. They are difficult to tear off without contaminating the remaining roll (Gould, 1994; Hoffman and Wilson, 1994).

9.222 To discourage the use of reusable towels, towel rails should not be installed next to clinical hand-wash basins. Fabric towels are recognised as a source of cross contamination and are not recommended in clinical practice (Blackmore, 1987).

9.223 Hot-air dryers should not be used in clinical areas as warm air currents dry hands slowly and can be used by only one individual at a time. This results in queues and the temptation to dry hands on clothing (Bushell, 2000).

9.224 Foot-pedal-operated bins with a waste bag should be provided by each clinical hand-wash basin (Gould, 1997).

9.225 A minimum of one hand-wash sink in each single room is required. En-suite single rooms should have a hand-wash basin in the en-suite facility in addition to a clinical hand-wash basin in the patient's room.

9.226 Isolation rooms/single rooms used to segregate patients should have a hand-wash sink in the ante-room, isolation room and en-suite facilities.

9.227 Ideally, in intensive care and high dependency units (critical care areas), consideration should be given to providing one hand-wash basin for each bed space.

Catering/food hygiene

9.228 There are many important requirements to be considered when planning a new catering facility, whether this is a new build or an upgrade of an existing building. In the planning and design of such a facility it is essential that professional input is obtained from a number of sources, particularly the Local Environmental Health Office, NHS Infection Control, Health & Safety.

9.229 It is important that the following areas are considered:

- the size of the facility must first of all be established and this is generally based on the estimated daily production requirements (size should be 'fit for purpose' and not restricted by the space available);
- style of food production and service to be used e.g. cook/serve, cook/chill, bulk or plated service. The patient type and layout of the hospital site can heavily influence this decision and will assist in the choice of equipment.

9.230 To enable ease of maintenance, the general fabric of the internal building should be given careful consideration with suitably finished surfaces for floors and walls. Consideration should be given to the following:

- general ventilation is a key factor to be considered including environmental temperatures of workspace;
- the design should be based on a logical flow pattern for production and service e.g. goods inward > checking and storage > preparation > production > service/distribution > returns > etc;
- safe holding and handling of food requires careful consideration when designing refrigeration/chilling/freezing requirements;
- satisfactory facilities must be made available for catering staff changing in accordance with guidance (e.g. HBN 10: 'Catering department'. Comments on use in Scotland can be found in SHHD/DGM 86/43), with specific planned arrangements for hand hygiene both prior to entering and whilst in the catering/food handling area;
- to aid compliance with the relevant Food Safety Legislation, a competent Hazard Analysis and Critical Control Point (HACCP) system must be developed. This should be developed in conjunction with the Local Environmental Health Department;
- attention should be given to planning for adequate segregated storage capacity e.g. chilled foods, raw, cooked, dry goods, dairy foods, disposable goods, cleaning materials, waste material awaiting uplift, etc;
- in the area of preparation facilities, attention must also be given to segregated temperature controlled areas particularly for chilled food handling.

9.231 Patients can be particularly vulnerable to the effects of food-borne infection. This is usually traced to a bacterial source and problems can arise from contamination from food handlers, utensils and work surfaces as well as incorrect or inadequate food hygiene precautions. It is important that management control systems, for example HACCP (Hazard Analysis and Critical Control Point): see the Department of Health's (1993) 'Assured safe catering – a management system for hazard analysis', good practices and the conditions in which the food is stored, prepared, processed, distributed and served all enable high standards of hygiene to be achieved and readily maintained.

9.232 To facilitate appropriate standards of personal hygiene for staff, there should be hand-wash basins in each preparation area and in the cooking and serving areas. Non-touch taps should be specified, and liquid soap and paper towels should be provided. Basins should be sited where they cannot splash onto food preparation equipment.

9.233 Once a decision has been taken on the style of cooking and service to be adopted, consideration should then be given to equipment choice. It is essential that equipment is chosen which will facilitate ease of cleaning, with mobility being a feature wherever possible.

9.234 Equipment selection should be carried out with as much research as possible into the technology available. Key features to take account of when planning equipment selection include:

- carefully specify requirements;
- use National Contracts available;
- carry out detailed tendering process with realistic time-scales;
- budget for preventative maintenance contracts for all production and service equipment, with particular emphasis on the ability of the equipment to maintain acceptable food temperatures during transit. Plan to include spare capacity in the stock of trolleys in order to allow for breakdown and removal from service for maintenance and cleaning.

Ward kitchens, pantries and therapeutic kitchens

9.235 Equipment purchased must conform to the standards in the Food Safety Act 1990 (Scotland). This includes the need for a separate hand-wash basin and finishes used for the floors, walls, etc. The size and design will vary according to the overall decision for food preparation in the premises. If a cook-chill system or regeneration of frozen food is to take place, the kitchen will need to be larger to house the regeneration oven and will need additional ventilation.

9.236 Catering facilities at ward level require careful consideration. During the course of the day, a wide range of catering procedures will take place in the ward kitchen/pantry areas. These procedures are normally carried out by either nursing or domestic services staff with the majority of the tasks carried out relating to the preparation of 'between meal' snacks and beverages and the washing up of crockery, cutlery and glassware. The ability to be able to

maintain a clean environment is of paramount importance and the ward kitchen should be designed to facilitate this.

9.237 Space required will vary according to the number of beds which the facility will serve and the style of food service will also dictate the space required. e.g. bulk food service or plated meals. A bulk food service may require crockery from all meals to be washed at ward level whilst the plated service will normally see crockery from the three main meals returned to the main hospital kitchen for wash-up, with only between meal snacks and beverage crockery washed at ward level. The ward kitchen should be designed to allow sufficient space to allow a number of staff to work in the area at the same time and to accommodate the required level of storage and equipment.

9.238 The ward equipment to be selected should be of industrial standard to ensure that it is capable of dealing with the heavy demands made on it. Domestic type appliances should be avoided, particularly refrigerators, ice-making machines, dish-wash machines and hot water boilers. Advice from the Infection Control Team should be sought prior to the purchase of equipment.

The following points should be complied with:

Refrigerators: The size of the unit selected should be capable of holding the routine daily supplies. This will be influenced by whether or not a 'pergal' milk dispenser is used in the kitchen or if the refrigerator is required to hold quantities of carton milk. An industrial unit will be more capable of handling the larger quantities of chilled food with a more effective recovery time for chilling of the unit given the frequent opening of the door and loss of temperature. The unit selected should be capable of maintaining a chill temperature of below 4 degrees centigrade.

Dish-wash machine: As with the refrigerator, this should be of industrial standard with the ability to achieve a rinse temperature of 82^0C. The machine should also be capable of operating with an automatic dosing system of wash and rinse products. Storage facilities should also be provided for safe keeping of the wash and rinse products.

Ice-making machine: The type selected should be capable of automatic dispensing of ice and without a storage reservoir, which requires the users to scoop ice from a stock which may have been made too far in advance. Ideally they should be plumbed from the mains water supply to ensure biofilms are minimised.

Hot water boilers: A thermostatically controlled water boiler should be provided for the preparation of beverages in preference to the use of kettles, particularly in kitchens that supply a service to a ward area.

Microwave: If sited in the ward area, should not be used to cook or reheat food intended for consumption by patients.

9.239 Sufficient storage facilities should be provided to accommodate the range of food and non-food supplies held at ward kitchen level. This is normally held in

base storage units and wall mounted cupboards with adequate provision of standard height work-surfaces. Attention must be given to establishing sufficient numbers of electrical sockets to accommodate electrical equipment.

9.240 The general environment should contain adequate levels of ventilation to handle the heat and steam generated by the main kitchen equipment. The floor surface should be easy to clean and preferably of a high slip-resistance. Walls and other surface should be impervious for ease of cleaning.

Occupational Therapy kitchens

9.241 In some hospitals, dedicated kitchen areas are required for use by Occupational Therapy staff for the rehabilitation of patients. The most important factor to consider for these areas is that they should simulate as closely as possible the kitchen conditions found in a standard household environment. However, the need for ease of cleaning, repair and maintenance is a priority.

9.242 The space required will vary from single to multi-use and this requires to be established by consultation with Occupational Therapy staff. Adequate provision should be made for ease of access, taking into account space for patients in wheelchairs and with walking aids. The layout of work-surfaces etc should be decided in consultation with the Occupational Therapist.

9.243 In terms of equipment, the kitchen should be fitted with the normal range of kitchen appliances and these should be of normal domestic size and not industrial specification. These include both electric and gas cookers with oven, microwave oven and fridge. Occupational Therapy staff should be consulted to determine the need for any other items of fixed equipment. Provision should also be made for sufficient numbers of electrical sockets (at worktop level) to accommodate the use of additional kitchen appliances such as toasters, mixers/blenders, kettles, etc.

9.244 The general environment should be to a standard that will facilitate ease of cleaning with no provision for curtains or carpets. The floor surface should be of vinyl with an impervious wall finish and appropriate ventilation in the cooking area. The facility should also be well fitted with a range of domestic type kitchen cupboards, worktops and wall mounted storage units. The level required should be determined by consultation with Occupational Therapy staff.

10. Construction/Refurbishment Stage

Introduction

10.1 During the construction or refurbishment of facilities, a range of circumstances prevail which present significant problems and opportunities in terms of prevention and control of infection. It is also at this stage where lifetime prevention and control of infection problems can either be built in or out depending on the profile and resources given to prevention and control of infection issues. This Section considers the main issues and highlights actions to minimise infection risks during and after the construction phase.

Construction and waste

10.2 Each year in Scotland approximately 6.28 million tonnes of waste are produced by the construction industry (SEPA 2000) and for projects attached to existing healthcare facilities this can cause considerable risk to susceptible patients due to increased risk of fungal spores being released into the air. It is important that this dust and debris is controlled and disposed of safely. Major earthworks are also a recognised factor in legionella infections.

10.3 Barrier systems should be erected and fit-for-purpose closed waste containers supplied.

10.4 Waste produced by the construction industry relating to projects at healthcare facilities, can give rise to infection problems, especially for susceptible patients, and careful planning is required if the potential for infection risk is to be designed out.

10.5 The clinical implications which arise when the system for managing construction waste goes wrong, or is simply not in place, include increased risks to immuno-compromised patients from incorrect transporting and disposal of the waste.

Methods of control

10.6 Construction work in a healthcare facility inevitably generates dirt and dust and with it certain micro-organisms which have the potential to harm immuno-compromised patients. This is especially true of *Aspergillus fumigatus*, a ubiquitous fungus which is spore producing and which is transmitted by inhalation or contact. Dust and debris control is essential along with the need for increased and regular cleaning during and after completion of the building project.

10.7 Designated entry and exit areas should be identified for use and, where appropriate, dedicated lifts should also be identified for use.

10.8 Input from Infection Control Specialists is essential in the planning of the building project as well as during, and on completion of, the construction work. HAI-SCRIBE should be applied as appropriate.

Issues to be considered include:

- refurbishment/new build project;
- workflow;
- infection risk/patient movement;
- specialised areas like theatres, critical care, laundry, treatment areas.

10.9 The prevention and control of infection measures to be considered will apply equally to new build and refurbishment projects.

10.10 Correct workflow systems must be maintained throughout the building project. Input from Infection Control Specialists is essential at each stage of the project, requiring close collaboration between Infection Control Specialists and the Design Team. This is especially important in the planning of specialised units like theatres and critical care facilities.

10.11 Most healthcare departments have clean-to-dirty workflow systems. Workflow is a fundamental of good prevention and control of infection practice and this needs to be reflected when the built environment is being considered. There is often an issue of space being at a premium and there is therefore the temptation to try to fit everything in. It is important to resist this temptation as problems caused by this may last the lifetime of the facility. The healthcare facility should be large enough to adequately accommodate activities taking place within it.

10.12 HAI-SCRIBE highlights the range of construction activities commonly undertaken in healthcare facilities and assesses the degree of risk in relation to population groups.

10.13 In order to ensure the risk of infection is minimised during construction works, consideration must be given to:

- the patient population group being treated;
- the type of construction work being carried out;
- the risk associated with these two factors.

Risk Management methodology

10.14 Kennedy (1996) developed a methodology which assesses the risk of infection from construction works and has highlighted the range of precautions needed to eliminate or manage this risk. Although this system was developed for use in the United States it can be applied to the redevelopment and refurbishment of healthcare facilities within NHSScotland.

Risk to patients of infection from construction work in healthcare premises by clinical areas		
Group 1	**Lowest risk**	1. Office areas. 2. Unoccupied wards. 3. Public areas.
Group 2	**Medium risk**	1. All other patient care areas (unless included in Group 3 or Group 4). 2. Outpatient clinics (unless included in Group 3 or Group 4). 3. Admission or discharge units.
Group 3	**High risk**	1. A & E (Accident and Emergency). 2. Medical wards. 3. Surgical wards (including Day Surgery) and Surgical outpatients. 4. Obstetric wards and neonatal nurseries. 5. Paediatrics. 6. Acute and long stay care of the elderly. 7. Patient investigation areas, including: • Cardiac catheterisation; • Invasive radiology; • Nuclear medicine; • Endoscopy. Also (indirect risk) 8. Pharmacy preparation areas. 9. Microbiology laboratories (risk of pseudo-outbreaks and unnecessary treatment).
Group 4	**Highest Risk**	1. Any area caring for immunocompromised patients*, including: • transplant units and outpatient clinics for patients who have received bone marrow or solid organ transplants; • oncology units and outpatient clinics for patients with cancer; • burns units. 2. All Intensive Care Units. 3. All operating theatres. Also (indirect risk) 4. CDUs (Central Decontamination Units).

*__Immunocompromised patients__ are those patients whose immune mechanisms are deficient because of immunologic disorders (e.g. human immunodeficiency virus [HIV] infection or congenital immune deficiency syndrome), chronic diseases (e.g. diabetes, cancer, emphysema, or cardiac failure), or immunosuppressive therapy (e.g. radiation, cytoxic chemotherapy, anti-rejection medication, or steroids). Immunocompromised patients who are identified as high-risk patients have the greatest risk of infection caused by airborne or waterborne micro-organisms. Patients in this subset include persons who are severely neutropenic for prolonged periods of time (i.e. an absolute neutrophil count [ANC] of ≤ 500 cells/mL), allogeneic HSCT patients, and those who have received the most intensive chemotherapy (e.g. childhood acute myelogneous leukaemia patients). (CCDR 2001.)

Immunosuppresive conditions identified as risk factors for construction-related nosocomial fungal infections include graft-versus-host disease requiring treatment; prolonged neutropenia or granulocytopenia because of cytoxic chemotherapy; prolonged use of antibiotics; and steroid therapy. Other risk factors for the development of aspergillosis include dialysis and mechanical ventilation, smoking and patient age, the very young and very old being at greater risk Grauhan and colleagues reported that the risk of a fungal infection increases in patients who exhibit three or more risk factors ($p<0.001$). (CCDR 2001.)

Table 7: Highlights the different population groups being treated in the healthcare facility and the degree of risk associated with them.

Type 1	**Inspection and non-invasive activities.** Includes, but is not limited to, removal of ceiling tiles for visual inspection, painting which does not include sanding, wall covering, electrical trim work, minor plumbing and activities which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection.
Type 2	**Small scale, short duration activities which create minimal dust.** Includes, but is not limited to, installation of telephone and computer cabling, access to chase spaces, cutting of walls or ceiling where dust migration can be controlled.
Type 3	**Any work which generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies.** Includes but is not limited to, sanding of walls for painting or wall covering, removal of floor coverings, ceiling tiles and casework, new wall construction, minor duct work or electrical work above ceilings, major cabling activities, and any activity which cannot be completed within a single work shift.
Type 4	**Major demolition and construction projects** Includes, but is not limited to, activities which require consecutive work shifts, requires heavy demolition or removal of a complete cabling system, and new construction.

Table 8: Indicates the types of construction work being carried out within the healthcare facility

	Construction Project Type			
Patient Risk Group	***TYPE 1***	***TYPE 2***	***TYPE 3***	***TYPE 4***
Low Risk	**Class I**	**Class II**	**Class II**	**Class III/IV**
Medium Risk	**Class I**	**Class II**	**Class III**	**Class IV**
High Risk	**Class I**	**Class II**	**Class III/IV**	**Class IV**
Highest Risk	**Class II**	**Class III/IV**	**Class III/IV**	**Class IV**

Table 9: Estimates the overall risk of infection arising and will indicate the class of precaution that should be implemented.

Protection of sensitive areas

10.15 Having highlighted the overall degree of infection risk, appropriate control measures can be implemented to manage or eliminate the risk of transmission. Table 10 highlights the appropriate prevention and control of infection precautions.

	During construction of a project	*Upon completion of a Project*
Class I	1. Execute work by methods to minimise raising dust from construction operations. 2. Immediately replace a ceiling tile displaced for visual inspection.	Clean areas.
Class II	1. Provide active means to prevent airborne dust from dispersing into atmosphere. 2. Water mist work surfaces to control dust while cutting. 3. Seal unused doors with duct tape. 4. Block off and seal air vents. 5. Place dust mat at entrance and exit of work area. 6. Remove or isolate HVAC system in areas where work is being performed.	1. Wipe work surfaces with disinfectant. 2. Contain construction waste before transport in tightly covered containers. 3. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area. 4. Remove isolation of HVAC system in areas where work is being performed.
Class III	1. Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system. 2. Complete all critical barriers ie plasterboard, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 4. Contain construction waste before transport in tightly covered containers. 5. Cover transport receptacles or carts. Tape covering unless solid lid.	1. Do not remove barriers from work area until completed project is inspected by the Board's Safety Department and Infection Control Department and thoroughly cleaned by the Board's Environmental Services Department. 2. Remove barrier materials carefully to minimise spreading of dirt and debris associated with construction. 3. Vacuum work area with HEPA filtered vacuums. 4. Wet mop area with disinfectant. 5. Remove isolation of HVAC system in areas where work is being performed.
Class IV	1. Isolate HVAC system in area where work is being done to prevent contamination of duct system. 2. Complete all critical barriers ie plasterboard, plywood, plastic to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. 3. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 4. Seal holes, pipes, conduits, and punctures appropriately. 5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site. 6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area. 7. Do not remove barriers from work area until completed project is inspected.	1. Remove barrier material carefully to minimise spreading of dirt and debris associated with construction. 2. Contain construction waste before transport in tightly covered containers. 3. Cover transport receptacles or carts. Tape covering unless solid lid. 4. Vacuum work area with HEPA filtered vacuums. 5. Wet mop area with detergent to remove physical soiling before disinfecting area. 6. Remove isolation of HVAC system in areas where work is being performed.

Table 10: Describes the required Infection Control Precautions depending on class of risk (Adapted from Kennedy, 1997)

Ventilation of work site/pressurisation

10.16 Physical barriers erected to allow work activity should be robust and take account of the work activities and potential for damage that can breach this barrier. The work area, where practical, should be at a negative pressure with respect to the clean working areas. Avoid extract outlets discharging into the same areas as clean air intakes. Regular planned inspection of the site, visual airflow or pressure indicators and alarms should be considered.

Procurement

10.17 Infection Control Specialist input is essential at the procurement stage of any construction/refurbishment project. This input is initially required when consideration is being given to the selection of Architects and Designers. There is a case for stipulating that Architects and Designers for healthcare projects are suitably qualified in terms of their knowledge and understanding of prevention and control of infection.

10.18 The specification of building materials, especially surface finishes, healthcare facility equipment, etc should take account of input from the Infection Control Specialist.

Commissioning of systems and equipment

10.19 The work plan should allow for a phased approach to commissioning of systems. Once an area has been commissioned, it needs to be cleaned and sealed off. Equipment can then be cleaned and laid out providing access is strictly controlled prior to final handover.

Validation and verification of equipment

10.20 The Health and Safety files need to be complete and hold all necessary manuals and commissioning certificates. Any reusable medical device requires decontamination information and all necessary instructions. These should be obtained prior to purchase to ensure that the available decontamination facilities are able to deal with the device.

Planning for expansion

10.21 At the planning stage, the Planning and Design Team must ensure input from the Infection Control Specialist. This input would cover the proposed facility expansion and the measures to be put in place during the course of the construction project.

10.22 The prevention and control of infection input at the planning and design stage will mirror that for new build situations and reference should be made to Sections 8 and 9.

10.24 Reference should also be made to the appropriate question sets of HAI-SCRIBE.

Decant facilities

10.25 Major refurbishment or expansion projects would ideally benefit from the availability of a decant facility where patients could be transferred during the course of the construction work. Such a decant facility would also be very useful during the course of an infection outbreak to allow additional isolation/segregation capacity or in the case of an infection outbreak in the community additional patient capacity.

10.26 Given scarce resources and the need to apply health economics, the provision of decant facilities may be regarded as a desirable luxury. However, when consideration is given to the situations in healthcare facilities where a decant facility would be of real value in minimising the risk of infection spread, it may be appropriate to make some decant capacity available.

Environmental sampling/inspection

Physical monitoring

10.27 Physical monitoring of the healthcare environment including temperature, humidity, air change rates, leak rates, direction of air and water flow, particle counts and filter efficiency testing methods can help ensure that environmental conditions in the healthcare facility are such that they do not contribute to the spread of infection.

10.28 No single test can be relied upon to provide the whole picture and trends rather than individual readings are most useful. Areas such as theatres, positive and negative pressure rooms, sterile preparation areas in pharmaceutical facilities, sterile services etc. will have specific guidance for testing regimens. These are used mainly to determine that the area is fit for the desired purpose. In the event of any problem, these records are useful to determine investigation pathways.

10.29 Conditions likely to promote microbial contamination include high moisture levels in air, particularly when associated with high air temperature. Stagnant air, possibly through poor ventilation, can contribute to fungal contamination whilst excessive air turbulence can increase airborne particulate levels and contribute to the dispersal of micro-organisms.

10.30 The maintenance of the environment is important to ensure that areas are intact, functioning properly and in a state such that they can be cleaned properly.

10.31 Water testing in a variety of situations (e.g. endoscope washer-disinfectors and steam for autoclaves) may require chemical and endotoxin testing as well as tests for conductivity and hardness.

10.32 Visual inspection must be part of physical monitoring to ensure for instance that filters are fitted correctly, that surfaces are smooth, impervious, free of cracks and joins, and without the accumulation of dust which may harbour fungi and bacteria.

Microbial monitoring

10.33 In terms of quality assurance, microbial sampling of the air, water and surfaces of the healthcare facility has an important role to play in helping combat the spread of infection within the built healthcare environment. NHS Healthcare Bodies should have a formal protocol for the monitoring of the built healthcare environment with regard to the control of infection. When sampling of the area is carried out, the laboratory should have appropriate accreditation for carrying out the sampling. Some sampling may have to be performed in response to an investigation of an outbreak of infection. Results obtained should be interpreted using scientifically established baseline values for comparison e.g. Health and Safety Executive guidelines. On completion of analysis, actions to be implemented should be based on the results obtained.

10.34 The microbial monitoring protocols should be developed by the Infection Control Team, with input from other disciplines and bodies as appropriate. Areas where the built environment is suspected of contributing to the spread of infection or where construction or refurbishment work is proposed, should be referred to the Infection Control Team for consideration of monitoring and advice as appropriate.

10.35 Helpful advice is available from the United States in the CDC publication 'Guidelines for Environmental Infection Control in Health-Care facilities'. This document states that biological monitoring of the healthcare facility should occur in the following four situations (CDC 2003):

- to support the investigation of disease or infection where environmental reservoirs or fomites have been implicated epidemiologically in the transmission of the disease or infection;
- for research purposes to provide information on the spread of infection within the built healthcare environment;
- to monitor a potentially hazardous situation;
- for quality assurance purposes as part of a quality control programme or to evaluate a change in prevention and control of infection.

10.36 Microbiological and other methods of sampling have an important role to play in training and education of healthcare staff.

Methods of microbial sampling

10.37 There are several types of microbial sampling methods. Conventional culture methods of microbial diagnosis are generally restricted by the amount of time it takes for qualification or quantification to occur. Culture techniques take a minimum of 18 hours to carry out and in some instances can take as long as 6 weeks.

10.38 There are a variety of methods and media available but many are poorly assessed and validated. In many circumstances there are no standards or set protocols for testing. Contact plates, swabs, enrichment versus selective media and sensitivity of the method needs to be assessed in order to allow

interpretation. It is important to know why the sampling is being carried out and the procedures to be implemented if abnormal results are found. Environmental sampling can place a heavy burden on clinical laboratories which may not be set up, funded or accredited for non-clinical sampling.

10.39 Non-culture techniques do not require pathogen multiplication and can be a more rapid method of detection. These methods are being utilised with increasing frequency, including techniques such as:

- antigen detection techniques e.g. Elisa;
- toxin detection techniques e.g. endotoxin assay;
- ATP(Adenosine Tri-phosphate) detection techniques e.g. bioluminescence, used in the food industry as a rapid hygiene test for surfaces;
- residue protein detection tests (ninhydrin tests);
- soil tests;
- cleaning efficacy tests;
- molecular techniques.

External specialist advice in the use of these and other rapid techniques is likely to be necessary.

10.40 Special consideration should be given to specialised areas such as control of Legionella. There is often specific guidance on such areas such as:

- Scottish Health Technical Memorandum (SHTM) 2040: 'The control of Legionellae in healthcare premises - a code of practice';
- Health and Safety Executive (HSE) guidance note L8 'Legionnaires Disease: The control of legionella bacteria in water systems. Approved code of practice and guidance'.

11. Operation/on-going maintenance

Importance of maintenance

11.1 Good design and equipment selection will ensure future maintenance is easy and cost effective. A planned maintenance system should be set up to start at the same time as handover or occupancy. A record of Planned Preventative Maintenance needs to be kept. Regular reviews of the building fabric should be undertaken as accidental damage to smooth surfaces makes effective decontamination difficult to achieve. The use of soft, difficult to decontaminate fabrics must be, as far as possible, avoided.

Access for maintenance

11.2 Where practical, maintainable elements should be located in separate plant rooms with easy access to plant and final connection through walls into clinical areas. Plant and services should be located behind panels that should be easily accessed with quick release fixings. Care should be taken when running services on the surface to avoid ledges where dust can collect. Equipment should be serviced *in-situ* where this helps to avoid cross infection. If equipment has to be removed from the area, consideration should be given to decontamination before and after servicing has been carried out.

Catering/food hygiene

11.3 All healthcare establishments must comply with requirements in the Food Safety Act 1990 (Scotland) and food hygiene regulations made under this Act. Reference should also be made to the Cook Chill Guidelines (DoH, 1989) and any other relevant legislation.

Ancillary areas

11.4 It is important that ancillary areas are of an appropriate standard and do not put the user at risk of cross-infection.

11.5 The evidence used is based on guidance from NHS Estates, England. Prevention and control of infection issues will depend on:

- the use of the ancillary area;
- who will have access; and
- the type of activity to be carried out there.

11.6 Ancillary areas include:

- dirty utility/sluice;
- clean utility/sterile products;
- treatment room;

- disposal room;
- day room/patient waiting area;
- play area;
- nappy-changing area;
- visitors toilets.

Dirty utility room

11.7 A dirty utility room should include facilities for:

- the cleaning of dressing trolleys and other items of equipment;
- testing urine;
- disposal of liquid waste; and
- temporarily holding items requiring reprocessing or disposal.

11.8 Space and facilities for holding and reprocessing of bed-pans, urinals and vomit bowls are required where in-patients are looked after (further guidance can be found in SHTM 2030: 'Washer Disinfectors'). Central Decontamination Units (CDUs) returns can also be held here, along with storage of sani-chairs, commodes and linen bag carriers.

11.9 Hand-hygiene facilities are necessary plus the provision of a 'slop-hopper' for disposal of body-fluid waste (SHPN 04: 'In-patient accommodation - options for choice') and a separate deep sink for decontaminating nursing equipment.

Clean utility room

11.10 A clean utility room is required where drugs and lotions may be stored and prepared. A working supply of clean and sterile supplies may be held and dressing trolleys prepared. Clinical hand-hygiene facilities are required.

11.11 In primary care facilities, the room should be located adjacent to the treatment area. It is important that planners think about the type of storage facilities provided; there must be sufficient storage area for sterile supplies equipment and other clean supplies to keep supplies off the floor. They must be able to be cleaned easily and quickly while protecting clean stores and equipment from dust and contamination.

11.12 Sterile and clean supplies should be stored away from any source of water splashing. Suitable storage will ensure packaging is not damaged while accessing supplies.

Treatment room

11.13 A treatment room may be required for in-patient examination or investigations on the ward. It will certainly be needed in primary care settings and will require different design features according to its planned use. For example, in areas where immunisation, redressing or surgical intervention and investigations take place the following points should be considered:

- adequate numbers of hand-wash basins should be provided;
- space should be available to allow for the storage of equipment and sterile supplies;
- carpets should be avoided.

Disposal room

11.14 The disposal room is the temporary storage point for all items of supplies and equipment which have to be removed for cleaning, reprocessing or disposal, e.g. linen, reusable medical devices.

Day room/patient waiting area

11.15 There is often conflict between the aesthetics of these areas and the prevention of contamination of the environment or furnishings. This is especially the case in waiting areas such as in Accident and Emergency departments, primary care and minor injury units (SHPN 04: 'In-patient accommodation - options for choice').

11.16 It is important that where blood and body-fluid spillages may occur, the environment should be able to be cleaned so that micro-organisms do not survive and should be able to withstand the use of high concentrations of aggressive disinfectants.

11.17 Flooring should be cleanable and be able to withstand the use of detergents and disinfectants. Carpets are not recommended where spillage is anticipated.

Play area

11.18 There are prevention and control of infection implications for toy cleaning (i.e. how they should be effectively cleaned) and storage (i.e. the provision of adequate toy storage facilities) plus issues for cleaning equipment and multiple use areas such as soft play areas and play mats.

11.19 Porous or fabric toys should be avoided, as they cannot easily be decontaminated on site.

Nappy-changing area

11.20 Provision of a nappy-changing area is a necessary addition to any healthcare premises.

11.21 Facilities for disposal of soiled nappies and for hand-hygiene are required along with a regular cleaning programme for equipment used.

11.22 The area for nappy-changing should have a surface which can be easily cleaned.

Visitors' toilets

11.23 These are heavily used and should provide sufficient space and be of a high grade of finish to maintain a good standard of hygiene.

11.24 There should be provision of disposal facilities for sanitary waste in both women's and mixed-sex toilets.

11.25 The number of toilets and hand-wash basins provided must be sufficient for the anticipated population.

Recommendations

11.26 Ancillary areas provided as part of a ward, department, primary care facility or community home must be easily accessible, fit for the purpose and safe, both from a health and safety perspective and a prevention and control of infection perspective.

11.27 The prevention and control of infection issues in an ancillary area must be included along with other design features and will depend on what the ancillary area is to be used for, who will have access, and what type of activity will be carried out there.

11.28 Ancillary areas must be easily cleaned, have facilities for hand-hygiene, disposal of fluid and clinical waste, if appropriate, and sufficient storage for supplies and equipment.

11.29 Clean and dirty areas must be kept separate and the workflow pattern and management of each area must be clearly defined.

Cleaning frequency/quality

11.30 The ability to effectively maintain a clean environment is essential in the planning and design stage of any new facility. This applies to the general fabric of the building, along with the equipment selected.

11.31 Cleaning of all fixtures, fittings and equipment should be managed by way of planned cleaning schedules, based on routine cleaning frequencies. This will not only ensure a clean environment but will also extend the working life of the facility.

11.32 In addition to the cleaning frequency schedules, attention must be given to ensuring that appropriate staff training is carried out.

11.33 In order to maintain a facility in good condition, the design must allow for protection to walls which can regularly be subject to repeated damage from trolley traffic. Plans should also be made at an early stage to have the area included on the routine maintenance programme in order to maintain a high standard and minimise deterioration of the fabric. (Further guidance can be found in the NHSScotland National Cleaning Specification produced by the HAI Task Force.)

Ventilation

11.34 Ventilation should dilute airborne contamination by removing contaminated air from the room or immediate patient vicinity and replacing it with clean air from the outside or from low-risk areas within the healthcare building.

11.35 The ventilation must be sufficient to maintain a comfortable environment for staff and prevent the premises and equipment from overheating. Artificial ventilation systems must be constructed to permit access for cleaning and maintenance. Conditions which give rise to condensation should be avoided as condensation will encourage the growth of mould.

11.36 Care should be taken when servicing ventilation systems as air-flows and pressure changes can allow contamination of clinical areas. Dust or contamination in the ductwork or within the plant rooms can find their way into the system. Fire dampers should be of the self-resetting type to avoid accidental disruption of airflow. Filters need to be changed at regular intervals and care needs to be taken to avoid contamination of the system due to overloaded filters collapsing. Regular checks of the ductwork and diffusers should form part of the maintenance plan. Microbiological monitoring and commissioning of specialised ventilation should be in accordance with guidance in SHTM 2025: 'Ventilation in healthcare premises'. Ventilation systems should be designed to allow removal of filters without contaminating filtered air space.

Ventilation in the clinical setting

11.37 Research has suggested that in specialised areas, ventilation can reduce the incidence of healthcare associated infection such as wound infections and communicable diseases (Ayliffe et al, 2000; Sanchez and Hernandez, 1999; Fox, 1997; O'Connell and Humphreys, 2000; Holton and Ridgway, 1993; Humphreys, 1993).

11.38 Effective ventilation in healthcare premises involves the dilution of the airborne contamination by removing contaminated air from the room or immediate patient vicinity and replacing it with clean air from the outside or from low risk areas within the healthcare building. The use of specialised ventilation systems mainly relates to high risk units such as operating theatres, special care baby units, burns units, high dependency and intensive care units and areas such as isolation rooms (negative pressure ventilation for infectious patients and positive pressure ventilation for immuno-compromised patients).

11.39 Health Facilities Scotland SHPNs and SHTMs along with Codes of Practice for design of buildings give advice on 'natural' ventilation, general extract ventilation and ventilation for specialised areas such as operating theatres, hydrotherapy suites, isolation rooms and are referenced under the respective specialised areas.

11.40 Wound infection has traditionally been a major cause of morbidity resulting from surgical procedures. Improvements such as ultra-clean theatre ventilation have contributed to reduced morbidity and mortality in specialised areas such as orthopaedics (Lidwell et al, 1982).

11.41 Airborne infections have been associated within treatment areas where patients are immuno-compromised, for example haematology wards, bone marrow transplant units (Alberti et al, 2001; Sherertz et al, 1987).

Cost implications

11.42 In some clinical areas, the decision to install sophisticated ventilation systems which need routine or constant monitoring must be balanced against the risks and costs of such controls. The evidence on which to base the risk analysis is usually either absent or controversial. Where air movement is induced by mechanical ventilation, the flow of air must be from clean-to-dirty areas (where these can be defined). Hoffman et al (1999) state that "*investment in mechanical air systems is large and as with many other areas of infection control, it is difficult to measure their true effectiveness when such a measure would be the absence of sporadic events implicating a failure of the system*".

Control and containment of infection

11.43 Ventilation of healthcare premises is considered in SHTM 2025: 'Ventilation in healthcare premises' which includes discussion of airflow and filtration:

- Humphreys (1993) states that whenever airborne infection is possible in theatres, the airflow must go from clean to contaminated areas, and not the opposite way;
- Isolation rooms can be equipped with appropriate ventilation, i.e. negative or positive air pressure (but preferably not both);
- information on planned maintenance of ventilation systems should be available ((see Health Facilities Scotland (formerly NHSScotland Property and Environment Forum) SHTM 2025: 'Vol. 4 – Operational management'));
- ultra-clean ventilation systems in operating theatres can reduce airborne contamination and subsequent wound infections more effectively in specialised areas such as orthopaedics;
- Wagenvoort et al (1993) demonstrated the problems associated with intermittent interruption of electricity to ventilation systems which shuts the system down briefly.

Clean air and ventilation systems

11.44 Controlling airborne infection in relation to prevention of cross-infection in healthcare buildings remains a controversial subject. Hoffman et al (1999) divided the acute ward environment into:

- the 'true environment', which comprises those organisms normally found in any non-hospital environment, for example fungal spores; and
- the 'special hospital environment' which consists mainly of organisms arising from patients, staff and visitors, for example tuberculosis.

11.45 The relative incidence of airborne infection in hospitals has been estimated to be about 10% (Schaal, 1991). However, this does not take into account such

factors as local respiratory pathogens, susceptibility of patients, climatic conditions, construction work, ventilation equipment and organisational policies in individual hospitals or wards.

11.46 The Control of Substances Hazardous to Health Regulations (COSHH) (1999) state that:

"Exposure to a biological agent shall be adequately controlled by designing work processes and engineering control measures so as to prevent or minimise the release of biological agents into the workplace."

11.47 The COSHH Regulations require work processes to be safe by design. However, in some cases such as multi-drug-resistant tuberculosis (MDRTB), both ventilation and Personal Protective Equipment (PPE) will be required.

11.48 Shutters, access doors or air direction slats, if fitted, should be easily accessible for cleaning or removal.

Heating

11.49 A heating element is likely to be an integral part of the ventilation system and should be easily controlled and maintained. Natural convection currents caused by heat loss needs to be considered when calculating airflows and direction of airflow.

Heating/temperature control

11.50 Special consideration should be given to the type of heating, cooling and general ventilation systems provided in patient care and clinical areas. The heating and ventilation strategy should be appropriate for the setting.

Heat emitters (radiators)

11.51 Health Facilities Scotland (formerly NHSScotland Property and Environment Forum) Scottish Health Guidance Note: ''Safe" hot water and surface temperatures' provides guidance on how to prevent patients burning themselves on heat emitters.

11.52 The SHGN recommends options to ensure safety as follows:

- guards/covers should be fitted;
- low surface temperature heat emitters should be used;
- temperature controls should fail to a safe position.

11.53 Of these options, covered heat emitters have raised the most prevention and control of infection concern. Heat emitter covers allow dust to build up beneath and inside the heat emitter grille. This dust has been found to contain MRSA (meticillin resistant *staphylococcus aureus)* and other potentially pathogenic organisms, and when heat emitters are switched on during the winter months, dust and bacteria are dispersed by heat convection to the ward area.

11.54 Where heat emitter covers are used, regular planned maintenance and cleaning should be undertaken to prevent the problems described.

11.55 When installing heat emitters, it is recommended that there be adequate space underneath the heat emitter to allow cleaning machinery to be used. These areas may suffer from a lack of planned maintenance and cleaning and, as such, can become heavily contaminated with dust and potentially pathogenic organisms.

Pipework siting and access

11.56 'Hidden' heating may provide a solution to the problems of cleaning as long as access is possible for regular planned maintenance and cleaning. Pipework running along a wall can easily trap dust. Pipework mounted on walls should be encased to facilitate easy cleaning.

Heating and ventilation grilles and diffusers

11.57 General heating/ventilation grilles and diffusers need to be accessed easily for inclusion in cleaning programmes by domestic staff. When infection outbreaks occur, it is essential that these fixtures and fittings are included in the remedial cleaning process. Therefore, the ability for them to be easily removed and cleaned away from the patient area is essential in limiting cross contamination. Cotterill et al (1996) and Kumari et al (1998) describe outbreaks associated with general ventilation grilles in an intensive care unit and an orthopaedic ward.

Supply and extract ductwork

11.58 Supply and extract ductwork should be installed in such a way that it can be accessed at pre-defined regular intervals and cleaned along their full length including all components.

Ceiling or wall mounted air-conditioning units

11.59 These can be extremely difficult to clean due to the fact their interstices can get very dusty. Any decision to install them should be taken with great caution and the need to close the ward/department to enable satisfactory cleaning to be undertaken also needs to be considered. Their use in high-risk areas should be undertaken with caution.

Water systems

Wash facilities

11.60 Due to the difficulty of cleaning of baths after each patient, showers are generally more acceptable to both patients and infection control personnel. However, showers have been implicated in outbreaks of infection due to *Legionella* spp. (Tobin et al, 1980). Such problems, however, can be minimised by proper planned maintenance.

11.61 WCs, bathrooms and showers should be designed and installed to aid cleanliness and prevent cross-contamination. Toilet facilities must have

facilities for hand-hygiene and SHPN 4: 'In-patient accommodation - options for choice' recommends that they should be no more than 12 metres from the bed area or dayroom.

11.62 Claesson and Claesson (1995) documented an outbreak of endometritis in a maternity unit caused by spread of *S. pyogenes* (sometimes referred to as Group A *streptococci)* from a showerhead and their conclusion was that showers, when used to clean the perineum following childbirth, pose a definite risk for post-partum endometritis. Again, proper planned maintenance should minimise this risk.

Protection of immuno-compromised patients

11.63 For areas with patients who have lowered immune responses, water fittings (washers, etc) should not support microbiological growth. Guidance can be sought from the Water Regulations Advisory Scheme (WRAS) (2001) 'Water Fittings and Materials Directory' and from BS 6920-1:2000 'Suitability of non-metallic products for use in contact with water intended for human consumption with regard to their effect on the quality of the water'.

11.64 Patients who have a lowered immune response are at risk from certain organisms found in water supplies in hospital, and as such, will need to be protected from this problem both in drinking water and wash-water facilities. Steinert et al (1998) and Miyamoto et al (2000) discuss the effects of plumbing systems on *Legionella* spp. in hospital hot-water systems and methods of disinfecting.

11.65 Graman et al (1997) demonstrated how an outbreak of healthcare associated legionellosis was traced to a contaminated ice machine. Manangan et al (1998) produced guidance on the sanitary care and maintenance of ice-storage chests and ice-making machines in response to the problems and requests for guidance from infection control professionals. Guidelines were also produced by Burnett et al (1994).

11.66 In another incident with an ice-making machine, an MDA Hazard Notice (Hazard (93) 42), was circulated following a report that leukaemia patients receiving chemotherapy treatment had developed septicaemia as a result of infection with *Stenotrophomonas maltophilia*. The source of this infection was traced to the storage cabinet of the ice-making machine in the ward. The Notice gave guidance for immediate action to ensure that ice is made directly from water that is of drinking quality.

11.67 Ice for the immuno-compromised should be made by putting drinking water into single-use icemakers, then into a conventional freezer.

11.68 Bosshammer et al (1995) carried out comparative hygienic surveillance of contamination with *Pseudomonas* spp. in a cystic fibrosis ward over a four year period and demonstrated how segregation of colonised and non-colonised patients was undermined through transfer of strains from a highly contaminated environment, that is, taps, sinks and wash basins.

11.69 Sniadack et al (1993) demonstrated how a pseudo-outbreak of *Mycobacterium xenopi* was attributable to exposure of clinical specimens to tap-water. This included rinsing of bronchoscopes with tap-water after disinfection; irrigation with tap-water during colonoscopy; gargling with tap-water before sputum specimen collection and collecting urine in recently rinsed bed-pans.

11.70 Showers have been implicated in outbreaks of legionellosis in a transplant unit (Tobin et al, 1980) and on an alcoholism rehabilitation ward (Burns et al, 1991).

11.71 Water has been implicated in outbreaks not only from drinking water sources but also when it has been used for processing specimens in equipment such as dialysis machines.

Wastewater

Wastewater and sanitation

11.72 Domestic sewage contains a large number of intestinal organisms and is therefore hazardous. It must therefore be disposed of via a safe system internally to the external wastewater sewerage systems for treatment.

11.73 This waste will include water and body fluids from sanitaryware such as toilets and bidets plus drainage systems from mortuary tables and waste disposal systems and washer-disinfectors.

11.74 Wastewater is generated from a huge number of tasks carried out in healthcare buildings, which range from domestic cleaning, hand-hygiene, specialised laundries, surgical operations and areas such as renal dialysis units. Most of the wastewater contains micro-organisms from blood and body fluids and therefore has the potential for cross-infection if not disposed of safely.

Sanitary facilities

11.75 These not only include WCs and bidets but also equipment to assist patients who are unable to use a WC such as commodes and bed-pans, plus the equipment to disinfect this equipment such as bed-pan washer-disinfectors and macerators. The importance of cleaning in and around sanitary areas has also been shown in investigations of outbreaks caused by *Clostridium difficile* (Zafar et al, 1998; Cartmill et al, 1994. (Further guidance on cleaning can be found in NHSScotland National Cleaning Specification produced by the HAI Task Force.)

11.76 Healthcare facilities have recently seen increasing numbers of patients with *C. difficile*, vancomycin-resistant enterococcus (VRE) and diarrhoea and vomiting due to small round structured virus (SRSV). The degree of environmental contamination appears to be a determining factor in healthcare associated infection with sanitary facilities acting as ‘hot spots’ for transmission.

Internal drainage system

11.77 An internal drainage system must use the minimum amount of pipework, retain water and be airtight at joints and connectors. It must be sufficiently ventilated to retain the integrity of water seals.

11.78 The design should comply with the relevant British Standards and Codes of Practice, including BS EN 12056 and the current Building Regulations. Recommendations for spatial and access requirements for public health engineering services are contained in CIBSE (Chartered Institution of Building Services Engineers) Guide G, 1999 and SHTM 2023:'Access and accommodation for engineering services'.

11.79 Provision for inspection, rodding and maintenance should be located to minimise disruption or possible contamination and manholes should not be sited within the building.

Waste disposal sinks

11.80 Sufficient and suitably located waste disposal sinks, for example slop-hoppers, should be provided to prevent contamination of hand-wash basins by disposal of wastewater.

Bed-pan washer-disinfectors/macerators

11.81 Where reusable bed-pans are used, ward areas require adequate and suitable bed-pan washer disinfectors that comply with SHTM 2030: 'Washer-disinfectors'. Wards housing certain specialised areas, for example urology wards, will need more than one bed-pan washer-disinfector. It should be noted that new BS and EN guidance will be issued on bed-pan washer-disinfectors.

11.82 Individual assessment of need should be made, as a uniform policy may lead to some areas being under-resourced. This also applies to the provision of macerators where disposable systems are used. Where macerators are used, there should be facilities to wash-disinfect bed-pan holders.

11.83 Rutala and Weber (1999) detail the role of disinfection and sterilization and discuss sanitary equipment in what they term 'non-critical item decontamination'. With the emergence of Vancomycin Resistant Enterococcus (VRE) as a healthcare associated pathogen during the past five years, urine containers and bed-pans have been implicated in outbreaks (Bonten et al, 1996).

11.84 Control or containment of these outbreaks depends on many factors, but not least the safe disposal of wastewater and sanitation and cleanliness of the equipment/environment.

11.85 Where fitted, bed-pan washer-disinfectors should be installed according to the Water Supply (Water Fittings) Regulations 1999 to prevent backflow and contamination.

Lighting

11.86 Lighting should be planned so that lamps can be easily cleaned with no edges or ridges where dust can gather. Lighting including emergency lighting should be maintained in good working order and maintenance records kept. Care needs to be taken when removing the diffusers as this is likely to disturb dust

and may lead to contamination of the clinical area. Regular cleaning of these fittings in clinical areas should form a part of the Maintenance Plan.

11.87 Lighting levels should be maintained according to the recommendations for specific areas such as wards (day and night), theatres, corridors, examination rooms, ancillary or utility rooms and specific areas such as critical care units so that observation of patients is achieved without glare (SHTM 2007: 'Electrical services, supply and distribution'). Additional task lighting needs to be provided in certain areas.

11.88 Location and design of luminaires should afford easy changing of lamps and frequent cleaning. They should be designed so that there are no ledges, ridges, etc. where dust can gather easily, build up and then be dispersed if the light is knocked or moved.

11.89 Light quality is as important as quantity and may help avoid mistakes such as invasive injuries during operative procedures or examinations.

11.90 Efficient lighting in all areas of wards or departments enables domestic staff to undertake cleaning more effectively.

Transportation

Movement/transfer of an infectious patient

11.91 Additional precautions should be observed and maintained when transferring a patient with an infection throughout the healthcare facility and during ambulance transport. It is important to limit movement and transportation of the patient only to that required for essential purposes.

11.92 If a patient is to be transferred it is essential to inform the receiving area of required precautions prior to patient transportation. Traffic in isolation/segregation areas should also be minimised.

Environmental control

11.93 Control of the physical environment includes monitoring parameters such as temperature, humidity and air change rates. Where practical, the environmental controls should be linked to a building management system capable of continual monitoring. Where this is not practical then regular testing of the system, appropriate to the application, will be required with appropriate records being kept.

Electrical supply and distribution

11.94 Guidance on supply and distribution can be found in SHTM 2007: 'Electrical services, supply and distribution'. Guidance on installation and testing is laid down in the current I.E.E. Regulations and should be followed with appropriate records being kept. Responsibility for ensuring commissioning and testing is carried out correctly lies with the building owner/occupier.

Bedhead services/patient entertainment

11.95 Bedside patient entertainment and communications systems may be provided by private companies.

11.96 The beside entertainment units are located in the wards at each bed. Cleaning of these units must comply with prevention and control of infection requirements and be approved by Infection Control personnel.

11.97 To this end, bedside entertainment units should be specifically designed with the healthcare facility environment in mind. All surfaces should be smooth, allowing effective cleaning with no areas that allow dirt to be trapped.

11.98 The system should allow each bedside entertainment unit cleaned to be logged, so that a detailed account of frequency and adherence to the cleaning specification is maintained.

11.99 A cleaning specification must be in place to ensure compliance with the Prevention and Control of Infection Procedures for cleaning areas and equipment in isolation rooms or bed areas where patients have a known infection. (Further guidance can be found in the NHSScotland National Cleaning Specification produced by the HAI Task Force.)

Medical gases: access and accommodation for services

11.100 Vacuum and suction equipment is a potential cross-infection risk. The delivery system is similar to that of gases, i.e. piped or via mobile equipment. The vacuum pipe system must be able to be isolated in case of incidents where pipework becomes contaminated with blood/body fluid. Contamination of piped vacuum systems can cause problems for Estates personnel. Access to the pipework may involve removal of the wall and ceiling fabric. The use of vacuum controlled units with overflow protection devices is essential to avoid contaminating the system with aspirated body fluid.

11.101 Guidance on the routine maintenance of Medical Gas equipment is laid down in SHTM 2022: 'Medical Gas Pipeline Systems'. SHTM 2022 gives guidance regarding piped medical gases and vacuum systems, and includes recommendations on:

- emergency procedures;
- power failure;
- access for cleaning contaminated vacuum systems;
- training and communication;
- maintenance and infection risk.

11.102 In some instances, surface mounted containment of pipework is unavoidable. If this is the case, regular cleaning of high-level ledges should be undertaken. Should any carry-over of body fluids occur within the piped vacuum system, advice should be sought from infection control. Again record keeping is critical

for these services. Before carrying out any maintenance work on vacuum systems and/or changing bacterial filters, the Infection Control Team should be informed so that advice can be given on any appropriate precautions to be observed.

Lifts

11.103 Routine maintenance of lifts is covered by SHTM 2024: 'Lifts'. Regular cleaning of the car should be undertaken, however, care should be taken during this procedure to isolate the automatic call function. Record keeping is critical for this service.

Laundry facilities

11.104 There should be separate storage areas for both clean linen and the storage of linen awaiting collection or laundering (see SHPN 04: 'In-patient accommodation - options for choice').

11.105 Due to the working environment for staff, professional advice needs to be taken from a number of authorities namely, Infection Control, Estates, Health and Safety, Fire Safety and Occupational Health.

11.106 Laundry requires to be thermally disinfected during the laundering process. Laundry from hospitals and healthcare facilities may be contaminated with blood or body fluids and may have been used on infected patients.

11.107 Segregation of linen is of the utmost importance to prevent cross contamination when it comes to dealing with laundry. Clean and dirty areas must be well controlled.

11.108 Linen requires segregation into four categories:

1. Used linen.
2. Soiled linen.
3. Infected linen, which should be placed in a water-soluble liner or bag before being placed into a laundry bag.
4. Heat labile linen.

11.109 Procedures must be in place to ensure all staff are trained in segregation within the ward/department and the laundry to ensure that there are safe work practices for handling of laundry.

11.110 When designing a healthcare laundry there should be clear workflow patterns in order that there is no cross over from clean to dirty areas. Dirty linen should come in and be able to be stored, short term, and then taken to be washed with the process continuing to the end of production, where a clean storage area will be available. It must be easy to identify which area of the laundry staff work in e.g. colour-coded uniforms.

Equipment

11.111 The correct choice of laundry equipment is important in order that thermal disinfection takes place during the laundering process i.e. that the correct temperatures are reached, and machinery must be maintained and calibrated regularly.

Cleaning

11.112 Space must be available around machinery, and safe access available to laundry and domestic staff, to allow the correct standards of cleaning to be maintained.

11.113 The laundry environment encourages dust and debris to develop and must be cleaned on a regular basis.

Ventilation

11.114 The ventilation strategy for a laundry facility should take into account the heat and dust generated in parts of the facility. Mechanical cooling should only be provided where other means of limiting temperature rise have been assessed and rejected on the basis of a full life-cycle cost analysis basis. The ventilation strategy must minimise the level of airborne contamination and dust and minimise the risk of cross infection.

Staff facilities

11.115 Hand hygiene facilities must be available throughout the laundry so that staff have access to this at all times during their working day. Adequate staff changing facilities with shower rooms should also be available in the event of spillage or contamination.

Waste handling

11.116 Waste is a major issue within the healthcare environment and there are many legislative controls and guidelines for the management of waste, to protect patients, visitors, staff and contractors working within this environment. (Further guidance can be found in SHTN 3: 'Management and disposal of clinical waste'.)

11.117 Good design of waste management processes can minimise problems with waste segregation, storage and disposal.

11.118 This part of the document discusses the problems of waste management and the guidance which must be adhered to if patients, staff and contractors are to be protected. The reality is that the disposal of waste is often poorly managed and inadequately catered for in wards, departments and community healthcare establishments and this can lead to escalating costs and heightened risks to healthcare staff.

11.119 Following a study of hospital waste management on 13 hospital sites, the Audit Commission (1997) stated that on average an acute hospital of 500 beds

produces over 10 tonnes of waste per week. Some of the waste, such as paper, food scraps, flowers and bottles, is disposed of into the household waste stream and costs between £20 and £70 per tonne. The rest consists of clinical waste and special waste and costs considerably more to dispose of, typically between £300 and £500 per tonne.

11.120 Areas discussed include:

- identification/segregation;
- disposal/clinical bins;
- hospital waste;
- community waste;
- construction waste;
- final disposal;
- clinical implications.

Identification/segregation

11.121 Identification of categories and the means of segregation of clinical and special waste form the key elements of a waste disposal strategy. Waste is a risk not only to healthcare staff but also to their colleagues, patients, visitors and contractors. Increasing costs, litigation and damage to the environment are also areas for concern.

11.122 The means of segregation will depend on the ratio of clinical waste to non-clinical waste. Space at the ward/unit level is needed for suitable waste containers, whether the area served produces large or small amounts of clinical waste and household waste. Bins must be supplied in the appropriate areas according to amounts produced.

11.123 Current strategies for clinical waste management are outlined in SHTN 3: 'Management and disposal of clinical waste' along with the present legislative and regulatory framework and guidance. It should be noted that at the time of writing, waste legislation is changing rapidly.

Disposal/clinical bins

11.124 Clinical waste bin lids sustain the heaviest bacterial contamination and need to be capable of being suitably cleaned and disinfected, therefore, the use of bins with sack holders to allow for adequate cleaning is recommended.

11.125 Bins should be foot-operated only, and the foot pedal should be sturdy and durable.

Hospital waste

11.126 Storage in large 'Eurobins' in hospital streets (corridors) has been used for clinical waste. However, Eurobins are unsightly and should be removed where possible. Therefore, any new developments should allow for secure disposal

storage cupboards sited at the entrance to the ward or department, preferably with access from both ward and hospital street. Waste can then be stored in this area instead of cluttering up dirty utility rooms, which are often inadequate for this purpose, while awaiting collection by the portering staff.

11.127 These rooms can be combined with those for soiled linen and household waste, but must be clearly subdivided so that the three types of waste are separated from each other. This will assist rapid collection and should minimise the risks of items for reprocessing being accidentally taken for disposal by incineration.

11.128 The subdivided areas must be able to be cleaned in the event of spillage and must be able to contain any spillage that does occur. The hold area should be large enough to hold a wheelie-bin or similar depending on the waste management strategy chosen, which in turn would reduce handling and the subsequent risks to porters. A designated, secure collection bay is also necessary to hold bins until waste is either incinerated/compacted/treated on-site or transported off-site for incineration.

11.129 Staff handling of waste sacks after removal from waste bins must be avoided and any decanting of waste into larger bins must be automated where possible to minimise manual handling risks.

Community waste

11.130 In healthcare facilities such as nursing/residential homes and primary care settings, all waste must be contained in bags inside a lockable container.

11.131 The system and frequency of collection of waste for the particular area needs to be taken into account when planning facilities for temporary holding bays, etc. If located externally, the holding bay or bin must be washable, secure and rodent-proof.

11.132 There must be a strict routine for removing waste to ensure it does not remain uncollected for extended periods. Further guidance is given in SHTN 3: 'Management and disposal of clinical waste'.

Construction waste

11.133 Each year in the UK, 70 million tonnes of waste are produced by the construction industry and for projects attached to existing healthcare facilities this can cause considerable risk to highly susceptible patients. It is important that this dust and debris are controlled and disposed of safely.

11.134 Barrier systems must be erected and closed waste containers supplied as necessary to avoid contamination of occupied areas.

11.135 Traffic control through designated entry and exit areas and dedicated lifts should be identified, if possible.

11.136 The management and minimisation of construction waste must be designed into the project.

Final disposal

11.137 Space at the ward/unit level is needed for provision of suitable secure waste containers, whether the area served produces large or small amounts of clinical waste. The storage facilities provided will vary with the type of healthcare facility and method of final disposal.

11.138 Final disposal is mainly achieved by the use of commercial, high temperature incinerators capable of meeting the increasingly tight emission limits set out by UK regulations.

11.139 Under the Environmental Protection Act 1990, certain types of clinical waste such as pharmaceuticals and chemicals must be incinerated at high temperature. However, much of what is usually designated as 'clinical waste' does not necessarily have to be burned but must be rendered safe.

11.140 Current strategies for clinical waste management are outlined in SHTN 3: 'Management and disposal of clinical waste' with the present legislative and regulatory framework and guidance. The Audit Scotland Baseline report (2001) entitled 'Waste Management in Scottish Hospitals' and the subsequent follow up report (2005) also contains an overview of waste management strategies.

11.141 In the past, in many cases, waste management has not been given the priority it requires and is still, in some cases, poorly handled and catered for within healthcare premises, both in the acute and the primary care setting. Thought must be given to adequate storage facilities for waste in a new build and when upgrading is taking place.

11.142 There are various categories of waste i.e. household waste going into the landfill waste stream, and such waste going for recycling or indeed confidential waste for destruction and clinical waste which must be rendered safe by heat treatment and where body parts and special waste are for disposal then this must be by incineration. (National contracts are in place meeting legislative compliance.) Thought must also be given to recycling particularly paper waste, which makes up a high percentage of our waste.

11.143 There must be appropriate space at ward level for suitable waste containers and multiple handling of waste should be avoided where possible. Dispose of waste as near to point of use as possible.

11.144 The correct number of bins should be in place for the amount and types of waste being produced and these bins should be foot operated and suitable to be cleaned and disinfected. Classification/guidance on types of waste and appropriate storage can be found in SHTN 3: 'Management and disposal of clinical waste'.

11.145 Storage areas for waste should be at the entrance to a ward or department with easy access for portering staff to pick up, not in dirty utility rooms, which in existing establishments do not provide enough space. Ideally these areas should be able to store wheelie bins, sharps boxes, magpie boxes for glass and

aerosols, dirty linen in order that all waste is in one place, easily identifiable and easily collected by portering staff.

11.146 The storage area should be easily cleaned and spillages easily dealt with. For example, sheet vinyl on the floors and particularly covering the walls should be encouraged to avoid damage and contamination.

11.147 When waste leaves the storage area it should be taken to its final destination where it can be held in a designated storage bay before it is incinerated, compacted, treated on site or taken off site for incineration or heat treatment.

11.148 Within primary care and community settings, waste must be kept in a lockable container, bin store etc and the appropriate frequency of collection agreed at the time of planning the premises in order that the store is large enough to cope with the amount of waste generated.

11.149 As before, the area is required to be easily maintained and kept clean.

Access to decontamination facility

11.150 Access to the decontamination facility should be such that it does not contribute to the spread of infection. As such, there should be appropriate decontamination facilities provided centrally for decontamination of reusable medical devices and the system in operation should comply with the current guidance on decontamination facilities and procedures. Not all items reprocessed centrally will be sterilized, for some forms disinfection will be the end point.

Decontamination equipment

11.151 Decontamination is the combination of processes which include cleaning, disinfection and sterilisation used to render a reusable medical device safe for reuse on patients and for handling by staff. This part of the document discusses the importance of decontamination of reusable medical devices and the evidence which can be used as a useful checklist for planning areas in the built environment.

11.152 For maintenance and validation, follow the guidelines laid down by the Infection Control Manager and the relevant SHTMs; 2030, 2031 and 2010. Record keeping forms a critical part of the management of decontamination for these types of equipment.

11.153 The effective decontamination of medical devices is essential in reducing the risks to patients from healthcare associated infection and minimising the potential iatrogenic transmission of Transmissible Spongiform Encephalopathies (TSEs), that is, Creutzfeldt–Jakob Disease (CJD), variant Creutzfeldt–Jakob Disease (vCJD), Gerstmann–Sträussler–Scheinker Disease (GSS) etc.

11.154 At each stage in the decontamination process, consideration should be given to location, facilities, equipment, management and policies/procedures.

11.155 Areas discussed in this part of the document include:

- decontamination and healthcare associated infection;
- transmission of TSEs including vCJD;
- decontamination assessment tools;
- decontamination facilities and accommodation.

Decontamination and healthcare associated infection

11.156 It has been demonstrated that 10% of in-patients acquire a hospital acquired infection (now referred to as healthcare associated infection) at any one time (Plowman et al 1999), the most common being urinary tract infection, surgical wound and lower respiratory tract infection.

11.157 There are common risk factors which cause infection, but it is not known how many infections could be prevented by improving decontamination procedures; however, it is known that failure in decontamination processes can result in a range of infections.

11.158 Saksena et al (1999) reported that transfer of infectious material had been demonstrated in inadequately decontaminated instruments. Scottish Healthcare Supplies Hazard Notice (SC) 95/02, referred to water contaminated with *Pseudomonas aeruginosa* being used to flush the lumens of a microsurgical hand-piece, which subsequently suffered ineffective sterilization before use. Three patients who had undergone surgery at the same time were found to be infected.

11.159 The possibility that TSEs might be spread from person to person in healthcare situations may arise for a number of reasons:

- classical CJD has been transmitted from person to person by medical procedures;
- abnormal prion protein has been demonstrated in the lymphatic tissue (including tonsils) of patients with established vCJD;
- abnormal prion protein has been demonstrated in the appendix of a patient who subsequently developed vCJD;
- abnormal prion protein may not be inactivated by normal sterilization procedures.

11.160 Research which gave rise to these concerns includes the identification of the abnormal form of prion protein reported in the appendix removed from a patient some months before he went on to develop clinical signs of vCJD (Hilton et al, 1998). This was the first time that the presence of abnormal prion protein had been detected in peripheral tissues before the onset of clinical disease. Furthermore, in another study (Hill et al, 1999), lymphoreticular tissues (tonsils, spleen and lymph nodes) from patients with neuropathologically confirmed vCJD were found to be positive for the abnormal protein associated with prion diseases.

11.161 The Spongiform Encephalopathy Advisory Committee (SEAC), which advises the Government on BSE/CJD issues, has advised that rigorous implementation of washing, decontamination and general hygiene procedures are key measures in reducing the risk of vCJD transmission via surgery. A risk assessment model developed by the Department of Health (DH) at SEAC's request and updated in June 2005 confirms this: 'Assessing the risk of vCJD transmission via surgery: an interim review', available on the DH website at http://www.dh.gov.uk/assetRoot/04/11/35/42/04113542.pdf.

Decontamination facilities and accommodation

11.162 If decontamination is to be undertaken in a safe and effective manner which reduces risk and contributes to a reduction in healthcare associated infection, then it must be carried out in a suitable environment, with validated automated processes, managed and operated by trained staff.

11.163 Centralised reprocessing of surgical instruments is the preferred option and local reprocessing should be the exception rather than the norm. Accommodation provided for decontamination should be designed and operated in a manner that does not contribute to the overall bio-burden of the instruments being processed. SHPN 13: 'Sterile Services Department' provides advice and guidance on provision of central sterile supply accommodation. Where local provision is required then it must be carried out to the same standard as central reprocessing. Further information on Local Decontamination Units can be found on the Health Protection Scotland (HPS) website http://www.show.scot.nhs.uk/scieh/infectious/hai/decontamination/haidecon.htm.

11.164 When designing clinical accommodation, consideration should be given to providing adequate and appropriate storage for centrally provided sterile supplies. If sterile supplies are stored inappropriately, then sterility can be compromised and contamination can occur.

Drainage

11.165 Care needs to be taken to ensure access for dismantling and cleaning of drainage if required. The use of glass traps will allow for monitoring of critical areas as necessary. Where it is important to maintain hygiene conditions within drainage systems, or integrity of water seals, regular flushing programmes should be implemented.

Sanitation

11.166 Regular maintenance of all sanitaryware is essential. Glazed surfaces free from cracks are easier to maintain. Care should also be taken where surface mounted equipment forms ledges at high levels which need to be cleaned regularly.

Environmental sampling

Physical monitoring

11.167 Physical monitoring of the healthcare environment including temperature, humidity, air change rates, leak rates, direction of air and water flow, particle counts, filter efficient testing methods, can help ensure that environmental conditions in the healthcare facility are such that they do not contribute to the spread of infection.

11.168 No single test can be relied upon to provide the whole picture and trends rather than individual readings are most useful. Areas such as theatres, positive and negative pressure rooms, sterile preparation areas in pharmaceutical facilities, sterile services etc will have specific guidance for testing regimens. These are used mainly to determine that the area is fit for the desired purpose. In the event of any problem, these records are useful to determine investigation pathways.

11.169 Conditions likely to promote microbial contamination include high moisture levels in air, particularly when associated with high air temperature. Stagnant air, possibly through poor ventilation, can contribute to fungal contamination whilst excessive air turbulence can increase airborne particulate levels and contribute to the dispersal of micro-organisms.

11.170 The maintenance of the environment is important to ensure that areas are intact, functioning properly and in a state such that they can be cleaned properly.

11.171 Water testing in a variety of situations (e.g. endoscope washer-disinfectors and steam for autoclaves) may require chemical and endotoxin testing as well as tests for conductivity and hardness.

11.172 Visual inspection must be part of physical monitoring to ensure for instance that filters are fitted correctly, that surfaces are smooth, impervious free of cracks and joins, and there is no accumulation of dust which may harbour fungi and bacteria.

Microbial monitoring

11.173 In terms of quality assurance, microbial sampling of the air, water and surfaces of the healthcare facility has an important role to play in helping combat the spread of infection within the built healthcare environment. NHS Healthcare Bodies should have a formal protocol for the monitoring of the built healthcare environment with regard to the control of infection. Some sampling may have to be performed in response to an investigation of an outbreak of infection. Results obtained should be interpreted using scientifically established baseline values for comparison e.g. Health and Safety Executive guidelines. On completion of analysis, actions to be implemented should be based on the results obtained.

11.174 The microbial monitoring protocols should be developed by the Infection Control Team, with input from other disciplines and bodies as appropriate. Areas where the built environment is suspected of contributing to the spread of infection, or where construction or refurbishment work is proposed should be referred to the Infection Control Team for consideration of monitoring and advice as appropriate.

11.175 Helpful advice is available from the United States in the CDC publication 'Guidelines for Environmental Infection Control in Health-Care facilities'. This document states that biological monitoring of the healthcare facility should occur in the following four situations (CDC; 2003):

- to support the investigation of disease or infection where environmental reservoirs or fomites have been implicated epidemiologically in the transmission of the disease or infection;
- for research purposes to provide information on the spread of infection within the built healthcare environment;
- to monitor a potentially hazardous situation;
- for quality assurance purposes as part of a quality control programme or to evaluate a change in prevention and control of infection.

11.176 Microbiological and other methods of sampling have an important role to play in training and education of healthcare staff.

Methods of microbial sampling

11.177 There are several types of microbial sampling methods. Conventional culture methods of microbial diagnosis are generally restricted by the amount of time it takes for qualification or quantification to occur. Culture techniques take a minimum of 18 hours to carry out and in some instances can take as long as 6 weeks.

11.178 There are a variety of methods and media available but many are poorly assessed and validated. In many circumstances there are no standards or set protocols for testing. Contact plates, swabs, enrichment versus selective media and sensitivity of the method needs to be assessed in order to allow interpretation. It is important to know why the sampling is being carried out and what will need to happen if abnormal results are found. Environmental sampling can place a heavy burden on clinical laboratories which may not be set up, funded or accredited for non-clinical sampling.

11.179 Non-culture techniques do not require pathogen multiplication and can be a more rapid method of detection. These methods are being utilised with increasing frequency, including techniques such as:

- antigen detection techniques e.g. Elisa;
- toxin detection techniques e.g. endotoxin assay;
- ATP(Adenosine Tri-phosphate) detection techniques e.g. bioluminescence, used in the food industry as a rapid hygiene test for surfaces;

- residue protein detection tests (ninhydrin tests);
- soil tests;
- cleaning efficacy tests;
- molecular techniques.

11.180 Special consideration should be given to specialised areas such as control of Legionella. There is often specific guidance on such areas as the:

- Scottish Health Technical Memorandum (SHTM) 2040: 'The control of Legionellae in healthcare premises - a code of practice';
- Health and Safety Executive (HSE) guidance note L8 'Legionnaires Disease: The control of legionella bacteria in water systems. Approved code of practice and guidance'.

Decant facilities

11.181 Ideally, decant facilities should be readily available where, for example, construction/refurbishment works are being carried out. Where practical, consideration should be given to vacating areas and screening of clinical areas. If decant facilities are not available then additional cleaning and regular inspection will need to be put in place along with the use of ventilation or pressure differentials to control the work area and avoid cross contamination.

Replacement of internal surfaces

11.182 Regular inspections of surfaces are important to ensure that smooth, easy to clean surfaces are maintained. Damaged surfaces can harbour dust and contamination and soft difficult to clean finishes should be avoided.

Redecoration

11.183 Where practical, whole areas should be decorated at the same time. If not practical, consider smaller areas of work that are screened off from the rest of the area. Finishes which are difficult to clean should be replaced with suitable alternatives, smooth, easy to clean surfaces.

12. Demolition

12.1 Work of this type will require a building warrant and a Decommissioning Team should be established. The Decommissioning Team needs to include a Planning Supervisor and consideration should be given to the likely spread of dust/dirt which the works will cause. Issues such as limitation of airborne fungal contamination need to be considered.

Decontamination of buildings and equipment

12.2 Buildings should be thoroughly cleaned after all furniture etc has been removed. There are some airborne decontamination methods which should be considered to minimise the risk prior to demolition. Equipment should be decontaminated prior to reuse elsewhere or final disposal.

Effect upon adjacent healthcare premises

12.3 There are health and safety issues which the Decommissioning Team will have to consider with the advice of the Planning Supervisor. Additional cleaning may be required due to the additional dust likely to be caused. Ventilation filters in areas likely to be subject to a high airborne dust load should be checked and changed if necessary, prior to demolition works starting. An overloaded filter can collapse and cause contamination. Filters should also be checked and changed if necessary once work is complete.

Planning for demolition works

12.4 Prevailing wind direction and the distance of the demolition works from occupied areas are key considerations when planning demolition works.

12.5 The demolition Project Plan should contain details of measures to be taken to minimise contamination of other areas. The person responsible for each control measure should also be named.

12.6 On completion of the work, the success or otherwise of the control outcomes should be formally assessed and the lessons learned disseminated widely, including outwith the organisation, for the benefit of colleagues involved in similar projects.

13. Decontamination prior to disposal of site

Decontamination of building and site

13.1 Any site to be disposed of will need to be clean and free of infection risk. It may be necessary to use a decontamination system such as fumigation. If such a procedure is carried out, records of site decontamination need to be kept and made available on request. Advice on disposal policies should be gained from Estates staff. Ash and clinker may also have been buried on the site and there may have been fuel leaks etc. These need to be identified to prospective purchasers.

Decontamination of land

13.2 There have been instances of hospital sites with dangerous materials such as clinical waste and asbestos disposed of within the hospital site. Decontamination of the site intending to be disposed of is the responsibility of the healthcare body. Contaminated land may need to be disposed of as special waste and can be extremely expensive as the soil removed must also be classified as special waste.

13.3 Current legislation constrains producers of waste to manage and dispose of it by means consistent with the hazard posed by the waste, through facilities approved for treatment of the particular category of waste e.g.

- ash and clinker may have been buried on site;
- fuel stored may give rise to fuel leaks;
- old sewers if not properly closed off can back flow into remaining premises and cause contamination with effluent.

13.4 Burying or long-term storage of waste on a healthcare site is likely to constitute an offence. Issues need to be identified to prospective purchasers.

14. Appendices

Appendix 1: Equipment groups

Equipment supplied for new building schemes can be one of four categories:

Group 1

Group 1 items are specified at the design stage and are supplied and fixed under the terms of a building/engineering contract and funded within the works cost. These are generally large items of plant/equipment which are permanently wired/installed, i.e.

1. Specialised equipment items best suited to central purchasing arrangements.
2. Excluded from this Group will be items subject to late selection due to considerations of for example, radio diagnostic equipment. Taps and basins also fall into Group 1 equipment.

Group 2

Items which have implications in respect of space/construction services and are installed under the terms of building engineering contracts, but are purchased by the Client under a separate equipment budget e.g.:

- paper towel dispensers;
- soap/scrub dispensers;
- shelving;
- washer/disinfectors;
- washing machines.

Group 3

Items which have implications in respect of space and/or construction/engineering services and are purchased and delivered/installed directly by the Client e.g.:

- small refrigerators;
- furniture;
- ventilators;
- monitors;
- trolleys.

Group 4

Items which may have storage implications but otherwise have no impact on space or engineering services e.g. medical devices.

Appendix 2: Glossary

Airborne Infection: A mechanism or transmission of an infectious agent by particles, dust or droplet nuclei suspended in the air (Last, 1995).

Aspergillosis: A fungal infection caused by *Aspergillus spp*., commonly found in soil, decaying vegetable matter, damp cellars, building materials and ventilation systems. The most common mode of transmission is by the airborne route, for example dispersal of contaminated aerosol. In fact, airborne *aspergillosis* is a risk to patients with highly compromised immunity.

Contact transmission has been reported, for example a recent cluster of cases in Manchester suggested a contaminated stockinette was the source of infection. The density of *Aspergillus* spp. spores in hospital air is increased considerably during construction, and there is evidence that healthcare associated aspergillosis is caused by contamination of ward air from outside. Hospital ventilation systems can draw in contaminated outside air because of either malfunction or inadequate mechanical ventilation and air filtration (Manuel and Kibbler, 1998; Cornet et al, 1999; Mahieu et al, 2000; Richardson et al, 2000; Thio et al, 2000).

Cleaning: The process of physically removing contamination including soil, dust, large numbers of micro-organisms and the organic matter that protects them.

Cohort Nursing: Placing patients infected with the same micro-organism (but with no other infection) in a discrete clinical area where they are cared for by staff who are restricted to these patients.

Communicable disease: An illness due to a specific infectious agent or its toxic products that arises through transmission of that agent or its products from an infected person, animal, or reservoir to a susceptible host, either directly or indirectly through an intermediate plant or animal host, vector or the inanimate environment.

Contact: Association with an infected person or animal or a contaminated environment such that there is an opportunity to acquire the infection.

Contamination: The presence of an infectious agent on a body surface; also on or in clothes, bedding, toys, surgical instruments or dressings, or other inanimate articles or substances including water and food. Contamination does not imply a carrier state.

Cross-infection: An infection either due to a microbe that came from another patient, member of staff or visitor in a healthcare establishment or due to a microbe that originated in the inanimate environment of the patient.

Decontamination: The combination of processes which include cleaning, disinfection and sterilization used to render a reusable medical device safe for reuse on patients and for handling by staff.

Dead-legs: In a water supply and distribution system, pipes that are capped off or rarely used, or regions of pipework which are not scavenged by flow.

Disinfection: The reduction of the number of micro-organisms to a safe or relatively safe, level but not usually the destruction of pores.

Fomites: Articles that convey infection to others because they have been contaminated by pathogenic organisms. Examples include hospital equipment, instruments, kidney dishes, hospital bed tables.

Fungi: Unicellular, multicellular or syncytial spore-forming organisms that feed on organic matter; includes yeasts and moulds (Baril, 2000). The most common fungal infections are caused by *Candida* spp. (see, for example, O'Connell and Humphreys, 2000).

Healthcare associated infections: Infections that a patient acquires during a visit to, or that is related to a stay in a healthcare facility.

Heat labile: That which is likely to be damaged or destroyed by the normal heat disinfection process.

Iatrogenic infection: Infection that arises as an unwanted consequence of a medical intervention.

Immunocompromised patient: A patient whose immune response is deficient because of an impaired immune system.

Indirect contact: A mode of transmission of infection involving fomites or vectors. Vectors may be mechanical or biological.

Non-touch (taps): Includes foot or knee-operated, or infrared sensor taps.

Pathogen: A bacterium, virus, or other micro-organism that can cause disease.

Prion: An infectious protein to which several so-called slow virus diseases (for example Creutzfeldt-Jakob Disease, scrapie and bovine spongiform encephalopathy) are attributed. The word was coined in 1982 by S. Prusiner, from *pro*teinaceous *in*fectious particles, reversing the order of the vowels.

Reservoir (of infection): Any person, animal, plant, soil or substance, or a combination of these, in which an infections agent normally lives and multiplies, on which it depends primarily for survival, and where it reproduces itself in such a manner that it can be transmitted to a susceptible host: the natural habitat of the infectious agent (Last, 1995; Dancer, 1999).

Single room / En-suite single room / Isolation room/Bay: For the purposes of this document, the following terminology is used:

1) **Single room:** This is a room with space for one patient and usually contains as a minimum: a bed; locker/wardrobe and clinical hand-wash basin, plus a small cupboard with worktop.

2) **En-suite single room:** As above but with any combination of en-suite facility i.e. shower, shower and toilet, bath and toilet or just toilet etc.

3) **Isolation room:** As in 1 and 2 but with either negative pressure ventilation for infectious patients (source isolation) or positive pressure for immunocompromised patients (protective isolation). May or may not have a lobby or en-suite facility.

4) **Bay:** Any room that contains more than one bed (i.e. two-bedded bay; three-bedded bay; four-bedded bay; six-bedded bay, etc) which may or may not have en-suite facilities.

Spore: Some species of bacteria, particularly those of the genera Bacillus and Clostridium, which are significant cause of infection in humans, develop highly resistant structures called spores when they are exposed to adverse conditions, such as a lack of nutrients or water. Spores are resistant to disinfectants and to high or low temperatures. They may remain viable for many years but when the environment conditions improve the spores germinate and the bacterial cell inside starts to multiply again.

Sterilisation: The process of removing or destruction of micro-organisms including spores.

Thermostatic mixing valves: Valves that mix the hot and cold water of the system to provide water at a predetermined temperature.

Transmissible Spongiform Encephalopathy (TSE): Name for a group of fatal degenerative brain diseases that causes sponge-like abnormalities in brain cells. TSE diseases are associated with accumulation of abnormal prion protein in the brain.

Transmission: Any mechanism by which an infectious agent is spread from a source or reservoir to a person. Modes of transmission of infection include direct transmission involving direct transfer of micro-organisms to the skin or mucous membranes by direct contact; indirect transmission involves an intermediate stage between the source of infection and the individual, for example infected food, water or vector-borne transmission by insects; airborne transmission involving inhaling aerosols containing micro-organisms, for example legionnaires' disease of tuberculosis (Last, 1995; Donaldson and Donaldson, 2000).

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Action plan from Susanne Lee report

Recommendation	Action	Owner	Timescale	Status
Recommendation 1 Water systems should be pressure tested with gas whenever possible and the systems filled with water as late in the build as possible. Once filled they should be disinfected and flushed to remove nutrients such as cutting fluids etc and kept flowing and disinfected as if the building was in full operational use. Records should be kept of when the system is filled; commissioned; handed over and occupied together with all disinfection monitoring and flushing and any remedial works that need to be carried out.	Noted Retrospective action Future learning	HPS/HFS to consider as part of report and for future guidance	N\A	Under Review **17/08/2018:** Commissioning Issue; Is guidance required from HFS perspective on Action Plan? All agreed, not at present, although should be considered as a long term requirement. It is unclear as yet as to whether additional work will be required
Recommendation 2 It is important that all internal maintenance staff; estates officers and contractors undergo training not just in Legionella awareness but also other potential waterborne pathogens of interest, the site policies; procedures; patient confidentiality; documentation requirements; requirements for bringing equipment safely on site; relevant legislation and guidelines etc	**Develop In-house training programme to include** • potential waterborne pathogens of interest, • Board policies & procedures; • patient confidentiality; • documentation requirements • requirements for bringing equipment safely on site **City &Guilds Accredited Training Provision to date - Competent Person:**	Phyllis Urquhart Alan Gallacher\Pamela Joannidis	1st September 2018 Training delivered for nominated personnel.	On-Going Programme under development for Policy & Procedure awareness via Learnpro mandatory in-house, e-learning tool (End July) **17/08/2018:** Training has been implemented at various levels, and is approximately 70% complete. An 'in house' module is being developed iro risk identification and water management - this has not yet been ratified. Support will be required for the delivery of awareness training. This training should focus on current issues and

	a. **WHH02**: Legionella Awareness Hospital HTM 04-01. **Authorised Person**: a. **WHH01:** Legionella Management HTM 04-01 b. **WH003**: Water systems Training " Legionella Control within Hot & Cold water Systems.			not replicate current standards. Once the face to face training has been completed, it is intended that a Learn Pro module will be put in place. IP/Phyllis Urquhart to progress ratification/training dates.
Recommendation 3 To ensure the plumbers / contractors use separate or disinfected tools for working on clean systems and these are kept apart from those used on waste water systems. Only contractors who have successfully completed an approved training programme should be allowed to work on the healthcare water systems.	Consider implementing a permit to work system for potable water systems, whereby competency & Hygiene arrangements would be assessed in line with formal risk assessments and Method statements (consideration should be given adoption of HAI Scribe RA for sign off and approval of control measures?)Would be assessed.	Ian Powrie\ Alan Gallacher SEM group to produce standard protocol for tools used on potable water system for adoption across GG&C. Including SOP for clean tools? Ether sanitisation process or separate clean\dirty tool sets? NHSGG&C will employee only contractors approved under a water safe Approved Contractors Scheme registered under WaterSafe, for Scotland ether of the following Schemes are acceptable: a) Scottish & Northern Ireland Plumbing	End July Water Compliance Manager (Phyllis Urquhart) to develop procedure for implementation across GG&C operational Estates/Capital & Procurement services.	On-going Implement by End Aug, including in-house awareness sessions. **17/08/2018:** Disinfected tools – Ongoing. Timescale has not yet been agreed. Work outstanding [including detail around contractors], and how work will be progressed – accreditation information is available.

		employers Federation (SNIPEF) Or b) Water Industry Approved Plumber Scheme (WIAPS) or : where the entry requirements are: • A recognised qualification in Plumbing. • A recognised qualification in Water Fittings Regulations or Scottish water Bylaws. • Hold an appropriate level of public liability insurance & employer's liability cover.		
Recommendation 4 The composition of the water group is reviewed so it has a more holistic multidisciplinary approach to water safety management	Member ship of Sector Water Safety Group to be reviewed at next Board Water Safety Group Meeting, issue invites to nominated key stake holders.	Alan Gallacher\BWSG	4\9\2018	On Going **17/08/2018:** Ongoing; Meeting to take place with MAK/TI/Tom Walsh. Clinical aspects to be included for discussion at this meeting.
Recommendation 5 The WSP should include water used in diagnosis and treatment. This needs to	Review membership of WSG to include high risk areas. Review monitoring particularly in	Board water safety group TI protocol for issue to	Next meeting Date W\C 18\6\2018	On Going Issued for approval.

be reflected in a greater input from IPCT who should lead the oversight of all uses of water for all types of user within the hospital including representation from special user groups such as renal dialysis, hydrotherapy, augmented care units etc.	relation to TVCs Review use of sterile water in high risk areas Review all water sources including hydro pools, water coolers, dishwashers, ECMO, renal dialysis, birthing pools	BWSG for ratification IPCT TI \IP to review as per SHTM requirements.	 TBC TBC	 TBC TBC **17/08/2018:** Ongoing - Links with [4] – needs to be discussed at Water Safety Group
Recommendation 6 To develop and asset register as described above. This asset register should then inform the group of the needs for risk assessment, management and maintenance regimes and surveillance and monitoring requirements	Review content and scope of current asset register and link to planned Preventive Maintenance strategy within SFG20, compliance template.	Water Compliance manager (Phyllis Urquhart) compiling\ reviewing asset.	End Sept 2018	On-Going **17/08/2018:** Ongoing - Developing an Asset Register. IP/Phyllis Urquhart extracting asset information, and is currently being progressed.
Recommendation 7 To review the numbers and placement of wash hand basins and remove those deemed unnecessary. The installation of flow sensors may indicate where there is lack of use and potential for stagnation. The WSG in consultation with the users should agree where WHBs should be retained and if flushing regime needs to be implemented. Self flushing outlets installation based on local risk assessment may reduce the risk of human factor	This contradicts SHTM and HBN guidance Can review little used outlets e.g. WHB in storage rooms Review board policy on flushing	Site designed is based on national single room policy with requisite hand wash facilities, national policy review required. HPS/HFS to advise Board water safety group	Dates from HPS\HFS Date of next meeting	On-Going **17/08/2018:** Complete: Wash Hand Basins [WHBs] – Completed; Is there scope to remove from single room accommodation? AG noted that this is a Clinical decision, and is not an Estates role. All agreed that the building has been designed to appropriate standards and any subsequent issues should be dealt with as they arise. [F] **17/08/2018:** On-Going – Flushing IPCT. [P]

Recommendation 8 Sluice rooms The trust to develop / review their design guidance in collaboration with IPCT to ensure infection risk is inherent in any future design. This includes the separation of hot and cold services to reduce the risk of heat gain/loss in water systems	Retrospective Learning point While hot and cold water services are run in common risers, they are fully insulated and separated by a minimum distance in order to address potential heat gain\loss issues.	HPS\HFS include within National design guidance. Completed at Design stage	HPS\HFS No Further, action.	Under Review **17/08/2018:** Completed [F] Design Guide – this is covered within the Guidance. Temporary monitoring in place in terms of tank temperature [cold water from storage – 2% rise is allowed, within a 4% fluctuation across the overall range]. Not more than a 2% rise has been recorded to the final outlet, which is within the agreed range. Building design is maintaining the temperature regime. The installation is therefore working within required parameters.
Recommendation 9 The trust design should exclude the use of outlets with inserts and opt for more hygienic single bore outlets which are demountable for disinfection. In high risk areas consideration should be given to removing these high risk outlets and replacing with those that can be easily maintained.	Consider removing taps from high risk areas and replacing with a demountable and autoclave safe Marwick 21 tap. (Incorporating bio guard open ended flow control device). High risk areas defined as per Pseudomonas risk assessment.	WTG agreed replacement of Clinical Horne Optitherm TMT's within high risk areas with Markwick 21 TMT's complete with bio-guard outlet. To be phased for installation after effective system sanitisation. En-suite taps to be upgraded to Contour 21 mark 2 demountable TMT complete with bio-guard outlet.	Approved: 15\7\2018	Expected commencement : March 2019 **17/08/2018**: Partially Complete [P]. The challenge of 'no inserts' remain. Action is 'Ongoing'. It is achievable, but range is limited.
Recommendation 10 For such outlets in low risk areas to develop a procedure for removing and disposing of the inserts at regular	In low risk areas ensure regular maintenance and change inserts every 3 months	All non high risk flow regulators have been replaced and included within a 3 monthly	Commenced 11\6\2018, expected completion 29\8\2018.	On-Going. **17/08/2018:** Completed [F] SOP in place for filter changing

intervals. The timescale to be determined by the amount of debris/film build-up. Quarterly would be a good starting point with review after 12 months.		replacement programme. A prototype WRAS certified adaptor for adoption of the bio-guard device on the existing Horne Optitherm TMT in conjunction with in-line isolation\flow regulator valves is currently under consideration for permanent removal of the tap outlet flow regulator device.	Instructed 18\6\2018, proposed development period to TBC.	On-Going. **17/08/2018:** Completed [F]
Recommendation 11 To ensure that filters are correctly fitted to the outlet; change only as recommended by the manufacturer or when the water pressure drops. It may be worth those fitting the filters are fully trained in both fitting and aseptic technique	Revert to 30 day changing of filters in all areas. Staff trained by the manufacturer or DMA Canyon or by a colleague under the train the trainer approach, supported by a written SOP incorporating hygiene aseptic technique.	WTG	complete 20\3\2018	Ongoing **17/08/2018:** Completed [F]
Recommendation 12 Parents should be advised to fill baby baths through the shower filters to reduce risk of filter removal and refitting.	Agreed	Lead IPCN	TBC	TBC **17/08/2018:** Completed [F]
Recommendation 13 Cleaning of filters with single use alcohol wipe	SOP Agreed	Karen Connolly	Complete 1/5/18	On-Going **17/08/2018:** Completed [F]
Recommendation 14 Where POU filters are deemed to be necessary on a WHB where there is	Agreed Removal of Plugs.	Estates	RHC Complete by end 2\5\2018.	Complete

insufficient height to retain both a sufficient air gap and activity space. Where this is not possible as an interim measures the plug can be removed. Users should be advised why the plug has been removed and on how to avoid contaminating the external surfaces of the filter	User advice on how to avoid external contamination	Lead IPCN	User advised of reason for removal 30\4\2018. Adult complete by end 4\5\2018. User advised of reason for removal 30\4\2018.	Complete

Whistleblowing Case
Ventilation at the Queen Elizabeth University Hospital and Royal Hospital for Children

1. Introduction

On 8 February 2018, an email was sent to me from Dr Penelope Redding, Consultant Microbiologist, regarding a number of concerns about ventilation at the Queen Elizabeth University Hospital (QEUH) and the Royal Hospital for Children (RHC). In her email, Dr Redding requested that these issues were taken forward for a Stage 2 investigation under the Whistleblowing Policy.

The main points of the complaint were:

1. The standard rooms at the QEUH and RHC should have 6 air changes per hour (ACH/hr). No room meets this standard. There are only 3 ACH/hr. This is clearly a breach of the standard.

2. Positively Pressurised Ventilated Lobby (PPVL) rooms are not suitable for the isolation of patients with air borne infections and they cannot be housed in this new hospital.

3. There are not sufficient rooms for the isolation of immunocompromised / Bone Marrow Transplant (BMT) patients at RHC.

4. The current management of immunocompromised adult patients.

5. Query on whether issues around ventilation are on the NHSGGC Risk Register?

2. Background

I met with Dr Penelope Redding (PR), and she brought with her Dr Christine Peters (CP) (Consultant Microbiologist), who shared her concerns. They stated that they felt the ventilation issues were only part of many concerns about infection control. They also said they felt isolated, with tarnished reputations due to raising the issues. Dr Redding felt that there had been lack of involvement of infection control doctors in the design and building of the QEUH, despite being involved at the very early stages of planning.

CP had first contacted Theresa Inkster (TI) who was covering the lead Infection Control Doctor ICD) in the summer of 2015 about the bone marrow transplant unit. Air quality sampling revealed problems and they jointly wrote to David Stewart identifying the issues. The service was transferred to the Beatson until the situation was considered safe. Around the same time, concerns were also raised about the paediatric unit.

During this time there were changes in the lead ICD as Dr Craig Williams left, TI resigned and CP took over and tried to change the whole IC structure and she resigned.

During the discussion with CP and PR, concerns were raised that the type of rooms used for both immunocompromised and infectious patients were inadequate. Drs Redding and Peters noted that there had been debate even amongst experts on the adequacy of PPVL rooms, but also concerns that PPVL rooms had not been built to standard. Although negative pressure and positive pressure rooms are now being built, they did not know if, or when, everything would be fixed.

Dr Peters also reported that sewage leaks were happening in the Institute of Neurological Sciences (INS) due to plumbing issues. She noted that Healthcare Improvement Scotland (HIS) had been involved and recommended rapid action, but reported that when she kept raising this as an issue, she was accused of bullying.

Both Dr Redding and Dr Peters felt that the roles in Infection Control were not clear, and that infection control should be a doctor led service, and there was poor Infection Control teamwork and communication.

Dr Peters said she investigated mycobacterium abscesses and identified a previously unknown outbreak in Cystic Fibrosis (CF) patients. She sent a Situation Background Assessment Recommendation (SBAR) to Dr Jennifer Armstrong, Medical Director for NHSGGC, and also contacted General Medical Council and Medical and Dental Defence Union of Scotland (MDDUS) as she felt action was not being taken.

3. Investigation

I interviewed the following people:

- Dr Iain Kennedy, Consultant in Public Health Medicine
- Dr Brian Jones, Head of Service, Diagnostics Directorate
- Mr Tom Walsh, Infection Control Manager
- Ms Sandra Devine (accompanied by her Royal Collage for Nursing representative), Associate Nurse Director for Infection Control
- Dr Rachel Green, Chief of Medicine, Diagnostics
- Dr Theresa Inkster, Consultant Microbiologist
- Ms Mary Anne Kane, Interim Director of Facilities (interviewed by Jennifer Haynes, Interim Corporate Services Manager, on my behalf)

Information was also given via email from the Director, Chief Nurse and General Manager responsible for the INS to cover the issues which relate to this aspect of the case.

I also reviewed the following documentation:

- Health Building Note 04-01 on isolation facilities for infectious patients in acute settings
- Minutes of meeting to discuss infection control estates issues at QEUH and RHC on 4/10/17
- Clinical and Care Governance Committee paper about the concerns raised re QEUH and RHC facilities December 2017
- emails and letters on organisation of infection control

4. Findings

Drs Redding and Peters have clearly identified their concerns regarding infection control and estates issues on the QEUH and RHC site over 3 years, and they sent an SBAR to Dr Armstrong which set out the issues. These were the subject of a meeting on 4 October 2017 chaired by Dr Armstrong. The minutes, which include a full list of attendees, are included in Appendix 1. External advice on the issues was also sought.

It appears there were 3 sets of issues:

- one set of deficiencies in the building, such as lack of High Efficiency Particulate Air (HEPA) filters, not fitted in places they should have been;
- a second set in which changes had been made to the building specification without sign-off from infection control experts;
- a third set that arose because Infectious Diseases and the High Dependency Unit were moved to the QEUH when not intended at the initial planning stage.

I am reassured from the notes of the meeting, the Board paper and my discussions with interviewees that the concerns raised by Drs Redding and Peters are being addressed. The RHC changes are now complete and the QEUH adaptations and new rooms are on schedule to be in place by end of October 2018.

I discussed with the lead infection control doctor the 3 versus 6 air changes. The Scottish hospital building note recommends 6 air changes per hour. However, the infection control team consider that the additional risk to patients in standard accommodation is negligible as 3 air changes brings contamination down to 5% and it is single accommodation. There has been no transmission of the higher risk pathogens and there are now alternative pathways in place for the very high risk ones such as MERS or MDR-TB. The risk in aerosol generating procedures is reduced by advising to keep FFP masks on whilst in the room and for period of time after end of procedure. 1 hour normally, but extended to 2 hours in QEUH/RHC on basis of recent SBAR.

In addition, Ms Kane has confirmed that an expert in this field is being recruited on a part time fixed term basis to specifically look at ventilation in the QEUH and RHC, and to make any recommendations for improvement.

During my meeting with Drs Redding and Peters, the problems in the INS with sewage due to pipe size were raised. These problems will take longer to resolve although they have been acknowledged with plans in place, including replacing the pipes (over the next 2 years). Four of the 6 theatres in the INS will move to the Imaging Centre of Excellence (ICE) building. There is not a confirmed timescale for this at the moment. There are plans to upgrade the remaining theatres in the INS – this is currently on hold to allow further discussion on the long term capital programme for the INS, and is a matter covered at the local Capital Board meetings.

HIS were involved in the issues regarding the sewage ingress. Extensive drainage surveys and remedial works were undertaken after that incident. HIS asked for a number of updates – most recently in November 2017 – and were happy with the measures taken and progress made.

Despite the legitimate concerns about patient safety raised by Dr Redding and Peters, there were no increased levels of infection and the recent national prevalence survey showed that RHC had lower rates than Edinburgh Children's Hospital, and for adults the rates were also under the national average.

Regular communication for on call microbiologists is organised weekly by the infection control team so that those on call are up to date with any infection control issues. There are regular microbiology team meetings where issues can be raised.

Drs Redding and Peters raised concerns that they were not being updated on progress to resolve their concerns. I discussed these concerns with everyone interviewed. I heard an unfortunate but consistent circumstance about the situation summarised below:

- Dr Peters is very knowledgeable about infection control including ventilation. She finds it difficult to accept balance of risk (e.g. if theatres or wards need to close, patients may be put at greater risk)
- She is no longer an infection control doctor having resigned from this role
- She does not accept being part of team and listening to views of others
- She does not accept that infection control is a nurse led service
- She sends frequent requests for updates which are not directly relevant to her role
- She has caused great anxiety to colleagues by her styles of communication particularly the persistent stream of emails to the IC team and to TI

Dr Redding has now retired.

I could find no evidence of the issues of ventilation being on the Risk Register through an analysis of Datix. Risk of flooding sits on the Regional Services Risk Register for the INS. There is no issue regarding ventilation on the Facilities Risk Register, as when the QEUH project was underway, the chilled beam system (with a reduced number of air changes) was noted to be a recognised and accepted standard. Ms Kane noted that Infection Control doctors were very much part of this process.

Dr Inkster, the current lead ICD, is reassured that all actions possible are in place. She agreed that the whistleblowers were right to alert the concerns and their diligence and insight should be acknowledged and respected.

She also confirmed that Dr Peters' behaviour is a problem in needing to know too much detail on issues not within her remit. This causes stress and takes time away from the main job. She would welcome an instruction to say it is not appropriate to keep answering the multiple emails.

Organisational development and mentoring support have been organised by Dr Rachael Green due to concerns on behaviours within microbiology and infection control teams.

5. Conclusion

The whistleblowing concerns about ventilation and patient safety were real but had already been dealt with in the main with action plans for the rest.

As Dr Peters is not an infection control doctor she must be informed and accept that she has no role in the day-to-day management. She should be asked to cease sending multiple emails, and the infection control team given permission to respond that they will not be answered in details as the actions are in hand. Infection control nurses should be reassured that the behaviours will be managed.

Timescale for some of the improvements required are not sufficiently clear.

There is now agreed policy that any changes from building regulations or original specifications must be signed off by infection control.

6. Recommendations

- Explicitly acknowledge to CP that she raised legitimate and important IC issues and was instrumental in ensuring they were dealt with

- Diagnostic Management colleagues should progress the already agreed OD and mentoring support for Dr Peters, the senior microbiology team and the IC team regarding roles, responsibilities and behaviours;

- The Infection control team should be supported to deal with multiple emails from Dr Peters about issues in which she has no direct role with a standard response;

- Follow up in 6 months time regarding progress with INS theatres moving to ICE / being upgraded;

- Follow up in 6 months time progress with expert being recruited to give a view on ventilation in QEUH / RHC.

- The issues raised in this complaint should be appropriately entered onto risk registers

Linda de Caestecker
Director of Public Health
May 2018

Tab	Information	Notes
The Healthcare Infection Incident Assessment Tool (HIIAT)	This is the mandatory process that should used by the Infection Prevention and Control Team (IPCT) or Health Protection Team (HPT) to assess every healthcare infection incident i.e. all outbreaks and incidents (including decontamination incidents or near misses) in any healthcare setting (that is, NHScotland, independent contractors providing NHS services and private providers of healthcare). It is this process that is utilised to assess the initial impact and monitor any ongoing impact (escalating and de-escalating the incident/outbreak until declared closed).	
Healthcare Infection, Incident and Outbreak Reporting Template (HIIORT)	This is the form referenced in the HIIAT	
Environmental Link	Line listing of Incidents & Outbreaks in QUEH/RHC reported to ARHAI Scotland from when it opened until end 2019 which have an environmental link. Detailed information about each I & O is being submitted as part of the suite of 4.1 to 4.3 documents.	Environmental Link v Non-Environmental Link: To determine if an incident or outbreak may have a possible environmental link, the type of organism, route of transmission and the common reservoir are taken into account. The outcome is that the incident or outbreak may have an environmental link, or it does not have an environmental link.
Non-Environmental Link	Line listing of Incidents & Outbreaks in QUEH/RHC reported to ARHAI Scotland from when it opened until end 2019 which do not have an environmental link. We believe these without an environental link to be out of scope because the route of transmission and common reservoir are not directly linked to the environment and more likely to be treatment/procedure/practice related. Accordingly no further details are being submitted.	Environmental Link v Non-Environmental Link: To determine if an incident or outbreak may have a possible environmental link, the type of organism, route of transmission and the common reservoir are taken into account. The outcome is that the incident or outbreak may have an environmental link, or it does not have an environmental link.

Appendix 14 –Mandatory - NIPCM Healthcare Infection Incident Assessment Tool (HIIAT)

The Healthcare Infection Incident Assessment Tool (HIIAT) should be used by the Infection Prevention and Control Team (IPCT) or Health Protection Team (HPT) to assess **every** healthcare infection incident i.e. all outbreaks and incidents (including decontamination incidents or near misses) in any healthcare setting (that is, NHScotland, independent contractors providing NHS services and private providers of healthcare).
The HIIAT has two parts/functions: both are detailed below.

Part 1: Assesses impact of a healthcare infection incident/outbreak on patients, services and public health.

The HIIAT should:

- Be utilised to assess the initial impact and monitor any ongoing impact (escalating and de-escalating the incident/outbreak until declared closed).
- Remain assessed 'Amber' or '**Red**' only whilst there is ongoing risk of exposure, new cases, or until all exposed cases have been informed.

An individual member of the IPCT or HPT may undertake the initial assessment. If a PAG/IMT is established then further assessments will be led by the chair of the PAG/IMT.

Part 1: Assessment

	Severity of illness	Impact on services	Risk of transmission	Public Anxiety
Minor	Patients require only minor clinical interventional support as a consequence of the incident. There is no associated mortality as a direct result of this incident.	No or minor impact on services.	Minor implications for Public Health. Minor risk or no evidence of cross transmission or on-going exposure	No or minor public anxiety is anticipated. No, or minimal, media interest: no press statement.
Moderate	Patients require moderate clinical interventional support as a consequence of the incident. There is no associated mortality as a direct result of this incident.	Moderate impact on services e.g. multiple wards closed or ITU closed as a consequence of the control measures	Moderate implications for Public Health. Moderate risk or evidence of cross transmission or on-going exposure	Moderate public anxiety is anticipated. Media interest expected: prepare press statement
Major	**Patients require major clinical interventional support as a consequence of the incident and/or** **Severe/life threatening/rare infection and/or** **there is associated mortality***	**Major impact on services e.g. hospital closure(s) for any period of time as a consequence of the control measures**	**Major implications to Public Health or Significant risk of cross transmission, of a severe/life threatening/rare infection or significant on-going exposure**	**Major public anxiety anticipated.** **Significant media interest: prepare press statement**

Minor = GREEN; 3 minor and 1 Moderate = GREEN;
-4 Moderate = AMBER; Any Major = RED.

Part 2: Supports a single channel of infection incident/outbreak assessment and information reporting both internally within a NHS Board area and externally to Health Protection Scotland (HPS) and Scottish Government Health and Social Care Department (SGHSCD).

Part 2: Communication

GREEN	AMBER	RED
Complete mandatory HIIAT Green reporting template and attach any prepared press statements. http://www.nipcm.hps.scot.nhs.uk/documents/hiiat-green-template/	Report to HPS and complete HIIORT within 24 hours for onward reporting to SGHSCD. NHS board will be cited.	Report to HPS and complete HIIORT within 24 hours for onward reporting to SGHSCD. NHS board will be cited.
A HIIORT is only required when HPS support is requested.	Press statement (holding or release) must be prepared and sent to HPS	Press statement (holding or release) must be prepared and sent to HPS.
Follow local governance procedures for assessing and reporting.	Request HPS support as required.	Request HPS support as required.
	Follow local governance procedures for assessing and reporting.	Follow local governance procedures for assessing and reporting.
	Review and report HIIAT **at least twice weekly** or as agreed between IMT and HPS	Review and report HIIAT **daily** or as agreed between HPS and IMT **(a minimum of weekly)**.
	The HIIAT should remain Amber only whilst there is ongoing risk of exposure to new cases or until all exposed cases have been informed	The HIIAT should remain Red only whilst there is significant ongoing risk of exposure to new cases or until all exposed cases have been informed.

The final decision to release a press statement irrespective of HIIAT assessment (colour) is the responsibility of the IMT chair.

Following assessment by the NHS Board and HPS one collective HIIORT may be submitted for instances where multiple areas within a site are affected by the same infection such as seasonal influenza.

*** Only HAI deaths which pose an acute and serious public health risk must be reported to the Procurator Fiscal (SGHD/CMO(2014)27).**

The full manual is available at www.nipcm.hps.scot.nhs.uk/

Appendix 15
Mandatory - Healthcare Infection, Incident and Outbreak Reporting Te HIIORT)

Initial assessment to be completed within 24 hours for all HIIAT Red and Amber; for HIIAT Green complete only if HPS Support requested.

Section 1 :Contact Details				
NHS Board/Care organisation				
Date and time of reporting				
Person Reporting and designation				
Telephone number and email				
Section 2: Infection Incident/outbreak Details				
Care facility/hospital				
Clinical area/ward and speciality				
Section 3: Initial assessment				
Type: Incident/outbreak/ data exceedance e.g. Gastrointestinal, decontamination failure				
Infectious agent known or suspected				
Case definition	*Please enter time/place/person/pathogen e.g. Any patient/staff member/person with laboratory confirmed [insert pathogen e.g. Group A Streptococcus] in ward [insert clinical area/ward] from [insert date]*			
Date of first case (if applicable)				
Total number of confirmed patient cases		Total number of probable patient cases	Total number of possible patient cases:	Total number of staff cases:
Number of patients giving clinical cause for concern as a consequence of this incident/outbreak				
Number of deaths as a consequence of this incident/outbreak				
Was the infectious agent cited as a cause of death on a **death certificate* (**if yes, state which part of the certificate**)**				
Are infection prevention and control measures as per National Infection Prevention and Control Manual (NIPCM) implemented? If not, state reason.				
Has additional information regarding this Incident/outbreak i.e. leaflets been provided to patients/relatives. Provide details:				
Additional Information: *e.g. closure of clinical area, control measures, staff exclusions, working hypothesis*				
Section 4: Healthcare Infection Incident Assessment Tool (HIIAT) (link to tool)				
Severity of illness	Minor/Moderate/Major			
Impact on services	Minor/Moderate/Major			
Risk of transmission	Minor/Moderate/Major			
Public anxiety	Minor/Moderate/Major			
HIIAT Assessment	Red Amber Green			
Section 5: Organisational Arrangements				
PAG/IMT meeting held	Y /N/ NA		Date:	Chair:
Next planned IMT	Y /N/ NA		Date:	
Press statement (proactive press statements **must** be sent with HIIORT)	Proactive Y/N		***Must*** *be sent prior to release*	
	Release Y/N		*Direct to SG comms within 48hrs*	
	Holding Y/N		*Direct to SG comms within 48hrs*	
HPS support requested	Y/N		Date.....	
Other information: e.g. decisions from IMT				

Complete this section if:
Red: complete daily or as agreed between IMT and HPS (a minimum of weekly)

Amber: complete twice weekly or as agreed between IMT and HPS (a minimum of weekly)

Green: complete if HPS support required (a minimum of weekly)

Section 6: Update						
On this date:						
Cumulative total of confirmed patient cases						
Cumulative total of probable patient cases						
Cumulative total of possible patient cases						
Cumulative total of staff cases						
Total number of symptomatic patients today						
Number of patients giving cause for concern						
Total number of deaths as a consequence of the incident since last HIIORT report						
Is the ward/services closed						
Is a service restricted						
HIIAT assessment						
Organisation update	*Comments (including changes to any control measures, case definition or death) certification information)*					
Date:						
Date:						
Date:						
Date:						
Date:						

ONCE COMPLETED, EMAIL TO: NSS.HPSInfectionControl@nhs.net

ARHAI Submission 4.1-4.3

HIIAT Log Incident Number	Date Reported	Infection Category	Organism	Hospital	Location-Ward	Highest RAG Status	IMT Meetings (Y/N)	NSS Attendance at IMT (Y/N)	Minutes Available (Y/N)	Communications associated w/ Incident (Y/N)	Further Comments
O15.43	29/10/2015	BSI and Colonisation	Serratia	QEUH-RHC	Neonatal NICU	RED	Y	Y	Y	Y	
O16.31	24/05/2016	Respiratory	Mycobacterium absecessus	QEUH	Literature review request	GREEN		N		Y	
G16.29	16/06/2016	BSI	Cupriavidus pauculus	QEUH-RHC	Aseptic Unit	GREEN					
G16.34	21/06/2016	Respiratory	Aspergillosis	QEUH	ITU	GREEN					
O16.35	29/07/2016	Mixed/Various	Serratia	QEUH-RHC	Maternity NNU	GREEN					
O16.37	05/08/2016	Respiratory	Aspergillus	QEUH-RHC	Schiehallion	AMBER	Y	N		Y	
G16.59	23/09/2016	BSI	Pseudomonas aeruginosa	QEUH-RHC	PICU	GREEN					
G16.70	07/10/2016	BSI	Pseudomonas	QEUH	ITU	GREEN					
O16.48	28/07/2016	Other	Serratia	QEUH	NICU	AMBER	Y	N		Y	
G17.010	06/02/2017	Colonisation	Serratia	QEUH-RHC	PICU	GREEN					
G17.023	03/03/2017	Other	Serratia	QEUH-RHC	NICU	GREEN					
G17.025	03/03/2017	BSI	Elizabethkingia miricola	QEUH-RHC	Haemotology Oncology	GREEN					
G17.026	03/03/2017	BSI	Mixed	QEUH-RHC	Haemotology Oncology	GREEN					
O17.09	07/03/2017	Mixed/Various	Aspergillus fumigatus	QEUH-RHC	Haemotology Oncology	RED	Y	N		Y	
O17.10	10/03/2017	BSI	Serratia	QEUH-RHC	Critical Care	AMBER	Y	N		Y	
G17.050	16/06/2017	SSI	Enterobacter	QEUH	Neurosurgery	GREEN					
O17.17	26/07/2017	BSI	Stenotrophomonas	QEUH-RHC	Oncology	RED	Y	N		Y	*media interest in Jan 2020
G17.068	02/08/2017	BSI	Pseudomonas	QEUH-RHC	PICU	GREEN					
G17.080	14/09/2017	Respiratory	E.coli (gent resistant)	QEUH	NICU	GREEN					
G17.084	22/09/2017	Respiratory	Acinetobacter baumannii complex	QEUH	INS South Glasgow	GREEN					
G17.089	11/10/2017	Colonisation	Acinetobacter baumanii	QEUH-RHC	NICU	GREEN					
G17.088	13/10/2017	Colonisation	Acinetobacter baumanii	QEUH-RHC	Ward 3A General Medicine	GREEN					
G17.093	27/10/2017	Respiratory	Probable invasive fungal infection	QEUH_RHC	NICU	GREEN					
G17.094	27/10/2017	SSI	Pseudomonas aeruginosa	QEUH	Ward 10D	GREEN					
O17.22	03/11/2017	Other	CRO Pseudomonas	QEUH	Orthopaedic (QEUH and GGH)	RED	Y	N		Y	
G17.104	15/11/2017	SSI	Acinetobacter baumanii	QEUH-RHC	PICU	GREEN					
G17.115	01/12/2017	SSI	Acinetobacter baumanii	QEUH-RHC	PICU	GREEN					
G18.04	05/01/2018	SSI	CPE Klebsiella	QEUH	Neurosurgical	GREEN					
O18.10	23/01/2018	Mixed/Various	Pseudomonas aeruginosa	QEUH	Paediatric ITU	AMBER	Y	N		Y	
G18.35	05/02/2018	BSI	Cupriavadis	QEUH-RHC	Aseptic Pharmacy	GREEN					
G18.038	13/02/2018	Colonisation	Klebsiella	QEUH	Spinal injuries rehab-Phillipshill	GREEN					
O18.11	01/03/2018	BSI	Pseudomonas aeruginosa, Cupriavidus pauculus, Stenotrophomonas, Enterobacter cloacae, Acinetobacter & Panetoea	QEUH-RHC	Paediatric Haemato-oncology	RED	Y	Y		Y	
C18.01	01/03/2018	Invokement of CNO algorithm		QEUH-RHC	Paediatric Haemato-oncology						Invoked due to ? contamination of water following detection of multiple infections in RHC Paediatric Haemato-oncology ward
G18.67	18/05/2018	BSI	Enterbacter cloacae	QEUH-RHC	Ward 2A	GREEN					
O18.17	18/05/2018	BSI	Gram negative	QEUH-RHC	Paediatric Haemato-oncology	RED	Y	Y		Y	
O18.21	20/06/2018	Mixed/Various	CPE Klebsiella	QEUH	Spinal injuries -Phillipshill Edenhall	AMBER	Y	N		Y	
G18.081	29/06/2018	Colonisation	Acinetobacter baumanii	QEUH-RHC	PICU	GREEN					
G18.088	20/07/2018	Respiratory	Aspergillus fumigatus	QEUH-RHC	Haemotology Oncology (2A)	GREEN					
G18.102	15/08/2018	BSI	Serratia	QEUH	Maternity-NICU	GREEN					
G18.113	05/09/2018	BSI	UNK Mixed	QEUH-RHC	Haematology 2A	GREEN					
G18.118	04/10/2018	Colonisation	S.maltophillia	QEUH	Maternity-NICU	GREEN					
G18.120	10/10/2018	Colonisation	P.aeruginosa	QEUH	Maternity-NICU	GREEN					
G18.123	25/10/2018	Colonisation	P.aeruginosa	QEUH	Theatres	GREEN					
O18.31	[redacted]/12/2018	BSI	Cryptococcus neoformans	QEUH	Ward 6A, 1D, and 4C	RED	Y	Y		Y	

O19.03	22/01/2019	Respiratory	Mucoraceous Mould	QEUH	ITU	RED	Y	N		Y	Glasgow media release related to incident, not in files attached to narrative
G19.015	31/01/2019	Colonisation	Serratia marcescens	QEUH-RHC	SCBU	GREEN					
G19.020	08/02/2019	Colonisation	Serratia	QEUH	Maternity-NICU	GREEN					
G19.028	25/02/2019	Colonisation	Serratia	QEUH	NICU	GREEN					
O19.17	18/03/2019	BSI	Acinetobacter baumanni	QEUH	Renal	AMBER	Y	N		Y	
G19.080	14/05/2019	Colonisation	Malassezia	QEUH-RHC	NICU	GREEN					
G19.072	04/06/2019	BSI	Mixed	QEUH	Temporary paediatric haemato-oncology ward	GREEN					
O19.24	20/06/2019	Mixed/Various	GNB and Mycobacteria chelonae	QEUH	Temporary paediatric haemato-oncology ward	RED	Y	Y	Y	Y	
G19.115	13/09/2019	SSI	Klebsiella pneumoniae and S.aureus	QEUH	INS Neurosurgery	GREEN					
G19.132	05/11/2019	Colonisation	Acinetobacter baumanii	QEUH-RHC	PICU	GREEN					
G19.136	19/11/2019	Colonisation	Pseudomonas aeruginosa	QEUH-RHC	PICU	GREEN					
O19.44	28/11/2019										
G19.164	20/12/2019										
G19.165	20/12/2019										

ARHAI Submission 4.1-4.3

HIIAT Log Incident Number	Date Reported	Infection Category	Organism	Hospital	Location-Ward	RAG Status	IMT Meetings (Y/N)	NSS Attendance at IMT (Y/N)	Minutes Available (Y/N)	Communications associated w/ Incident (Y/N)	Further Comments
O15.48	12/11/2015	Not known		QEUH	BMT	HIIAT RAG status not done					Regarding ventilation and building risks for putting Beatson patients in QEUH.
O15.59	23/12/2015	GI	CDI	QEUH	Various	HIIAT RAG status not done					
O16.01	06/01/2016	Respiratory	TB	QEUH	Maternity	AMBER					
O16.03	07/01/2016	Blood Stream Infections	Staph epi	QEUH-RHC	Cardiac (Golden Jubilee and RHC)	AMBER					
D16.03	18/04/2016	N/A	N/A	QEUH	Neurology Theatres	HIIAT RAG status not done					Support with theatre issues regarding significant leaks from waste water pipes.
O16.27	10/05/2016	N/A	N/A	QEUH-RHC	Cardiac (Golden Jubilee and RHC)	GREEN					Continuation of O16.03 following new information on typing
G16.45	22/07/2016	SSI	None	QEUH	Neurosurgery-INS	GREEN					Increase in SSI infections
G16.49	04/08/2016	GI	VRE	QEUH-RHC	Haemotology/oncology	GREEN					
G16.52	24/08/2016	Decon incident-endoscope	None	QEUH	N/A	GREEN					
G16.75	24/11/2016	GI	CDI	QEUH	Medical	GREEN					
G17.018	19/02/2017	Respiratory	Flu A	QEUH	Medical	GREEN					
G17.024	03/03/2017	Respiratory	Influenza	QEUH-RHC	Medical Surgical	GREEN					
G17.034	10/04/2017	GI	CDI	QEUH	Langlands Young Disabled Unit (part of PDRU)	GREEN					
O17.11	13/04/2017	GI	Rotavirus	QEUH-RHC	Haemato-oncoloy	RED					
G17.038	24/04/2017	GI	4 CNS	QEUH	NICU	GREEN					
G17.039	02/05/2017	Respiratory	Influenza A	QEUH-RHC	Cardiology	GREEN					
G17.042	18/05/2017	GI	CDI	QEUH	Medicine for the Elderly (Langlands)	GREEN					
G17.046	31/05/2017	GI	Norovirus	QEUH-RHC	Haemotology/oncology	GREEN					
G17.045	05/06/2017	GI	CDI	QEUH	Gen Surgical	GREEN					
G17.058	14/07/2017	BSI	Staphylococcus capitis	QEUH	NICU	GREEN					
G17.059	18/07/2017	GI	CDI	QEUH	Gastro	GREEN					
G17.083	21/09/2017	SSI	MSSA	QEUH	Ortho	GREEN					
G17.086	21/09/2017	Decon incident	Exophasia	QEUH	CF	GREEN					
G17.107	21/11/2017	Respiratory	Influenza A	QEUH	Medical	GREEN					
O17.32	22/12/2017	Respiratory	Influenza	QEUH	Mixed	AMBER					
G18.005	05/01/2018	Respiratory	Influenza A	QEUH-RHC	Paediatrics	GREEN					
G18.015	15/01/2018	Colonisation	Staph. capitis	QEUH-RHC	NICU	GREEN					
G18.034	06/02/2018	GI	VRE	QEUH	Renal	GREEN					
G18.039	16/02/2018	Respiratory	Rhinovirus/enterovirus	QEUH-RHC	Paeds	GREEN					
G18.051	09/04/2018	GI	Norovirus	QEUH	QEUH and RHC	GREEN					
O18.16	10/04/2018	GI	Astrovirus	QEUH-RHC	Paediatric Haemato-oncology	AMBER					
G18.061	03/05/2018	GI	VRE	QEUH-RHC	Haemotology/oncology	GREEN					
G18.075	11/06/2018	SSI	GP A Strep	QEUH	Maternity	GREEN					
G18.089	20/07/2018	Respiratory	Pertussis	QEUH RHC	Acute Receiving	GREEN					
G18.203	17/08/2018	Colonisation	MRSA	QEUH	Spinal Injuries Unit	GREEN					
G18.109	03/09/2018	GI	CDI	QEUH	ITU	GREEN					
G18.114	06/09/2018	Respiratory	UNK Pertussis	QEUH	Haematology-4B	GREEN					
G18.115	24/09/2018	SSI	Mixed	QEUH	Vascular surgery	GREEN					
G18.117	28/09/2018	BSI	Staph Epi	QEUH	Maternity NICU	GREEN					
C18.01	16/11/2018			QEUH RHC							Invokement of algorithm due to suspension of certificate under the Medical Devices regulations authorising reprocessing of reusable medical devices in central decontamination unit (CDU) Cowlairs
C19.01	29/01/2019			QEUH RHC							CNO algorithm invokement by NHS GG&C following 3 cases of SAB in the NICU resulting in 2 deaths cited as main and contributing cause. Further 2 possible cases identified on case finding
G19.021	19/02/2019	SSI	Mixed	QEUH	Surgical	GREEN					
G19.039	14/03/2019	Respiratory	Varicella zoster	QEUH RHC	Paediatric	GREEN					
G19.069	22/05/2019	GI	CDI	QEUH RHC	Ward 1D	GREEN					
G19.068	23/05/2019	BSI	S. Capitis	QEUH RHC	NICU	GREEN					
G19.107	21/08/2019	BSI	VRE	QEUH	Haematology	GREEN					
O19.32	23/09/2019	Respiratory	Bordetella pertussis	QEUH RHC	PICU	AMBER					
G19.119	27/09/2019	GI	Norovirus	QEUH	BMT	GREEN					
G19.126	23/10/2019	GI	CDI	QEUH	Gastroenterology	GREEN					
O19.40	05/11/2019	SSI	Mixed/other	QEUH	Surgical-Institute of Neurological Sciences	RED					

Situational Assessment
Wards 2A/B
Royal Hospital for Children
NHS Greater Glasgow and Clyde

Status: Confidential Draft

Contents

Background

NHS Greater Glasgow and Clyde (NHSGGC) are currently investigating and managing a contaminated water system across the Queen Elizabeth University Hospital (QEUH) and Royal Hospital for Children (RHC) with probable linked cases of bloodstream infections associated with wards 2A/2B RHC. During this investigation it was identified that there was a higher than expected level of Healthcare Associated Incidents (HCAI) linked to wards 2A/2B. The National Support Framework (http://www.nipcm.scot.nhs.uk/documents/the-national-support-framework-2017//) was invoked by the Scottish Government HAI/AMR Policy Unit to request Health Protection Scotland (HPS) undertake a review of Ward 2A/2B.

Due to the ongoing water contamination investigation and resultant summary report being prepared by HPS for Scottish Government it was agreed that whilst the review of wards 2A/2B was ongoing the report would not be undertaken until final submission of the water investigation report was completed. The final submission of this report was on 21st December 2018.

Wards 2A/2B RHC is a paediatric haemato-oncology unit, also known as Schiehallion, and houses the National Bone Marrow Transplant (BMT) Unit. The RHC is a 256 bedded childrens hospital which was handed over to the Board on 26th January 2015 with migration of patients occurring between 10th and 14th June 2015 from the previous Yorkhill site. The RHC was fully occupied from 15th June 2015.

All water related issues linked to wards 2A/B are discussed in the water incident report submitted to Scottish Government 21st December 2018 and not within this report. In addition a ventilation review of wards 2A/2B is currently being undertaken and will be covered within a separate NHSGGC report.

Wards 2A/2B closed on 26th September 2018 to allow for a works relating to water contamination to be completed. At this time the opportunity was taken to review the ventilation. Patients were transferred to wards 6A/4B at the Queen Elizabeth University Hospital.

Introduction

Since January 2016 NHSGGC have reported 15 Healthcare Infection Incident Assessment Tool (HIIAT) incidents/outbreaks within wards 2A/2B RHC. Comparative data for this setting (all paediatric hospitals) within NHSScotland identified no reported incidents or outbreaks outwith NHSGGC. The HIIAT allows NHS boards to assess the impact of a healthcare infection incident/outbreak on patients, services and public health and should be used by the Infection Prevention and Control Team (IPCT) or Health Protection Team (HPT) in their assessment of any incident/outbreak within a healthcare setting. In addition it supports a single communication channel for infection incident/outbreak assessment and reporting both internally within an NHS board area and externally to Health Protection Scotland (HPS) and Scottish Government Health and Social Care Department (SGHSCD).

Mandatory HIIAT Green (non-norovirus) reporting for NHS boards was introduced in April 2016; providing a more robust epidemiological picture of incidents and outbreaks across acute healthcare in NHSScotland. A HIIAT assessment is scored Red, Amber or Green according to a four part criteria:

- Severity of illness
- Impact on services

- Risk of transmission
- Public anxiety

Of the 15 HIIATs reported from 2A/2B since 2016 there have been 5 reds, 2 ambers and 8 greens reported to Health Protection Scotland (HPS). Details of the incidents reported are contained in appendix 1. Four of these HIIATs (2 red and 2 green) are attributed to the ongoing water incident. It could be hypothesised that ventilation may have been a contributory factor in several incidents however this cannot be confirmed until a full ventilation review has been completed.

Wards 2A/2B Assessment

Observational assessment walk rounds of wards 2A/2B was undertaken by a Senior Nurse Infection Control from HPS on 18th to 22nd June, 2nd July and 8th August 2018.. During these walk rounds practice and environmental hygiene were observed.

A meeting was held between the Chief Nurse Hospital Paediatrics and Neonatology, Consultant Surgeon and two Nurse Consultants Infection Control (HPS) to discuss ongoing work into central line-associated blood stream infections (CLABSI). This meeting took place on 17th July 2018.

It is noted that overall practice was described as good with no major issues observed or reported. Compliance with standard infection control precautions (SICPS), particularly hand hygiene, use of personal protective equipment and environmental cleanliness was observed to be good. Awareness of infection control practices were high with noteable visibility of the local infection prevention and control team (IPCT).

Ward 2A Overview (Floor plan appendix 2)

- Ward 2A consists of 25 ensuite single rooms.
- There are three distinct areas to the ward; the BMT bedrooms, standard rooms and the remaining Teenage Cancer Trust (TCT) and haemato-oncology rooms.
- The main entrance to the ward is through the entrance at the BMT section of the ward.
- Children with haemato-oncology and haematology disorders are the main patient population within this ward.

Ward 2B Overview (Floor plan appendix 3)

- Ward 2B consists of five consultation rooms and two 4-bed-bay areas.
- Ward 2B has a main waiting area at the reception of the ward with a TCT waiting area beside the TCT bay area.
- Ward 2B cares for children with haemato-oncology and haematology disorders on a Monday to Friday day care basis.

Water
A detailed summary report was prepared and submitted to HAI/AMR Policy Unit on 21st December 2018. This summary report documents all the findings from water-related investigations carried out until the decant of patients from Ward 2A/2B.

Ventilation
Work has been undertaken to convert the positive pressure ventilated lobbied rooms (PPVL) used predominantly for bone marrow transplant recipients into specification compliant positively pressured isolation rooms.

Ventilation within these wards is subject to a review by NHSGGC and will be covered in the resultant report. An SBAR covering initial findings has been prepared at the request of Scottish Government (SG) and submitted to SG by NHSGGC (November 2018).

Chilled beams
Chilled beams were noted to have significant level of dust present in two separate rooms (Ward 2A) there was also discolouration to the edges of the ceiling around the supply. This is potentially due to water contamination and was under review by estates department.

Dripping from the chilled beams had been observed by staff on a number of occasions. This was reported to estates and it has been identified that there were no dew point controls on the chilled beams. A dew point control has been fitted to the central system to alleviate the issue.

Temperature
Ward 2A was observed to be very warm and humid on the day of the visit and staff reported this was common for the ward.

HEPA filtration
The corridors within these wards are not HEPA filtered. The previous facility within Yorkhill hospital was reported to have 8 HEPA filtered rooms with all other rooms being conventionally ventilated.

Pressure stabilisers
Pressure stabilisers were noted in the rooms and also to the corridor of all the BMT rooms. There was no noted issue with overall pressures during this time however some of the stabilisers were noted to have no oscillation when the doors were opened.

Air Changes
It is noted from an SBAR prepared by NHSGGC on 12th November 2018 that the single room accommodation has a nominal air change rate of 2.5 air-changes per hour (ACH).

Air flow/pressure
The single rooms are negative to neutral pressure relative to the ward corridor. There is a further potential risk whereby extract air via the ensuite toilets may combine with the air supply passing through the thermal wheel which may result in an increased chance of cross contamination between single rooms.

All aspects of ventilation including the mixing of extract air with air supply and the potential resultant cross contamination risk will be explored as part of the ventilation review by NHSGGC.

Standard Infection control precautions (SICPs)
Compliance with SICPs was noted to be good, including hand hygiene and the use of personal protective equipment. A programme of monthly SICPs monitoring is in place. All SICPs audits reviewed at the time of the visit were of an optimal score. The IPCT undertake environmental audits in line with the agreed NHSGGC IPCT monitoring programme. At the time of the walkround it was reported that both wards had been given a GREEN audit score at the last IPCT audit. Follow up audit results from August 2018 have been reported as 96% (GOLD) for ward 2A and 98% (GOLD) for ward 2B.

Central Venous Line Management

Significant work has been undertaken across RHC relating to line management. A central venous line quality improvement project steering group was formed in May 2017 following a noted increase in line infections. The group collected data on central line-associated blood stream infections (CLABSI) on a week-by-week basis on lines inserted on the RHC site and includes all patients within the haemato-oncology cohort (including those cared for at home, shared with other hospital sites and inpatients). It was reported that the figures for CLABSI (outwith the BSIs identified as part of the water related incident) are reducing. The group is led by the Chief Nurse (RHC) and a consultant paediatric surgeon.

HPS undertook an epidemiological review of all positive blood samples from patients recorded as being admitted to wards 2A/2B and compared these to samples obtained prior to the move from Yorkhill and those obtained from patients in other areas of the hospital. A detailed report on the findings is included in appendix 4.

Summary

Any issues identified during the walkround visits were reported to staff at the time to ensure they were addressed. Overall there were no significant practice related concerns identified and awareness of infection prevention and control by all staff was high. There was a good presence of the infection prevention and control team on both wards with daily visits (Monday to Friday) being undertaken. A joint weekly walkround with infection control staff, nursing staff, facilities and estates staff is undertaken in an attempt for early identification of any issues which require to be addressed.

Based on the ward reviews and the epidemiological data presented in this report it is hypothesised that the increased number of HIIAT reports could all be linked to environmental factors and are not considered to be indicative of poor or compromised practice.

Recommendations

Consideration should be given to:

- The ventilation review underway within wards 2A/2B is completed with the involvement of the IPCT.
- A ventilation review is undertaken in other areas across RHC/QEUH in particular areas where high risk patients are to ensure compliance with national guidance.
- Issues identified within the ventilation review which are considered by the IPCT to pose an increased risk of cross infection should be addressed and signed off by the IPCT prior to repatriation of the patients.
- High visibility of IPCT within the wards should continue.

- CLABSI work continues.
- IPCT continue to observe infection rates and trigger breaches and report as per HIIAT where required.

Appendix 1: HIIAT Assessments

NHSScotland Incident and Outbreak Summary Ward 2A RHC (January 2016- Dec 2018).

NHS Greater Glasgow and Clyde have reported a total of 10 outbreaks and incidents for the clinical setting paediatric haemato-oncology. Of the 15 incidents and outbreaks HIIAT assessed; 5 were Red, 2 were Amber and 8 were Green. The data is displayed in the tables below providing a breakdown of the outbreaks reported by annual period with exception of the current period to date for 2018 and HIIAT Green in 2016 following introduction of mandatory report (non-Norovirus) from April 2016. Comparative data for this setting within NHSScotland identified no reported incidents or outbreaks outwith NHS Greater Glasgow and Clyde.

2018:

Table 1 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT RED 2018 – Total (2)		
Date reported	**Organism**	**Infection Category**
01/03/2018	*Pseudomonas aeruginosa* or *Cupriavidus pauculus*	BSI
18/05/2018	*Stenotrophomonas maltophilia*	BSI

Table 2 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT AMBER 2018 – Total (1)		
Date reported	**Organism**	**Infection Category**
10/04/2018	Astrovirus	Respiratory

Table 3 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT GREEN 2018- Total (4)		
Date reported	**Organism**	**Infection Category**
03/05/2018	Vancomycin- Resistant *Enterococci*	GI
18/05/2018	*Enterobacter cloacae*	BSI
20/07/2018	*Aspergillus fumigatus*	Respiratory
05/09/2018	Various	BSI

2017:

Table 4 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT RED 2017 – Total (3)		
Date reported	**Organism**	**Infection Category**
07/03/2017	*Aspergillus fumigatus*	Airborne
13/04/2017	Rotavirus	GI
26/07/2017	*Stenotrophomonas*	BSI

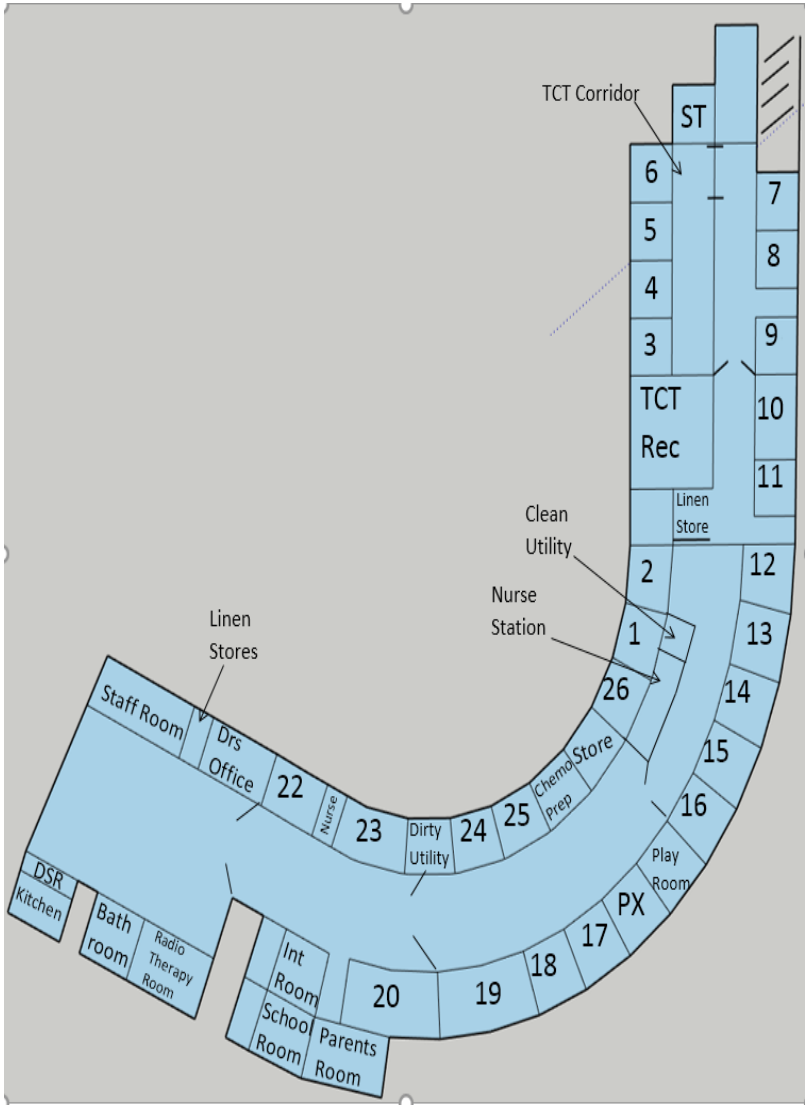
Table 5 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT GREEN 2017 – Total (3)		
Date reported	**Organism**	**Infection Category**
03/03/2017	*Elizabethkingia miricola*	BSI
03/03/2017	Mixed	BSI
31/05/2017	Norovirus	GI

2016:

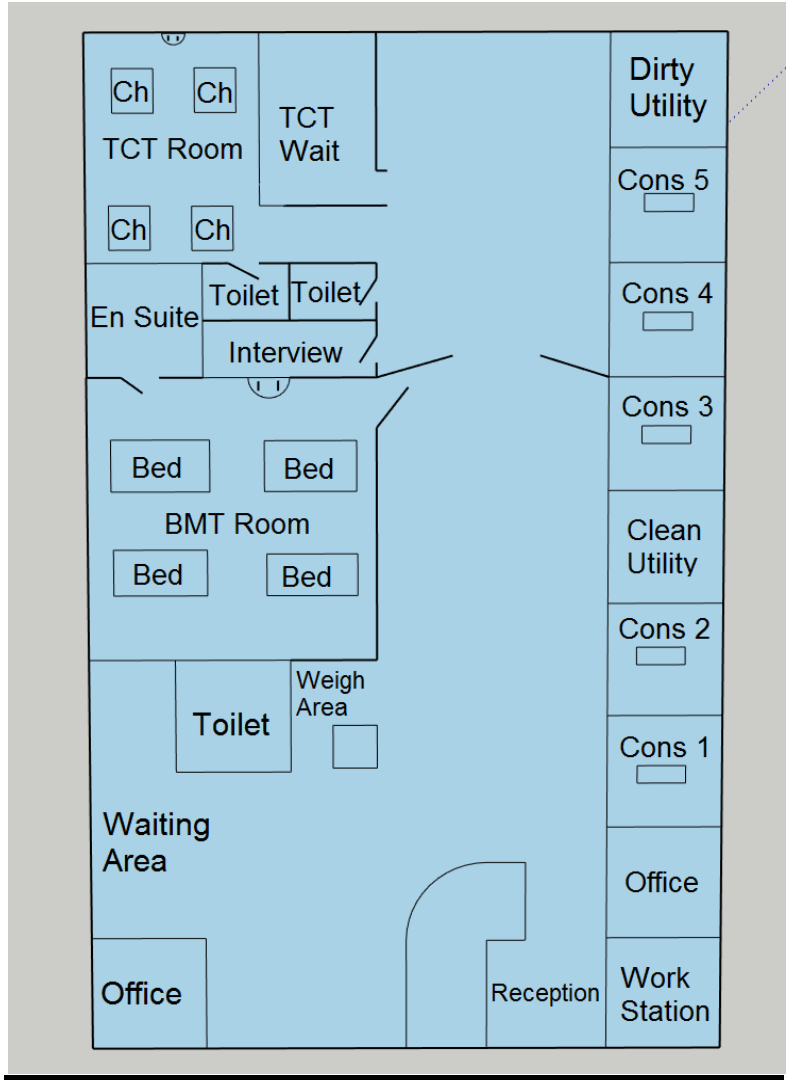
Table 6 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT AMBER 2016- Total (1)		
Date reported	**Organism**	**Infection Category**
05/08/2016	*Aspergillus*	Respiratory

Table 7 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT GREEN 2016- Total (1)		
Date reported	**Organism**	**Infection Category**
04/08/2016	Vancomycin- Resistant *Enterococci*	GI

Appendix 2: Ward Floor Plan 2A



Appendix 3: Ward Floor Plan 2B



Appendix 4: Health Protection Scotland - Epidemiology Report, December 2018

Royal Hospital for Children, NHS Greater Glasgow & Clyde

Background

Health Protection Scotland (HPS) were asked to support NHS Greater Glasgow and Clyde (NHSGGC) with the ongoing investigation of the potentially contaminated water system at the Royal Hospital for Children (RHC). The RHC opened in June 2015 replacing Yorkhill Hospital (YH). The patient population that was cared for in Schiehallion ward and Ward 7A of Yorkhill Hospital are now cared for in Wards 2A and 2B of RHC. The purpose of this report is to describe the incidence of positive blood cultures in the patient population cared for in these wards and more widely across RHC/YH hospitals, before and after the move to the RHC.

Methods

For the purposes of this report, the patient population was categorised into two groups:

- 2A/2B Group
    - Patients cared for in Yorkhill Hospital (YH) Schiehallion or Ward 7a; Royal Hospital for Children (RHC) Wards 2A and 2B; patients cared for in haematology/oncology specialties including A&E admissions with previous admission to RHC haematology/oncology specialties.
- RHC Other Group:
    - Patients cared for in other specialties in RHC/YC

Case and episode definitions

Data were extracted from the Electronic Communication of Surveillance in Scotland (ECOSS) system. An extract of all positive blood cultures for any patient under 16 years of age in NHSGGC was taken from ECOSS on the 13th June 2018 with an update taken on 20th August 2018. The case definition was a positive blood culture reported in patients aged less than 16 years in RHC/YC between July 2013 and June 2018. An episode was defined as one positive sample per species in a rolling 14-day period.

Microbiology

Positive blood cultures of the following micro-organisms were included:

- Gram-negative bacteria
- Gram-positive bacteria
- *Staphylococcus* species
- Environmental bacteria (all species of the following: *Achromobacter; Acinetobacter; Aeromonas; Brevundimonas; Brevibacillus species; Brevundimonas; Burkholderia; Chryseobacterium; Citrobacter; Cupriavidus; Delftia acidovorans; Elizabethkingia; Enterobacter; Klebsiella; Pantoea; Pseudomonas; Rhizobium; Rhodococcus; Serratia; Sphingomonas; Stenotrophomonas).*

- Non environmental bacteria (all species of the following: *Abiotrophia; Actinomyces; Aerococcus; Bacillus; Bacteroides; Bifidobacterium; Brevibacterium; Capnocytophaga; Clavibacter; Clostridium; Corynebacterium; Dermacoccus; Dietzia; Enhydrobacter; Enterococcus; Escherichia; Fusobacterium; Gemella; Granulicatella; Haemophilus; Kingella; Kocuria; Lactobacillus; Lactococcus; Leclercia; Leuconostoc; Microbacterium; Micrococcus; Moraxella; Mycobacterium; Neisseria; Paenibacillus; Propionibacterium; Proteus; Raoultella; Roseomonas; Rothia; Salmonella; Staphylococcus; Streptococcus; Veillonella).*
- Fungi (all species of the following: Candida; Rhodotorula).

The following species were previously isolated in water samples from 2A/2B: *Achromobacter*;*Acinetobacter; Brevundimonas*;*Burkholderia; Chryseobacterium; Comamonas; Cupriavidus; Delftia acidovorans; Elizabethkingia; Pantoea; Pseudomonas; Rhizobium; Sphingomonas*;*Stenotrophomonas*.

The following species were previously isolated in drain samples from 2A/2B: *Citrobacter; Cupriavidus; Delftia acidovorans; Enterobacter; Klebsiella; Pantoea; Pseudomonas; Serratia; Stenotrophomonas.*

Analytical methods

The total numbers of episodes of positive blood cultures in the included micro-organisms were described and polymicrobial episodes, where more than one species was identified in the blood sample, were compared in the 2A/2B Group with the RHC Other Group. Monthly incidence rates were calculated using bed-days at specialty level as the denominator. These data were obtained from the Information Services Division ISD(S)1 data source. The denominators for the 2A/2B Group were the monthly number of bed-days for haematology/oncology specialties in RHC/YH. The monthly bed-days for all other specialties in RHC/YH were used as the denominators for the RHC Other Group.

The incidence rates between July 2013 and June 2018 were analysed using statistical process control (SPC) U charts.[1] The SPC charts describe the incidence of positive blood cultures over time with the opening of the RHC represented in the charts with a vertical black line. In addition, the following control measures have been added to the 2A/2B chart – filters added to taps marked as an orange vertical line and cleaning of drains marked as purple vertical line.

The incidence rates for Gram-negative bacteria, Gram-positive bacteria, environmental bacteria and fungal blood cultures before and after the move to RHC were calculated and compared using rate ratios. In addition, two SPC charts were created each for Gram-negative, Gram-positive and environmental bacteria positive blood cultures; one for 2A/2B Group and one for the RHC Other Group. The centreline of the SPC was calculated as the median of the monthly rates between July 2013 and June 2018. The following SPC rules were applied:

TABLE 1: Statistical Process Control (SPC) rules

Rule	Description	Marker
Outlier	Data point(s) exceeding the upper or lower control limit (as 3 standard deviations)	Red diamond
Trigger point	Data point(s) exceeding the upper or lower warning limit (as 2 standard deviations)	Yellow triangle
Shift	A run of 8 or more consecutive data points above or below the centreline	Circle drawn round points
Trend	A run of 6 or more consecutive data points either increasing or decreasing.	N/A

The incidence rate of positive blood cultures over the 5-year period and the latest two-year period were compared with the combined incidence rate of the other two Scottish children's hospitals (Royal Aberdeen Children's Hospital (NHS Grampian) and Royal Hospital for Sick Children (NHS Lothian)). These were compared by calculation of rate ratios and accompanying p-values.

Results

Episodes

A total of 1,786 episodes were identified in 1,149 patients in RHC/YH over the five-year period from July 2013 to June 2018. In the 2A/2B Group, there were 542 episodes in 234 patients (range 1 - 23 episodes per patient) with a median age of 4 years. In the RHC Other Group there were 1,244 episodes in 927 patients (range 1 – 17 episodes per patient) with a median age < 1 years. The number of episodes in each patient group is described in TABLE 2. As the episode definition is by species, a patient could have more than one episode at any one time. TABLE 2 also describes the number of polymicrobial episodes when more than one species was identified in blood sample(s). Patients in the 2A/2B group were more likely to have a polymicrobial episode of positive blood culture (p<0.001).

TABLE 2: Total number of episodes (n=1,786) broken into each subgroup of 2A/2B Group and RHC Other Group over 5 years

	2A/2B Group			RHC Other Group		
	Monomicrobial (n = 413)[1]	Polymicrobial (n = 129)[2]	Total (n= 542)	Monomicrobial (n = 1,101)[1]	Polymicrobial (n = 143)[2]	Total (n=1,244)
Gram-negative bacteria	110 (65%)	59 (35%)	169	193 (85%)	35 (15%)	228
Gram-positive bacteria	291 (82%)	66 (18%)	357	884 (89%)	105 (11%)	989
Staphylococcus species	208 (87%)	30 (13%)	238	643 (94%)	41 (6%)	684
Environmental	77 (61%)	50 (39%)	127	101 (81%)	23 (19%)	124
Non-Environmental	324 (81%)	75 (19%)	399	976 (89%)	117 (11%)	1,093
Fungi	12 (75%)	4 (25%)	16	24 (89%)	3 (11%)	27

[1] Monomicrobial was only one species isolated on the episode reporting date.
[2] Polymicrobial if more than one species was isolated from cultures of blood samples on the same day as the episode reporting date.

Incidence rates

Figures 1 to 3 describe the incidence rates using SPC charts showing the incidence of positive blood cultures before and after the move to the RHC (23 months of data from YH and 37 months from RHC).

Figure 1 describes the incidence of Gram-negative blood cultures in both patient groups. The incidence of Gram-negative blood cultures in the 2A/2B Group prior to the move and in the months following were below the centreline of the SPC.

From March 2017, there was a run of 10 months/data points above the centreline identifying an upward shift in the rate with one point above the upper warning limit (UWL).

In March and May 2018, the 2A/2B Group had a rate above the upper control limit (UCL) highlighting a higher than expected incidence of positive blood cultures.

No shift in rates was observed in the RHC Other Group however the rate was above the UWL in April 2014, February 2016 and April 2017. In addition, comparison of the overall incidence of Gram-negative blood cultures before and after the move to RHC indicated the rate was higher after the move in the 2A/2B Group (RR = 1.47, CI: 1.05 to 2.04, p = 0.023) and did not change in the RHC Other Group (RR = 1.15, CI: 0.87 to 1.52, p = 0.34).

FIGURE 1: SPC charts of Gram-negative blood culture incidence rates per 1,000 total occupied days for 2A/2B Group and RHC Other Group.

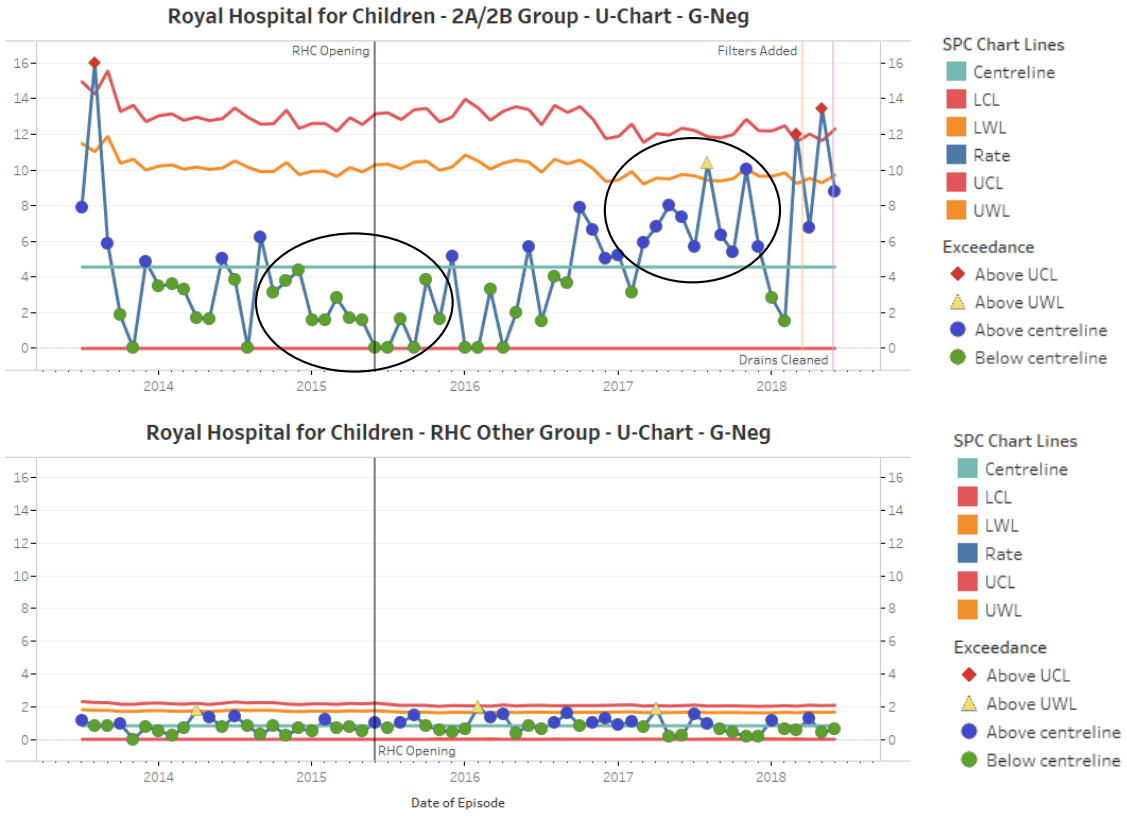
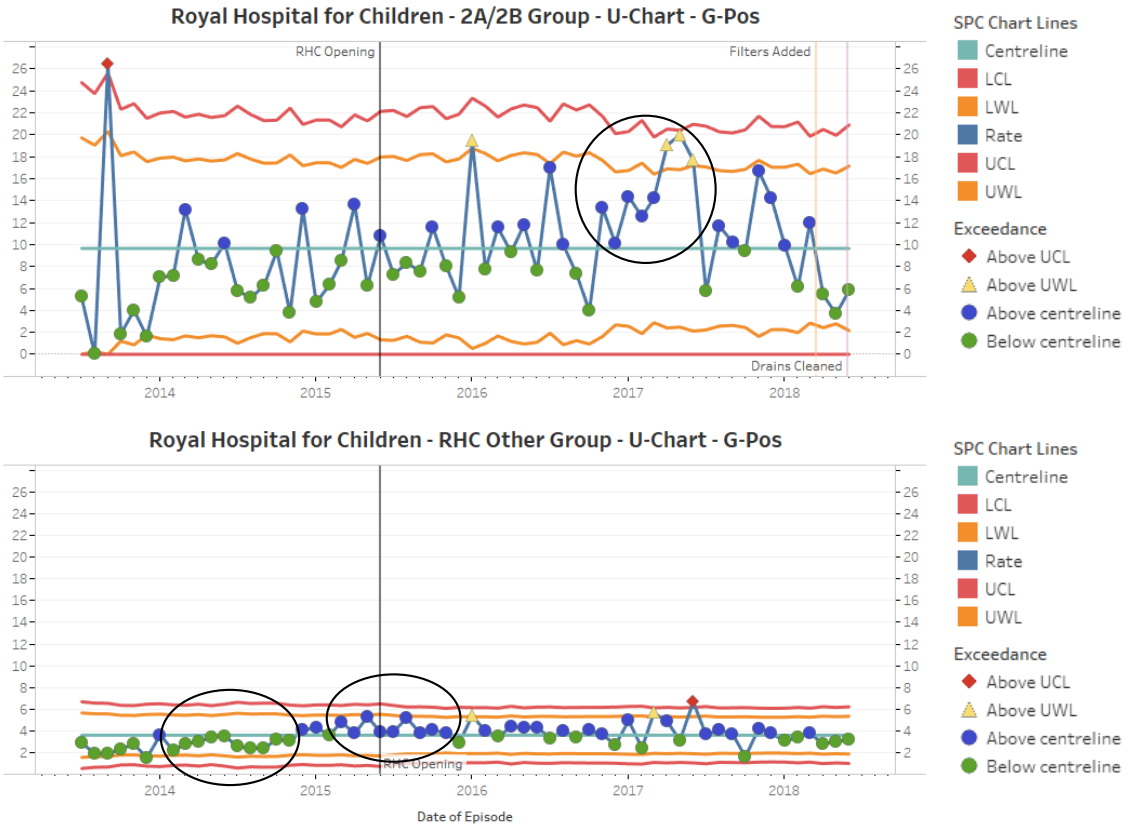


Figure 2 describes the incidence of Gram-positive blood cultures in both patient groups.

There was an upward shift in incidence of Gram-positive blood cultures in the RHC Other Group prior to the move with rates above the UWL in January 2016 and March 2017 and an outlier (above the UCL) in June 2017.

In 2A/2B Group, there was an upward shift after the move and the rate was above UWL in January 2016, and in April, May and June 2017. *Staphylococcus* species accounted for 52% of the Gram-positive blood culture episodes with 45% of those being *Staphylococcus epidermidis*. In addition, comparison of the overall incidence of Gram-positive blood cultures before and after the move to RHC indicated the rate was higher after in both the 2A/2B Group (RR = 1.43, CI: 1.14 to 1.81, p = 0.002) and the RHC Other Group (RR = 1.23, CI: 1.07 to 1.41, p = 0.003) .

FIGURE 2 SPC charts of Gram-positive blood culture incidence rates per 1,000 total occupied days for 2A/2B Group and RHC Other Group.



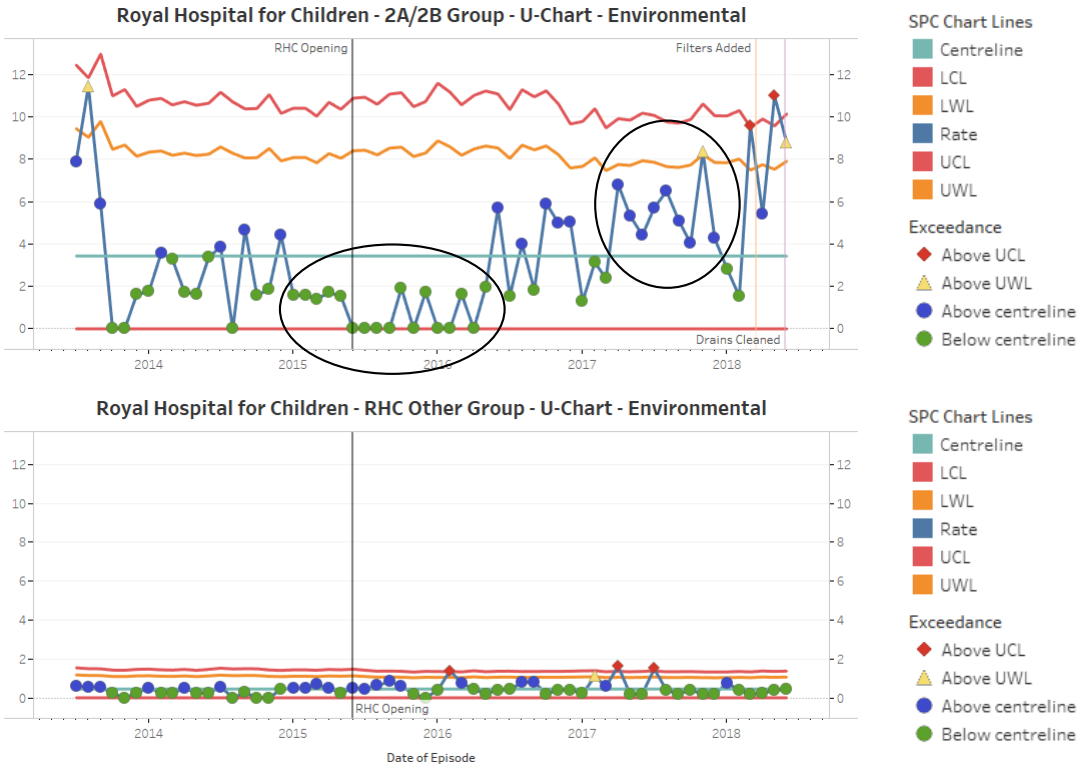
The incidence of positive blood culture caused by species of environmental bacteria (described in the methods section) which included all species isolated in water or drain samples taken from 2A/2B are shown in Figure 3.

In the 2A/2B Group, the SPC chart shows a shift below the centreline for 17 months from January 2015 to May 2016, then a shift above the centreline from April 2017 to December 2017. The rate was also above the UCL, and therefore higher than expected, in March and May 2018 and was above the UWL in November 2017 and June 2018.

There were no shifts in the incidence rates in the RHC Other Group, though the incidence was above the UCL in February 2016, April 2017 and July 2017 and above the UWL in February 2017.

In addition, comparison of the overall incidence of environmental bacteria positive blood cultures before and after the move to RHC indicated the rate was marginally higher in both the 2A/2B Group (RR=1.45, CI 0.98 to 2.13, p=0.06) and RHC Other Group (RR = 1.52, CI: 1.02 to 2.29, p=0.04) however the 2A/2B group the increase was not significant (p >0.05) which may be due to the small sample size.

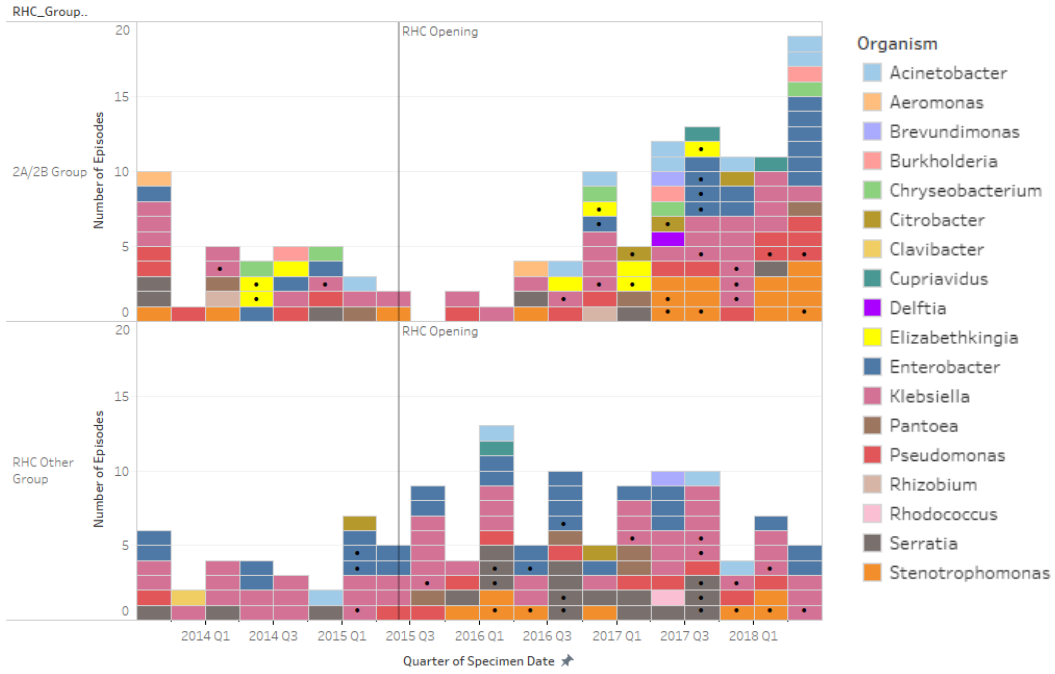
FIGURE 3: SPC charts of environmental bacteria blood culture incidence rates per 1,000 total occupied days for 2A/2B Group and RHC Other Group.



A comparison of the overall incidence of fungal positive blood cultures before and after the move to RHC indicated the rate did not change after the move in either group (2a2b group RR = 1.65, CI: 0.53 to 5.12, p = 0.40; RHC Other group RR = 0.86, CI: 0.40 to 1.89; p = 0.71).

Figure 4 describes the environmental bacteria blood culture isolates in both groups. The episodes with dots represent the first and recurrent episodes of the same species in the same patient. There were 20 patients with two episodes, one patient with three episodes and one patient with five episodes.

FIGURE 4: Quarterly episodes of environmental organism blood cultures in 2A/2B group and RCH other group. Dots represent the first and recurrent episodes of the same species from the same patient.



Comparison with other health boards

When comparing the overall rate over 5 years at RCH/YH to the combined rate of the other two Scottish children's hospitals (Royal Aberdeen Children's Hospital (NHS Grampian) and Royal Hospital for Sick Children (NHS Lothian)), the incidence of positive blood cultures in RCH/YH was higher compared with the other hospitals for environmental bacteria (RR = 1.70, CI: 1.34 to 2.16, $p < 0.001$) and fungi (RR = 5.36, CI: 2.12 to 13.53, $p < 0.001$), but lower for Gram-positive bacteria (RR = 0.71, CI: 0.66 to 0.77, $p < 0.001$) and non-environmental bacteria (RR = 0.79, CI: 0.73 to 0.85, $p = 0.001$). There was no difference in the rates of Gram-negative blood cultures (RR = 1.12, CI: 0.95 to 1.33, $p = 0.16$).

When compared over 2 years (July 2016 to June 2018), the rate of positive blood cultures was higher in RCH/YH for environmental bacteria (RR = 2.74, CI: 1.47 to 5.10, $p < 0.001$), Gram-negative bacteria (RR = 1.29, CI: 1.01 to 1.66, $p = 0.038$) and fungi (RR = 12.26, CI: 1.65 to 90.97, $p < 0.001$)) and lower for Gram-positive bacteria (RR = 0.81, CI: 0.72 to 0.92, $p = 0.001$) , and non-environmental bacteria (RR = 0.79, CI: 0.70 to 0.89, ($p<0.001$).

Summary and Recommendations

In summary, the overall incidence of Gram-negative, Gram-positive and environmental bacteria blood cultures increased in the 2A/2B Group after the move to the RHC. The RHC Other Group, the incidence of Gram-negative bacteria and fungal blood culture did not change and the incidence of Gram-positive and environmental bacteria blood cultures increased. SPC charts provide an alternative method of analysis that identifies variation at a level of detail not provided by comparison of incidence rates before and after the move to RHC. The SPC charts indicated that the Gram-negative, Gram-positive and environmental bacteria blood culture incidence rates in the 2A/2B Group were higher than expected following the move to RHC. The same changes in the incidence of blood cultures were not observed in the RHC Other Group. Whilst this conclusion must be interpreted with some degree of caution, as changes in the patient population have not been accounted for in this analysis, the shift in the incidence identified by the SPC charts indicates that the trends in blood culture incidence changed after this time.

Patients in the 2A/2B Group were more likely to have a polymicrobial episode than patients in the RHC other group. This was highest in the patients with a positive blood culture of environmental bacteria where nearly 40% had a polymicrobial blood culture. This is similar to figures reported in the literature with higher risk of polymicrobial bloodstream infection being associated with younger age groups and presence of central venous catheter.[3-6] The rate of environmental bacteria and fungal blood cultures were higher at RHC/YH than the other Scottish paediatric hospitals over 5 years and over the latest 2-year period. In contrast, the incidence of Gram-positive blood cultures, often considered to be associated with devices and device care, was lower in RHC/YH compared with the other Scottish paediatric hospitals.

Ward 2A and 2B have been closed since the 26th September 2018. It is recommended that when the wards re-open that all positive blood cultures are monitored in particular those related to an environmental organism.

Limitations

There are a number of limitations associated with the use of ECOSS blood culture data. All positive blood samples apart from those reported through mandatory surveillance programmes are non-validated records. The cases may include contaminants, and may include non-blood cases which are incorrectly mapped to a blood sample within either the laboratory system or within ECOSS. From the data collected through the enhanced *Staphylococcus aureus* bacteraemia (SAB) surveillance programme, 10% of episodes in under 16s were classed as contaminants[2] whereas the enhanced *Escherichia coli* bacteraemia (ECB) surveillance the figure was less than 1% (unpublished data).

The cases were identified using only laboratory data without any clinical review of patients. It is not possible to determine whether changes in incidence are confounded by changes in the patient population and their underlying medical conditions. Duplication per species in ECOSS may mean that a patient is recorded as having more than one episode of positive blood culture in a 14-day period leading to an overestimate of the number of episodes. The breakdown of polymicrobial samples only included isolates recorded on the same day as the episode reporting date which may underestimate the numbers of polymicrobial episodes.

In addition, the comparison between RCH/YC and paediatric hospitals in other health boards should also be interpreted with caution. Differences in the patient population between the RHC/YC and the other children's hospitals may introduce bias to the comparison.

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Initial report on the findings of the NHS Greater Glasgow and Clyde: Queen Elizabeth University Hospital/Royal Hospital for Children water contamination incident and recommendations for NHS Scotland

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Contents

Executive summary

NHS Greater Glasgow and Clyde (NHSGGC) are currently investigating a potentially contaminated water system across the Queen Elizabeth University Hospital (QEUH) and Royal Hospital for Children (RHC) with possible linked cases of bloodstream infections associated with ward 2A RHC.

Ward 2A RHC is a haemato-oncology unit, also known as Schiehallion, and houses the National Bone Marrow Transplant Unit. In 2016 a patient within ward 2A RHC was identified as having a blood stream infection (BSI) as a result of *Cupriavidus pauculus*. NHSGGC investigations included water samples from outlets within the aseptic suite of the pharmacy department where the parenteral nutrition was made that the child had received. *Cupriavidus pauculus* was isolated from water samples taken from a tap on a wash hand basin within this area. The wash hand basin was subsequently removed as a result. A further single case of *Cupriavidus pauculus* was identified in September 2017 however no environmental or water sampling was undertaken at this time.

Between the period of 29th January and 3rd April 2018 7 cases of blood stream infections (3 different organisms) with potential links to water contamination were identified. As a result widespread testing of the water supply was undertaken across both hospital sites. This testing identified widespread contamination of the water system. Control measures implemented included sanitisation of the water supply to ward 2A, the use of point of use filters in wash hand basins and showers in ward 2A and other areas where patients were considered high risk. There have been no new linked cases identified since the implementation of the control measures and whilst the investigation remains ongoing the clinical incident has been declared over with a full debrief held on 15th May 2018.

NHSGGC requested support from HPS with this incident on 16th March 2018 and Scottish Government invoked the national support framework on 20th March 2018 which requires HPS to lead an investigation and provide board support. This report is an initial summary of the findings from this investigation. A detailed technical report will be produced for NHSGGC by 31st July 2018

Introduction

NHS Greater Glasgow and Clyde (NHSGGC) are currently investigating a potentially contaminated water system across the Queen Elizabeth University Hospital (QEUH) and Royal Hospital for Children (RHC) with possible linked cases of bloodstream infections associated with ward 2A RHC. NHSGGC requested support from HPS with this incident on 16th March 2018 and Scottish Government invoked the national support framework[1] on 20th March 2018 which requires HPS to lead an investigation and provide board support. This report is an initial summary of the findings from this investigation. A detailed technical report will be produced for NHSGGC by 31st July 2018.

Background

NHS Greater Glasgow and Clyde's (NHSGGC) Queen Elizabeth University hospital (QEUH) is a 1109 bedded hospital with 100% en suite single side rooms which was handed over to the Board on 26th January 2015 with patient migration commencing from 24th April 2015 until 7th June 2015. The adjoining Royal Hospital for Children (RHC) is a 256 bedded childrens hospital which was handed over to the Board on 26th January 2015 with migration of patients occurring between 10th and 14th June 2015. The QEUH and RHC were both fully occupied from 15th June 2015 There are a number of additional healthcare facilities in the surrounding grounds including the maternity unit, neurosurgical unit, elderly care unit and the national spinal injuries unit.

Ward 2A RHC is a haemato-oncology unit, also known as Shiehallion, and houses the National Bone Marrow Transplant Unit. In February 2016 a patient within ward 2A RHC was identified as having a bloodstream infection (BSI) as a result of *Cupriavidus pauculus*. NHSGGC investigations included water samples from outlets within the aseptic suite of the pharmacy department where the parenteral nutrition was made that the child had received. *Cupriavidus pauculus* was isolated from water samples taken from a tap on a wash hand basin within this area. The wash hand basin was subsequently removed as a result. A further single case of *Cupriavidus pauculus* was identified in September 2017 however no environmental or water sampling was undertaken at this time. Appendix 1 details all incidents reported to Health Protection Scotland under the Healthcare associated incident investigation tool[2] related to ward 2A since 1st January 2016.

On 29th January 2018 *Cupriavidus pauculus* was identified from a bloodstream infection (BSI) in a patient in ward 2A. A series of investigations were undertaken including water sampling from outlets within the ward area. On 21st February *Pseudomonas* was identified from a BSI and between 11th and 16th March 2018 4 cases of *Stenotrophomonas maltophilia* were identified from patients in ward 2A and 1 patient in Paediatric ICU. *Cupriavidus, Pseudomonas and Stenotrophomonas* (amongst other gram negative bacillus and fungi) were identified. This led to enhanced control measures being applied within ward 2A and an extensive investigation into the potentially contaminated water system across the QEUH and RHC. Testing of the organisms in this incident has not provided an exact link to the patient cases and the water system. Testing in an incident like this can be difficult and should only be used to include cases rather than exclude. To attain appropriate representation of the bacteria within the water would require significant sampling of each organism identified to ensure a representation of strains was identified. A timeline of the patients with infections included in this incident is detailed in Appendix 2. A further case of *Stenotrophomonas* bacteraemia presented on admission to 2A on 3rd April 2018. Due to previous ward contact before implementation of control measures this case was included.

This report is an overview report of this investigation due to the large volume of data and complexities associated with this incident. A second more detailed and technical report is currently being produced which will cover more technical details and will be issued to Scottish Government and NHS GGC by end of July 2018. The longer timescale for this report is as a result of this incident being an ongoing live situation and covers information from the design and commissioning of the hospitals to the current position. HPS worked with

the support of Health Facilities Scotland (HFS) as the technical engineering experts to support this investigation and report production.

Organisms linked to cases of infection in this incident

Details on the 3 organisms (*Cupriavidas, Stenotrophomonas and Pseudomonas*) that are linked to patient cases in this current investigation are covered in appendix 3.

The role of biofilm

Biofilm is a group of microorganisms in which the cells adhere to each other and often to a surface. These cells then become embedded within a slimy substance and can be prevalent in natural, industrial and hospital settings. There is a multitude of information in the published literature which directly links biofillm production/biofilm producing organisms to water source related outbreaks. In addition, 3 recent review articles focussed on the role of water in healthcare associated infections, with specific mention of biofilm formation as a key mechanism for sustained contamination of water systems.[3-5] Biofilm formation has been described for *Cupriavidus* species and *Pseudomonas spp*, particularly in association with water systems. Biofilm formation with *Stenotrophomonas* on a variety of surfaces has also been demonstrated.[6] As a specific example; an *S maltophilia* biofilm was found to be formed within a flexible tube running from a carbon filter to a chiller, which was connected to a tap in a kitchen sink, used to supply patients with drinking water.[6]

Initial findings

HPS, HFS and NHS GGC initiated a detailed investigation into the contaminated water system within QEUH/RHC. This includes reviewing commission, installation and maintenance records provided by the contractor. This has proved challenging due to the archiving of data and the fact that there are very few members of the initial project team available who are technically qualified to retrieve data and provide verbal clarification.

Results from ongoing water testing are being reviewed on a weekly basis and would appear to confirm that there continues to be regressional seeding of contamination and supports the theory that a whole system remedial approach is required. In addition to the 3 organisms associated with the clinical incident, numerous additional gram negative bacilli and fungal species have been identified from samples.

A technical and epidemiological report is currently being produced which will include details of this investigation. Initial preliminary findings have identified that prior to handover from the contractor there were a number of water samples taken that produced results with high level of total viable counts (TVCs). TVCs are indicators that there are hygiene issues within the water system and are quantified as a generic indicator for microbial contamination. Specific microorganisms which can be tested for include: Coliforms, *Escherichia coli (*including O157), *Pseudomonas aeruginosa, Salmonella spp*, *Campylobacter spp* and Environmental Mycobacteria. Testing for these is not conducted as standard within current guidance and typically occurs in response to a suspected or confirmed outbreak, or due to identification of a series of sequential cases.

Commissioning and design of the hospital system

As part of the normal water system commissioning water samples were obtained. Some samples yielded high TVCs. In response to the high levels of TVCs NHSGGC did not accept the handover of the hospital at this time sanitisation of the water supply was undertaken prior to handover, with some impact and a reduction in TVCs in most areas, however there are a number of reports which indicate that there may still have been a number of areas with higher than normally acceptable levels of TVCs however work is still ongoing with this.

Evidence has been requested from NHS GG&C in relation to the infection control sign off of results and the system at commissioning/handover. Work continues to locate appropriate documentation and will be discussed in the final report. Water was first placed on the Infection prevention and control (IPCT) risk register in 2018.

The design and construct of wash hand basins, showers and taps in this hospital were agreed with NHS GGC in line with the Scottish Health Technical Memorandum (SHTM) in place at the point the hospital was designed, this included the installation of taps with flow regulators. HFS and HPS were involved in this decision making process as was NHSGGC Infection Control team. The SHTM (SHTM 04-01)[7] was revised in 2015 and no longer supports the use of flow regulators in clinical wash hand basins.

Biofilm formation in flow straighteners has been identified in a previous published outbreak.[8] The manufacturers of the taps/flow regulators recommend regular removal of the flow straighteners for cleaning/decontamination. Any records relating to decontamination of the flow straighteners will be reviewed in the wider review being undertaken.

The taps in place across all clinical wash hand basins in the hospital are not compatible with silver hydrogen peroxide, a product used during commission stage to sanitise the water system in view of the high TVC results. It is unclear whether this has caused any degradation of the taps, however NHS GGC have sent taps removed from the installation for metallurgical testing. In addition a tap was deconstructed and examined for the presence of biofilm, in addition to microbiological sampling. The presence of high levels of gram negative bacteria and fungus in the water system suggests that temperature control required has not always been achieved. This will be reviewed as part of the wider review being undertaken. In line with the national guidance there is a water safety group (WSG), and local Sector/Hospital Water Safety Groups. The Board Water Safety Group is a sub group of the Board Infection Control Group .Water Safety is a standing agenda item for the infection Control Team Senior Managers Team meeting.

There is a flushing regime in place across both hospitals however it is unclear whether the flushing process is adequate and all outlets are being flushed, including little used outlets, water coolers, baths etc. Due to the size of the system this is extremely difficult to assess. The wider report will review this.

Current management of situation

Point of use filters

Point of use (POU) filters were installed as one of the main control measures initially in high risk areas (wash hand basins and showers) to ensure a safe water supply at the point of use. These filters have been installed across all areas within QEUH and RHC where there are likely to be immunocompromised patients or in identified clinically higher risk areas. POU filters require to be changed every 30 days and are a costly approach. However, in the interim until the water contamination can be addressed, is the only feasible approach to ensure safe delivery of water. A number of studies found that installation of point of use filters reduced either infection rates in associated healthcare settings[9; 10] or pathogen counts within tested water samples.[11]

Water treatment

It is well recognised that drinking water distribution systems contain a diverse range of microorganisms.[12-14] The presence of microorganisms is affected by various factors including; the disinfection processes employed, the location and age of the system as well as pipe material.[15]

There are a number of options to be explored for longer term water treatment and NHS GGC are preparing a feasibility report on the most appropriate solution: these options include

Chlorine dioxide

A number of studies were identified which utilised chlorine dioxide systems within hospital settings, and use of these was found to reduce bacterial numbers. [14;16;17]

Various advantages and limitations associated with use of chlorine dioxide are known, with the most relevant summarised below.[18;19]

Advantages: Known to be effective against a wide range of bacteria, viruses and some protozoa including Giardia.

Limitations: Production of disinfection by- products (DBP's). Although potential production of DBP's always needs to be considered, the efficacy of water disinfection should not be compromised in trying to eliminate these. [19]

UV light

A number of drinking-water treatment technologies are available which employ UV light radiation to inactivate microorganisms.[19]

As with chlorine dioxide, various advantages and limitations associated with use UV are known, with the most relevant summarised below. [18-20]

Advantages: Bacteria, fungi and protozoa (considered to be more effective at killing Cryptosporidium than chlorine dioxide) are readily inactivated at low UV doses, with higher doses required for virus inactivation. In addition, UV disinfection does not result in the formation of DBP's like chlorine dioxide.

Limitations: UV disinfection does not leave any residual compound in treated water and therefore does not offer protection against possible microbial re-growth in distribution pipe-work.

Thermal disinfection

Very limited information was identified in the published literature in relation to advantages and limitations of thermal disinfection.

One study found that heat shock treatment at 80˚C reduced Gram negative bacteria in a hospital water system but did not lead to complete eradication.[21]

A risk benefit analysis of each option will be undertaken as part of the wider report. An additional approach for sanitisation which will also be reviewed is copper silver ionisation.

Hypothesis

There are a number of workable hypotheses being explored; it is currently considered the most likely cause of the widespread contamination is a combination of hypothesis B and C

A: Ingress contamination

A small low level number of micro-organisms may have been present in the water supply at the point of entry. Lack of temperature or chemical control may have enabled biofilm formation. Due to the increasing biofilm throughout the system this may have allowed any subsequent micro-organisms present at point of entry an opportunity to flourish and cause widespread contamination of the system.

B: Regressional contamination

This may have occurred due to contamination occurring at the taps/outlets or flow straighteners and contamination has regressed backwards throughout the system causing widespread contamination. The widespread positive results and array of bacteria point to contaminated outlets at installation or contamination of high risk components in the tap from ingress as opposed to the patient contact route.

C: Contamination at installation/commissioning

Contamination may have occurred due to presence of contaminated pipework or outlets. Prior to handover the system required to be sanitised due to high TVC counts. It is unclear if a robust flushing regime was in place from installation to handover and from handover to occupancy to prevent contamination.

Summary

There have been no new reported cases since 3rd April 2018 and the clinical aspect of this incident has been closed. This will be reopened if any new cases are identified. Control measures are in place to mitigate the risk however further work to address the widespread contamination is required. HPS will continue to liaise with HFS and NHSGGC and co-ordinate and produce a detailed technical report for NHSGGC and Scottish government which will include the review of installation, commission and maintenance and the risk/benefits of remedial approaches such as water dosing and tap replacement. This report will be prepared by July 2018.

Recommendations:

- Point of use filters will continue to be in place in ward 2A and other areas identified by the IMT until the risk to patients from the current situation of water contamination has been minimised.
- HPS will continue to liaise with HFS and NHSGGC and co-ordinate a wider technical report by 31st July 2018
- HPS via the existing Infection Control Built environment programme will, in conjunction with HFS:
    A. Prioritise water safety and undertake a review of NHS Scotland current approach to water safety
    B. Review existing national and international guidance relating to water safety and consider robust requirements for building handover requirements in relation to the water systems.
    C. Establish a risk based approach to water testing and any remedial action required, including roles and responsibilities.

Appendix 1 - NHSScotland Incident and Outbreak Summary Ward 2a RHC (January 2016- April 2018).

NHS Greater Glasgow and Clyde have reported a total of 10 outbreaks and incidents for the clinical setting paediatric haemato-oncology. Of the 10 incidents and outbreaks HIIAT assessed; 4 were Red, 2 were Amber and 4 were Green. The data is displayed in the tables below providing a breakdown of the outbreaks reported by annual period with exception of the current period to date for 2018 and HIIAT Green in 2016 following introduction of mandatory report (non Norovirus) from April. Comparative data for this setting within NHSScotland identified no reported incidents or outbreaks out with NHS Greater Glasgow and Clyde.

2018:

Table 1 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT RED 2018 ± Total (1)			
Date reported	**Organism**	**Infection Category**	**Summary**
01/03/2018	*Pseudomonas aeruginosa* or *Cupriavidus pauculus*	BSI	**Current ongoing** incident following initial reporting water system contamination with Cupriavidus pauculus/ Pseudomonas aeruginosa within ward 2A (haemato-oncology ward) at the Royal Hospital for Sick Children following 2 confirmed cases, 1 with *Cupriavidus pauculus* bacteraemia, 1 with *Pseudomonas aeruginosa* bacteraemia resulting in invokement of the national framework by Scottish Government on 21/3/18.

Table 2 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT AMBER 2018 ± Total (1)			
Date reported	**Organism**	**Infection Category**	**Summary**
10/04/2018	Astrovirus	Respiratory	12 patient cases identified with Astrovirus

2017:

Table 3 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT GREEN 2017 ± Total (3)			
Date reported	**Organism**	**Infection Category**	**Summary**
03/03/2017	*Elizabethkingia miricola*	BSI	Three cases BSI infection since September 2016. Action plan - focus on the environment
03/03/2017	Mixed	BSI	IPCT and clinical team noted a general increase in the number of blood cultures over January and February
31/5/2017	Norovirus	GI	3 cases, 2 of which HAI (some cases amongst parents within the unit)

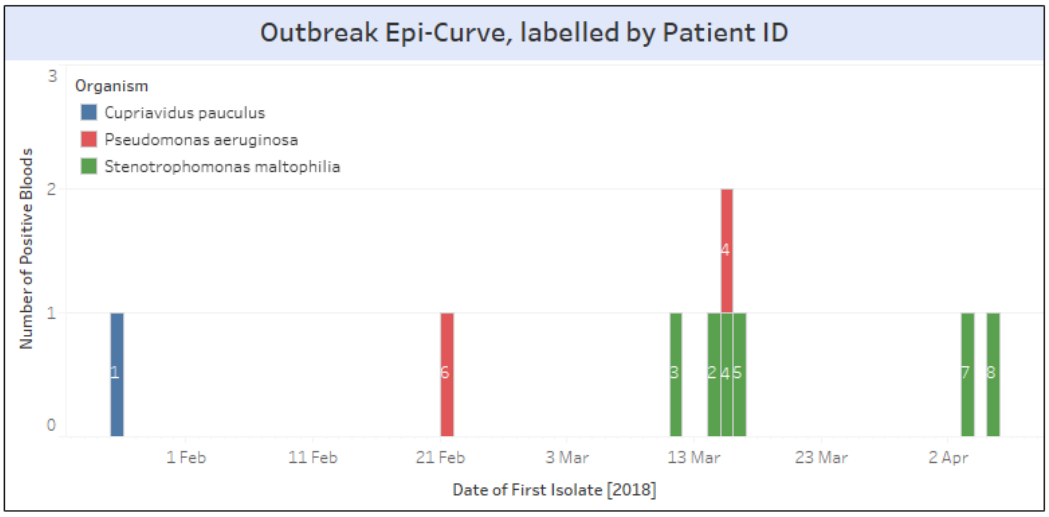
Table 4 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT RED 2017 ± Total (3)			
Date reported	**Organism**	**Infection Category**	**Summary**
7/3/2017	*Aspergillus fumigatus*	Airborne	A higher than expected incidence of Aspergillus in this patient population since June 2016. Three patients met the case definition of probable Aspergillosis
13/04/2017	Rotavirus	GI	5 patient cases of VRE 3 of which have rotavirus. 2 staff members confirmed rotavirus
26/7/2017	Stenotrophomonas	BSI	Two patients with positive Stenotrophomonas bacteraemia within 8 days. Both cases considered to be HAI. Control measures in place

2016:

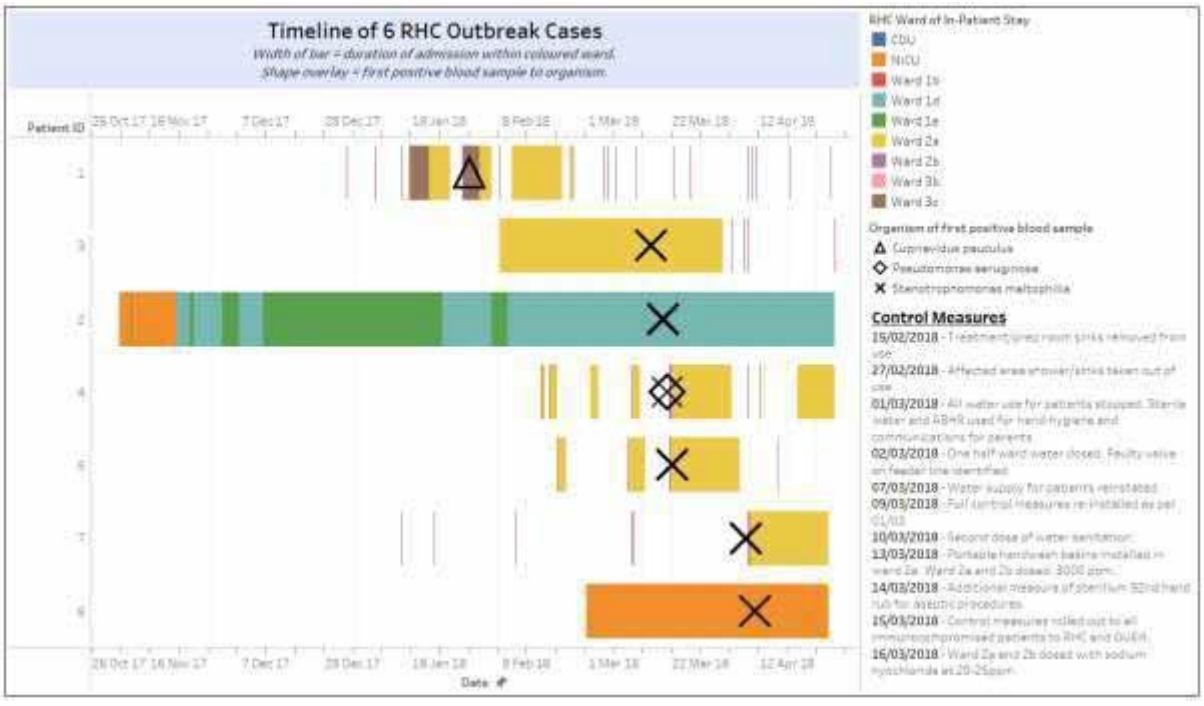
Table 5 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT GREEN 2016- Total (1)			
Date reported	**Organism**	**Infection Category**	**Summary**
04/08/2016	Vancomycin Resistant *Enterococci*	GI	Increase in VRE

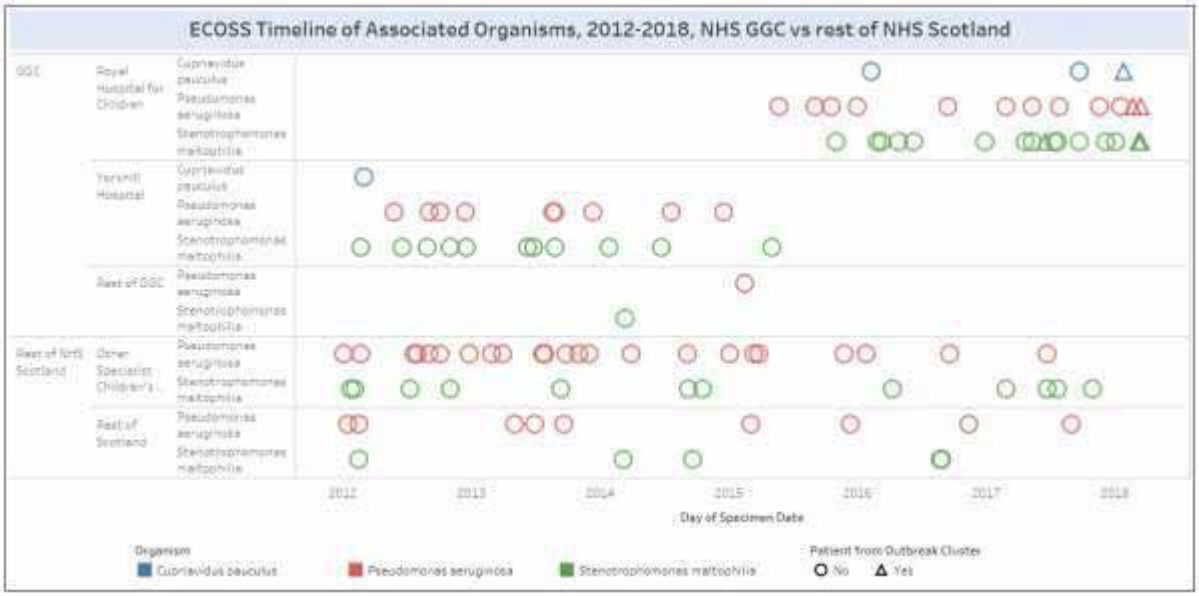
Table 6 NHS Greater Glasgow & Clyde, RHC haemato-oncology (ward 2A), HIIAT AMBER 2016- Total (1)			
Date reported to HPS	**Organism**	**Infection Category**	**Summary**
05/08/2016	Aspergillus	Respiratory	Two cases: one confirmed and one probable Neither giving cause for clinical concern specific to Aspergillus. Possible contributing environmental factors for cross transmission.

Appendix 2 Timeline of cases



The epi-curve demonstrates that only one case of *Cupriavidus pauculus* was reported from 26th January 2018, with the other associated cases being *Stenotrophomonas maltophilia* and/or *Pseudomonas aeruginosa* positive between 21st February 2018 and 5th April 2018.




ECOSS Timeline of Associated Organisms, 2012-2018, NHS GGC vs rest of NHS Scotland
GGC
Royal Hospital for Children
Cupriavidus pauculus
Pseudomonas aeruginosa
Stenotrophomonas maltophilia
Yorkhill Hospital
Cupriavidus pauculus
Pseudomonas aeruginosa
Stenotrophomonas maltophilia
Rest of GGC
Pseudomonas aeruginosa
Stenotrophomonas maltophilia
Rest of NHS Scotland
Other Specialist Children's
Pseudomonas aeruginosa
Stenotrophomonas maltophilia
Rest of Scotland
Pseudomonas aeruginosa
Stenotrophomonas maltophilia
2012
2013
2014
2015
2016
2017
2018
Day of Specimen Date
Organism
Cupriavidus pauculus
Pseudomonas aeruginosa
Stenotrophomonas maltophilia
Patient from Outbreak Cluster
No
Yes

Appendix 3 - *Cupriavidus, Stenotrophomonas, Pseudomonas*

Cupriavidus pauculus

1. Background

Cupriavidus species are Gram-negative, aerobic, non-spore-forming, motile bacilli.[22]

Various naming conventions have previously been associated with this organism (formerly known as *Ralstonia paucula*, *Wautersia paucula* and CDC group IVc-2)[22-24]

a. Reservoir/s
C. pauculus and other *Cupriavidus* species are considered to be environmental organisms,[24;25] (although negative environmental screening when investigating incidents/outbreaks has occasionally been reported[26;27]). More specifically, water is known to be a potential source of infection, including drinking water.[24;28-30]

b. Mode/s of transmission
Very limited information on the mode of transmission of the organism is available. Contact with the environment has been proposed as the primary mode of transmission.[25-27] Person-to-person spread has been considered, but has not been proven.[31] In addition, other modes of transmission, including following a cat bite[32] have also been reported.

c. Biofilm formation
Biofilm formation has been described for *Cupriavidus* species, particularly in association with water systems.[26;30;33-35]

2. Summary of published incidents/outbreaks

There are numerous case reports of infections caused by *C. pauculus* within the published literature. Many of these occurred in Europe, [31;32;36-42] but to date, there have been no case reports of infection in Scotland, or the UK.

The majority of case reports identified one affected patient[23;25;27;32;36-38;40-50] therefore it may be most appropriate to considered these as 'incidents' rather than true outbreaks.

A number of the reports[23;31;38;43;44;47;49] considered infections to be nosocomial, although many of the patients had prolonged/intermittent hospital stays and it was therefore difficult to accurately establish healthcare versus community acquisition.

The majority of reports were associated with immunocompromised patients, [27;31;38;39;41-43;48;50] or those with various co-morbidities, with or without known immunosupression. [23;37;40;44;46;47]

A significant number of reports were associated with neonates, or paediatric patients. [23;25;31;36;44-46;48]

Various types of infections were described, the majority of reports described bacteraemia/septicaemia.[23;25;37;41-45;47;49;50] Other presentations included pneumonia,[36-38;46] meningitis,[25] peritonitis,[40] and osteomyelitis/septic arthritis.[43] In addition, catheter associated infections were also reported.[27;42] A number of patient deaths

occurred, [37;44;46;48] but in most cases it was difficult to determine whether these were directly due to infection with the organism, or other factors associated with patient immunosupression /chronic disease.

Water as a source[23;27;29;43;44;47] was suspected in a number of reports, but no source was determined in the majority of cases.

In addition, two pseudo-outbreaks were reported, due likely environmental contamination by this organism of specimen swabs[29] and blood culture bottles.[26]

Stenotrophomonas maltophilia

1. Background

Stenotrophomonas maltophilia is a non-lactose fermenting Gram-negative aerobic bacillus, previously known as *Xanthomonas maltophilia* and *Pseudomonas maltophilia.* The organism has been implicated in causing outbreaks since the 1970's.[51]

a. Reservoir/s
The organism is found in a variety of environments, including water, sewage and soil. Specifically within healthcare settings, *S. maltophilia* has been isolated from various reservoirs including taps, humidifiers, nebulizers, and ventilation equipment.[51] In addition, the organism has been isolated from bottled water.[52]

b. Mode/s of transmission
Although numerous outbreaks associated with this organism have been reported, the source and mode of transmission it often difficult to establish. Typically, direct or indirect contact with a contaminated healthcare environment/equipment has been reported. Human carriage has also been noted in a number of studies, and therefore gives rise to the potential for person-to-person transmission.[51]

c. Biofilm formation
Biofilm formation on a variety of surfaces has been demonstrated.[6] As a specific example; an *S maltophilia* biofilm was found to be formed within a flexible tube running from a carbon filter to a chiller, which was connected to a tap in a kitchen sink, used to supply patients with drinking water.[53]

Under laboratory conditions, optimum temperature for growth is considered to be 37ÛC, although environmental isolates tend to have a propensity for growth at lower temperatures (20-30ÛC). The organism is also known to survive in temperatures as low as 4˚C for significant periods of time.[54] In addition, it has been indicated that biofilm formation is temperature dependent, with one study citing optimum biofilm formation at 32˚C (in comparison to 18 and 37°C).[55]

2. Summary of published incidents/outbreaks

There are numerous published case reports and outbreak studies describing nosocomial infection and/or colonisation. One of these referred to an outbreak which occurred in the UK. [53]

The majority of studies were associated with immunocompromised patients, [56-60] or those with various co-morbidities, with or without known immunosupression.[53;61-66]

25% (4 out of 16) of identified studies were associated with neonates, or paediatric patients.[62;64;66;67]

Various types of infections were described; predominantly bacteraemia/septicaemia.[56-61;64;66;67] Other presentations included endopthalmitis,[68] as well as respiratory,[53;62;63;69] soft tissue[58] and catheter associated infections.[59] In addition, a number of studies described cases of both colonisation and infection[53;60;63;64] and one described colonisation alone.[70]

Various sources of infection were reported including taps/tap water[53;58;64;70;71] and related environments (wash-hand basins[62;65] and a shower outlet[60]), medical solutions, [56;68] and various medical equipment;[61;63;66;69;71-73] predominantly bronchoscopes (N.B all bronchoscope related outbreaks were found to be pseudo-outbreaks).

Limited information was provided on the mode of transmission but most studies considered this to be contact with the healthcare environment, relating to the sources described above. Two outbreaks stipulated that person-to-person transmission from colonised healthcare workers may have occurred.[66;67]

In addition, a number of reports described co-infections; primarily with other Gram negative organisms.[71-74]

Pseudomonas spp

Biofilm formation

Pseudomonas spp are known to form biofilms both within the environment and in patient infections (i.e. on implanted biomaterials).[75]

P. aeruginosa is known to survive a range of temperatures; typically 4-42° C, with optimum growth occurring at 37°C.[76] Biofilm formation has been shown to be temperature dependent, with one experimental study citing optimum biofilm formation at 37°C (in comparison to 28, 33 and 42°C).[3]

Further specific information in relation to biofilm formation associated with water sources can be found in '*Are biofilms associated with water source related transmission with healthcare settings?*' below.

Summary of published incidents/outbreaks

A multitude of nosocomial *Pseudomonas spp* outbreaks have been reported in the published literature. The summary below includes outbreaks occurring in the last 10 years only.

Outbreaks were reported internationally, with four of these occurring in the UK.[4;5;9;10]

The majority of studies were associated with immunocompromised patients, [56;77-89] or those with various co-morbidities, with or without known immunosupression.[4;9;10;90-118]

9% (7 out of 63) of identified studies were associated with neonates, or paediatric patients.[77;79;99;101;106;110;114] A recent systematic review outlines risk factors and environmental sources associated *with P. aeruginosa* outbreaks in neonatal intensive care settings.[119]

Various types of infections were described; predominantly bacteraemia/septicaemia.[11;56;78-81;83;85;88;89;94;98-101;107;109;113;114;118;120-122] Other presentations included endopthalmitis,[123-126] endocarditis[127] as well as respiratory,[10;69;78;80;89;96;105;109;112;113;118;128] surgical site[88;89;115;118;129] and urinary tract infections.[80;88;95;109;118;120;122;128;130;131] In addition, a number of studies described cases of both colonisation and infection. [78-81;93;94;97;99;104;110;111;114;116;128]

Various sources of infection were reported including bottled water,[91;99] taps/tap water, [5-77;82;97;101] as well as wider wash-hand basin environments [4;90;110;113;116] including a soap dispenser.[80] In addition, a further study demonstrated isolation of *P. aeruginosa* from various water fittings in intensive care rooms, in the absence of a recognised outbreak.[132] Outbreaks have also been associated with various medical solutions,[56;96;121;124;126;127] and medical equipment, including various types of endoscopes, [69;81;93;120;130;133] arthroscopic shavers,[129] a urodynamic transducer[122] and a transesophageal echocardiogram probe.[94]

Limited information was provided on the mode of transmission but most studies considered this to be contact with the healthcare environment, relating to the sources described above. A number of outbreak reports stipulated that person-to-person transmission from colonised healthcare workers/patients may have occurred. [11;79;84;92;95;98;102;104;112;114]

The majority of outbreaks were associated with *P. aeruginosa* but other species were also reported including *P. putida* [56;100;93], *P. fulva*[93] and *P. fluorescens*.[107]

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SCOTTISH EXECUTIVE

Health Department
Directorate of Nursing, Midwifery and Allied Health Professionals

Dear Colleague

A REVISED FRAMEWORK FOR NATIONAL SURVEILLANCE OF HEALTHCARE ASSOCIATED INFECTION IN SCOTLAND

This letter updates the framework for National Surveillance of Healthcare Associated Infection (HAI) in Scotland which was originally set out in HDL(2001)57. The revised framework reflects policy developments since the issue of that HDL and forms part of the work programme for the Ministerial HAI Task Force.

NHS Boards are required to implement the revised and new systems to take these changes into account. This letter should be drawn to the attention of Infection Control Managers; Consultant Microbiologists; Infection Control Teams; and Infection Control, Clinical Governance and Risk Management Committees.

Actions

Mandatory elements of surveillance

The requirement for all NHS Boards to collect data on Meticillin Resistant *Staphylococcus aureus* (MRSA) bacteraemias will remain. This continues to be an important proxy measure for the incidence of MRSA infections and for HAIs generally. Reporting under the European Antimicrobial Resistance Surveillance Survey (EARSS) protocol is mandatory with immediate effect: this surveillance system has been combined with the Health Protection Scotland (HPS) surveillance system to supply more complete MRSA data, and Boards already have systems in place to collect and submit this EARSS information.

The inclusion of all Meticillin sensitive *Staph. aureus* (MSSA) bacteraemia will also be mandatory with immediate effect as per the EARSS protocol.

10 July 2006

Addresses

For action

Chief Executives, NHS Boards
Chief Executive, Golden Jubilee National Hospital

For information

Director, Health Protection Scotland
Chief Executive, NHS Education for Scotland
Chief Executive, Health Facilities Scotland
Chief Executive, NHS Quality Improvement Scotland
Chief Executive, NHS Health Scotland
Medical Directors
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Surveillance of *Clostridium difficile* will become mandatory from 1 September 2006, and Boards should implement systems from July 2006 with a view to collecting these surveillance data according to the Scottish Surveillance of HAI Programme (SSHAIP) protocol. All SSHAIP protocols are available at http://www.hps.scot.nhs.uk/haiic/HDLSurveillanceMay06.asp

As previously stated in HDL(2001)57, all Boards are required to implement surveillance of in-patient surgical site infection (SSI) for at least two operative procedures: these were chosen from a list provided with HDL(2001)57, now revised and available within the HPS SSI SSHAIP protocol version 4 (weblink as above). In order to achieve comparable indicators across Scotland and beyond, **surveillance of hip arthroplasties and caesarean sections will be mandatory from 1 January 2007** for those boards performing these procedures. However, if Boards do not perform one or either of these two procedures, then they should substitute from the list within the SSHAIP protocol. Neurosurgery SSI surveillance is now included within this 'voluntary' list and is therefore no longer mandatory, with immediate effect.

Post Discharge Surveillance (PDS) must be undertaken, using prospective readmissions data, up to 30 days following discharge on **all** orthopaedic surgical cases under inpatient surveillance, as specified in the SSHAIP protocol. PDS on caesarean sections will also be mandatory for the 30 days following discharge, and a protocol and methodology for this will be defined in the SSHAIP SSI protocol. **Reporting on these two PDS areas is mandatory from 1 January 2007**.

The table below sets out the changes required and the date by which they should be implemented.

Mandatory data to be collected	**Action required**	**Deadline**
MRSA bacteraemias • Reporting under EARSS • All *Staph. aureus* bacteraemias (including MSSA)	• All MRSA cases to be reported using EARSS criteria • Put systems in place	Immediate
Clostridium difficile	Put surveillance systems in place Reporting by SSHAIP protocol	from July 2006 1 September 2006
Surgical site infections to include hip arthroplasty and caesarean sections	Put surveillance systems in place Reporting by SSHAIP protocol	from July 2006 1 January 2007
Post Discharge Surveillance • to be undertaken using readmission surveillance for 30 days post discharge on all orthopaedic surgical cases. • Caesarean sections	Reporting by SSHAIP protocol	1 January 2007

Voluntary elements of surveillance

We encourage NHS boards to comply with the NHS Quality Improvement Scotland (NHS QIS) standard for surveillance within the NHS QIS HAI Infection Control Standards. As a mimimum, structures should be in place for alert organism surveillance, alert condition surveillance and surveillance of HAI outbreaks with reporting according to the existing SSHAIP HAI outbreaks protocol in all NHS directly managed beds within NHS Boards.

In addition to mandatory requirements for surveillance, all infection control teams should also target local HAI surveillance to locally identified priority areas. Whenever possible, this surveillance should be carried out using SSHAIP surveillance protocols. Boards are encouraged to implement as many of the 'voluntary' list of surveillance topics as possible, and a minimum of two in addition to the compulsory elements.

It is widely recognised that increasing resistance to antibiotics and other antimicrobials poses a major threat to the public health. The Antimicrobial Resistance Strategy for Scotland (2002) is currently being revised, and this will include recommendations for future surveillance of resistant organisms. An essential first step is the standardisation of routine resistance testing by NHSScotland laboratories, and the HAI Task Force is looking at supporting this by capital investment in automated sensitivity testing equipment. NHS Boards will be expected to contribute to implementing and sustaining this important initiative, which will be the subject of future communications from the Department.

An integrated and validated system of surveillance is vital for informing local and national interventions and strategic development, and in ensuring the earliest possible ascertainment and characterisation of new and re-emerging hazards. I am grateful for your assistance in ensuring the implementation of the above requirements

Yours sincerely,

[redacted]

KEVIN WOODS	PAUL MARTIN	DR HARRY BURNS
CE NHSScotland	Chief Nursing Officer	Chief Medical Officer

Extract from ARHAI Scotland Electronic Report Template – Filtered for entries from NHSGGC Paediatrics 2019-2023

Date First Reporting	4_Specialty.grouped	5_Ward	6_Organism	Date First Reporting	HIIAT_Highest
31/01/2019	Neonatology	SCBU	Environmental Bacteria: Serratia marcescens	31/01/2019	Green
14/03/2019	Paediatrics	Paediatric	Respiratory Viruses: Varicella zoster	14/03/2019	Green
22/05/2019	Paediatrics	Ward 1D	Gastrointestinal Bacteria: CDI	22/05/2019	Green
23/05/2019	Neonatology	NICU	Commensal Organisms: S.capitis	23/05/2019	Green
14/06/2019	Neonatology	NICU	Other Fungi/Yeast: Malassezia	14/06/2019	Green
23/09/2019	Paediatrics	1D/ PICU	Other Gram-Negative Bacteria: Bordetella pertussis	23/09/2019	Amber
05/11/2019	Paediatrics	PICU	Environmental Bacteria: Acinetobacter baumanii	05/11/2019	Green
19/11/2019	Paediatrics	PICU	Environmental Bacteria: Pseudomonas aeruginosa	19/11/2019	Green
28/11/2019	Intensive care	1D/PICU	Environmental Bacteria: serratia marcescens	28/11/2019	Amber
20/12/2019	Neonatology	SCBU	Commensal Organisms: Group B Streptococcus	20/12/2019	Green
20/12/2019	Neonatology	NICU	Environmental Bacteria: Serratia marcescens	20/12/2019	Green
17/03/2020	Paediatrics	Ward 6a (paeds) Haem-onc	Other Gram-Positive Bacteria: VRE	17/03/2020	Green
09/04/2020	Oncology	6A	Other Gram-Negative Bacteria: Klebsiella pneumoniae, Enterobacter cloacae	09/04/2020	Amber
16/07/2020	Neonatology	NA	Environmental Bacteria: Acinetobacter ursingii	16/07/2020	Green
28/07/2020	Neonatology	NICU	Other Gram-Negative Bacteria: Enterobacter clocae	28/07/2020	Green
28/07/2020	Neonatology	NICU	Other Gram-Negative Bacteria: Klebsiella Oxytoca	28/07/2020	Green
10/09/2020	Paediatrics	PICU	Other/Mixed: Acinetobacter nosocomialis. Enterobacter cloacae complex	10/09/2020	Green
30/09/2020	Neonatology	NICU	Commensal Organisms: MSSA- Gentamicin Resistant	30/09/2020	Green
15/10/2020	Neonatology	NICU	Environmental Bacteria: Serratia marcescens	15/10/2020	Green
25/01/2021	Paediatrics	Ward 1D	Other Gram-Negative Bacteria: Mixed: Klebsiella varicola, Sphingomonas paucimobilis	25/01/2021	Amber
11/03/2021	Paediatrics	RHC PICU/NICU and Vicotria	Environmental Fungi: Rhizopus	11/03/2021	Red

		Infirmary NHS Fife post natal ward and NICU			
17/03/2021	Paediatrics	1D	Environmental Bacteria: Mixed: Serratia marsescens, Acinetobacter nosocomialis, E Coli	17/03/2021	Green
30/03/2021	Paediatrics	Ward 1D	Other/Mixed: Mixed: Acinetobacter nosocomialis, E Coli, Stenotrophomonas maltophilia and Klebsiella pneumoniae	30/03/2021	Green
15/04/2021	Neonatology	NICU	Environmental Bacteria: Serratia marcescens	15/04/2021	Amber
26/04/2021	Paediatrics	NICU	Other Gram-Negative Bacteria: Enterobacter cloacae	26/04/2021	Green
28/05/2021	Neonatology	NICU	Commensal Organisms: Staphylococcus capitis	28/05/2021	Green
06/08/2021	Paediatrics	6a	Other Gram-Negative Bacteria: Mixed: Enterobacter cloacae, Enterobacter cancerogenus, Klebsiella pneumoniae.	06/08/2021	Amber
15/11/2021	Paediatrics	NICU	Environmental Bacteria: Burkholderia contaminans	15/11/2021	Green
07/01/2022	Paediatrics	NICU	Commensal Organisms: Staphylococcus capitis	07/01/2022	Green
13/01/2022	Paediatrics	6a	Environmental Bacteria: Chryseobacterium species	13/01/2022	Amber
15/03/2022	Paediatrics	NICU	Environmental Bacteria: Burkholderia contaminans	15/03/2022	Green
06/05/2022	Neonatology	NICU	Environmental Bacteria: Burkholderia contaminans	06/05/2022	Green
25/05/2022	Paediatrics	Ward 1D (PICU)	Other Gram-Negative Bacteria: Klebsiella pneumoniae	25/05/2022	Amber
01/08/2022	Neonatology	NICU	Environmental Bacteria: Pseudomonas putida	01/08/2022	Green
14/12/2022	Paediatrics	NICU	Environmental Bacteria: Mixed: Burkholderia contaminans Serratia marcescens	14/12/2022	Green
15/02/2023	Oncology	2A	Unknown: NA	15/02/2023	Green
24/05/2023	Neonatology	NICU	Env Bacteria: Mixed: Serratia marcescens. Other GNB	24/05/2023	Green
12/07/2023	Intensive care	PICU	Environmental Bacteria: Pseudomonas aeruginosa	12/07/2023	Red
28/09/2023	Neonatology	NICU	Environmental Bacteria: Serratia marcescens	28/09/2023	Green
13/10/2023	Haematology	Ward 2A & 2B	Other Gram-Negative Bacteria: Bordetella pertussis	13/10/2023	Green
08/11/2023	Neonatology	NICU	Commensal Organisms: Staphylococcus aureus	08/11/2023	Green
22/12/2023	Paediatrics	PICU/Theatre	TB: Mycobacterium tuberculosis	22/12/2023	Green

Page	Section	Statement	GGC comment	HPS comment
3	Introduction	..is investigated admissions have been restricted admissions...	Duplicate words	Accepted Removed duplicate word "admissions"
3	Introduction	...the reported increase in environmental Gram-negative blood cultures...	There has been reported a potential increase in cases.	Accepted Removed 'reported' and added 'suspected'
3	Introduction	Objectives	Can we ask why an exploration of the potential causes of the perceived increase were not part of the objectives?	This was a review of clinical data. Information required to answer the objective was not provided.
4	NHSGGC CLABSI surveillance data	n/a	The note on CLABSI should say the denominator is bed days. Could this be stated? In addition, regarding those pts getting lines outwith RHC. Only 2 patients in the past 14 months were excluded from this process.	Denominator not mentioned, only case number reviewed. Protocol supplied by NHSGG&C will be added to Appendix 1. Regarding the comment about patients getting lines out with RHC, this was a method section so would not include numbers. Wording was changed to 'Exclusion criteria..'.
4	NHS GGC ECOSS extract	n/a	As written, suggests this was raw data – details of protocol for deduplication and validation of haem/onc cohort were included in information provided to HPS and should be included here	Protocol supplied by NHSGG&C will be added to Appendix 1 and reference been added to start of the Methods section.
5	HPS data extract – ECOSS data	...or the equivalent within Schiehalion ward in Yorkhill hospital...	Was Yorkhill ward 7 (teenage cancer trust) included in this data so that we can benchmark against our own data.	Ward 7a was included in the data
10 1 A49756324	Table 3	Episodes missing from both the NHSGGC Micro LIMS and CLABSI and datasets	Word missing	Accepted Extra word "and" removed. In addition the following changes were made: Amend (n=5.9) to (n=5) Change time period in heading to June 2014 to

				September 2019. Table 2 and 3: Column 1 heading change to "HPS episodes without corresponding NHSGGC episode" Column 2 heading "NHSGGC episodes without corresponding HPS episode" Table2: 18 years of age or above (not ">18")
12	Figure 3	Scale	The magnitude of outpatient v daycase means using the same scale on y axis for both is perhaps a misrepresentation of the scale of the change in day cases?	Comparison should be made using the same scale
12	Case level data	Paragraphs 1 and 2	Given the potential overlap between case definition groups, and differences at group and species level, this text is difficult to follow. Would it be possible to have this represented as a graphic?	Reworded to explain case numbers using different case definitions. Unable to show graphically as not mutually exclusive counts – cases de-duplicated within each case definition grouping.
12	Case level data	Approximately one third (33.5%, n=56) of the species episodes reported formed part of polymicrobial environmental gram negative bacteraemia episodes.	The first half of the paragraph is about ENV/ENT group, this sentence appears to be about ENV group. We would ask that this text should be clarified.	The paragraph moved to the paragraph before and is referring to environmental including enteric group.
12	Case level data	..extensive drain contamination...	Drains will contain enteric organisms, a more precise description would be helpful	Removed the word extensive from text. The organisms isolated from the drain were included in the methods section.
7 & later figures	Incidence Rate	Rate per 100,000 total occupied bed days	SPC charts are per 1000 bed days, would be good to be consistent with scale throughout	Figures 4, 6 and 7 missing y axis label – updated and typo in Methods changed to 'Rate per 1,000 total occupied bed days..'
16	Comparison with other boards	N/A	In September 2018 a significant change occurred as we decanted	Figures added comparing data since the move to QEUH (October 2018 to September 2019). Please

			to ward 6a and 4b. The previous HPS SBAR detailed comparative data with NHS Lothian and NHS Grampian for the one year time period following that move. The same comparison should be detailed in this report.	note the comparison is for the whole hospital (RHC plus wards 6A and 4B of QEUH) to the combined rate a the other two hospitals.
17&18	Figure 8&9	n/a	As this is a chart of %, it would be helpful to total count, and perhaps time period labelled.	Accepted, total count added to existing time periods detailed in footnote 2.
19	Limitations	There may also be important environmental bacteria in this setting that were not identified for inclusion in the environmental bacteria grouping	Could we suggest that this is extremely unlikely, given the search strategy included all gram positive and gram negative bacteria.	Statement removed
20	Summary and Recommendations	SPCs	When the SPCs were produced were the cases during the water and drain incident from 2018 excluded from the analysis? Is the Upper Warning Line (UWL) statistically significant or is it an indication to review.	Yes, excludes Sep 2018 – mean based on pre-RHC data Focus should not be of statistical significance as there is no formal hypothesis to test. If the process is in control and all characteristics of the process are the same as in the reference period then you would expect to have points above the UWL 2.5% of the time. Any point about the UWL needs to be reviewed. Indication/warning trigger to review.
20	Summary and Recommendations	n\a	Could there be some detail/ explanation about the clinically defined high risk group i.e. The restrictions were agreed by	Suggested wording to be provided from NHSGG&C

			microbiology and clinicians based on those deemed clinically high risk: newly diagnosed patents undertaking induction chemotherapy and infusional chemotherapy patients	
20	Summary and Recommendations	The statement "NHS GG&C should develop clear justification for the continued restriction on services for newly diagnosed patients".	Does HPS recommend that the continued closure should be reconsidered based on the report findings and the controls which have already been put in place by NHS GGC? Does the report support the IMT conclusion that NHS GG&C does not have evidence the hospitals patient pathway/ environment was the cause of the variation in gram negative infections?	Recommendation updated ' NHS GG&C should consider current control measures around restriction on services for newly diagnosed patients.'
25	Appendix 1	CLABSI and GGC selected Gram Negative columns	How these lists were generated needs to be explained, and in terms of selected gram negative list the column is inaccurate (data were extracted at genus level, and other organisms were included in the grouping, but there were zero results in ECOSS for them).	These were the organisms included in each dataset with positive isolates – does not include every organism of interest if no cases were found during the time period. Footnote added to tables.
7			What is the statistical opinion on the use of SPC charts for organisms that are not	Need further clarity on what is being asked

			endogenous flora and considered non endemic?	
12			The SPC chart is not identifying outbreaks. During Feb- Sept 2018 there was a significant water/drain contamination incident with 23 cases and typing results linked to environmental isolates. However at no point is the UCL breached. There are several other episodes whereby the definitions in Chapter 3 of the national manual are met yet not detected by these charts There are no charts provided for individual organisms, again meaning that outbreaks can be undetected. These would however likely be too sensitive due to the non-endemic nature of these organisms. UCLs are likely to be frequently breached. I would be worried about using SPC charts moving forward as	Not all outbreaks will show in an SPC chart so should be used in conjunction with other triggers and local monitoring.

			they may lead to a false sense of security and the concept of preventable HAI is lost in them.	
17			The QEUH 6a/4b chart does not appear to contain all the cases from the current incident therefore the diverity is not captured There is huge diversity within the Pseudomonas genus , therefore the species should be separated out . Some of these cases are Ps putida which is much rarer than Ps aeruginosa	Chart was displayed at genus level.
19		'it is difficult to ensure that the blood cultures are true clinical cases of bacteremia' .	Gram negatives are always treated by microbiologists as clinically signficant especially in such an immunosuppressed patient group, all of these were classed as true cases.	Blood culture bottles are sometimes used to culture aspirate and pus samples so may be labelled as blood cultures.
20			Triggers for environmental Gram negatives have been in place in GGC since 2016 and were adapted from Barat Patels work on neonatal	For info

			outbreaks The triggers for investigation are ; - a single case of bacteraemia - two infections in a 2 week period - three colonisations in a 3 week period - a general increase in environmental Gram negs at the discretion of an ICD - **relevant to current incident, and acknowledges that more than one organism may be involved when there is an environmental source**	
NA			**General comments** There is no commentary on the nature of the bacteria and how they differ from other units. We have previously highlighted that these environmental bacteria are out of keeping with elsewhere. I don't think we can benchmark against Yorkhill which is an old building and based on Legionella results, one which has poor water quality. I don't	Not the scope of this review

			recall Gram negatives being looked for. There is no commentary on the period from Sept 2018-March 2019 where there were no cases - that is key in understanding the hypothesis, a prolonged period with not a single case. It is likely due to environmental control and all the measures that were put in place prior to 6A. Similarly there have been no new cases since the start of October, is this because there is now source control ie. removal of wet material from kitchen. At the time I chaired the IMT we did not have this info but observing the water damage, it would appear to be a long standing drip. This ,coupled with other water leaks on the ward and what is emerging from John Hoods ventilation work could be the explanation i.e. airborne dispersal of bacteria made even more effective by a	

			suboptimal ventilation strategy. Lastly, clinical data is collected routinely by microbiologists for all cases and RCAs undertaken with identification of risk factors and potential source. What would be more useful and should be part of any outbreak investigation is a case control study to identify why some and not other children are developing bacteraemias	

The Scottish Parliament
Pàrlamaid na h-Alba

Jeane Freeman MSP
Cabinet Secretary for Health and Sport

Via email only

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2 May 2019

Dear Cabinet Secretary

Health Hazards in the Healthcare Environment Inquiry

The Health and Sport Committee's inquiry into Health Hazards in the Healthcare Environment has highlighted a range of themes and issues which we wish to draw to your attention. This letter sets out these issues, which we would be grateful for your consideration and response.

As you will be aware in February the Committee launched its inquiry following concerns regarding a range of incidents and infections at the Queen Elizabeth University Hospital (QEUH).

Our short inquiry is looking at the issues arising from the QEUH in the wider context. We have been seeking to identify the scale of any health problems acquired from the healthcare environment in Scotland whilst also considering the wider implications for health facilities across Scotland.

To date, the Committee's evidence gathering has included receipt of 27 written submissions and an oral evidence session held on 19 March with representatives from the Health and Safety Executive (HSE), Healthcare Improvement Scotland (HIS), Health Facilities Scotland (HFS) and Health Protection Scotland (HPS). We issued further correspondence to these organisations on the 22 March and a response was received on 29 March.

Prevalence

One issue we have explored is the scale of health problems acquired from the healthcare environment.

The evidence we received from HPS suggested that levels are low, with 48 healthcare associated incidents and/or outbreaks having possible links to the healthcare environment in the period 1 April 2016- 31 January 2019. HPS detailed this accounted for just 10.5% of the total infection incidents and outbreaks reported to them during the same period.

HPS also highlighted the complexity faced in determining the built environment as the sole contributing factor for incidents due to challenges in assessing whether an incident originated from its design, maintenance or use.

We recognise the existence of these issues as factors in monitoring accurately the scale of health problems acquired from the healthcare environment. However, as we detail in this letter we have concerns regarding how comprehensive the current surveillance and monitoring approach is in identifying incidents and producing accurate data on their prevalence across NHS Scotland.

Are you confident the data provided by HPS is capturing all healthcare associated incidents linked to the healthcare environment?

Monitoring and Surveillance

We believe it is important to ensure appropriate monitoring and surveillance systems are in place not only to identify where the healthcare environment has resulted in incidents or outbreaks but where it may cause potential issues.

The Committee is concerned that problems may only come to light once patients are infected. We have been unable to glean whether – aside from legionella testing – any proactive testing of systems such as ventilation and water takes place. We heard evidence about the point prevalence survey but as this only takes place every 5 years, we are concerned there is nothing else in the meantime.

Can the Cabinet Secretary clarify whether proactive testing of such systems should take place (as well as legionella testing)?

Surveillance to prevent outbreaks

We have been keen to understand whether surveillance systems can be used to prevent outbreaks/infections from occurring in the first place. To what extent do you believe there is scope to consider a more pro-active, routine, forward-looking surveillance element in the approaches currently adopted?

HPS (in response to question 6[1] in our follow up correspondence to HPS) detail that infection surveillance intelligence is used to measure success of infection prevention and control and identify areas for improvement. HPS highlight that currently across NHS Scotland methods used for carrying out surveillance of laboratory samples vary depending on the IT systems available at board level. HPS suggest that development of electronic surveillance systems at a national level may improve intelligence.

[1] Question 6: Can surveillance systems be used to prevent outbreaks/infections from occurring in the first place? (Col 11)

Do you agree that prioritisation should be given to development of such a system? If so, what steps are the Scottish Government taking to deliver a national system? How will it be funded and by when will the Scottish Government be looking to achieve delivery? What changes do you expect a national system to deliver?

Governance of estates and maintenance

The current approach to the governance of NHS estates and maintenance seems to place a high level of dependence on NHS boards own internal mechanisms to highlight possible issues. While there is an expectation on NHS boards to comply with relevant guidance and memoranda, there does not appear to be any external body providing systematic monitoring of NHS boards compliance and performance against some of these standards/expectations. The system relies on the presumption that NHS boards are complying with the guidance. In the oral evidence, Jim Miller from HFS said:

> My organisation presumes that there is compliance with the guidance. Health Facilities Scotland asks for compliance in two areas against the guidance: national cleaning standards and the decontamination of medical instruments. Other areas refer back to the boards' internal management structures and how they use the guidance to best manage their estates.

We are concerned that where systems within an NHS board are not operating effectively, there is limited opportunity for problems to be identified by an external organisation and steps taken to improve an NHS board's performance.

Is this a concern shared by the Scottish Government and if so what steps do you believe should be taken to improve the current approach?

The letter we received from HSE, HIS, HFS and HPS following their oral evidence session provides several examples of the emphasis being placed on the accountability of the NHS board to deliver appropriate monitoring and surveillance. There appears to be a limited role for HIS, HFS and HPS.

Examples from the letter include the following:

- HPS (in response to question 4[2]), detailed that its literature review of risk associated with healthcare ventilation concluded that—

  > "Improper design and poor maintenance of the ventilation systems have repeatedly been identified as contributing factors for outbreak".

HPS state that following these findings one of the recommendations made regarding ventilation in healthcare settings was—

> "Current guidance should be followed (i.e. HAI-Scribe and the Scottish Health Technical Memorandums)"

[2] Question 4: Phillip Couser referenced that HPS had conducted literature research on the issues and incidents internationally on healthcare associated infections that had been attributed to the built environment. It would be helpful to have further information on the findings from that literature review. (Col 18)

- HFS (in response to question 9[3]) explain that boards can monitor and manage compliance in relation to Estates issues areas using SCART (Statutory Compliance Audit and Risk Tool). HFS, however state they do not monitor Boards usage or assessment performance on SCART. Boards utilise the information obtained from SCART to inform their Property and Asset Management Strategy submission, which HFS use to inform NHS Scotland Asset and Facilities report.

- HFS (in response to question 10[4]) referred to the Healthcare Associated Infection System for Controlling Risk in the Built Environment (HAI-SCRIBE). HFS stated it does not monitor Boards usage or assessment performance on HAI-SCRIBE or other risk assessment. HFS manage the NHSS design assessment process (NDAP) which requires boards to make a written statement or evidence that HAI-SCRIBE is undertaken as appropriate to the scale/complexity of the project.

Our concern is the onus is placed on NHS boards to ensure compliance with this guidance. There does not appear to be an external assessment made of whether this is being achieved. Also, when the guidance is not being adhered to by NHS boards there does not appear to be a route for this to be addressed to ensure compliance is achieved. This is also borne out in the evidence received by the Committee from senior infection control personnel within the NHS who state that they have raised concerns on numerous occasions but they were not listened to or they were not acted upon. Some felt their only option was to whistleblow. Are these concerns you also share? Do you consider there should be a greater role to assess and ensure NHS boards are performing and delivering against relevant guidance and standards? Do you think there should be another route by which staff can escalate concerns outwith the NHS board?

Do you believe consideration should be given to greater monitoring by external bodies of NHS boards usage of HAI-SCRIBE, SCART and other risk assessment processes or do you believe the current process enables issues to be identified and where required improved?

During our evidence gathering we considered there to be a lack of transparency and clarity regarding the roles and responsibilities of HSE, HIS, HFS and HPS. We had to request further written information from these organisations to determine who was responsible for specific aspects with regards to health hazards in the healthcare environment. Do you believe roles and responsibilities of these organisations could be made clearer? Do you think consideration should be given to one external

[3] Question 9: Jim Miller said the organisation "presumes that there is compliance with the guidance" and aside from cleaning standards and decontamination of medical instruments, compliance with other areas refers back to the boards' internal management structures (Col 17). Do you know what the NHS boards do to ensure compliance with the rest? What gives confidence that best practice is being implemented across the country

[4] Question 10: Jim Miller referred to the Healthcare Associated Infection System for Controlling Risk in the Built Environment (HAI- SCRIBE) (Col 13). Is there currently any monitoring by Health Facilities Scotland of a board's usage of HAI-SCRIBE and an assessment of their performance against this tool?

organisation having responsibility for monitoring the adequacy of NHS board internal controls?

Relationships between clinical staff and estates staff

The inspection report from HIS on the QEUH highlighted that it was made aware of some challenges in the working relationships between senior staff in the infection prevention and control team and the estates department. The Committee also received written evidence about the concerns of clinical staff not being acted upon. Are the challenges in the working relationships at QEUH unique or are they found in other board areas?

As HIS does not routinely consider the work of estates departments during its inspections what tools and intelligence do you use to assess whether other estate departments across NHS Scotland are operating effectively? If there are concerns with working relationships between departments within an NHS board what steps would you expect an NHS board to take to address these?

When do you consider it appropriate for you to be made aware of concerns and take an active role in ensuring they are addressed?

Plant rooms

One of our written submissions stated that plant rooms at one hospital were infested with pigeons and cockroaches because ‘no-one seems to have been designated responsible for cleaning and/or monitoring these areas.’

Our inquiry has highlighted that plant rooms are not subject to regular routine inspection. HIS inspections focus on the cleaning specification in clinical areas. HIS told us that if concerns were raised about a plant room their inspection team would have the ability to access the area, however they would be likely to refer it to others with appropriate expertise.

The Committee finds it hard to understand why areas such as plant rooms would not be subject to more rigorous cleaning and monitoring. While HIS assured the Committee it would look at plant rooms in response to intelligence about any issues, we believe that due to the hidden nature of such areas, it is unlikely such concerns would ever come to light. As such, it is clear plant rooms must become routine areas for inspection given the issues raised about their cleanliness. We are also concerned about the suggestion that it can be unclear who within a hospital has responsibility for their maintenance. We consider clarity of responsibility for and inspection of these areas should be addressed as a matter of priority. Do you agree with this view and how quickly could plant rooms become part of regular routine inspections?

If HIS is the most appropriate organisation to take on responsibility for inspection of these areas how can it be ensured they have the appropriate expertise to conduct these types of inspection?

Maintenance

The HEI report on the QUEH details a list of around 300 maintenance jobs for a hospital that is less than four years old. HIS told the Committee “Any such backlog could pose a risk to patient care”.

In its most recent overview report on the NHS in Scotland Audit Scotland detailed that the backlog of maintenance for the whole NHS estate in 2017/18 was costed at £889m.

What assurances can you provide that NHS boards are giving the maintenance backlog the priority and funding it requires?

Serious Adverse Events

An issue explored in our inquiry The Governance of the NHS in Scotland – ensuring the delivery of the best healthcare for Scotland was the investigation of serious adverse events (SAEs). An adverse event can be defined as an event that could have caused, or did result in, harm to people or groups of people.

We stated in our Governance Report there was a need for greater consistency on how SAEs are dealt with. The arrangements for recording SAEs present a key tool for managing risk. We called for centralised reporting of SAEs. We stated that it was important to be able to identify in a timely manner similar SAEs which have occurred across boards, and to avoid the build-up of systematic issues which affect the provision of safe and appropriate care.

Have recent events at the QEUH been recorded as SAEs? What changes have been made to reporting monitoring and oversight of SAEs since we made our recommendations in our Governance report in July 2018 and what improvements have these changes made to the operation of the current system?

Specialist expertise

Another recurring theme has been whether the correct expertise is available and is being utilised to assist in the prevention and identification of health hazards in the healthcare environment.

NHS Fife raised concern that a restructuring of microbiology training (whereby trainees now undertake joint training in microbiology and another speciality) had resulted in significantly less training in infection control. NHS Fife were concerned this could result in individuals being less keen to take on infection control responsibilities as a consultant. What steps can the Scottish Government take to ensure infection control is an attractive and appealing role for prospective and new NHS staff?

NHS Fife also highlighted concerns with its current vacancy for a consultant microbiologist. How widespread are staffing shortages in infection control teams and microbiology across NHS boards?

The management of water and ventilation systems can require authorising engineers with highly specialist technical skills. We learnt this expertise was currently being bought in by NHS boards and HFS on a case by case basis.

HFS suggested NHS boards were calling for a team of authorising engineers to be employed hosted by HFS and available to be utilised by individual NHS boards. Ensuring there is appropriate access to this expertise is important. Do you believe employing a team of authorising engineers at a national level will improve access to this expertise for individual NHS boards, reduce risk and be more cost effective?

Building design

One issue discussed during our evidence gathering has been how infection risk is considered in the design and commissioning of new health facilities.

HFS explained it had no formal compliance or assurance role in building design and commissioning but operated in an advisory capacity.

One of the anonymous submissions we received stated that current systems and processes for managing environmental hazards were inadequate. Infection control personnel were either side-lined during design and planning of health facilities or advice was circumvented due to ignorance, time and resource implications.

The inclusion of infection control staff in the selection of equipment was also raised as an issue. For example, taps, sinks, drains and ventilation systems were cited by two submissions as being of particular importance for minimising infection (ref A2 and A3). In relation to ventilation systems specifically, submission A2 wrote:

> Inadequate ventilation systems have been installed in new build hospitals; these are not fit for purpose for the specialist patient groups they are intended for, e.g. bone marrow transplant and haematology wards.
>
> And:
>
> Likewise, the adoption of positive pressure ventilation rooms (PPVL) room design throughout a number of Scottish hospitals is inadequate to protect isolated immunosuppressed and/or vulnerable patients against airborne contamination from both inside the unit and outside the hospital, e.g. other patients; building and renovation.

Submission A2 also states:

> There is plenty of evidence and guidance for appropriate installation, maintenance, decontamination and monitoring of all of these [plumbing, ventilation and cleaning], so there is concern that recent new builds appear to have defaulted on vital systems.

We find these accounts deeply concerning. Will the Scottish Government undertake a review of recently built facilities to assess their compliance with the appropriate installation, maintenance, decontamination and monitoring of vital systems?

Will the Scottish Government also undertake a review to ensure all high risk clinical areas, in both new and existing facilities, have the appropriate equipment for minimising infection?

Infection prevention must be a priority in the design and commissioning of new health facilities and equipment choices. However, the BMA highlights that where infection control staff are involved in the design of a building, they may not have enough time or experience to optimally deliver this input. This is supported to some extent by submissions which highlight staffing shortages in infection control and microbiology, as well as a lack of training for more general staff. The BMA suggests creating a national expert service to provide infection control oversight of new building projects. They also suggest that there should be greater standardisation of new facilities which comply with infection control standards to avoid repeated interpretations of guidance and variation. What further steps can be taken to ensure infection risk prevention is given the appropriate prominence and value required?

Does the Scottish Government see merit in the suggestions for a national expert group in infection control and less variation in building design? Is there also merit in strengthening the role of HFS to ensure infection control is not side-lined during the design and commissioning of buildings?

Cleaning

Some of the submissions we received highlighted the importance of adequate cleaning in controlling pathogens in the hospital environment. However, we heard concerns about the adequacy of cleaning in Scottish hospitals and the resources available to it.

For example one submission we received listed several concerns:

-visual inspections of rooms i.e. if the room looks visually clean then cleaning is not carried out

-daily cleaning is only carried out in ‘high risk areas’ but the author contends that daily cleaning should be conducted for all frequently touched surfaces such as bedside tables

-the use of microfibre mops do not remove dirt but just re-disperse it elsewhere

-environmental sampling suggest that domestic staff have not been trained properly in the use of mops/wipes and the use of cleaning fluids and disinfectants.

This submission also contended that failing to maintain the domestic workforce increases the risk of HAI:

“While management of water and air require urgent attention, cleaning remains the ‘Cinderella’ of infection control.”

We note the HIS report on the QUEH found the hospital had a 14.5% absence and 10% vacancy in domestic staff.

Cleaning is integral to infection control and prevention. Do you consider cleaning the ‘Cinderella’ of infection control? What assurances can you provide that domestic services in Scottish hospitals are adequately resourced?

HIS told us that its recent work had highlighted that sometimes there was a lack of clarity regarding where accountability and responsibility lay for conducting certain maintenance and cleaning tasks. HIS gave the example of the recent increase in

single rooms in new hospitals resulting in more sinks and toilets. HIS explained when these were not being used it was important to ensure someone was responsible for the flushing regime. How is it ensured that NHS boards are keeping their operating procedures up to date for new hospitals? Should this be reviewed centrally and what focus is given to this area in Ministerial annual reviews of NHS boards?

We explored in follow-up correspondence with HFS and HIS (question 16[5]) concerns around a discrepancy in reports of cleaning compliance from HFS and HIS. Whilst Facilities Monitoring Reports from HFS show a high level of compliance with the cleaning specifications across all hospitals, the reports from HIS which cover the same hospitals and time period show a much lower level of compliance. HIS explained that the information referred to relates to different types of monitoring activity by HFS and HIS. However, do you agree that such a difference in assessments undermines confidence in the reporting system?

Whistleblowing

The Committee received submissions which raised a number of concerns about the NHS estate and its role in infection control. Some of those submitting to us wished to remain anonymous, indicating they were not comfortable speaking out.

This reflects the concerns we first raised in our Governance Inquiry Report in July 2018. Our report emphasised the need for a culture of openness and transparency with mechanisms in place for staff to raise concerns in an environment where the support and guidance offered to NHS staff is both valued and trusted.

One of the submissions to our current inquiry stated that Microbiologists in Glasgow highlighted problems and concerns with the building in 2014 and later in 2015. However, in 2017 they raised their concerns via whistleblowing as they felt they had no alternative. This demonstrates that there are instances where NHS staff are not being listened too.

We noted in our Governance Report the forthcoming post of Independent National Whistleblowing Officer had the potential to make a valuable contribution to achieving a cultural change in how the NHS in Scotland treats whistleblowing. This post is still to be created. Please provide an update on when it is expected to be operational and what changes you expect this post to deliver for whistleblowers.

HIS highlighted that they host the whistleblowing helpline, however, as noted in our NHS Governance report this is primarily an advice line for staff and not an investigative line. We still believe that the introduction of a reporting line for NHS whistleblowers would further enhance the external support services available to NHS staff. This recommendation was previously rejected by the Scottish Government. Given the ongoing concerns that current mechanism and procedures are proving insufficient to support whistleblowers. We again recommend its implementation.

[5] The Committee has also received concerns around a discrepancy in reports of cleaning compliance from HFS and HIS. The correspondence states that the Facilities Monitoring Reports from HFS show a high level of compliance (90%+) with the cleaning specification across all hospitals, while the reports from HIS which cover the same hospitals and time period show a much lower level of compliance. Can you please comment on this and if appropriate explain this apparent discrepancy?

Other healthcare environments

Our inquiry remit is explicit in its reference to health hazards in the 'healthcare environment' not just the hospital environment. We also suggest recent events in hospitals regarding healthcare hazards should lead the Scottish Government to consider the current practice and assessment of performance in dealing with health hazards in all healthcare environments (including care homes). We would welcome your views on any reasons why there should be differentiation between sites.

Independent Review of Queen Elizabeth University Hospital

We agree with the sentiments expressed in your Ministerial Statement to the Scottish Parliament on 26 February regarding the importance of ensuring the right clinical experts were appointed to Chair the Independent review of the Queen Elizabeth University Hospital.

You confirmed in a letter to the Committee on 5 March that Dr Brian Montgomery and Dr Andrew Fraser had been appointed as Chairs to the review group.

Your letter details the wealth of experience both will bring to the role, we also note both are former NHS Scotland employees with Dr Montgomery also having worked in recent years with NHSScotland. How will you address and ensure concerns that these close ties to the NHS in Scotland cannot raise any questions about the independence of the review and its potential findings?

Also given neither Chair has direct clinical expertise in the field of infection control or microbiology what expectations do you have that this expertise will become an integral part of their review?

In addition, in a PQ you stated that the independent chair will soon be appointed on the basis of their proven expertise in construction design and knowledge of the health care system. As far as we are aware, neither chair has expertise in construction design. Can you explain why a candidate with suitable experience in construction was not appointed? How will the review access such expertise?

We recognise it is important to ensure a review of this nature is given the appropriate time to gather evidence and formulate its findings. However, given the importance of the issues they are investigating and the potential changes the review findings could bring to current practice, what timescales do you consider would be appropriate for such a review to be concluded?

Given this review will consider building design, commissioning and construction what actions are you planning to implement to ensure ongoing proposals for new hospitals or facilities in Scotland can be informed and incorporate the reviews findings?

What interim steps are expected to be taken by the Scottish Government in advance of the review making its recommendations or are all potential changes in policy approach predicated on what the review concludes?

It would be helpful to receive a response to this letter by Tuesday 14 May to inform our consideration of next steps for our inquiry.

Yours sincerely

[redacted]

Lewis Macdonald

Convener, Health and Sport Committee

Inkster, Teresa

From: Inkster, Teresa
Sent: 05 July 2019 17:50
To: Connelly, Karen; 'denniskelly[redacted]; Gallacher, Alan; Hood, John; Kane, Mary Anne; Kennedy, Iain; Purdon, Colin; Riddell, Mark; 'Tim Wafer'; Steele, Tom
Subject: RE:

Thanks

No comments on the dosing schedule.

Re the action plan and the email correspondence from Tom;

- I think we need to be clear that whilst exposure to atypical mycobacteria is common, infection is not. M chelonae infections in particular are very rare and in Glasgow during the last decade we have had only 4 adult cases , and now we have the two paediatric ones
- the work that Joseph Falkinham at Virigina tech has done on aytpical mycobacteria is important to consider. This has demonstrated survival of M avium (another atypical) to survive during periods where the concentration of disinfectant eliminated heterotrophic bacteria. In one study on pipework elimination of these bacteria led to a population of almost 100% M avium . There are somevery useful papers accessible on pubmed from this author
- it is possible that the lower dose chlorine dioxide is allowing mycobacteria to flourish
- re assessment of biocide activity - this was all considered by the WTG and with a number of experts present. Silver hydrogen peroxide and copper silver were discounted due to resistance and PH levels . Ideally we would have liked to shock dose with Chlorine dioxide but logistically this was felt to be very difficult although we did acknowledge it might eventaully come to that.

Kind regards
Teresa

From: Powrie, Ian
Sent: 01 July 2019 18:33
To: Connelly, Karen; 'denniskelly[redacted]'; Gallacher, Alan; Hood, John; Inkster, Teresa; Kane, Mary Anne; Kennedy, Iain; Mallon, John; Powrie, Ian; Purdon, Colin; Riddell, Mark; 'Tim Wafer'; 'Alistair Cameron'; Steele, Tom
Cc: McNeil, Elaine; Hirst, Allyson
Subject:

Dear all,

Further to last week's review meeting, Please find attached the updated action plan, draft proposal for consultation on "enhanced ClO2 short duration dosing" and associated Appendices.

I would be grateful if you would review and feed back any comments to Alan Gallacher.

Best regards

Ian

[redacted]
Deputy General Manager (Estates)

Queen Elizabeth University Hospital Campus
Property, Procurement & Facilities Management Directorate
Facilities Corporate Services Dept
CMB Building

Queen Elisabeth University Hospital\Royal Hospital for Children

Potable Water System: Proposed Sanitisation Strategy Paper

5/06/2018

The purpose of this paper is to set out the principles required for the systemic sanitisation of the potable water system supplying the Queen Elisabeth University Hospital & Royal Hospital for Children following identification of a systemic microbial and sustaining biofilm contamination of the distribution systems and final outlets.

During the lead time required to develop a suitable sanitisation plan and implementation programme, Sterilising grade Point of Use (POU) filters have been deployed as an interim control measure to maintain the safety of patient groups identified as high risk by the Incident Management Team (IMT).

Data collated from the water sampling programme carried out to date have confirmed the need for systemic sanitisation of the system, previous attempts to decontaminate specific areas using Silver Hydrogen Peroxide and local outlet heat sanitisation have proven to be unsuccessful due to the suspected retention of systemic biofilm which harbours and supports microbial activity.

In order to effectively sanitise the distribution system, biofilm must be chemically treated to penetrate, soften and kill the microbial organisms protected within the biofilm followed by high volume flushing of the pipe work to scour, dislodged and discharge the biofilm from all internal Domestic Hot & Cold water pipe work and valve surfaces.

Sanitant selection:

There are several biocides available which have been considered by the IMT, with respect to effectively addressing the conditions established within the above water system, however the preferred water treatment is Chlorine Dioxide (ClO_2). This preference is based on previous successful experience with ClO_2 across the Boards property portfolio in management and control of biofilm as well as expert advice from Dr Tom Makin, (Microbiologist): Co-author of, HSE, ACOP (L8) on the "Control of Legionella in water systems" and HTM 04-01 "Safe water in healthcare premises". That Chlorine Dioxide (ClO_2) is a proven and effective shock treatment biocide for the disruption and removal of established biofilm and in control of microbial activity by continual water treatment.

Advice was also sought from Dennis Kelly, (Boards Authorising Engineer Water) who agreed that ClO_2 would be the most effective treatment for established biofilm, Dennis introduced a relatively new ClO_2 produce "Clorious 2 Care" which is a stabilised ClO_2 solution.

Traditionally ClO_2 is manufactured using in a 2 part chemical production process mixing Chlorite & and acid activator and is highly corrosive due to its acidic content. "Clorious2 Care" (patented Product) is manufactured mixing a chlorite and oxidising per-sulphate with

1. *provided a 100% conversion of Sodium chlorite to ClO_2*
2. *No acid produced*
3. *Low level Chlorite and chlorate concentrations during production will below WHO limits for drinking water*

4. *Stabilised manufactured product, therefore no reversion to Chlorite & Chlorate*
5. *Increased efficacy of ClO_2 (approx 30% improvement).*
6. *Allows for potential increase shock dosing levels (to be confirmed with pipework manufacturer)*
7. *Improved efficacy at 0.5 PPM WHO dosing levels.*
8. *Stabilised solution release lower levels of gaseous chlorine dioxide and also to have a lower odour impact within the working environment and reduced H&S risk.*

BSI Published Document, PD 855468:2015 (Guide to the flushing and disinfection of services supplying water for domestic use within buildings and their curtilages) states that:

"Only biocides and materials appearing in the List of Approved Products for use in Public Water Supply in the United Kingdom published by the Drinking Water Inspectorate should be used in contact with water."

"Clorious 2 Care" *is registered in the approved products list Ref:* ***DWI 56/4/1196*** *under section A4: "Disinfestation, Disinfection or Cleaning Agents of Waterworks Apparatus and Distribution Systems "*

Recommendation 1: *IMT approve the adoption ClO_2 as the treatment chemical for control of the QEUH water system.*

Recommendation 2: *IMT approve "Clorious 2 Care" over traditional ClO_2 production methods.*

Queen Elisabeth University Hospital\Royal Hospital for Children

Potable Water System: Proposed Sanitisation Strategy Paper

5/06/2018

Water Treatment: *The Proposed treatment process to establish an effective control of the system is to install water treatment plant for continual dosing of the system via the bulk storage filtrate tanks proportional to supply volume at >0.5ppm (in line with EU Drinking Water Directive & World Health Organisation Guidance) for distribution throughout the Domestic Cold Water (DCW) & Domestic Hot Water (DHW) systems to establish a maximum residual ClO_2 level of 0.5mg\l (0.5 PPM) at the point of use (user outlets) , at least 4 weeks ahead of the shock treatment. This will allow for pre-shock treatment control levels to be established as a baseline and will support establishing system control levels post a shock treatment to achieve an effective and sustainable control of the water system.*

This treatment process will require routine inspection and maintenance detailed in the bulleted list below which is usually sufficient to ensure control, with any remedial action taken when necessary and recorded.

a) *Weekly – check the system operation and chemical stocks in the reservoir;*
b) *Monthly – test the treated water for both chlorine dioxide and total oxidant/ chlorite at an outlet close to the point of injection to verify the dosage rate and conversion yield;*
c) *Monthly – measure the concentration of chlorine dioxide at the sentinel taps – the concentration should be at least 0.1 mg/l; and adjust the chlorine dioxide dosage to establish the required residual at the sentinel sample points;*
d) *Annually – test the chlorine dioxide and total oxidant/chlorite concentration at a representative selection of outlets throughout the distribution system – the concentration should be at least 0.1 mg/l chlorine dioxide.*
e) *A recorded programme of regularly flushing of outlets (in line with NHS guidance for flushing of seldom used outlets) is required to maintain chlorine dioxide residual levels*

During initial set up, the system will be monitored on a daily basis for the first week and then weekly for the first month at key sentinel points to establish residual ClO_2 levels achieved across the system, once a level of 0.1mg\l (0.1 PPM) is achieved in any area Microbiological monitoring will commence at the agreed sentinel points to establish efficacy of the system as the residual level increase.

Once an acceptable baseline has been established, continual monitoring protocols will be agreed via the IMT.

Shock Water Treatment: *In order to effectively disrupt and remove established biofilm, Dr Tom Makin recommended that the shock treatment should be carried out at 30 mg\l (30PPM) for a contact time of one hour, followed up by a high volume flushing programme at all outlets to scour, dislodge and discharge biofilm from the system. However there have been multiple concerns raised by the authorising Engineer (Water), chemical manufacturers, system material manufacturers etc that this level is undeliverable within a live hospital environment, namely:*

- *Effect on the integrity of the water system and its components.*
- *Strong chlorine disinfectant odour,*
- *Concern over the presence of unacceptable chlorine dioxide gas levels in a live the hospital environment during the disinfection process that may impact on the patients with potential irritation, sensitisation issues at this strength.*
- *Safety implications of mixing and using chlorine dioxide*
- *Charging chlorine dioxide solutions into the bulk storage tank in an enclosed and unvented area.*

- *Adverse long term impact on water distribution system components, where material are susceptible to chemical induced stress corrosion failure.*
- *System contact time limits at this strength*

It should be noted that the Manufacturers of the Stainless Steel pipework and associated valves (Pegler\Yorkshire) have imposed a 5mg\l (5ppm) limit with a maximum 12 hour contact time (including flushing programme) on shock dosing or 10mg\l (10 PPM) for a contact time of 3 hours (including flushing programme). However due to the size and scale of the system a 3 hour window is in sufficient to execute the required measures. It is therefore proposed that the system be treated at 5mg\l (5ppm) for a contact time of 6 hours to achieve the same efficacy as dosing at the recommended 30 mg\l (30PPM) for one hour contact time? Followed by a 6 hour flushing programme to bring the system back to 0.5mg\l (0.5PPM) at the outlet in line with continual dosing protocol levels.

Due to the scale and complexity of the distribution system the shock dosing and flushing procedures will be carried out over 7 stages based on each discrete Domestic Hot Water System (DHWS) distribution arrangements, namely:

Booster set No 1:

- *Plant room 31 – 122 Cal 01,02 & 03 (Adult Podium:-AAU, MDU & Stroke wards, Theatres)*
- *Plant room 31 – 128 Cal 07, 08 & 09 (Ward Tower "B" wing)*
- *Plant room 31 – 129 Cal 04, 05 & 06 (Ward Tower "C" wing)*
- *Plant room 32 – 223 Cal 01,02 & 03 (Ward Tower "A" wing)*
- *Plant room 33 – 323 Cal 01,02 & 03 (Ward Tower "D" wing)*

Booster set No 2:

- *Plant room 21 – 123 Cal 01,02 & 03 (RHC & Adult ED, Adult ARU, ICU & CCU)*
- *Plant room 41 – 123Cal 01, 02 & 03 (RHC Wards & OPD) & Plant room 22 – 223 Cal 01, 02 & 03 (RHC Theatres & Adult OPD).*

During these shock dosing stages the Staff & patients within each stage of the process will be without hot & cold running water for a period of 12 -24 hours.

During the shock dosing process the residual strength of ClO_2 will be monitored at agreed sentinel points on each system to ensure that the residual chemical is maintained above 60% of its initial value, should this fall below 60% the process will require to be repeated.

Microbiological monitoring of each stage will commence at identified sentinel points 5 days after the completion of the shock dosing of each system.

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5/06/2018

Recommendation 3: *IMT approve the proposed shock dosing programme at 5mg\l (5ppm) for a 6 hour contact time, followed by 6 hours flushing programme to bring the system back to 0.5mg\l (0.5PPM) at the outlet in line with continual dosing protocol levels.*

Recommendation 4: *IMT to agree minimum continual dosing ClO_2 residual levels of 0.1mg\l (0.1PPM) for commencing microbiological monitoring at agreed sentinel points.*

Risk Assessment & HAI SCRIBE requirements:

Due to the complexity of this process within a live hospital environment a Risk assessment and Method statement (RAMS) and HAI SCRIBE will require to be developed with key stake holder involvement to address the following issues:

I. *HAI Scribe relating to:*
   a. *Exposure \control arrangements chemical irritant\odour*
   b. *Exposure\control of to biofilm discharge*
   c. *Exposure\control of building services risers etc within the patient environment.*

II. *RAMS:*

   a. *Alternative water supply arrangements during shock Dosing?*
   b. *Bulk storage tank\micro filtration cleaning\sanitisation.*
   c. *Chemical management & control continual dosing*
   d. *Chemical management & control shock dosing*
   e. *Shock dosing logistics*
   f. *Set and agree sentinel monitoring points*
   g. *H&S Engineering works*
      i. *H&S Pipework engineering modifications.*
      ii. *Machinery and equipment isolation;*
      iii. *Work in confined spaces;*
      iv. *Manual handling;*
      v. *Work at height;*
      vi. *slips, trips and falls;*
      vii. *Electrical equipment;*
      viii. *Personal protective equipment;*

The Risk Assessment (RA) will be carried out by members of the Incident Management Team where appropriate including:

a) *Lead ICD*
b) *Lead ICN*
c) *Clinical Leads*
d) *H&S Representative*

e) Estates
f) Site appointed Water Management Risk assessor
g) Authorising Engineer (Water Systems)

Summary of IMT approval requirements:

The IMT are requested to approve the following recommendations to allow these to progress to full development:

Recommendation 1: *IMT approve the adoption ClO_2 as the treatment chemical for control of the QEUH water system.*

Recommendation 2: *IMT approve "Clorious 2 Care" over traditional ClO_2 production methods.*

Recommendation 3: *IMT approve the proposed shock dosing programme at 5mg\l (5ppm) for a 6 hour contact time, followed by 6 hours flushing programme to bring the system back to 0.5mg\l (0.5PPM) at the outlet in line with continual dosing protocol levels.*

Recommendation 4: *IMT to agree minimum continual dosing ClO_2 residual levels of 0.1mg\l (0.1PPM) for commencing microbiological monitoring at agreed sentinel points.*

Ian Powrie

Deputy General Manager (Estates)

Authorising Engineer (Water) Annual Report December 2016 to December 2017

Client: NHS Greater Glasgow and Clyde
Date: February 2018
Customer: Mr A Gallacher, General Manager (Estates)
LCI Staff Member: Dennis Kelly

Legionella Control International Ltd.,
Warren Bruce Rd, Stretford, Manchester, M17 1LB,
United Kingdom.
Company Registration Number: 5325807

Contents

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1. Background

The Legionella risk reduction programme adopted by NHS Greater Glasgow and Clyde (NHS GGC) is supported by the use of an Authorising Engineer for water (AE). Part of the role of the AE is the completion of an annual report to comment on the suitability and effectiveness of the NHS GGC Legionella based risk reduction processes and procedures that are used in NHS GGC properties.

This report provides information on the processes and procedures as seen from late 2016 through to December 2017.

Comments are made on the following:-

- Management structure
- Risk assessment
- Remedial actions
- Written schemes and ongoing risk reduction procedures
- Training and authorised person competency
- Legionella sampling and results
- Pseudomonas

The plan for 2017 included the AE being invited to attend two Water Safety Group meetings. However no invitation to attend any of the Water Safety Group meetings was received during 2017. As a consequence of this the AE is not always provided with updates on the status of many of the risk reduction management processes and procedures that are covered in this report.

The comments made do not cover the risk reduction processes and procedures that are undertaken at any PFI hospitals or PFI properties that may form part of the NHS GGC estate. While another NHS Board has decided to include PFI properties in the annual review process, this is currently not the case in NHS GGC.

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2. General Findings and Executive Summary

The AE has been involved with NHS Greater Glasgow and Clyde for approximately 34 months. In that time a number of AE related tasks have been completed and these are commented on in this report.

We would summarise our findings as follows:-

- The levels of understanding of the Estates staff at the various hospitals that were visited by the AE can best be described as mixed. This is the same statement that was made in last year's annual report. Many of the estates staff have attended training course in the past eighteen months. However, the level of understanding as evidenced by the answer to questions in some of the hospital audits was at times less than would be expected. There is therefore opportunity for improvement in this area.

- With regard to risk assessments, there does not appear to be a centrally controlled or directed process for completing risk assessments. As a result a number of different suppliers have been used. This again is the same statement that was made in the 2017 report.

- The application of the risk control processes and procedures, as evidenced by the hospital audits that have been completed is also best described as mixed. There are hospitals where many of the required risk reduction processes and procedures are being applied and recorded, some hospitals where there are a number of the required tasks being applied, and properties where it appears that very few of the required tasks are being completed. As a result there are situations, where in the event of a legionella related problem occurring, the hospital in question would be exposed to criticism.

- With regard to logging and recording task completion and the required data, most of the hospitals rely on a paper based system. There are areas where electronic task planning and data collection is in place, and indeed some hospitals which seem to utilise a mixture of paper and electronic recording. There does not seem to be a centrally controlled or directed approach to the planning and recording of the required tasks and data collection. The level of recording of the required data was also mixed across the hospitals that were audited.

- As part of the role of Authorising Engineer (AE) a check and measure of the technical competence of the Estates staff who are to be appointed as Authorised Persons (AP) should be made. This requirement is described in the SHTM 04-01 Part B document. Given the large size of the NHS GGC Estate, only a relatively limited number of people have so far been assessed and nominated as being suitable to be considered as authorised persons. It

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should also be noted that there were no requests received by the AE during 2017 for any AP competency checks to be completed.

- A programme of AE works was agreed in October 2016, to be completed in late 2016 and 2017. All the requested work was completed by the AE. However there was some work that was planned but not requested. Details of this are given later in this report.

- It was stated that any additional AE work that was requested within the NHS GGC estate should be considered as additional and that separate locally raised order numbers would be required for the work to be undertaken.

- Other than the agreed contract work, one small piece of additional work was requested during 2017. Details of this can be found later on in this report.

- Outwith the centrally agreed workload the AE was asked to be involved in the following:

    - Comments on the water system upgrades for Wards 20 and 21 at the GRI.

3. Management Structure/Water Safety Group

Water Policy Document and Water Procedures Document

NHS GGC have a Water Systems Safety Policy document. It states on the cover that the policy document should be read in conjunction with the NHSGGC Water Safety Written Scheme and Operational Procedures document.

The Water Systems Safety policy document is dated May 2016 and it states that it is due for review 12 months from the date of approval.

With regard to the Water Safety Written Scheme and Operational Procedures, this document is dated February 2014, and it states that it is due for review on February 2015. At the time of completing this report, the AE understands that the document was being reviewed.

It is recognised therefore that NHSGGC does have both a policy and procedures documents in place. The current status of the documents is unknown in terms of review and update status, and also circulation and application across the NHSGGC estate.

Management Structure

The Water Systems Safety Policy document defines the roles and responsibilities of the following staff:-

- Chief Executive – Duty Holder

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- The Corporate Management Team
- Director of Facilities – Designated Person (Water)
- Infection Control Manager – Designated Person (Pseudomonas)
- Sector Estates Manager – Responsible Person (Water)
- Authorising Engineer
- Authorised Person
- Head of Capital Planning – Deputy Responsible Person (Water)
- Site Maintenance Manager/Site Estates Manager – Deputy Responsible Person (Water)
- Acute Services Directors, CHCP Directors and Corporate Division Directors
- Heads of Service, Departmental Managers, Clinical Managers, Senior Charge Nurses

The comments that were made on this document by the AE on April 1st 2015 contained suggestions on the roles and responsibilities of the various involved parties.

The policy mentions the "NHSGGC Water Systems Safety Group" in the governance section of the document. It further mentions that this group reports to the Board Infection Control Committee. This is outlined in a "Governance" organogram in section 4 of the document. This organogram indicates that there should be Sector Water Systems Safety Groups which should be chaired by the Sector General Facilities Managers.

At the time of completing this report the AE has not been invited to any Board Water Systems Safety Group meetings in the past twelve months.

Since the involvement of LCI with NHSGGC, the AE has been invited to partial attendance of one Sector Water Group Meeting in the Partnerships Sector.

It is noted that the Water Systems Safety Group has a terms of reference.

In other Boards it appears to be standard practice that the AE is invited to the water group meetings. Attendance at Water Group Meetings is outlined as being "desirable" in the specification for the role of AE. This does not appear to be the case for NHSGGC and while we understand that this may be Board policy, we would recommend that consideration is given to inviting the AE to the Water Systems Safety Group meetings at Board and at sector level, in order to help the process of continual improvement.

For reference we have copied the guidance given in the SHTM 04-01 Part B document on the structure and role of Water Safety Groups and this is detailed below.

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Water Safety Group

Water Safety Groups (WSG) within NHS Boards will be led and chaired, as a minimum, by the Responsible Person (Water) who will ensure that responsibility is taken for microbiological hazards and are identified by appropriate Group members They will assess risks, identify and monitor control measures and develop incident protocols. WSG should be a sub-group of and report to the Chair of the hospital Infection Control Committee and ensure a coordinated approach exists between Infection Prevention and Control Teams, clinical staff and Estates & Facilities on all water issues. There should be a clear line of responsibility to the Chief Executive through the Infection Control or other Committee.

The Water Safety Group will be responsible for supporting, co-ordinating and reviewing operational management and controls in accordance with statutory requirements (such as COSHH and HSE ACOP L8) and mandatory requirements (such as SHTM 04-01), for when and where water is supplied, stored, distributed and used safely, by:

- *providing leadership for the overall provision of water services management and supervision for maintenance, operational and design procedures;*
- *facilitating Water Safety Group meetings (at least quarterly) with formal minutes, with stakeholders concerned on a regular basis;*
- *setting, promoting and maintaining consistent standards and practice;*
- *providing advice and preparation of safety and risk control notices;*
- *ensuring that Legionellosis risk assessments are compiled and refreshed every two years (with interim risk re-assessment being conducted as and when appropriate e.g. if there is a significant change to a water distribution system or change of use by the users);*

- *ensuring that Legionellosis risk assessments are reviewed at Water Safety Group meetings;*
- *ensuring that drinking water quality standards are maintained;*
- *ensuring that premises and site performance are reviewed in SCART and in the NHS Board (Datix) Risk Register;*
- *developing and agreeing risk based programmes of work to reduce risk;*
- *ensuring that the system to collect information and measure the efficiency, effectiveness and reliability of the management arrangements against set performance standards is regularly reviewed and instigating plans for corrective actions where required;*
- *ensuring that the policy, operational, maintenance and design procedures and training are regularly reviewed and updated as required to take account of new legislation, guidance, changes to personnel, procedures, protocols etc. and as a result of audit findings*
- *promoting new technologies and encouraging innovation;*

the Water Safety Group will report quarterly to the NHS Board's Corporate Health & Safety Committee. Membership will comprise representatives of Senior Nurses, Estates, Medical Physics, Health & Safety and Domestic Services Managers. An acceptable quorum will be determined by individual NHS Boards as appropriate.

Management Structure

It is noted that over the past 12 months there have been a number of retirements of senior hospital engineer staff. It is also understood that there may have been structural and reporting changes within the NHS GGC Sector arrangements and within the Estates Department in general. It is pointed out that the AE could find no evidence of these changes during the hospital reviews that were undertaken throughout 2017/18. Additionally, no information on any management or structural changes that may have taken place have been intimated to the AE.

Management Structure/Water Safety Group – Recommended Actions

- Confirm the circulation and application status of the Policy and Procedures documents throughout the NHSGGC Estate.
- Consider inviting the AE to the Water Management Safety Group Meetings.
- Consider inviting the AE to all, or some of water group meetings at Board and Sector level.
- It is recommended that as management and structural changes within the Estates organisation of the NHS GGC may have an impact of the application of the required risk reduction processes and procedures for the hospital water systems, these changes are notified to the AE on a regular basis.

4. Authorising Engineer Workload within NHSGGC

The working relationship between the AE and the Board is based on an amount of work that is agreed for the forthcoming year. The agreed work covers a number of hospital audits and AP competency assessments plus attendance at some Water Group meetings and the completion of the annual report. Any work in addition to this agreed level of work is based upon request from within NHSGGC and has to be charged for separately after an order number has been provided.

The agreed, and utilised contracted hours for 2017/18 was as follows:-

Task/Works	Planned Time (Days)	Actual Days Used	Balance
QEUH Audit including the Tower and one other building on the site	5	6	-1
Yorkhill Audit	3	3	0
Review First Audit at GRI	2.5	2.5	0
Review First Audit at IRH	2.5	2.5	0
Review First Audit at RAH	2.5	2.5	0
Review First Audit at Vale of Leven	2.5	2	0.5
AP Competency Checks	1.5	0	1.5
Annual Report	4	3	1
Water Group Meetings and AG review meetings	2	0	2
Incidental time for answering tech issues, emails, telephone calls and admin	1	1	0
Total	**26.5**	**22.5**	**4**

Authorising Engineer Workload – Recommended Actions

- Agree the Authorising Engineer workload for the forthcoming 12 months.

5. Written Schemes

The production of written schemes, based on the findings of the risk assessment, is a requirement of the HSE L8 approved code of practice, and of the and HSG 274 guidance document. Furthermore, in para 5.1 of the SHTM 04-01 Part B document it states the following:-

All premises are required to have a Legionella risk assessment and a written scheme for controlling any identified risks in accordance with the Health and Safety Commission's Approved Code of Practice L8. Guidance on the preparation of Written Schemes can be found in Part G of this SHTM.

The written schemes are examined as part of the hospital audit process. The findings of the audits indicated that in some hospitals there were written schemes in place while in others they were almost completely absent. The creation and operation of a written scheme is viewed as a core requirement in the risk reduction process. As a result of the variable quality, and in some cases virtual absence, of a written scheme as defined in the HSG 274 document, some hospitals are leaving themselves exposed to criticism in the event that a Legionella based problem occurs.

An outline of what should be contained in a written scheme can be found in the HSG

274 document and also in the SHTM 04-10 Part G document.

There was evidence at some hospitals that great effort had been put in at a local level to create a working written scheme document. This was most readily apparent at the Vale of Leven where credit is due to Mr John Menzies for the effort put into improving the water based risk reduction delivery requirements at the hospital. The AE understands that at the time of this audit there was an ongoing review and improvement process for the hospital written schemes.

Written Schemes – Recommended Actions

- Complete a review of the written schemes at the various hospitals based on the requirements of the L8, HSG 274 and SHTM 04-01 documents.
- Once the review is complete put into place written schemes where required.

6. Hospital Audits and Audit Reviews Completed since October 2014

Legionella Control International Ltd LCI has been involved in supplying the services of an AE to NHSGGC since late 2014. As a result of that, and as this is the first annual report that has been completed, we have detailed all the hospital audits and audit reviews that have occurred since that time.

The details are as follows:-

Hospital	Month Completed	Task
Beatson Oncology Hospital	Oct-14	Audit
Glasgow Dental Hospital	Jan-15	Audit
Glasgow Royal Infirmary	Jan-15	Audit
Inverclyde Royal Hospital	Feb-15	Audit
Vale of Leven Hospital	Feb-15	Audit
Royal Alexandra Hospital	Jun-15	Audit
Southern General Retained Estate	Jun-15	Audit
Gartnavel Royal Hospital	Jun-16	Audit
Stobhill Hospital	Jul-16	Audit
Gartnavel General Hospital	Jul-16	Audit
Dykebar Hospital	Aug-16	Audit
Queen Elizabeth University Hospital	May-17	Audit
West Of Scotland Ambulatory Care Hospital	May-17	Audit
Inverclyde Royal Hospital	May-17	Audit
Glasgow Royal Infirmary	Jun-17	Audit Review
Vale of Leven Hospital	Jul-17	Audit Review
Royal Alexandria Hospital	Jul-17	Audit Review
Neurology Building Southern General	Aug-17	Audit

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There was a wide variation in the compliance levels at the various hospitals that were audited. In one sector there is the partial use of electronic monitoring and there is generally a better level of compliance in the hospitals utilising the electronic planning and recording approach.

Elsewhere, where paper systems are in use, there were variations in the level of compliance. However, there is undoubtedly signs of improvement in the more recent audits as more regimented and stringent processes and procedures are being implemented in many areas of the NHS GGC property portfolio. In none of the hospitals audited, could it be said that there was a completely acceptable level of recorded compliance.

There was a notable desire to comply with the guidance and the requirements on all sites, but in virtually all hospitals, the issue of resources was raised as a reason for varying levels of compliance. It is not the place of the AE audits to comment on resources and we merely report this as an observation and not as a criticism.

The reports from the audits and audit reviews were sent back to all of the hospitals concerned. There is now a formal follow up procedure to list, address and record the required follow up actions. It was noted in some of the audit reviews that many of the required follow up actions had been completed.

We would recommend that the audits and audit reviews are used as a basis for improvement and that they are discussed at the Water Group Meetings. We would also recommend senior management follow up on the hospital audits to ensure that the identified issues are being addressed at the hospitals.

Hospital Audits – Recommended Actions

- Review the use of the audits to assess whether the recommendations are being followed up and completed.
- Ensure that written schemes are in place at all NHSGGC hospitals.
- NHS GGC should decide on whether to follow a paper based or an electronic control and recording format for the operation of the water based risk reduction processes and procedures. Experience in other Boards suggests that an electronic format should be implemented.

7. Risk Assessments

Risk assessments were in place at the audited hospitals but it was not always possible to state by looking in the existing record systems whether the hospital had completed the remedial actions from the risk assessments.

It was also noted that, at the time of the audits and audit reviews of the sites visited during 2017, that three different suppliers had been used to deliver the risk assessments to site.

While all the risk assessments may be of an acceptable standard, we would recommend that a single supplier is sourced in order to provide a high degree of uniformity across the NHS GGC estate portfolio.

Furthermore, some of the risk assessments were out of date at the time of the audit and audit reviews. While the new L8 and HSG 274 documents have removed the need to review or redo risk assessments on a two year cycle, it should be noted that the SHTM 04-01 document still requires to completion of new, or the review of existing risk assessments every two years. The AE is aware that in this regard NHS GGC are utilising the recommendation for risk assessments that can be found in the HSE's HSG 274 document. We would recommend that NHS GGC makes a formal policy statement in this regard. We would also point out that since the undertaking of the audits and audit reviews, that some of the risk assessments may have since been updated.

Details of the status of the risk assessments at the hospitals that were audited or audit reviewed in the past year are given below.

Site	RA Provider	Date of Risk Assessment
Vale of Leven Hospital	DMA Ltd	Feb-16
West of Scotland Ambulatory Care Hospital	DMA Ltd	Apr-16
Inverclyde Royal Hospital	Chemtech Ltd	Nov-16
Neurology Building - Southern General	DMA Ltd	Nov-16
Glasgow Royal Infirmary	Clearwater Ltd	Dec-16
Queen Elizabeth University Hospital	DMA Ltd	Apr-15
Queen Elizabeth University Hospital	DMA Ltd	Nov-17

Risk Assessments – Recommended Actions

- NHS GGC might consider the use of a single supplier, after a suitable tendering process, for the provision of risk assessments to assist in providing a uniform approach to the written schemes.
- A formal decision should be made as to how often the risk assessments should be undertaken and this should be applied across the Estates portfolio of buildings.

8. Training and Authorised Persons Appointments

Training

Training is regarded by the Health and Safety Executive as being a vitally important component of the Legionella risk reduction process. It is also recommended in the SHTM 04-01 Part B document. It is understood that NHSGGC purchased training

from a supplier during 2015 and 2016. Neither the he details of this training, nor any training records have been provided to the AE. As a result it is not therefore possible to make comments with regard to the status of training within NHSGGC.

For reference we have however detailed below para 5.2 from the SHTM 04-01 Part B document. This Paragraph is headed “Competence”.

Management should implement a programme of staff training to ensure that those appointed to devise strategies and carry out control measures are appropriately informed, instructed and trained, and should be assessed as to their competency. It is also essential that they have an overall appreciation of the practices affecting water hygiene and safety and that they can interpret the available guidance and perform their tasks in a safe and technically competent manner. The rate of change in building service technology is not great, but knowledge of harmful bacteria continues to grow and management should review the competence of staff on a regular basis, and refresher training should be given; records of training attendance would need to be maintained. Although training is an essential element of ensuring competence, it should be viewed within the context of experience, knowledge and other personal qualities that are needed to work safely. Competence is dependent on specific needs of individual installations and the nature of risks involved.

We would recommend therefore that the guidelines, as outlined in the SHTM document and detailed above, are followed within NHSGGC. It may be that this is already the case, and that training is completed within the Estates department.

Refresher Training

There is no specific guidance given by the Health and Safety Executive on how often staff should receive refresher training. There is an accepted “norm” in the water hygiene industry that training should be considered and updated approximately every three years. As a number of people were trained in 2014, it may be the case that they are now at a stage where refresher training would be recommended.

Authorised Person Assessment

As part of the AE role, recommendations are made by the AE as to the suitability of NHSGGC personnel to be designated as Authorised Person, as defined in the SHTM 04-01 Part B. This process is completed via a multiple choice questionnaire and a technical interview stage.

The people detailed below have been previously assessed, and recommended, for the position of Authorised Person.

Name	Date	Hospital
John Menzies	12/02/16	Vale of Leven
Terry Regan	12/02/16	Glasgow Dental
Alan Milligan	12/02/16	Glasgow Dental
Phyllis Urquhart	20/05/16	Gartnavel General
Mark Riddell	20/05/16	Gartnavel General
Eddie Morrison	02/06/16	Inverclyde
Ross Campbell	02/06/16	Inverclyde
Garry Cameron	01/07/16	Inverclyde
Joe Nelis	01/07/16	Inverclyde

As the information above indicates, nine people, across 4 hospitals, have been previously assessed and recommended as being technically competent for the role of Authorised Person (AP).

Given that NHSGGC has, according to the NHSGGC website, thirty six hospital locations, as well as 7 day hospitals, the number of recommended AP appointments appears to be low. As an example there are no AP appointments made for large hospitals such as The Royal Infirmary, the Queen Elizabeth University Hospital, the Royal Alexandra Hospital or Stobhill Hospital among others. Additionally, given the size of NHSGGC, there are fewer AP appointments than at some other smaller NHS Boards where the AE is currently providing support.

When considering the guidance in the SHTM 04-01 document, it might therefore be viewed that there is a relatively low number of AP competency checks completed in NHSGGC, relative to the size of the organisation. We would therefore recommend that more AP competency assessments are completed which as a result would lead to the appointment of more AP's.

Training and Authorised Persons – Recommended Actions

- Review the number of AP appointments within NHSGGC and complete the technical competency checks and the subsequent appointments where required.

9. Legionella Sampling

Legionella sampling is completed in a number of acute hospitals in NHSGGC. None of the legionella test results are forwarded to the AE for comment or discussion but the AE was informed that all legionella results are shared with the Infection Prevention and Control Team

It is understood that a sampling protocol is now in place for the hospitals in NHS GGC. The AE understands from conversations at various hospital sites that legionella sampling is still being undertaken at a number of sites.

It is recommended that the updated legionella sampling protocol is completed and circulated within NHSGGC Estates department for use, where applicable, throughout the hospital property portfolio.

Legionella Sampling – Recommended Actions

- Complete the legionella sampling protocol and circulate within the Estates department for use throughout the NHSGGC property portfolio.

10.Pseudomonas

To date the AE has had no involvement, other than discussions during hospital audits, on the issues linked to Pseudomonas.

It should be stated that the Estates Department only has involvement in one of the six critical control points defined as requiring to be addressed in the Health Protection Scotland (HPS) guidance issued in 2018.

The response and need for action in regard to the issue posed by the Pseudomonas organism are generally considered to be under the responsibility of the Infection Control department in the hospitals.

In March 2015, a report was produced by John Green, Professor Williams and Pamela Joannidis which detailed 14 areas in NHSGGC which required to be risk assessed for potential issues linked to Pseudomonas. These areas were across seven hospitals. The Victoria Infirmary was listed and is now closed. Yorkhill Hospital was also listed and is still partially open but may no longer have any areas of augmented care. Nothing was listed for the Queen Elizabeth University Hospital or the Southern General Hospital.

It states on the report completed by John Green, Professor Williams and Pamela Joannidis that a copy would be sent to Estates, amongst others, for action. At this stage it is not known if any of the actions have been undertaken.

We would recommend that this report is updated in light of hospital closures and changes to the NHSGGC property portfolio. We would also recommend that a review is made of the current status of the requirements with regard to Pseudomonas.

A copy of the document produced in March 2015 can be found in the Appendix of this report.

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It should be noted that the statements above in relation to the situation regarding Pseudomonas within NHS GGC hospitals is unchanged from the statement made in the previous year's report.

Pseudomonas – Recommended Actions

- Review the current status of the risk reduction processes and procedures, that fall under the remit of the Estates department, and update as necessary.
- Review the overall Pseudomonas based requirements in light of the changes to the NHSGGC property portfolio and contact Infection Control to review and update the list of areas of concern in NHSGGC.

11.Capital Projects

The AE had no requests for any involvement in Capital Projects during 2017. Comments were requested on some refurbishment work at the GRI and this is detailed below. It is not known if this was a Capital Project.

12.Additional AE Works

A small amount of additional work was completed by the AE during the past year. The work that was completed was as follows:-

- Comments and advice on the design of the water services for the GRI upgrades to wards 20 and 21. This work was completed in June 2017 for Mr Chris Milligan of Wyllie Shank Architects.

It is noted that during 20176 a request was received to comment and advise on the planned pipework changes in the refurbishment of levels 7 and 8 of Gartnavel General Hospital. Since that time no further requests have been made for any refurbishment work at Gartnavel General Hospital.

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13.Appendix

Management Structure/Water Safety Group – Recommended Actions

- Confirm the circulation and application status of the Policy and Procedures documents throughout the NHSGGC Estate.
- Consider inviting the AE to the Water Management Safety Group Meetings.
- Consider inviting the AE to all, or some of water group meetings at Board and Sector level.
- It is recommended that as management and structural changes within the Estates organisation of the NHS GGC may have an impact of the application of the required risk reduction processes and procedures for the hospital water systems, these changes are notified to the AE on a regular basis.

Authorising Engineer Workload – Recommended Actions

- Agree the Authorising Engineer workload for the forthcoming 12 months.

Written Schemes – Recommended Actions

- Complete a review of the written schemes at the various hospitals based on the requirements of the L8, HSG 274 and SHTM 04-01 documents.
- Once the review is complete put into place written schemes where required.

Hospital Audits – Recommended Actions

- Review the use of the audits to assess whether the recommendations are being followed up and completed.
- Ensure that written schemes are in place at all NHSGGC hospitals.
- NHS GGC should decide on whether to follow a paper based or an electronic control and recording format for the operation of the water based risk reduction processes and procedures. Experience in other Boards suggests that an electronic format should be implemented.

Risk Assessments – Recommended Actions

- NHS GGC might consider the use of a single supplier, after a suitable tendering process, for the provision of risk assessments to assist in providing a uniform approach to the written schemes.
- A formal decision should be made as to how often the risk assessments should be undertaken and this should be applied across the Estates portfolio of buildings.

Training and Authorised Persons – Recommended Actions

- Review the number of AP appointments within NHSGGC and complete the technical competency checks and the subsequent appointments where required.

Legionella Sampling – Recommended Actions

- Complete the legionella sampling protocol and circulate within the Estates department for use throughout the NHSGGC property portfolio.

Training – Recommended Actions

- Review the number of AP appointments within NHSGGC and complete the technical competency checks and the subsequent appointments where required.

Legionella Sampling – Recommended Actions

- Include more detail in the monthly exception reports when a "fail" is listed under the Legionella sampling area of the report.

Pseudomonas – Recommended Actions

- Review the current status of the risk reduction processes and procedures, that fall under the remit of the Estates department, and update as necessary.
- Review the overall Pseudomonas based requirements in light of the changes to the NHSGGC property portfolio and contact Infection Control to review and update the list of areas of concern in NHSGGC.

Legionella Control International Ltd.,
Warren Bru
A49756324
Warren Bruce Rd, Stretford, Manchester, M17 1LB,
United Kingdom.
Company Registration Number: 5325807

Pseudomonas Risk Assessment Form

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United Kingdom.
Company Registration Number: 5325807

NHS Greater Glasgow and Clyde

ID:

Risk Assessment Form

Use this form for any detailed risk assessment unless a specific form is provided. Refer to your Summary of Hazards/Risks and complete forms as required, including those that are adequately controlled but could be serious in the absence of active management. The Action Plan and reply section is to help you pursue those requiring action.

Name of Assessor:	John Green, Professor Williams and Pamela Joannidis	**Post Held:**	
Department:	**Estates**	**Date:**	March 2015

Subject of Assessment: E.g.: hazard, task, equipment, location, people

Identification of areas within NHS GGC within which patients may be at a higher risk of from pseudomonas and related infections.

Hazards (Describe the harmful agent(s) and the adverse consequences they could cause)

Pseudomonas aeruginosa from uncontrolled water systems.

Description of Risk

Describe the work that causes exposure to the hazard, and the relevant circumstances. Who is at risk? Highlight significant factors: what makes the risk more or less serious – e.g.: the time taken, how often the work is done, who does it, the work environment, anything else relevant.

Pseudomonas aeruginosa (Pa), and other similar opportunistic pathogens, are micro-organisms that can cause outbreaks in any healthcare setting where patients are immunocompromised through drugs, disease, invasive device use or the presence of wounds. There have been serious healthcare associated outbreaks mainly in NNUs and ICUs (adult and paediatric) attributed to Pa where the source of the organism was thought to be tap water[1] A review of all blood cultures for *Pseudomonas aeruginosa* in NHS GGC was undertaken in year 2014 – 2015, to identify areas with significant number of PA isolates. Other than receiving units, the main areas identified were intensive care areas across all NHS GGC sites and the Beatson Oncology Unit (wards 7,8 and 9). Ward 54 (RAD) at SGH also had 2 patients with HAI-PA blood cultures. Table 1 shows areas and actions required following risk assessment.

Existing Precautions

Summarise current controls In place	**Describe how they might fail to prevent adverse outcomes.**
Water Safety Systems Policy and Written Scheme Infection Prevention and Control Environmental Audit Annual review of epidemiology of pseudomonas in blood culture	Failure to follow Policy and Written Scheme.

Level of Risk - Is the control of this risk adequate?
Give more than one risk level if the assessment covers a range of circumstances. You can use the 'matrix' to show how 'likelihood' and 'consequences' combine to give a conclusion. Also, be critical of existing measures: if you can think how they might fail, or how they could be improved, these are indications of a red or orange risk.

Risk Matrix

Likelihood	**Impact/Consequences**				
	Negligible	**Minor**	**Moderate**	**Major**	**Extreme**
Almost Certain	**Medium**	**High**	**High**	**V High**	**V High**
Likely	**Medium**	**Medium**	**High**	**High**	**V High**
Possible	**Low**	**Medium**	**Medium**	**High**	**High**
Unlikely	**Low**	**Medium**	**Medium**	**Medium**	**High**
Rare	**Low**	**Low**	**Low**	**Medium**	**Medium**

Very High **High** **Medium** **Low**

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Current risk level

Given the current precautions, and how effective and reliable they are, what is the current level of risk? Green is the target – you have thought it through critically and you have no serious worries. Devise ways of making the risk green wherever you can. Yellow is acceptable but with some reservations. You can achieve these levels by reducing the inherent risk and or by effective and reliable precautions.
High (Orange) or Very High (Red) risks are unacceptable and must be acted on: use the Action Plan section to summarise and communicate the problems and actions required.

Action Plan (if risk level is High (Orange) or Very High (Red)

Use this part of the form for risks that require action. Use it to communicate, with your Line Manager or Risk Coordinator or others if required. If using a copy of this form to notify others, they should reply on the form and return to you. Check that you do receive replies.

Describe the measures required to make the work safe. Include hardware – engineering controls, and procedures. Say what you intend to change. If proposed actions are out with your remit, identify them on the plan below but do not say who or by when; leave this to the manager with the authority to decide this and allocate the resources required.

Proposed actions to control the problem List the actions required. If action by others is required, you must send them a copy	**By Whom**	**Start date**	**Action due date**
Domestic services will continue to clean CHWB daily in clinical areas and notify the SCN if this cannot be completed. SCN will run taps as per SOP if not undertaken by Facilities staff.	SCN	Ongoing	Ongoing

Action by Others Required - Complete as appropriate: (please tick or enter YES, name and date where appropriate)

Report up management chain for action	Yes, as per Written Scheme
Report to Estates for action	Yes, as per Written Scheme
Contact advisers/specialists	Yes, as per Written Scheme
Alert your staff to problem, new working practice, interim solutions, etc	Yes, as per Written Scheme

Reply
If you receive this form as a manager from someone in your department, you must decide how the risk is to be managed. Update the action plan and reply with a copy to others who need to know. If appropriate, you should note additions to the Directorate / Service Risk Register.
If you receive this as an adviser or other specialist, reply to the sender and investigate further as required.

Table 1: Areas where action required to prevent *Pseudomonas aeruginosa* infection in healthcare settings

Site	Hospital	Ward	Assessment
GRI	GRI	ICU W / ICU E	Water Safety Written Scheme
GRI	PRM	NICU / SCBU	Water Safety Written Scheme
SGH	SGH	SITU	Water Safety Written Scheme
SGH	Langlands	54	Water Safety Written Scheme
SGH	INS	ITU /HDU	Water Safety Written Scheme
SGH	Maternity Building	NICU	Water Safety Written Scheme
SGH	Maternity Building	SCBU	Water Safety Written Scheme
Yorkhill	RHSC	PICU/HDU	Water Safety Written Scheme
Yorkhill	RHSC	NICU	Water Safety Written Scheme
VI	VI	ITU	Water Safety Written Scheme
RAH	RAH	ICU	Water Safety Written Scheme
RAH	Maternity Unit	SCBU/NICU	Water Safety Written Scheme
Inverclyde	Inverclyde	ICU/HDU	Water Safety Written Scheme
NHS GGC	Transplant units:	Ward B8, Gartnavel Scheihallion Ward, RHSC	Water Safety Written Scheme

Assessment completed - date:	March 2015	**Review date:**	March 2016

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Disclaimer

This site specific report document and the data contained within is based upon the information provided by the client / site and may not be complete with regards to all best practices detailed within various published guidelines or governing authorities. The client named within this document assumes full responsibility for the content within.

No warranty as to the completeness of the information is given as this document is in part based upon information related to Legionella Control International Ltd by the facility / site or client personnel, monitoring records, maintenance schedules, logbook data and any other records. Legionella Control International Ltd utilises due diligence whilst creating this report, but Legionella Control International Ltd disclaim all liability and the responsibility for the direct or indirect loss that may be suffered through the reliance upon the completeness of the data upon which Legionella Control International Ltd has no control. Regular monitoring and Maintenance schedules are critical to the operation and safety of the systems included within this document.

The Legionella Control International Ltd reporting process is designed to reduce health-related risks associated with the growth of *Legionella* within cooling systems, domestic hot and cold water systems, air handling units and various process water systems. However, if the recommended practices are to be followed as detailed, then the health-related risks from other waterborne pathogens should likewise be reduced. While other recommendations are designed to reduce health-related risks to ensure the overall health and safety of all site / facility personnel (including all visitors) no programme can fully eliminate all health-related risks. In addition, the recommended practices detailed within this document do not guarantee the water quality within the systems assessed will meet governmental or non-governmental standards. Local regulations override specific recommendations where relevant.

Legionella Control International Ltd.,
Warren Bruce Rd, Stretford, Manchester, M17 1LB,
United Kingdom.
Company Registration Number: 5325807

From: Mcgeown, Carmel
Sent: 08 December 2021 14:22
To: Steele, Tom; Smith, Euan; Clarkson, Kerr; Gallacher, Alan; Huddleston, James; MacMillan, Melville; Bagrade, Linda; Leanord, Alistair; Joannidis, Pamela; Devine, Sandra; Marek, Aleksandra; Dennis Kelly; David Watson; Ian Storrar; Richard Beattie; Annette Rankin
Subject: Water Technical Group Minutes
Attachments: Water Technical Group Meeting Minutes 06.12.2021.doc; Plumbing Back flush RAMS V2. docx.pdf; 2111 QEUH W2A Backflush RAMS V2.pdf; 2112 QEUH W2A Autoflush Install RAMS V2.pdf; DMA HFS Response 211202.xlsx

Follow Up Flag: Follow up
Flag Status: Flagged

Dear all,

Please see attached minutes from Monday's meeting and take note of any assigned actions. I have also attached the following documents referred to within the minutes:

- Item 6 Risk Assessments – please see RAMS (3 off)
- Item 8 NHS Assure Observations – please see DMA-HFS Response 211202

Euan circulated the WTG 2A Sanitisation Method & Timeline yesterday for review and feedback as per action detailed in item 9 and is collating the responses.

Kind regards,
Carmel

Carmel McGeown | PA to Head of Operational Estates – Mark Riddell
NHS Greater Glasgow and Clyde
CMB Building |1345 Govan Road | Glasgow | G51 4TF
e: [redacted] **t:** [redacted] **w:** www.nhsggc.org.uk

NHS Greater Glasgow & Clyde
Water Technical Group Meeting
Monday 6 December 2021 @ 15.00
Via MSTeams

Present:

Tom Steele (TS)	-	Director of Estates & Facilities
Euan Smith (Chair) (ES)	-	Assistant Head of Operational Estates, South Sector
Kerr Clarkson (KCL)	-	Site Manager Operational Estates, QEUH
Mel McMillan (MM)	-	Estates Manager, QEUH
Alan Gallacher (AG)	-	Head of Corporate Estates
James Huddleston (JH)	-	Assistant Head of Capital Planning
Linda Bagrade (LB)	-	Consultant Medical Microbiologist, IPC, GRI
Sandra Devine (SD)	-	Associate Nurse Director – IPC
Pamela Joannidis (PJ)	-	Associate Nurse Director – IPC
Ian Storrar (IS)	-	Head of Engineering, Health Facilities Scotland
Annette Rankin (AR)	-	ARHAI, Health Facilities Scotland
Dennis Kelly (DK)	-	Authorising Engineer
David Watson (DW)	-	Director, DMA Canyon
Carmel McGeown (CMcG)	-	Personal Assistant - Minutes

Apologies:

Aleksandra Mareks	-	Consultant Medical Microbiologist, IPC
Richard Beattie	-	Senior Engineer, Health Facilities Scotland

1. Introduction

As noted above.

2. Apologies

As noted above

3. Minutes of Previous Meeting

N/A

4. Purpose of Meeting

- To discuss current Ward 2A water issues and review attached proposals
- Propose and agree a robust sampling and replacement tap plan.

5. Current Situation

- Water results to date
    - Ward 2A & 2B sampling has been carried out over the last few months as part of the delivery requirements for the 2A/2B Project before the Ward is made live. Following a significant number of out of spec results it was agreed with the project team, ICT, Water AE and Microbiology to carry out similar sampling in other wards suppled via the same riser.
    - This was over and above the standard water sampling within the

QEUH A&C which includes raw tanks, filtration units, filtered tanks and Wards. Note - GNB Sampling is carried out in various areas including Clinics in RHC.

- Currently acceptable levels from sampling in basement tanks, risers and various outlet in floors 1, 3 & 4. Although some out of specs. Wards 2A & 2B however show high TVC's and gram negative results.
- Only difference in conditions of floor 2 is empty wards, no domestic cleaning or any ventilation in operation. The floor has been a building site for last 2 years. DMA have continued to carry out flushing regime throughout this time. This included daily flushing for most of the project time with a period of twice weekly flushing in between with records available.
- Sampling sweeps taken at various location across floor 2 (from 18/10/21 and ongoing). As per results as per detailed below.
- DK advised the standard disinfection of 50ppm over the period of 1hour could not be carried out due to the integrity and warranty of the components, however a disinfection of 25ppm carried out over a period of 2hrs had virtually no impact on bacterial counts.
- IS asked if samples above and below floor 2 were considered satisfactory and considering the retrograde, what protection has been given to the site? Flushing regime in place for cold and during project hot water was removed from ward and looped (short circuited to ward between flow and return).
- JH advised some areas have been isolated, however risk of contamination due to building works within the area.
- Floors above and below showed no pseudomonas detected, some moulds, some gram negatives and some TVC's (as per results detailed below).
- Cupriavadis found at outlets. Defined process used at the QEUH. This includes the following actions on detection of out of specs above agreed thresholds; Incident report raised, full disinfection and maintenance of tap, check taps, contact Facilities to carry out review flushing and cleaning regime. DMA then continue to take samples until 3 not detected. DMA share out of specs information with IPC, Microbiology and Estates. Following this Estates complete document summary of new out of specs, current out of specs, cleared out of specs. This information is then shared through a governance process up to Board level.
- DMA to check historical results although gram negatives not routinely checked in 2018. Difficult to compare as sampling/testing regime has changed since 2018 and no other Board carries out same testing regime to same extent. **ACTION - DMA**
- IS suggested sampling pipework. **ACTION - DMA/MM**
- SD concerned current flushing regime does not replicate "normal" daily usage.
- KC suggested daily domestic cleaning and flushing should be introduced over and above DMA flushing.
- DMA advised water temps at 22 degrees dropping to 12-13 degrees quickly once flushing begins.

6. Risk Assessments

- See attached RAMS for proposed activities within 2A/2B to mitigate issues Identified .e.g. further disinfections of the system.

7. Current Tap Situation

- Markwik taps currently installed have shown significant corrosion of rubber seal, pebbledash effect to surface and de-chroming of taps. Manufacturer have advised this is down to chemical reaction, (but with no further details of failure mechanism) **ACTION - MM to seek further information from supplier.**
- Two of the same taps from other locations also showed the same corrosion (one from Louisa Jordan at 6mths old and a new tap from IRH), again Manufacturer reports corrosion is due to chemical reaction, however no CL02 systems in place in these locations. **ACTION - MM following up with Manufacturer.**
- ES advised Scottish Water dose all water as standard (commonly chloramination [$Cl+NH_3$]).
- All taps as part of project for 2A have had full maintenance carried out including strainers disinfected and cartridges have been replaced. Some debate between meeting attendee's on replacement taps Markwik v Delabie. Note - Delabie taps are WRAS approved, used in other hospitals in GG&C and throughout the UK. Supplier has confirmed that they can withstand high levels of chlorine.
- ES indicated that urgent consideration should be given to the replacement of the Markwik tap with a suitable alternative. This is a broader issue that will potentially affect other hospitals within the UK.
- Current plan is to replace like for like taps. It was suggested to replace with Markwik taps once sanitisation has been carried out while checking compliance of Delabie and replacing these during 1st year validation works following robust assessment of replacements.
- AG indicated that the Markwik 21+ is the approved tap (by previous Water Technical Group) and is being used in a large number of projects across the GG&C Board.
- Working group to be set up through WTG to investigate recommended replacement taps.
- Replacement Markwik and Optitherm taps have been ordered (both types currently in situ) and arriving this week.
    - Unknowns
        - Why is the tap degrading?
        - Why such failure in a tap in a location that does not use CL02?
        - What is the infection risk due to corrosion? Is this acceptable?
        -

NOTE - POU filters would be fitted on all taps and showers regardless of results.

8. NHS Assure Observations

- See attached paper with Richard Beattie's responses to DMA/GG&C proposals on actions.

9. AOCB

- AG suggested a plan with acceptable level of risk. Process of elimination and agree order of work being carried out (over and above the attached proposed sanitisation process to the meeting invite).
- Sample results should be at a minimum compliant with SHTM guidance and then agree what is acceptable with regards to gram negative results (in absence of national guidance).
- Suggested plan to be agreed by WTG and meeting attendees:
    - Approved process to remove sections of pipework for swabbing (i.e. start at areas of highest count, cold, hot flow and hot return). Liaise with JH to advise contractors currently working in area. **ACTION – To be agreed 7.12.2021**
    - KC/DK to develop sanitisation process and testing regime, circulate by email with meeting attendees voting and providing comments/feedback by 12noon on 8.12.21. **ACTION – KC/DK**
    - LB to complete microbiology testing request form. LB to liaise contact GRI regarding swabbing procedure and kit required. KC/DK to ascertain number of samples, types of samples required and timeframe. **ACTION – LN/KC/DK**

10. Date & Time of Next Meeting

To be confirmed.

Out of spec Summary as of 25/11/21 (excluding Tank Room)

November 2021

Status	Building	Department/Floor	Unique Outlet Identification	Sample Point	Outlet Type (Tap Shower, CWST)	Hot, Cold, Mixed (TMV)	Filtered tap	Sample Temp	Leg cfu/L	Other	Type	Comment
New	Spinal	Ground Floor	L0/67	Philipshill Room 6 WHB	Tap **NEW**	Mixed	No	35.8	100	N/A	Legionella Species	Full maintenance to be carried out and Facilities to review flushing regime
	Spinal	Ground Floor	L0/67	Edenhall Bed 3 WHB	Tap **NEW**	Cold	No	21.3	50	N/A	Legionella Species	Full maintenance to be carried out and Facilities to review flushing regime
	Spinal	Ground Floor	L0/77	Philipshill Kitchen LHS SSS	Tap **NEW**	Hot	No	29	50	N/A	Legionella Species	Full maintenance to be carried out and Facilities to review flushing regime
	Spinal	Ground Floor	L0/77	Philipshill Kitchen LHS SSS	Tap **NEW**	Cold	No	24	50	N/A	Legionella Species	Full maintenance to be carried out and Facilities to review flushing regime
	Childrens	6th Floor Ward 6A	GENW1-035	Room 15 WHB (With Filter)	Optitherm	Mixed	Yes	-	N/A	TVC 13 GNB 16	TVC & Blastomonas Paucimobilis	Filter changed. Facilities to review flushing and cleaning regime
	Childrens	1st Floor Ward 1D PICU	CCW-118	Facilities Mop Sink (With Filter)	Swan Neck	Hot	Yes	-	N/A	TVC@22c 75 TVC@22c 118	TVC	Filter changed. Facilities to review flushing and cleaning regime
	Childrens	1st Floor Ward 1D PICU	CCW-118	Facilities SSS (With Filter)	Swan Neck	Cold	Yes	-	N/A	TVC@22c 69 TVC@22c 40	TVC	Filter changed. Facilities to review flushing and cleaning regime
	Childrens	1st Floor Ward 1D PICU	CCW-059	Staff Kitchen (With Filter)	Swan Neck	Cold	Yes	-	N/A	TVC@17c 75 TVC@22c 11	TVC	Filter changed. Facilities to review flushing and cleaning regime
	Childrens	1st Floor Ward 1D PICU	CCW-059	Staff Kitchen (With Filter)	Swan Neck	Hot	Yes	-	N/A	TVC@22c 18 TVC@22c 10	TVC	Filter changed. Facilities to review flushing and cleaning regime
Existing	Childrens	Ground Floor Clinic 1	OPD 026	Facilities	Janitorial Sink	Cold	No	-	N/A	12	AMS	Further full maintenance to be carried out and Facilties to review practices in these areas
	Childrens	Ground Floor Clinic 1	OPD 026	Facilities	Janitorial Sink SSS	Cold	No	-	N/A	>100	AMS	Further full maintenance to be carried out and Facilties to review practices in these areas
	Childrens	Ground Floor Clinic 1 & 2	OPD 028	Clinc 1 - WC Public	Cold Tap	Mixed	No	-	N/A	>100	AMS	Further full maintenance to be carried out and Facilties to review practices in these areas
	Childrens	Ground Floor Clinic 1	OPD 009	Public WC	Contour	Mixed	No	-	N/A	4	Psudomonas Aeruginosa was AMS previously	Further full maintenance to be carried out and Facilties to review practices in these areas
	Neurosurgery	5th Floor	L5/29	Advanced Procedure Room WHB	Tap	Cold	No	21.9	550		Legionella Species	
	Neurosurgery	4th Floor Ward 65	L4/54	Procedure Room WHB	Tap	Cold	No	23.3	150		Legionella Species	
	Neurosurgery	4th Floor Ward 65	L4/54	Procedure Room WHB	Tap	Mixed	No	39.5	2300		Legionella Species	
	Neurosurgery	2nd Floor CNS Office	L2/71	WC WHB	Tap	Mixed	No	39.5	50		Legionella Species	
	Podiatry	Ground Floor	L0/24	Student Change Room LHS WHB	Tap	Cold	No	18.7	150		Legionella Species	
	Podiatry	Ground Floor	L0/17	Staff Room SSS	Tap	Cold	No	18.5	150		Legionella Species	
	Old Maternity	3rd Floor	L2/36	Ward 48 Room 8 WHB	Tap	Cold	No	15.8	300		Legionella Species	
	Old Maternity	Groumd Floor	FM D.36	Scanning Room 7 WHB	Tap	Cold	No	24.8	50		Legionella Species	
	Spinal	Ground	L0/124	Clean Utility	Tap	Cold	No	26.2	150		Legionella Species	Further full maintenance to be carried out and Facilties to review practices in these areas
	Spinal	Ground	L0/128	Kitchen SSS	Tap	Hot	No	54.8	650		Legionella Species	Further full maintenance to be carried out and Facilties to review practices in these areas
	Spinal	Philipshill Ground Floor	L0/125	Disposal WHB	Tap	Mixed	No	43.9	50		Legionella Species	Further full maintenance to be carried out and Facilties to review practices in these areas
	Spinal	Philipshill Ground Floor	L0/82	Laundry SSS	Tap	Hot	No	39.9	200		Legionella Species	Further full maintenance to be carried out and Facilties to review practices in these areas
Not Detected after works carried out or review of protocols e.g. flushing, cleaning	Spinal	Ground	L0/128	Kitchen WHB	Tap	Cold	No	27.70	N/A		Legionella Species	
	Neurology	2nd Floor	L2/30	Multipurpose Room WHB	Tap	Mixed	No	29.6	N/A		Legionella Species	
	Podiatry	Ground Floor	L0/35	Chair 24 WHB	Tap	Mixed	No	35.8	N/A		Legionella Species	
	Neurosurgery	4th Flooor Ward 65	L4/09	Room 6	Tap	Mixed	No	43	N/A		Legionella Species	
	Neurosurgery	5th Floor	L5/29	Advanced Procedure Room WHB	Tap	Mixed	No	42.2	N/A		Legionella Species	
	Neurosurgery	2nd Floor Ward 62	L2/23	Room 1 WHB	Tap	Mixed	No	33.1	N/A		Legionella Species	
	Neurosurgery	Basement Plantroom	0	Pre-filter CWST (RHS)	CWST	Mixed	No	16.8	N/A		Legionella Species	
	Adults	2nd Floor	THE139	Theatre 9/10 Prep Room	Optitherm	Cold	No		N/A		Unidentified GNB	
	Adults	11th Floor Ward D	Facilities	GENW22-066	Hot Tap	Hot	No		N/A		Coliform	
	Adults	5th Floor Ward C	Facilities	GENWC-066	Hot Tap	Hot	No		N/A		Coliform	
	Childrens	6th Floor Ward 6A	GENW1-030	Room 13 En-Suite (With Filter)	Shower	Mixed	Yes		N/A		Blastomonas Ursincola	
	Childrens	6th Floor Ward 6A	GENW1-057	Room 15 WHB (With Filter)	Optitherm	Mixed	Yes		N/A		TVC & GNB	
	Childrens	6th Floor Ward 6A	GENW1-057	Room 24 WHB (With Filter)	Optitherm	Mixed	Yes		N/A		Sphingomonas Paucimobilis & AMS	
	Childrens	Ground Floor Clinic 1 & 2	Clinic 1 - Treatment Room A	OPD 031	Optitherm	Mixed	No		N/A		Brevundimonas Dimunta/Vescicularis	

Client/Site	QEUH – Royal Hospital for Children	RAMS No. **SRAMS-21/09-V2**
Activity	Plumbing works required in relation to back-flushing of domestic water systems within Wards 2A & 2B	Issue Date 21/11
		Revision No. 2
Date Works Carried Out	24/11/21 (proposed)	
Method Statement Created By	David Watson & Gordon McAlpine	Operator review prior to works commencing

Operators On Site	**Name**	It is the responsibility of the operator(s) on site to review the safety risk assessment included and to complete the dynamic risk assessment detailing any additional risks and the precautions taken whilst on site.
Lead Operator	Gordon McAlpine	
Additional Operators	TBC	

N.B. This method statement shall be issued to DMA operators and those from Estates and any other contractors applicable for these works. Please note DMA shall not supervise other contractors and no responsibility for their works or records can be accepted.

Lead Operator is responsible for Implementing MS/RA and Managing Works on site
All operators to review Method Statement and Risk Assessment prior to works commencing.
Lead Operator to produce appropriate works record upon completion of works.

COSHH Details

DMA Canyon Operators should ensure copies of all relevant COSHH sheets are carried on site, either electronically (on Laptop/Smartphone) or paper copy.

Emergency, First Aid, Fire Safety, Welfare Arrangements and Site Rules

It is the responsibility of DMA Canyon Operators in conjunction with Site/Client to familiarise themselves with site/local Emergency, First Aid, Fire Safety and Welfare arrangements and to ensure compliance with all local site safety rules prior to works commencing. First Aid Kits should be carried in vehicles at all times.

DMA Canyon Escalation Details:

In the event of an emergency DMA Canyon Operators should contact their Supervisor/Manager.
In the event of Line Manager being unavailable then DMA Canyon Directors should be contacted.
Site/Client should alert DMA Canyon Operators to any sites specific or local emergency contact procedures.

DMA Canyon Office	[redacted]
Chris Canty	[redacted]
Gordon McAlpine	[redacted]
Graeme McCullie	[redacted]
David Watson	[redacted]
Mike Kinghorn	[redacted]

General Plumbing Install RAMS

Operators should ensure copies of all relevant COSHH sheets are carried on site, either electronically (on Laptop/Smartphone) or paper copy.

Cleaning and Disinfection of tools prior to works being carried out

1. Accumulations of grease, dirt, debris etc. should be removed from tools with a clean wipe prior to disinfection of the tools.
2. Disinfection shall be carried out use a spray bottle or similar device with a disinfectant solution of 70% IPA to spray all tool surfaces.
3. Leave for 2 minutes to disinfect the tools prior to use. If tool(s) to be set down during this period it shall be set down on a clean surface which has Clinell Wipe(s) (Disinfectant/Green Pack) laid out for tools to sit on until ready for use.
4. Tools should be cleaned and disinfected at start of each day and if tools become soiled or if nature of works causes tools to become contaminated.

N.B. Tools may require to be oiled/greased periodically to maintain in working condition as disinfectant may cause lubricants to be washed out from tools in accordance with manufacturer's instructions.

If tools are not in a suitable condition they must not be used, and job halted until suitable replacement tools are available and used.

General Plumbing

Works shall be carried out by suitably trained/competent operators in accordance with this method statement, as guided by manufacturer's instructions and current regulations.

1. Prior to any works commencing the area/pipework being worked on should be suitably isolated (Liaison with other contractors and/or site facilities staff may be required for this).

2. Drain down the water system (or relevant section of the water system being worked on) where necessary.

3. Identify the pipework/fittings required in order to carry out replacement of parts or repairs required. Ensure no pipework is cut or fittings disconnected until suitable fittings in order to complete works have been obtained.

4. Cut pipework, or disconnect at suitable fitting, at appropriate point for works to proceed.

5. Install new section of pipework/valve or new fitting to be installed using appropriate materials for the system being connected into (i.e. stainless steel fittings and pipework to be used where original system is installed in stainless steel, copper pipework where original system is copper). If required in order to allow works to proceed or is necessary for future works new isolation valves should be installed.

6. Connect and tighten all new fittings using appropriate method (e.g. crimp, compression) **N.B.** No hot working/soldering shall be carried out unless previously advised and appropriate fire prevention measures are in place and client has issued appropriate permits.

7. All newly installed pipework will be clipped approximately every meter or where operative deems necessary.

8. If required the new section fittings will be disinfected prior to completion of works and handover to client (See appropriate DMA Canyon RAMS for this or for minor alterations/repairs see "Disinfection Procedure" below).

9. On completion of works the isolation valve(s) will be opened allowing the system to refill with water and will be checked over to ensure no leaks. Any leaks identified will be remedied at this time.

10. The water system(s) will then be reinstated ready for use.

11. Lead plumbing operative for the job will then carry out final checks to ensure the newly installed system is watertight and for the quality of the finish prior to leaving site.

12. Site reports will be generated on completion of works and placed within the site water logbook and/or emailed to the relevant person.

Local Disinfection Procedure

When minor alterations/repairs are carried out the local disinfection of fittings will be carried out by spraying all surfaces of fittings with a 70% Isopropyl Alcohol solution and leaving for a period of 2 minutes. If component to be set down during this period it shall be set down on a clean surface which has Clinell Wipe(s) (Disinfectant/Green Pack) laid out for components to sit on until ready for use.

Method Statement

Hazard Type	Hazard Effect	Who Might be Harmed	S	L	R	Control Measures	Residual Risk S	Residual Risk L	Residual Risk R
Manual Handling	Physical Injury caused by lifting heavy and or awkward loads	Operators	**3**	**2**	**6**	Split equipment into small easily handled parts. Decant chemicals into small amounts/containers. Individual should not lift or carry loads beyond their own capability and for bulky or heavy objects obtain assistance. Ensure work area and pathways are clear and suitable for lifting loads.	**2**	**1**	**2**
Exposure to Chemicals/Chemical Splash	Chemical burns to skin, eyes, respiratory/ingestion system (refer to COSHH Sheets for further info)	Operators	**3**	**3**	**9**	Use of Suitable PPE (e.g. Gloves, Goggles, Overalls) Decant chemicals into small amounts and suitably labelled containers or use suitable transfer equipment (e.g. pumps). Follow instructions on MSDS/COSHH sheets.	**2**	**2**	**4**
Chemical Spill	Environmental impact of chemicals being released into water course	Environment	**4**	**2**	**8**	Spill Kits to be carried to clean up chemical spills (refer to above for personal protection measures). Spill kit to be suitable bagged and returned to DMA for proper safe disposal.	**4**	**1**	**4**
Exposure to Biological Contamination	Risk of contracting Legionnaires Disease or other infections (e.g. Weils Disease, e.coli, coliforms)	Operators	**5**	**2**	**10**	Pre-disinfection of water tanks if badly fouled, no spray cleaning to be carried out. Minimise creation of aerosols. Ensure are is free of bacterial contamination (e.g. rodent bird droppings). Suitable PPE to be worn if general area contaminated (e.g. Gloves, Masks)	**5**	**1**	**5**
Cuts/Abrasions	Cutting / trapping hands or fingers on tools & equipment or on sharp materials in work area	Operators	**3**	**3**	**9**	Wear suitable protective footwear, clothing, gloves and goggles where appropriate, and follow manufacturer's instructions for equipment. Inspect all equipment and ensure is fit for purpose prior to use.	**2**	**2**	**4**
Working at Height	Physical injury from falling off ladder roof or platforms, or equipment being dropped from height	Operators & others in area below	**5**	**2**	**10**	Ladders to be inspected prior to use to ensure fit for purpose. Only tasks of short duration to be carried out from ladders, or for access only. Roofs/platforms to be inspected to ensure safe prior to accessing.	**5**	**1**	**5**
Slip/Trip	Physical injury from falling slipping on wet/slippery surfaces or tripping over equipment/obstacles	Operators	**4**	**2**	**8**	Safety boots provide grip and ankle support and must be worn at all times Ensure that work area is kept tidy at all times. Ensure that hoses and cables do not present a trip hazard. Mop up any spills immediately. Ensure work area is adequately lit. When draining water systems ensure water is drained to a safe are (Drain) and does not contribute to a slipping or any other type of hazard.	**3**	**1**	**3**
Asbestos	Inhalation of asbestos fibres	Operators & others in area if disturbed	**5**	**3**	**15**	Consult Asbestos Register. Visual inspection of work area prior to commencing work. Stopping of all work if disturbed asbestos is suspected in any areas being worked in or could be disturbed by works being carried out.	**5**	**1**	**5**
Contamination of Water Systems	Contaminants entering into domestic water systems from external sources or disinfectant interfering with lab/renal equipment	Environmental Medical Equipment and/or Patients	**5**	**3**	**15**	Only pumps and hoses designated for use on domestic water systems to be used for working on domestic water systems. Prior to works commencing client to confirm no lab/renal equipment connected to systems or alternative arrangements made for water supply for duration of works.	**5**	**1**	**5**
Electrocution	Burns/injury caused by electrocution	Operators	**4**	**2**	**8**	All equipment should be 110V (or less) and be PAT tested with an up to date label. All electrical equipment should be inspected prior to use by the operator in accordance with DMA Canyon procedures.	**3**	**1**	**3**
Weather Conditions	Potentially increases the risk potential of other hazard types and weather conditions should be considered prior to works commencing.	Operators	To be completed in inclement weather			Operatives will remain vigilant where early morning dew frost is evident. Safety boots provide grip and should be worn at all times. Care will be taken when handling equipment/materials to ensure they are dry and frost free before handling. No work in high winds or driving rain when working at height or in situations which may cause unsafe working practices. Where access to site (or cabins) is restricted then comfort/shelter can be taken in the company vehicle	To be completed in inclement weather		

DYNAMIC RISK ASSESSMENT - TO BE COMPLETED BY OPERATOR(S) ON SITE

ADDITIONAL SITE SPECIFIC RISKS NOT PREVIOUSLY IDENTIFIED OR SITE CONDITION WHICH AFFECTS THIS ASSESSMENT SHOULD HAVE A DYNAMIC RISK ASSESSMENT FORM COMPLETED.

Hazard Type	Hazard Effect	Who Might be Harmed	S	L	R	Control Measures	Residual Risk S	Residual Risk L	Residual Risk R
No additional Risks Noted									

SEVERITY						
	Fatal/Permanent Disability	5	10	15	20	25
	Long Term Absence	4	8	12	16	20
	Injury - >3 days lost time	3	6	9	12	15
	Injury - <3 days lost time	2	4	6	8	10
	Negligible – No lost time	1	2	3	4	5
		Remote	Possible	Likely	Very Likely	Inevitable
		LIKELIHOOD				

Final Assessment

Provided company personnel have fully assessed area/task and follow the control measures and carry out tasks in a safe manner as detailed above, the level of risk associated with the tasks identified will be reduced to an acceptable low level of risk. Site operators must assess the site/work area and tasks to be carried out on site prior to works commencing. Any additional risks not covered by the initial assessment must be added, assessed in the relevant area on following page prior to works commencing and suitable safety precautions recorded and taken in order to maintain acceptable level of risk.

EMERGENCY CONTACTS:	
Emergency Contact Number (If required):	To be filled in on site prior to works commencing.
Site Contact & Number (If required):	To be filled in on site prior to works commencing.
DMA Canyon Emergency Contact & Number (If required):	See also DMA Canyon Contact Numbers on Covering Page. To be filled in on site prior to works commencing.

EMERGENCY PROCEDURES

In the event of an emergency occurring whilst operator working DMA Canyon "Attendant" operator should contact the emergency services, highlighting the nature of the incident, site address, contact numbers (both DMA Canyon and site). Operators shall follow emergency services instructions as appropriate. Site First Aid should be contacted for assistance until emergency services attend. Site contact and DMA Canyon emergency contact should also be contacted ASAP.
Details of all incidents should be recorded on accident/incident forms as per DMA Canyon procedures.

Client/Site	QEUH – Royal Hospital for Children	Draft for Approval
Activity	Back-flushing of Domestic water lines within Wards 2A & 2B	Version 2 **Review**
Date Works to Be Carried Out	TBC	N/A – One off works
Method Statement Created By	David Watson/Gordon McAlpine	Operator review prior to works commencing

Operators On Site	**Name**	**Signature**	**Date**
Lead Operator	Mark Morning		
Additional Operators	John Fraser		
	Shaun Russell		
	David Watson		
	Gordon McAlpine		
	Craig Guyer		

Lead Operator is responsible for Implementing MS/RA and Managing Works on site
All operators to review Method Statement and Risk Assessment prior to works commencing.
Lead Operator to produce appropriate works record upon completion of works.

COSHH Details

DMA Canyon Operators should ensure copies of all relevant COSHH sheets are carried on site, either electronically (on Laptop/Smartphone) or paper copy.

Emergency, First Aid, Fire Safety, Welfare Arrangements and Site Rules

It is the responsibility of DMA Canyon Operators in conjunction with Site/Client to familiarise themselves with site/local Emergency, First Aid, Fire Safety and Welfare arrangements and to ensure compliance with all local site safety rules prior to works commencing. First Aid Kits should be carried in vehicles at all times.

DMA Canyon Escalation Details:

In the event of an emergency DMA Canyon Operators should contact their Supervisor/Manager.
In the event of Line Manager being unavailable then DMA Canyon Directors should be contacted.
Site/Client should alert DMA Canyon Operators to any sites specific or local emergency contact procedures.

DMA Canyon Office	[redacted]
Isabel Staniard	[redacted]
Chris Canty	[redacted]
David Watson	[redacted]
Mike Kinghorn	[redacted]
Gordon McAlpine	[redacted]
Graeme McCullie	[redacted]

Method Statement

Backflushing of Domestic Hot and Cold Water Lines

1. This method statement will be used for the Backflushing of the domestic water lines within Wards 2A & 2B of the RHC.

2. Works shall be carried out by suitably trained/competent operators in accordance with this method statement.

3. As close as is possible to the end of the cold and hot flow lines a t-piece and a valve dropping down below ceiling to allow for cross connections will be installed, as required for backflushing.

    a. For W2A – BMT - this will be in corridor above ceiling at Room 17
    b. For W2A – HOTCT - this will be at nurse's station above ceiling at Play Room
    c. For W2B – this will be above ceiling at Consultant Room 1

4. Cut ins point shall be after local isolation on each of the hot and cold lines at the locations detailed above which will then allow for the main pipe runs through the ward to be backflushed. **Note**: this will not permit backflushing of the local pipework to each room, on the side rooms within HOTCT (Rooms 3 – 6) or individual outlets as these are off the main runs. These will be flushed in the normal direction of flow during this procedure.

5. BMT Side (Fed from Riser M39) – Cold Line Backflushing

    a. Cold water lines shall be isolated within riser M39 (both isolation valves open/online shall be closed to minimise any risk of potential backflow into the live system).

    b. The hot water line shall then be connected from the Hot flow line into the cold line at new cut in locations as described above.

    c. Hot water shall then be flushed into the cold line and drawn off to drain point in the riser, M39, and run to drain.

    d. Water condition at drain shall be monitored to determine if any discolouration of water being discharged is noted (visually monitored only at this point) and to ensure that water at temperature similar to hot flow is being discharged to drain point.

    e. All cold outlets on BMT side of ward shall then be opened and flushed through, again monitoring for any signs of discolouration (visual) and to ensure that hot water is being discharged from the cold outlets.

    f. This flushing shall continue for a minimum period of 60 minutes. If discolouration of water is noted at any outlets/discharge point then flushing shall continue until water is running clear. All valves will then be shut off and temporary backflushing pipework disconnected.

    g. The cold line shall then be opened in the riser and flushing of the outlets within the area carried out through outlets until no hot water remains within the system. Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).

6. BMT Side (Fed from Riser M39) – Hot Flow Line Backflushing

    a. Hot water lines shall be isolated within riser M39 (both isolation valves open/online shall be closed to minimise any risk of potential backflow into the live system).

    b. The cold water line shall then be connected from the cold line into the hot flow line at new cut in locations as described above.

    c. Cold water shall then be flushed into the hot flow line and drawn off to drain point in the riser, M39, and run to drain.

    d. Water condition at drain shall be monitored to determine if any discolouration of water being discharged is noted (visually monitored only at this point) and to ensure that water at temperature similar to cold is being discharged to drain point.

    e. All hot outlets on BMT side of ward shall then be opened and flushed through, again monitoring for any signs of discolouration (visual) and to ensure that cold water is being discharged from the hot outlets.

    f. This flushing shall continue for a minimum period of 60 minutes. If discolouration of water is noted at any outlets/discharge point then flushing shall continue until water is running clear. All valves to then be shut off and temporary backflushing pipework disconnected.

    g. The hot flow line shall then be opened in the riser and flushing of the outlets within the area carried out through outlets until no cold water remains within the system. Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).

7. BMT Side (Fed from Riser M39) – Hot Return Line Backflushing

    a. Hot water flow water lines shall be isolated within riser M39 (both isolation valves open/online shall be closed to minimise any risk of potential backflow into the live system).

    b. The hot water return line shall then be opened within riser M39. **Note:** Cold water line within Riser M39 shall also require to be open at this stage so that TMT cartridges will not "slam" and will permit water to be discharged from outlets.

    c. Hot water shall then be flushed from Riser M39 into Ward 2A BMT side of ward.

    d. All hot outlets on BMT side of ward shall then be opened and flushed through, again monitoring for any signs of discolouration (visual) and to ensure that hot water is being discharged from the hot outlets.

    e. This flushing shall continue for a minimum period of 60 minutes. If discolouration of water is noted at any outlets/discharge point then flushing shall continue until water is running clear. All valves to then be shut off.

    f. Once backflushing of the hot return lines is complete the hot return line shall be closed in the riser (both valves closed) and hot flow line opened and flushing of the outlets within the area carried out through outlets until hot water backflushed in from the return line is flushed out (Anticipated flushing time of approx. 10 – 15 minutes required). Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).

8. HOTCT Side (Fed from Riser M36) – Cold Line Backflushing

    a. Cold water lines shall be isolated within riser M36 (both isolation valves open/online shall be closed to minimise any risk of potential backflow into the live system) and hot lines isolated at point where hot and cold are joined above entrance to the ward.

    b. The hot water line shall then be connected from the Hot flow line in BMT side of ward into the cold line at new cut in locations as described above on HOTCT side of ward.

    c. Hot water shall then be flushed into the cold line and drawn off to drain point in the riser, M36, and run to drain (**Note:** in order to draw off to drain point in riser there is only a single isolation valve to live system between draw off point and live system. Therefore flushing to outlets within wards may only be possible unless an additional t-piece and drain off point can be installed prior to double isolation).

    d. Water condition at drain shall be monitored to determine if any discolouration of water being discharged is noted (visual monitored only at this point) and to ensure that water at temperature similar to hot flow is being discharged to drain point.

    e. All cold outlets on HOTCT side of ward shall then be opened and flushed through, again monitoring for any signs of discolouration (visual) and to ensure that hot water is being discharged from the cold outlets.

    f. This flushing shall continue for a minimum period of 60 minutes. If discolouration of water is noted at any outlets/discharge point then flushing shall continue until water is running clear. All valves to then be shut off and temporary backflushing pipework disconnected.

    g. The cold line shall then be opened in the riser and flushing of the outlets within the are carried out through outlets until no hot water remains within the system. Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).

9. HOTCT Side (Fed from Riser M39) – Hot Flow Line Backflushing

    a. Hot water flow lines shall be isolated at point where hot and cold are joined above entrance to the ward.

    b. The hot water flow line shall then be connected from the Hot flow line in BMT side of ward into the hot flow line at new cut in locations as described above on HOTCT side of ward.

    c. Hot water shall then be flushed into the hot flow line and flushed to outlets within HOTCT side of the ward. **Note:** Cold line from Riser M36 into HOTCT side of ward will require to be live at this stage so that TMT cartridges will not "slam" and will permit water to be discharged from outlets.

    d. Water condition at drain shall be monitored to determine if any discolouration of water being discharged is noted (visually monitored only at this point) and where direct hot outlets (TCT Social) to ensure that water at temperature similar to hot flow from BMT side is being discharged at outlets.

    e. All hot outlets on HOTCT side of ward shall then be opened and flushed through, again monitoring for any signs of discolouration (visual) and to ensure that hot water is being discharged from the hot outlets.

    f. This flushing shall continue for a minimum period of 60 minutes. If discolouration of water is noted at any outlets/discharge point then flushing shall continue until water is running clear. All valves to then be shut off and temporary backflushing pipework disconnected.

g. Once backflushing of the hot flow lines is complete the cold line shall be opened at point where hot and cold are joined together above entrance and flushing of the outlets within the area carried out through outlets until no hot water remains within the system. Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).

10. HOTCT Side (Fed from Riser M39) – Hot Return Line Backflushing

a. Hot water return lines shall be isolated at point where hot and cold are looped together above entrance to the ward.

b. The hot water return line shall then be looped across from the Hot flow line in BMT side of ward into the hot return line at new cut in locations as described above on HOTCT side of ward.

c. Hot water shall then be flushed into the hot return line and flushed to outlets within HOTCT side of the ward. **Note:** Cold line from Riser M36 into HOTCT side of ward will require to be live at this stage so that TMT cartridges will not "slam" and will permit water to be discharged from outlets.

d. Water condition at drain shall be monitored to determine if any discolouration of water being discharged is noted (visually monitored only at this point) and where direct hot outlets (TCT Social) to ensure that water at temperature similar to hot flow from BMT side is being discharged at outlets.

e. All hot outlets on HOTCT side of ward shall then be opened and flushed through, again monitoring for any signs of discolouration (visual) and to ensure that hot water is being discharged from the hot outlets.

f. This flushing shall continue for a minimum period of 60 minutes. If discolouration of water is noted at any outlets/discharge point then flushing shall continue until water is running clear. All valves to then be shut off and temporary backflushing pipework disconnected.

g. Once backflushing of the hot return lines is complete the cold line shall be opened at point where hot and cold are joined together above entrance and flushing of the outlets within the area carried out through outlets until no hot water remains within the system. Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).

11. Ward 2B (Fed from Riser M39) – Cold Line Backflushing

a. Cold water lines shall be isolated within riser M39 (both isolation valves on line shall be closed to minimise any risk of potential backflow into the live system).

b. The hot water line shall then be looped across from the Hot flow line into the cold line at new cut in locations as described above.

c. Hot water shall then be flushed into the cold line and drawn off to drain point in the riser M39, and run to drain.

d. Water condition at drain shall be monitored to determine if any discolouration of water being discharged is noted (visually monitored only at this point) and to ensure that water at temperature similar to hot flow is being discharged to drain point.

e. All cold outlets on in Ward 2B shall then be opened and flushed through, again monitoring for any signs of discolouration (visual) and to ensure that hot water is being discharged from the cold outlets.

f. This flushing shall continue for a minimum period of 60 minutes. If discolouration of water is noted at any outlets/discharge point then flushing shall continue until water is running clear. All valves to then be shut off and temporary backflushing pipework disconnected.

g. Once backflushing of the cold lines is complete the line shall be opened in the riser and flushing of the outlets within the area carried out through outlets until no hot water remains within the system. Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).

12. Ward 2B (Fed from Riser M39) – Hot Flow Line Backflushing

a. Hot water lines shall be isolated within riser M39 (both isolation valves open/online shall be closed to minimise any risk of potential backflow into the live system).

b. The cold water line shall then be connected from the cold line into the hot flow line at new cut in locations as described above.

c. Cold water shall then be flushed into the hot flow line and drawn off to drain point in the riser, M39, and run to drain.

d. Water condition at drain shall be monitored to determine if any discolouration of water being discharged is noted (visually monitored only at this point) and to ensure that water at temperature similar to cold is being discharged to drain point.

e. All hot outlets on Ward 2B shall then be opened and flushed through, again monitoring for any signs of discolouration (visual) and to ensure that cold water is being discharged from the hot outlets.

f. This flushing shall continue for a minimum period of 60 minutes. If discolouration of water is noted at any outlets/discharge point then flushing shall continue until water is running clear. All valves to then be shut off and temporary backflushing pipework disconnected.

g. Once backflushing of the hot flow lines is complete the line shall be opened in the riser and flushing of the outlets within the area carried out through outlets until no cold water remains within the system. Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).

13. Ward 2B (Fed from Riser M39) – Hot Return Line Backflushing

a. Hot water flow water lines shall be isolated within riser M39 (both isolation valves open/online shall be closed to minimise any risk of potential backflow into the live system).

b. The hot water return line shall then be opened within riser M39. Note: Cold water line within Riser M39 shall also require to be open at this stage so that TMT cartridges will not "slam" and will permit water to be discharged from outlets.

c. Hot water shall then be flushed from Riser M39 into Ward 2B

d. All hot outlets on Ward 2B shall then be opened and flushed through, again monitoring for any signs of discolouration (visual) and to ensure that hot water is being discharged from the hot outlets.

e. This flushing shall continue for a minimum period of 60 minutes. If discolouration of water is noted at any outlets/discharge point then flushing shall continue until water is running clear. All valves to then be shut off and temporary backflushing pipework disconnected.

f. Once backflushing of the hot return lines is complete the hot return line shall be closed in the riser (both valves closed) and hot flow line opened and flushing of the outlets within the area carried out through outlets until hot water backflushed in from the return line is flushed out (Anticipated flushing time of approx. 10 – 15 minutes required). Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).

14. Upon completion of backflushing, all isolation valves within risers etc. shall be shut off to prevent any back contamination into the live system. These shall remain closed until disinfection complete, and Estates provide permission for system to be opened to live system and all valves returned to normal system.

15. All new valves installed to allow for backflushing shall be removed and straight pipework reinserted ensuring no deadlegs created by this work.

16. System shall then be returned to normal service and flushing regime continued.

Reporting

Upon completion of works a site report should be completed, and submitted to client/site contact and inserted into the site logbook.

Client and/or site contacts should be notified of findings and any issues of concern noted during site visit.

Where site contact was not available to communicate finding to directly this should be recorded on the site report sheet.

Safety Risk Assessment

Hazard Type	Hazard Effect	Who Might be Harmed	S	L	R	Control Measures	Residual Risk		
							S	L	R
Manual Handling	Physical Injury caused by lifting heavy and or awkward loads	Operators	**3**	**2**	**6**	Split equipment into small easily handled parts. Individual should not lift or carry loads beyond their own capability and for bulky or heavy objects obtain assistance. Ensure work area and pathways are clear and suitable for lifting loads.	**2**	**1**	**2**
Exposure to Biological Contamination	Risk of contracting Legionnaires Disease or other infections (e.g. Weils Disease, e.coli, coliforms)	Operators	**5**	**2**	**10**	Minimise creation of aerosols. Ensure are is free of bacterial contamination (e.g. rodent bird droppings). Suitable PPE to be worn if general area contaminated (e.g. Gloves, Masks)	**5**	**1**	**5**
Cuts/Abrasions	Cutting / trapping hands or fingers on tools & equipment or on sharp materials in work area	Operators	**3**	**3**	**9**	Wear suitable protective footwear, clothing, gloves and goggles where appropriate, and follow manufacturer's instructions for equipment. Inspect all equipment and ensure is fit for purpose prior to use.	**2**	**2**	**4**
Working at Height	Physical injury from falling off ladder roof or platforms, or equipment being dropped from height	Operators & others in area below	**5**	**2**	**10**	Ladders to be inspected prior to use to ensure fit for purpose. Only tasks of short duration to be carried out from ladders, or for access only. Roofs/platforms to be inspected to ensure safe prior to accessing.	**5**	**1**	**5**
Slip/Trip	Physical injury from falling slipping on wet/slippery surfaces or tripping over equipment/obstacles	Operators	**4**	**2**	**8**	Safety boots provide grip and ankle support and must be worn at all times Ensure that work area is kept tidy at all times. Ensure that hoses and cables do not present a trip hazard. Mop up any spills immediately. Ensure work area is adequately lit. When draining water systems ensure water is drained to a safe are (Drain) and does not contribute to a slipping or any other type of hazard.	**3**	**1**	**3**
Asbestos	Inhalation of asbestos fibres	Operators & others in area if disturbed	**5**	**3**	**15**	Consult Asbestos Register. Visual inspection of work area prior to commencing work. Stopping of all work if disturbed asbestos is suspected in any areas being worked in or could be disturbed by works being carried out.	**5**	**1**	**5**
Contamination of Water Systems	Contaminants entering into domestic water systems from external sources	Operators	**5**	**3**	**15**	Only pumps and hoses designated for use on domestic water systems to be used for working on domestic water systems.	**5**	**1**	**5**
Electrocution	Burns/injury caused by electrocution	Operators	**4**	**2**	**8**	All equipment should be 110V (or less) and be PAT tested with an up to date label. All electrical equipment should be inspected prior to use by the operator in accordance with DMA Canyon procedures.	**3**	**1**	**3**

Safety Risk Assessment

ADDITIONAL SITE SPECIFIC RISKS NOT PREVIOUSLY IDENTIFIED OR SITE CONDITION WHICH AFFECTS THIS ASSESSMENT SHOULD HAVE A DYNAMIC RISK ASSESSMENT FORM COMPLETED.											
Hazard Type	**Hazard Effect**	**Who Might be Harmed**	**S**	**L**	**R**	**Control Measures**	**Residual Risk**		

SEVERITY						
	Fatal/Permanent Disability	**5**	**10**	**15**	**20**	**25**
	Long Term Absence	**4**	**8**	**12**	**16**	**20**
	Injury - >3 days lost time	**3**	**6**	**9**	**12**	**15**
	Injury - <3 days lost time	**2**	**4**	**6**	**8**	**10**
	Negligible – No lost time	**1**	**2**	**3**	**4**	**5**
		Remote	Possible	Likely	Very Likely	Inevitable
		LIKELIHOOD				

Final Assessment

Provided company personnel have fully assessed area/task and follow the control measures and carry out tasks in a safe manner as detailed above, the level of risk associated with the tasks identified will be reduced to an acceptable low level of risk. Site operators must assess the site/work area and tasks to be carried out on site prior to works commencing. Any additional risks not covered by the initial assessment must be added, assessed in the relevant area on following page prior to works commencing and suitable safety precautions recorded and taken in order to maintain acceptable level of risk.

EMERGENCY CONTACTS:	
Emergency Contact Number:	To be filled in on site prior to works commencing.
Site Contact & Number:	To be filled in on site prior to works commencing.
DMA Canyon Emergency Contact & Number:	See also DMA Canyon Contact Numbers on Covering Page. To be filled in on site prior to works commencing.

EMERGENCY PROCEDURES

In the event of an emergency occurring whilst operator working inside CWST DMA Canyon "Attendant" operator should contact the emergency services, highlighting the nature of the incident, site address, contact numbers (both DMA Canyon and site). Operators shall follow emergency services instructions as appropriate. Site First Aid should be contacted for assistance until emergency services attend. Site contact and DMA Canyon emergency contact should also be contacted ASAP. Details of all incidents should be recorded on accident/incident forms as per DMA Canyon procedures.

Client/Site	QEUH – Royal Hospital for Children	Draft for Approval
Activity	Installation of Auto-flushing units (Aqua Free 2.0) within Wards 2A & 2B	Version 1 **Review**
Date Works to Be Carried Out	TBC	N/A – One off works
Method Statement Created By	David Watson/Gordon McAlpine	Operator review prior to works commencing

Operators On Site	**Name**	**Signature**	**Date**
Lead Operator	Craig Guyer		
Additional Operators	Mark Rawlinson		
	Robert Taylor		
	David Watson		

Lead Operator is responsible for Implementing MS/RA and Managing Works on site
All operators to review Method Statement and Risk Assessment prior to works commencing.
Lead Operator to produce appropriate works record upon completion of works.

COSHH Details

DMA Canyon Operators should ensure copies of all relevant COSHH sheets are carried on site, either electronically (on Laptop/Smartphone) or paper copy.

Emergency, First Aid, Fire Safety, Welfare Arrangements and Site Rules

It is the responsibility of DMA Canyon Operators in conjunction with Site/Client to familiarise themselves with site/local Emergency, First Aid, Fire Safety and Welfare arrangements and to ensure compliance with all local site safety rules prior to works commencing. First Aid Kits should be carried in vehicles at all times.

DMA Canyon Escalation Details:

In the event of an emergency DMA Canyon Operators should contact their Supervisor/Manager.
In the event of Line Manager being unavailable then DMA Canyon Directors should be contacted.
Site/Client should alert DMA Canyon Operators to any sites specific or local emergency contact procedures.

DMA Canyon Office	[redacted]
Isabel Staniard	[redacted]
Chris Canty	[redacted]
David Watson	[redacted]
Mike Kinghorn	[redacted]
Gordon McAlpine	[redacted]
Graeme McCullie	[redacted]

Method Statement

Installation of Auto Flushing Units in Wards 2A & 2B

1. This method statement will be used for the installation of auto flushing units (Aqua Free 2.0) in Wards 2A & 2B of the RHC.

2. Works shall be carried out by suitably trained/competent operators in accordance with this method statement.

3. The only tools which should be required for these works is a small shifting spanner to tighten tap adaptors into the spout. Ensure tools are clean before commencing works and disinfected prior to works being carried out. Tools should be set down on Clinell wipes (Green Pack/Disinfecting Wipes) when not being used.

4. Operators shall ensure hands are thoroughly washed prior to commencing works and new disposable gloves shall be worn for each tap adaptor/flushing unit being installed. Gloves shall be removed and disposed of immediately after unit installed.

5. Units shall be fitted on outlets as agreed with GGC Estates/Projects/ICT (proposed list for confirmation is included below).

6. A TAP21MV (or Tap21MN) adaptor shall be fitted to the end of the tap spout where unit has to be fitted. Prior to installation the fitting (and connection point on spout) shall be sprayed with 70% IPA and set down on a Clinell wipe for 2 minutes. Screw adaptor into tap spout and if necessary tighten with shifting spanner.

7. Remove the Auto flushing unit from box and spray end to be connected into tap adaptor with 70% IPA (and down into the inside of connector lug). Leave to dry for 2 minutes. If unit is to be set down during this period it should be set down on Clinell Wipes.

8. Insert unit into the tap adaptor ensure it clicks into place.

9. Remove the front cover of the flushing unit and insert 9V battery into unit.

10. Turn unit onto manual flushing and open tap to ensure the unit is flushing freely to drain and not splashing water out of sink. Also check that tap adaptor and unit are sealed and no water is escaping around fittings.

11. Set unit to flush every hour for a period of 10 minutes and place unit onto Auto flushing mode.

12. Tap Spout and Flushing unit shall eb wiped down with Clinell wipe upon completion of works.

Ward 2A Proposed Locations	**Comments**
HOTCT Room 7 – Clinical WHB & En-suite WHB	First Room on HOTCT side of ward (also on sampling list)
HOTCT Room 3 – Clinical WHB & En-suite WHB	End of branch for TCT Rooms (also on Sampling List)
HOTCT Room 10 – Clinical WHB & En-suite WHB	On Sampling List
HOTCT Room 13 – Clinical WHB & En-suite WHB	
HOTCT Room 2 – Clinical WHB & En-suite WHB	
HOTCT Room 26 – Clinical WHB	End of line within HOTCT
HOTCT Playroom	End of line within HOTCT
BMT DSR - WHB	First Room on BMT side of ward (Also on sampling List)
BMT Room 25 – Clinical WHB & En-suite WHB	End of line within BMT
BMT Treatment Room (at double doors) – Clinical WHB	End of line within BMT (Also on sampling List)
BMT Room 21 (Main Room) – Clinical WHB & En-suite WHB	
BMT Room 22 – Clinical WHB & En-suite WHB	On Sampling List
BMT Room 18 – Clinical WHB & En-suite WHB	
BMT Treatment Room (Next to Room 21) Clinical WHB	ON Sampling List

Ward 2B Proposed Locations	**Comments**
Toilet at Entrance to Ward 2B (2A side)	First Room on within Ward 2B
Consulting Room 1 – Clinical WHB	End of line within Ward 2B
Room A – Clinical WHB & En-suite WHB	On Sampling List
Room B – Clinical WHB & En-suite WHB	On Sampling List
Consulting Room 4 – Clinical WHB	

Safety Risk Assessment

Hazard Type	Hazard Effect	Who Might be Harmed	S	L	R	Control Measures	Residual Risk		
							S	L	R
Manual Handling	Physical Injury caused by lifting heavy and or awkward loads	Operators	**3**	**2**	**6**	Split equipment into small easily handled parts. Individual should not lift or carry loads beyond their own capability and for bulky or heavy objects obtain assistance. Ensure work area and pathways are clear and suitable for lifting loads.	**2**	**1**	**2**
Exposure to Biological Contamination	Risk of contracting Legionnaires Disease or other infections (e.g. Weils Disease, e.coli, coliforms)	Operators	**5**	**2**	**10**	Minimise creation of aerosols. Ensure are is free of bacterial contamination (e.g. rodent bird droppings). Suitable PPE to be worn if general area contaminated (e.g. Gloves, Masks)	**5**	**1**	**5**
Cuts/Abrasions	Cutting / trapping hands or fingers on tools & equipment or on sharp materials in work area	Operators	**3**	**3**	**9**	Wear suitable protective footwear, clothing, gloves and goggles where appropriate, and follow manufacturer's instructions for equipment. Inspect all equipment and ensure is fit for purpose prior to use.	**2**	**2**	**4**
Working at Height	Physical injury from falling off ladder roof or platforms, or equipment being dropped from height	Operators & others in area below	**N/A**	**N/A**	**N/A**	Ladders to be inspected prior to use to ensure fit for purpose. Only tasks of short duration to be carried out from ladders, or for access only. Roofs/platforms to be inspected to ensure safe prior to accessing.	**N/A**	**N/A**	**N/A**
Slip/Trip	Physical injury from falling slipping on wet/slippery surfaces or tripping over equipment/obstacles	Operators	**4**	**2**	**8**	Safety boots provide grip and ankle support and must be worn at all times Ensure that work area is kept tidy at all times. Ensure that hoses and cables do not present a trip hazard. Mop up any spills immediately. Ensure work area is adequately lit. When draining water systems ensure water is drained to a safe are (Drain) and does not contribute to a slipping or any other type of hazard.	**3**	**1**	**3**
Asbestos	Inhalation of asbestos fibres	Operators & others in area if disturbed	**N/A**	**N/A**	**N/A**	Consult Asbestos Register. Visual inspection of work area prior to commencing work. Stopping of all work if disturbed asbestos is suspected in any areas being worked in or could be disturbed by works being carried out.	**N/A**	**N/A**	**N/A**
Contamination of Water Systems	Contaminants entering into domestic water systems from external sources	Operators	**5**	**3**	**15**	Only materials designated for use on domestic water systems to be used for working on domestic water systems.	**5**	**1**	**5**
Electrocution	Burns/injury caused by electrocution	Operators	**4**	**2**	**8**	All equipment should be 110V (or less) and be PAT tested with an up to date label. All electrical equipment should be inspected prior to use by the operator in accordance with DMA Canyon procedures.	**3**	**1**	**3**

Safety Risk Assessment

ADDITIONAL SITE SPECIFIC RISKS NOT PREVIOUSLY IDENTIFIED OR SITE CONDITION WHICH AFFECTS THIS ASSESSMENT SHOULD HAVE A DYNAMIC RISK ASSESSMENT FORM COMPLETED.												
Hazard Type	**Hazard Effect**	**Who Might be Harmed**	**S**	**L**	**R**	**Control Measures**	**Residual Risk**		

SEVERITY						
	Fatal/Permanent Disability	**5**	**10**	**15**	**20**	**25**
	Long Term Absence	**4**	**8**	**12**	**16**	**20**
	Injury - >3 days lost time	**3**	**6**	**9**	**12**	**15**
	Injury - <3 days lost time	**2**	**4**	**6**	**8**	**10**
	Negligible – No lost time	**1**	**2**	**3**	**4**	**5**
		Remote	Possible	Likely	Very Likely	Inevitable
		LIKELIHOOD				

Final Assessment

Provided company personnel have fully assessed area/task and follow the control measures and carry out tasks in a safe manner as detailed above, the level of risk associated with the tasks identified will be reduced to an acceptable low level of risk. Site operators must assess the site/work area and tasks to be carried out on site prior to works commencing. Any additional risks not covered by the initial assessment must be added, assessed in the relevant area on following page prior to works commencing and suitable safety precautions recorded and taken in order to maintain acceptable level of risk.

EMERGENCY CONTACTS:	
Emergency Contact Number:	To be filled in on site prior to works commencing.
Site Contact & Number:	To be filled in on site prior to works commencing.
DMA Canyon Emergency Contact & Number:	See also DMA Canyon Contact Numbers on Covering Page. To be filled in on site prior to works commencing.

EMERGENCY PROCEDURES

In the event of an emergency occurring whilst operator working inside CWST DMA Canyon "Attendant" operator should contact the emergency services, highlighting the nature of the incident, site address, contact numbers (both DMA Canyon and site). Operators shall follow emergency services instructions as appropriate. Site First Aid should be contacted for assistance until emergency services attend. Site contact and DMA Canyon emergency contact should also be contacted ASAP. Details of all incidents should be recorded on accident/incident forms as per DMA Canyon procedures.

Item No.	HFS questions raised via HFS email issued 24/11/2021	Response email by (AE water) 24/11/2021	HFS response (01/12/2021)	DMA Comments
1	from the meeting note for 19/11/2021 section 3.A – *'There was a previous issue with internal tap corrosion with all spouts being replaced with new as a result. MM confirmed that Armitage Shanks had prepared a fairly generic response subsequent to their investigations blaming chemical attack. Additional results are still awaited from taps from other sites where Cl02 is not in use.'* When were the spouts replaced? Is an independent review being undertaken into the tap corrosion? Are there pictures of the corrosion?			Kerr Clarkson has these photos. Unsure if independent report into corrosion has been asked for. All spouts have not been replaced as yet. The new spouts are being stored (in orginal packing) in Plantroom 31 ready to be installed when instructed/ward ready for use to prevent possible contamination of new spouts. All sampling is carried out using new spouts which are stored in 70% IPA.
2	are there diagrams/ schematics indicating where the cut-ins etc. are proposed? – as its currently unclear.			These are being marked up and will be sent back with the RAMS for these works
3	are there RAMS for the cut-ins/ backflush? The DMA email refers to back flush as *'then back flush from here down each of the lines through all outlets within ward.'* What testing/ checks will be undertaken then?		RAMS received 23/11/2021 - see below for comments.	
4	is there evidence of a biofilm?	The pipework looks clear when any sections have been removed in the past but no swabs have been taken.	1 - *'The pipework looks clear…'* how was this assessed that visually the pipework cleanliness is suitable? 2 - *'…when any sections have been removed…'* Which sections were removed? Why were they removed? Who removed them? Was suitable RAMS in place? 3 - *'...removed in the past...'* When was the past? was the sections removed prior to the ward closure or as a result of the recent DMA enhanced testing? 4 - *'...no swabs have been taken.'* why were no swabs taken? how was this risk assessed? was NHS GG&C WSG consulted?	Pipework has only been inspected visually so far as we are aware. This was not a formal inspection, just a comment that the internal surfaces did not appear to have obviously visible fouling on small sections which we saw. Sections removed and inspected have been small sections which were removed to allow for modifications for new taps to be installed. These were removed by other contractors (Livingston Mechanical, MPMH, James Frew). Projects/Estates would have to comment on RAMS etc. Period when these were removed vary from 2018/2019 through to 2020 as various upgrade works were carried out. Other sections may have been removed and inspected by Projects/Estates or other contractors but we havent seen these. *The reason no swabs taken would have to be answered by Projects/Estates/ICT. We were not requested to do any inspection/analysis on pipework removed during any of the upgrade works.*

5	please advise what level of sampling was undertaken by MPMH and were these reviewed and signed off?			*This would have to be answered by Projects/Estates as we have not seen any MPMH sampling records.*
6	what microbiological results are being seen across the QEUH/ children's hospital?	Sampling has been undertaken at the floor below and above as a comparison. The levels in 2A and 2B seem to be higher.	1 - HFS received sampling results for floors Grd/First and third/fourth - received 20/11/2021 2 - what are the results like across the rest of the QEUH and children's hospital?	Should full A&C DMA Sample spreadsheets be shared with HFS?
7	has consideration been given to the pipework between the main riser and the ward?	The water samples look ok from the tanks and the riser and the thought is that there is something concerning between the riser and the outlets but we currently cannot be sure where the issue might be in that area.	1 - HFS comment was in relation to pipework between the riser and ward. However, due to the RAMS being developed - no further comment.	No response required.
8	have the microbiological results been compared to levels before the ward closed?			At present this has not been carried out so far as we are aware. Information abailable to be shared with whoever this is tasked to.
9	is there a Plan C if the proposed does not work?			*This would have to be answered by Projects/Estates/ICT.*
10	has the project been handed over from MPMH? – who is responsible for the ward			*This would have to be answered by Projects/Estates.*
11	when was the pipework wetted prior to commissioning? And was the sequence of activities witnessed and signed off? Is all tap commissioning complete?			*This would have to be answered by Projects/Estates.*
12	has MPMH checked/ cleaned the drains?			*This would have to be answered by Projects/Estates.*
13	does the ward have WC lids? And have these been risk assessed due to the 'WC sneeze' ?			No - WCS within Ward 2A/2B (and across the entire A&C) do not have lids on them.

14	has the disinfection method been checked with the systems fittings manufacturers. I.e.. The pipework/ taps etc.?	Yes - almost without exception they say that chemical disinfection will invalidate the warranty. We feel that we are beyond that warranty issue now.	1- Email received 23/11/2021 states: *'Please note that as discussed using peroxide at higher concentrations can have a detrimental effect on system materials and may invalidate warranties on pipework valves, taps and other system materials.'* Using the term '*may* ' implies this has not been checked with the manufacturers - can written letters be evidence as required for materials? Please advise the warranty periods for system components? 2 - HFS are aware new stainless steel pipework was installed within 2A HOTCT during the ventilation refurbishment project, is this still in the warranty period?	*This would have to be answered by Projects/Estates. If disinfection proposed is to be amended then RAMS can be updated accordingly based on instructions given.*
15	have the installed taps/ showers/ strainers been internally swabbed?			So far as we are aware no swabs of the internal surfaces of taps, showers, strainers etc. have been carried out and we have not been requested to do this.
16	DMA general RAMS document received 23/11/2021.	Page 1 of 4. general project details.	Document is missing client/site name, date, activity etc. Please complete and reissue to NHS GG&C.	RAMS will be updated to include site name, activity etc.
17	DMA general RAMS document received 23/11/2021.	Page 2 of 4. Point 2 refers to '*…to spray all tool surfaces'* Point 3. *'leave for 2 minutes to disinfect the tools prior to use'*	When sprayed where does the tools go to dry? On a hygienically clean surface? please advise	RAMS have been update to state tools would be placed onto a clean surface with Clinnell wipes laid out for tools to sit on.
18	DMA general RAMS document received 23/11/2021.	Page 2 of 4. '*If tools are not in a suitable condition they must not be used,…'*	Please advise what is defined as '*not in a suitable condition'.*	By suitable condition this is referring to tools fit for purpose and not damaged or dirty/fouled. Plumbers trained by site AE on requirements of working within hospitals and the use of clean tools etc.
19	DMA general RAMS document received 23/11/2021.	Page 2 of 4. General plumbing, '*Works shall be carried out by suitably trained/ competent operators…* '	Please advise details of *'suitably trained/ competent operators'* has GG&C reviewed?	Training certs supplied to Estates and plumbers have take CP test on site.

20	DMA general RAMS document received 23/11/2021.	Page 2 of 4 Local disinfection procedure *'When minor alterations/ repairs are carried out the local disinfection of fittings will be carried out by spraying all surfaces of fittings with a 70% Isopropyl Alcohol solution and leaving for a period of 2 minutes.'*	Leave where? Leave on what?	RAMS have been update to state components would be placed onto a clean surface with Clinnell wipes laid out forcomponents to sit on.
21	DMA general RAMS document received 23/11/2021.	HFS general comment	It is unclear what pipe materials, valves etc. are being put into the system as part of the cut ins. Please advise. Please advise and provide photos of any stored materials that will be cut into the system to demonstrate that they have been stored to SHTM standards. It is unclear if at any time the system will be drained for the cut-ins. If it is to be drained, for how long for the works? has this been risk assessed and discussed with the WSG?	Cut in materials will be a combination of Xpress pressfit stainless steel fittings, albion lever valves (brass) and Hep2O plastic pipework and copper if necessary. When this is removed all slip straights to be reinserted shall be Xpress stainless steel and 316 Stainless steel pipe. Materials bought for the works we purchased on the morning of 30/11 from merchants and brought straight to site with the intention of materials being used that day. When it became clear that the works were to be delayed all materials were brought back to DMA office and labelled up and set aside for these works. All materials are still in packaging/bag as delivered by merchant and placed into a plastic box. 2 lengths of stainless steel purchased for works had caps placed onto ends when brought back to office. Locations selected for cut ins are after local isolation valves to minimise drain downs, and the practicalities of accessing the piepwork to create the cut ins (much of the pipework is inaccessible to cut in and remove valves). It is anticipated that cuts ins will take approx 20-30 minutes, but this may take longer depending on how easily accessible each individual point is. Not aware of this process being discussed out with the recent meetings or at WSG.
22	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 Point 2. *'Works shall be carried out by suitably trained/competent operators…'*	Has NHS GG&C reviewed the proposed operators CV etc.?	Training certificates sumbitted previoulsy to GGC for operators who would be working on the system and plumbers have taken CP test on site.
23	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 describes the works.	No drawing or mark-up has been issued for clarity of the works. Will a mark-up etc. be issued prior to commencement of the works?	Drawings will be marked up and submitted along with RAMS

24	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 section 5 point (A) *'Cold water lines shall be isolated within riser M39 (both isolation valves open/ online shall be closed to minimise any risk of potential backflow into the live system'*	The word *'minimise'* implies there is still a risk? Has the Isolation valves been checked for erosion from general wear and tear or CL02 effects? Should an additional isolation valve be considered or the end of line pipework section removed and have a physical air break?	The word "minimise" has been used as no guarantee can be provided that there is "no" risk of back contamintation. The back flushing proposal has been generated based on how the system is currently set up and utilising valves currently on the system. Should additonal valves or a system break be requested then an alternative proposal would have to be generated. We are unaware of any valve inspections having been carried out on the isolation valves. MPMH, James Frew may be able to comment on whether valves held and were working as expected if/when closed during their works on the ward.
25	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 section 5 point (B) *'The hot water line shall be connected from the hot water flow line into the cold line at new cut in locations as described above'*	Has backflow protection been considered from the cold pipe to the hot pipe when filling and flushing?	If additonal backflow is considered necessary on the hot and cold lines when carrying out the back flushing then these can be incorporated. A check valve in the Hep2O line between the hot and cold connections being created can be incorporated into the back flushing setup/cut ins.
26	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 section 5 point C *'Hot water shall then be flushed into the cold line and drawn off to drain point in riser, M39 and run to drain '*	Where does the drain run into i.e. Existing stack? Is there a dead leg between the isolation valve from the riser and the drain point?	There are drain stacks within the risers where lines are to be flushed back to (these were installed as part of the W2A ClO_2 installation). The connection points on the lines are drain cocks, which for the purposes of disinfection and other works have temporarily been exchanged for 15mm lever valves.
27	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 section 5 point E *'All cold water outlets in BMT side of ward shall then be opened and flushed through…'*	The Marwick taps have scalding slam shuts, has consideration been given how this will be effected by having no cold water in the pipework?	This has been addressed within the RAMS.
28	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 section 5 point F *'This flushing shall continue for a minimum period of 45 minutes'*	If the process proposed is to also sterilise the cold water pipework as a *'heat flush',* has consideration been given to SHTM 04-01 Part D Clause 2.8: '…b*y circulating the water throughout the system for at least an hour at 75oC.'* NHS GG&C have indicated that the water temperature will be about 65oC. The efficacy of this approach is untested. What is the driver for the 45 minutes? Has the thermal expansion of the pipework been considered?	This process was never proposed as a "heat flush". Proposal was for a back flush of the system only.

29	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 section 5 point (g) *'The cold line shall then be opened in the riser and flushing of the outlets within the area carried out through outlets until no hot water remains within the system. Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually).*	Regarding *'..until no hot water remains within the system.'* Will temperature checks be made on the cold water being flushed with a temperature probe? Has consideration been given to how long the cold outlets will be flushed for after reaching temperature at outlets? - has consideration been given that the pipe insulation may be warm after the heat flush and as the cold water is moving its not picking it up until after the outlets are closed and cold water not used? '*...until water runs clear (visually)'* was this agreed with WSG/AE? just a visual check?	Water temperatures would be checked to ensure water returns to normal operating temperature (using thermometers) on all hot and cold lines after flushing. If water requires to be flushed for additonal period after temperature returns to normal temperatures then RAMS can be amended to incorpoate this extra flushing (this may increase timescales for works to be completed). Running water until visually clear was what was discussed on original meeting. If an alternative methodology is proposed and agreed this can be incorporated into the RAMS.
30	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 section 6 point A *'Hot water lines shall be isolated within riser M39 (both isolation valves open/online shall be closed to minimise any risk of potential backflow into the live system).'*	The word *'minimise'* implies there is still a risk? Has the Isolation valves been checked for erosion from general wear and tear or CL02 effects? Should an additional isolation valve be considered or the end of line pipework section removed and have a physical air break?	See response to Q24 above.
31	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 section 6 point F *'This flushing shall continue for a minimum period of 45 minutes.'*	If the process proposed is to also sterilise the cold water pipework as a *'heat flush',* has consideration been given to SHTM 04-01 Part D Clause 2.8: '…b*y circulating the water throughout the system for at least an hour at 75oC.'* NHS GG&C have indicated that the water temperature will be about 65oC. The efficacy of this approach is untested. What is the driver for the 45 minutes? Has the thermal expansion of the pipework been considered?	See response to Q28 above.

32	DMA Back-flushing RAMS document received 23/11/2021.	Page 2 of 8 section 6 point G *'The hot flow line shall then be opened in the riser and flushing of the outlets within the area carried out through outlets until no cold water remains within the system. Again, system shall be monitored for signs of discolouration and any outlets discharging discoloured water shall be flushed until water runs clear (visually)'*	*...until water runs clear (visually)'* was this agreed with WSG/AE? just a visual check?	See response to Q29 above.
33	DMA Back-flushing RAMS document received 23/11/2021.	HFS general comment	Note. Above comments also apply to pages 3/4/5 of the DMA back flushing document and the other pipe branches back flushing.	No response required.
34	DMA Back-flushing RAMS document received 23/11/2021.	Page 5 of 8 section 14 *'Upon completion of back flushing, all isolation valves within risers etc. shall be shut off to prevent any back contamination into the live system. These shall remain closed until disinfection complete, and Estates provide permission for system to be opened to live system and all valves returned to normal system.'*	When will any strainers and internal chambers of taps be checked if any dislodged biofilm has accumulated? Has consideration been given that if biofilm has collected at strainers etc. should this be removed before disinfection? Has consideration been given that cross connecting system pipework could spread the micro bacteria problems?	Checking of strainers has been included within the timeline/description of works. When this is to be carried out to be agreed with WSG. When microbiological results were discussed it was discused and noted that both hot and cold systems appeared to have similar levels of contamination. Projects/Estates/ICT would have to advise if this is considered an issue/risk before works progress.
35	DMA Back-flushing RAMS document received 23/11/2021.	Page 5 of 8 section 16 *'System shall then be returned to normal service and flushing regime continued.'*	Please advise what is the normal flushing regime? Who recently has been flushing? Please advise records are being maintained of the flushing regime?	Normal flushing regime is all outlets within the ward are flushed on a daily basis (7 days per week). This is carried out by DMA. Records for flushing are being maintained and submitted to GGC.
36	DMA Back-flushing RAMS document received 23/11/2021.	Page 6 of 8 reporting: *'Upon completion of works a site report should be completed, and submitted to client/site contact and inserted into the site logbook.'*	*...report <u>should</u> be completed'* We assume that a report will be completed.	A report will be completed.

37	DMA injection disinfection of domestic hot and cold water lines document received 22/11/2021.	Page 2 of 6 point 1 *' This method statement will be used for the DISINFECTION of COLD WATER SERVICES PIPEWORK by chemical means using Hydrogen Peroxide/Silver Ion Solution at 1000ppm H_2O_2 (2000ppm product) (see below for peroxide dose rates).'*	Has consideration been given whether this PPM will affect the longevity of the system or have detrimental effects on the system materials?	*This is tied into the warrantly issue raised during the meetings and is for Projects/Estates to consider.*
38	DMA injection disinfection of domestic hot and cold water lines document received 22/11/2021.	Page 2 of 6 point 5 *'Water tank used for disinfection shall washed out/rinsed with fresh water and then filled with fresh water.'*	What is defined as *'fresh water'*? Where will this water be taken from? Filtered?	Where the water for disinfection will be taken from is designated within the RAMS. Options are limited for where water can be obtained from as the only water supply in the area is within Ward 2A/2B or from the risers. "Fresh Water" in this instance is water which is being used as domestic water within the hospital. Should this water require to be filtered for the disinfection process then RAMS can be amended, though this has not been discussed previously.
39	DMA injection disinfection of domestic hot and cold water lines document received 22/11/2021.	HFS general comment	It is unclear what consideration has been given to whether the tap cartridges should or should not be in the tap during disinfection?, what age are these cartridges? Should they be removed before disinfection? Will the cartridges be replaced? - same questions for strainers. Will strainers be swabbed? replaced? when?	For Markwik taps the cartridges have to remain in the tap during the backflushing/disinfection procedure as the cartridge controls whether the tap is open or closed. If cartridge removed then effectively taps are open ends. Cartridges were replaced in October 2021. No swabbing has been requested previously. If cartridges are to be replaced again this would be a decision for Projects/Estates.
40	DMA issued the HUWA-SAN TR50 disinfection sheet, received 22/11/2021	Page 2 of 2 *'NOTE: In the first 12 hours after disinfection, you may notice discoloured water or pieces of biofilm coming through taps. This will subside.'*	Will strainers/ cartridges be replaced after 12hrs of disinfection? Will swabs be taken?	See response to Q39 above. Swabs can be taken if ICT/Estates/Projects request.
41	RHC Ward 2A - Water Sampling word document of meeting minutes (19th November 2021), received 20/11/2021	Page 2 section 2. *'Point of use filters will be installed prior to occupation which will mitigate any risk to the patients however all agreed that it needs to be understood why there are higher counts within Ward 2A with the issue resolved before ward occupation'*	Has it been confirmed that the POUF will mitigate all water borne bacteria from passing to the patients?	*Estates/ICT would require to answer this.*

42	RHC Ward 2A - Water Sampling word document of meeting minutes (19th November 2021), received 20/11/2021 (HFS was not invited to this meeting)	Page 2 section 3 part C: Ward Environment *'The ward has been unoccupied for nearly 2 years, as such environmental conditions are not that of a clean ward but of a building site. The ventilation is not yet switched on and cleaning has not been to a clinical clean standard. It was discussed that the environmental factors could have a bearing on results.'*	Have ductwork swabs been undertaken? Has air quality been tested? Can the ward start to be clinically cleaned? If so, when?	*This would have to be answered by Projects/Estates/ICT.*
43	RHC Ward 2A - Water Sampling word document of meeting minutes (19th November 2021), received 20/11/2021 (HFS was not invited to this meeting)	Page 3 of 3 section 3 *'• Daily flushing to be undertaken and automatic flushing values to be installed to better replicate normal water usage of a live ward and keep water circulating throughout the day.'*	Has a risk assessment been completed regarding automatic flushing valves? Has consideration been given to how the automatic flushing valves are cleaned/ disinfected before being installed? - to mitigate contamination of the valve to the tap.	A method statement for this will be produced.
44	2021 NHS QEUH Ward 2A-B sample Login sheet, received 20/11/2021	out of spec' excel tab - Column X - Pseudomonas	There are values ranging from '0' to >100 cfu/100ml. Please advise the sampling results from MPMHs testing? Is there a current Pseudomonas risk assessment? Has consideration been made to HPS '*Pseudomonas aeruginosa routine water sampling in augmented care areas for NHSScotland* .' document page 2 of 5, which discusses risk assess the need to remove outlets >10cfu/100mls? Has water splashing and distances also been reviewed/ monitored on site?	*Projects/Estates would require to answer this.* A Pseudomonas risk assessment was carried out by DMA in 2015 for ward 2A. Unaware of any other assessments since this and if one has been carried out as part of the upgrade works.

45	2021 NHS QEUH Ward 2A-B sample Login sheet, received 20/11/2021	out of spec' excel tab - Column R & S (TVCs), column Y (Mould), Column Z (Yeast), Column AA (Cupriavidus), Column AB (AMS) and Column AC (GNB other)	There are values across each column noted in RED. Please advise the bench marks being used for each column? And where these have been referenced too.	Parameters were as set by ICT.
46	2021 NHS QEUH Ward 2A-B sample Login sheet, received 20/11/2021	HFS general comment	As discussed on 23/11/2021. Have the current sample results been compared to results before the ward closed and previously to that when the Marwick taps were initially installed? Are the results similar?	Please see response to Q8 above.
47	Investigation failure of Markwik 21 + spout for ideal standard, received 23/11/2021	Page 5 of 19 Section 6.0 Conclusions *'Although a chrome finish is typically inert to most chemical attack, the presence of localised mechanical damage, rupturing the chrome layer, may have provided an initial site for the attack to occur.'*	Have the spouts or taps all been checked to ensure there is no mechanical damage?	New spouts are on site awaiting to be fitted. These are stil in original packing as supplied from Armitage Shanks and have not been inspected.
48	RHC Ward 2A - Water sampling email summary of actions by DMA. Received 21/11/2021	*'DMA shall reinstate the auto-flushing units onto outlets throughout the wards. Locations where these are to be fitted will be recorded so these are clearly identified. These shall be spaced throughout the wards to try and maximise water flow to all parts of the wards.'*	How are the auto-flush locations being chosen? What is the process of fitting auto-flushing units? Has the process of fitting and the location of the auto-flush units been reviewed by NHS GG&C? There are no formal documents capturing all sequences of events, including when strainers etc. will be checked for example. From a governance perspective the information to date is not in one consolidated package, as such any review of how the works were completed will be difficult. Have any previous auto-flush units that had been installed been swabbed?	Locations where these are to be fitted will be proposed within the RAMS for fitting. Unaware of any previous units being swabbed. Old units have been in storage for anumber of months and swabbing now may not refect the conditon of the units when they were removed.

49	RHC Ward 2A - Water sampling email, by AP Water (K Clarkson) Received 21/11/2021	*However anyone thoughts or options, would be appreciate on if there are other options rather than shock dosing the system and views on such high concentrations and any longer term clinical risk from any degradation.* *However the plan regardless is to still fit point use filters with at least 0.2ppm.* *We also did agree to :-* *1. Replace one Marwick 21+ tap existing with a new Marwick 21+ tap* *2. Replace a Marwick 21+ with a Delabie tap.* *3. Sample directly from the water source after removal of a tap.* *This is to potentially assist in identifying whether the issue is the tap and not the pipework. Mel will liaise with DMA on this.'*	The points listed here were not captured in the issued minutes from the previous meeting. This raises a concern of steps/ items being missed or lost. It is unclear what discussions there have been as to why shock dosing is being undertaken first rather than investigating the taps/ localised bacteria counts? Please advise that the Point of use Filters is only being considered as a temporary measure and not a long term solution to mask the issue? As per previous questions above, if the back-wash and disinfection does not work please advise on plan C? Were any previous Point of use Filters swabbed on the outgoing flow side to the basin?	Replacement of taps was considered previoulsy but due to time and other project constraints this was decided against and therefore system disinfection, and other subsequent actions was decided as the most appropriate course of action. *ICT/Estates would have to repsond to points re Plan C and Filters.*
50		HFS general comment	It is unclear from the email trails when water sampling will be undertaken during the processes? It is unclear whether the sampling method by DMA has been reviewed by NHS GG&C?	Sampling requirements has been clarified within the timeline/description of works. RAMS for sampling have been submitted to GGC previously for approval.
51	From TEAMS meeting 30/11/2021	HFS general comment: regarding cleanliness of strainers	DMA/ Estates advised some strainers are in walls/ IPS and new strainers are not available. Please advise whether a markup diagram can be created to indicate strainers that are inaccessible and whether these considerations have been risk assessed and formally documented?	*This will require input from Estates/Projects to confrim if/where the inline strainers are still fitted. These could then be marked up into a drawing.*

Chief Medical Officer, Public Health and Sport Directorate

The Scottish Government

CEL 03 (2012)

07 February 2012

Dear Colleague

Water sources and potential infection risk to patients in high risk units[1]

Introduction

The purpose of this letter is to remind you of the potential infection risks posed by water systems in healthcare facilities and to clarify actions required. This follows up the Health Facilities Scotland (HFS) email of 25 January 2011 "Water sources and potential for infection from taps and sinks" and communication to Infection Prevention and Control Teams (IPCTs) of January 2012 "SBAR on Pseudomonas and water".

Background

A number of incidents of pseudomonas and related infections have been reported across the UK where the source of infection is thought to be related to handwashing facilities. The emerging evidence is being collated and UK technical guidance is expected to issue later in the spring (2012) on sampling, testing and monitoring, along with further advice to inform local water safety plans. Detailed guidance will also be issued from Health Protection Scotland (HPS) and HFS to IPCTs.

In the meantime the immediate actions required are:

Actions

Chief Executives

- Ensure all high risk units[1] where patients may be at increased risk of pseudomonas and related infections are identified
- Ensure directors of these units are fully alerted to this issue
- Ensure best practice relating to the use of hand washing facilities is consistently and fully applied.

Infection Prevention and Control Teams

- Ensure any *Pseudomonas. aeruginosa** found in invasive specimens are identified as an alert organism and ensure appropriate surveillance systems are in place
- Ensure full and appropriate investigation of any such infection, including an assessment of whether the source may be water in this instance
- If water may be considered the source, the case/incident must be discussed with HPS

Review existing microbiological data to determine whether there are areas which could pose an immediate pseudomonas risk and undertake a risk assessment in these

For action
Board Chief Executives
Directors of Estates/Facilities
Strategic Facilities Group
HAI Executive Leads
Infection Control Managers
Infection Control Doctors

For information
Directors Nursing
Medical Directors
Directors Public Health
CsPHM (Health Protection)
HAI Task Force
Health Protection Scotland
Health Facilities Scotland

Enquiries to:

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- areas as a priority, including sampling
- In an area where there may be an immediate risk, work urgently with Estates/Facilities to minimise any risk identified

Directors of Estates/Facilities

- Ensure site engineering and cleaning protocols are fully compliant with current guidance (including SHTM 04-01) and that manufacturers' instructions with regard to installation and maintenance have been followed
- Ensure a coordinated approach between IPCTs and Estates/Facilities department on all water issues including through the establishment of a board/hospital water safety group
- Ensure all taps are flushed in accordance with the attached best practice for handwash basins to minimise the risk of *Pseudomonas aeruginosa* contamination in high risk units

[1] For example high dependency adult, paediatric and neonatal critical care, renal, transplant, haemato-oncology and burns unit

* *Pseudomonas aeruginosa* and other related Gram negative water-borne organisms.

Yours sincerely

Harry Burns ***Derek Feeley***

SIR HARRY BURNS **DEREK FEELEY**
Chief Medical Officer Director General

1. Best practice for hand wash basins to minimise the risk of P*seudomonas aeruginosa*[1] contamination in high risk units[2] in Scotland

1.1 Only use the hand wash basin for hand washing

- Do not dispose of body fluids at the hand wash basin – use the dirty utility area
- Do not wash any patient equipment in hand wash basins
- Do not use hand wash basins for storing used equipment awaiting decontamination

1.2 Run **all** taps (hot and cold) in high risk units (manually or automatically) at maximum flow first thing every morning for a period of two minutes and keep a record of when they were flushed.

1.3 Identify any problems or concerns relating to safety, maintenance and cleanliness of the hand wash basin to the Infection Prevention & Control Team (IPCT) and the Estates and Facilities Department.

1.4 Encourage good dialogue and communication between the IPCT, Infection Control Manager (ICM), Estates and Facilities department and High Risk Unit(s).

1.5 Use pre-filled single-use bottles for all hand hygiene products. Do not top-up hand hygiene dispensers or cleaning sprays/bottles.

1.6 Ensure that domestic staff have been trained on the correct decontamination procedures for taps and sinks and follow the guidance in the National Cleaning Specification for wash hand basins.

[1] *Pseudomonas aeruginosa* and other related gram negative water-borne organisms
[2] For example high dependency, adult and neonatal critical care, renal, transplant, haemato-oncology and burns units

2. Best practice for assessing and managing the risks[1] in high risk units[2] to minimise the risk of *Pseudomonas*[3] *aeruginosa* contamination

2.1 NHS Boards should set up a Water Safety Group to develop a water safety action plan - see link for more information http://whqlibdoc.who.int/publications/2011/9789241548106_eng.pdf

2.2 NHS Boards should identify a Responsible Person (Water).

2.3 Boards should develop a risk assessment and written scheme specific to *Pseudomonas aeruginosa* in addition to that in place for legionella. The risk assessment should identify elements such as: at risk patients and services, the suitability of the water distribution system – including types of taps used, identifying under-used outlets and hand wash basins, use of flexible hoses.

2.4 Ensure the Board's ability to demonstrate compliance with the National Infection Prevention and Control Manual and related guidance.

2.5 Ensure taps and thermostatic mixing valves (manual and automated) have been commissioned (including programming auto flushing cycles), and routinely validated, as per the manufacturer's instructions.

2.6 Further advice can be obtained from Health Protection Scotland and/or Health Facilities Scotland.

[1] Technical guidance on testing, sampling and managing the risk of *Pseudomonas aeruginosa* contamination in high risk units will be published in spring 2012. The implications of this document on the recently published SHTM 04-01 will be assessed for NHS Scotland.
[2] For example high dependency, adult and neonatal critical care, renal, transplant, haemato-oncology and burns units
[3] *Pseudomonas aeruginosa* and other related gram negative water-borne organisms

Summary of Incidents and Outbreaks on ward 2A since 1st March 2017

Ward 2A, RHC, is a 25 bedded Haemato oncology ward which cares for some of the sickest children in the hospital. Many of these patients have complex medical diagnosis and are very immunocompromised. Since the beginning of March, a number of incidents and outbreaks have been recognised in this ward requiring a high volume of Infection and Prevention Control Team resource and input, creating an increased workload for staff with associated anxiety and stress and detrimental outcomes for patients. Below is a list of the outbreaks and incidents since 1st March 2017.

Date	Incident	IPC Actions	Outcomes
28/02/17	X3 cases of Elizaethakingia miricola isolated from patient line cultures. This is a very rare organisms and associated with water and environment.	Problem Assessment Group (PAG) convened 3/3/17. • HIIAT Green. • Review of vent cleaning and maintenance by estates. • Lab sampling of vents and water outlets for analysis. • Infection Prevention and Control Nurse (IPCN) carried out visual inspection of environment.	• All 3 strains unique • Water and vent testing negative • Incident closed 27/3/17
03/03/17	Increased bacteraemia rates. General upward trend identified since July 2016. 11-13 positive blood cultures per month.	PAG convened 3/3/17. • HIIAT Green • Observational review of line care carried out by IPCNs – poor practices identified. Report collated and fed back to clinical team. • Review of environment for reconstitution of medications – inadequate space available and IV drugs therefore being prepared on a corridor worktop. Suggestions for improvements submitted. • Quality Improvement group focusing on Catheter Associated Blood Stream Infections (CLABSI) developed by Dr Timothy Bradnock.	• Continued high rates of bacteraemias within the unit. • QI group continue to meet and work on various aspects of action place specific to line care however as yet, no changes have been implemented.

		• Review of line care in Royal Marsden and Great Ormond Street Hospital by Lead IPCN – Findings relayed to CLABSI QI group and local teams.	
03/03/17	Perceived increase of invasive fungal infections first highlighted by medical staff.	PAG convened 6/3/17. • ICD carried out review of invasive fungal isolates and in general did not find rates of invasive infection to be any higher however it was recognised that there had been 3 cases of invasive Aspergillus fumigates infection within an 8 month timeframe which was higher than expected. Incident Management Team arranged for 7/7/17 specific to Aspergillus (see next entry).	• Incident specific to invasive fungal infections closed 06/03/17.
07/03/17	3 cases of invasive Aspergillus. All 3 cases were significantly affected and had increased morbidity as a result. 1 patient spent a lengthy period in PICU and 1 patient required lobectomy. All 3 had chemotherapy postponed and required long term anti fungals.	IMT convened 7/7/17. • HIIAT red and subsequently reported to HPS. • Ventilation specification • Review of construction and demolition works on and around the site by IPCT and exposure to patients. • Review of CLIC sargent house (Resident facility for patient and families of RHC) as possible risk by IPCT. • Review of general ward environment by IPCT for water leaks/estates works which may have exposed patients – a subsequent inspection by IPCT found mouldy ceiling tiles. Inspection of full ceiling void then followed and necessary repairs carried out. • General cleaning of ward found to be inadequate - Full terminal clean of ward took place. • Inspection of cooling beams which were reported to leak periodically. • Air sampling ongoing and water sampling carried out. • Hand hygiene audit carried out – Scored 85%	• All 3 patient cases recovered from the episode of Aspergillus infection and HIIAT was downgraded to Amber then eventually green once ceiling void repairs had been carried out. • Incident closed 28/4/17. • Ongoing surveillance reliant on clinical teams reporting a clinical diagnosis of Aspergillosis as lab testing is not reliable. To date, IPCT have been alerted to possible cases only after querying any new cases with clinical teams.

		• Anti fungals administered to all ALL patients on commencement of treatment.	
11/4/17	Increased incidence of Vancomycin Resistant Enterococci (VRE) isolates in stool. Total of 9 cases over 1 month period (previously 2 cases over 6 months). 8 of the 9 are HAI, 1 of which is to Edinburgh Sick Kids. VRE not the cause of GI upset however will be dispersed into the environment if patient having loose stools for any reason .	• PAG convened 12/4/17. The incident then became an outbreak of Rotavirus and Astrovirus (tabled below). • Review of antimicrobial prescribing carried out which revealed a marked increase in the use of Vancomycin and teicoplanin most likely as a result of the increased bacteraemia rates. • All isolates sent for typing – 4 patients had matching strains. The rest were unique. • Full terminal clean of ward carried out. • Actichlor cleaning daily previously discontinued across GGC after winter then resumed on a permanent basis for this ward. • Enforce use of Bristol stool chart to accurately record which patients were having loose stools. Further PAG held 28/4/17 after Astrovirus/Rotavirus outbreak was closed. • Action plan developed mainly focused on reduction of bacteraemia rates. • Increased visits to ward by IPCNs to reinforce Standard Infection Control Precautions (SICPs), Transmission Based Precautions (TBPs) and hand hygiene.	• Total cases now 10 with only 1 new HAI since the initial reporting. • Ongoing monitoring by IPCT. • Action plan still ongoing.
12/4/17	Roatvirus and Astrovirus outbreak. Lasted 14 days affecting 9 patients with 1 patient admitted to PICU as a direct result of vomiting associated with Astrovirus. Significant impact on service	PAG convened 12/4/17 intially to review VRE increase. PAGs held over subsequent days then identified the transmission of Rotavirus and Astrovirus. • HIIAT initially Amber then upgraded to Red following transfer of patient to PICU. • Infection Prevention and Control Audit (IPCAT) carried out 20/4/17. Scored within green range	• Ward reopened 25/4/17 with an increase in staff numbers to allow for burden of patients in isolation. • SICPs audit repeated with SCN and IPCN. Scored 96% although

	with transplant cases being diverted to Edinburgh.	(87% overall) however significant concerns with cleaning standards (scored 33%) despite twice daily cleaning prior to audit and terminal clean in previous days. • Extensive cleaning carried out and external contractor brought in to terminally clean ward before reopening. • Hand hygiene audit – scored 70%. Poor practice amongst medical staff. • Hand hygiene education sessions provided – currently 8 sessions carried out. Poor attendance by medical staff. • Daily IPCN visit to ward, sometimes twice daily. • Daily IMTs. • Staffing levels were increased on the ward. • Meeting held with Infection control doctor, Associate nurse director of IC, GM facilities and GM of 2A to discuss cleaning concerns on the ward.	some environmental issues identified again. • Hand hygiene sessions ongoing.
30/5/17	3 cases of Norovirus on ward, 2 HAI, 1 non HAI. All 3 symptomatic and nursed in rooms in close proximity to each other.	PAG convened 31/5/17. • HIIAT green. • IPCAT audit repeated 1/6/17 – poor score of 74% (SICPs 69%, SPE 69%, TBPs 94%, QA 50%) • Hand hygiene audit carried out – results awaited. • Daily visits to ward • Meeting requested with facilities management again to discuss cleaning standards on the ward.	• Ongoing daily assessments • Education to be arranged for staff re. SICPs.

SCOTTISH HOSPITALS INQUIRY

Bundle of documents for Oral hearings commencing from 19 August 2024 in relation to the Queen Elizabeth University Hospital and the Royal Hospital for Children, Glasgow

Bundle 27 - Miscellaneous Documents - Volume 3

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