

**Notes for Boards:
Infection Prevention and
Control (IPC) Risks in
the Design of a Neonatal
Unit (NNU)**

May 2024

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Contents

Introduction	5
Questions and answers.....	6
Question 1: What is the optimal functional and design considerations/requirements/guidance specifications for a neonatal unit/facility/build within the UK?	6
Question 2: What are the laundry facility requirements within a neonatal unit?.....	7
Question 3: What are the recommended requirements regarding provision of CHWB, toilet and shower facilities for NNU?	8
Question 4: What air change rate should be provided to a NNU?	9
Question 5: What pressure differentials should be applied to a NNU?	10
Question 6: What monitoring of ward ventilation pressure cascades should be used in NNU?	10
Question 7: What level of ward ventilation filtration should be applied to NNU?.....	11
Question 8: Are HEPA filters advocated for use in NNU?	12
Question 9: What is the recommended water and drainage system design for NNU?	12
Question 10: How do ventilation systems design and components exacerbate/contribute to an increased infection risk and what design considerations should be taken to reduce those risks within NNU settings?	14

Question 11: Are there any recommendations for installing POU/inline filters as a control measure within NNU? 15

Question 12: What maintenance considerations are essential to prevent infection risk in water and drainage systems in NNU? 16

Question 13: What maintenance considerations are essential to prevent infection risk in ventilation systems in NNU? 17

Question 14: What are the commissioning requirements for a NNU?..... 17

Question 15: Should chilled beams be used in a NNU?.. 18

Appendix 1: Summary of relevant guidance 19

Introduction

There is limited technical standards and guidance currently available to aid decision making in respect of optimal design considerations when planning to undertake a new build, adapt, extend, or undertake refurbishment within a Neonatal Unit.

This document aims to support NHSScotland boards by providing them with a summarised set of questions and answers which will signpost them to any applicable technical guidance documents and summarise key considerations pertaining to:

- functionality
- layout
- support spaces
- maintenance access arrangements
- water systems (including drainage)
- ventilation systems

In addition to design considerations, project teams must engage with HAI-SCRIBE and NDAP/KSAR processes. Neonatal units are high risk areas so particular care must be taken around protecting its water and ventilation systems during construction and there needs to be a robust commissioning plan from the outset. Clear project governance structures and involvement of IPC through each stage of the project are key to ensuring a safe environment for patients is delivered.

Questions and answers

Question 1: What are the optimal functional and design considerations/requirements/guidance specifications for a neonatal unit/facility/build within the UK?

Answer:

In this document, neonatal units refer to all three levels of care:

- special care
- high-dependency
- intensive care

Design should consider unit activity and local needs, relevant guidance, and footprint available. This requires multidisciplinary input from clinicians, IPC and the project team. A collaborative approach to identifying IPC risks and designing them out or planning mitigation is crucial to ensuring delivery of a safe neonatal unit.

[HBN 09-03](#) provides an outline for design of a neonatal unit. This includes cot space sizes and consideration of bays vs single rooms with regard to function and staffing. A mixture of bays and single rooms would usually be required. Though not explicitly stated in HBN 09-03, it is expected single rooms are neutral pressure to the ward, for instance it would be exceptional for a unit to require for specialist ventilation isolation facilities. HBN 09-03 also contains advice around ancillary rooms and facilities and accommodation for parents.

Relevant technical standards and guidance:

1. [Health Building Note: Neonatal Settings \(HBN 09-03\) 2013](#)
2. [Health Building Note: Maternity care facilities \(HBN 09-02\)](#)
3. [Neonatal Care in Scotland: A Quality Framework” Scottish Government March 2013](#)

4. [Bliss Baby Charter Standards 2020](#)

The following are **not** intended for use in neonatal settings:

- Health Building Note: Critical care units (HBN 04-02)
- Health Building Note: Hospital accommodation for children and young people (HBN 23)

Question 2: What are the laundry facility requirements within a neonatal unit?

Answer:

[HBN 09-03](#) suggests industrial laundry facilities should be provided within the neonatal unit to wash baby clothes, including a washer and dryer (1). A full options appraisal and risk assessment, with engagement from the IPCT, is needed prior to deciding on local management of laundry (2, 3). Options appraisal should include consideration of whether central laundry facilities would be appropriate. Risk assessment should also include how the equipment will be operated. Although [HBN 09-03](#) implies parents should operate the laundry equipment, this approach may not be suitable for all units. Household washing machines are not suitable however there are no specific recommendations in national guidance for choice of laundry equipment in neonatal settings.

Relevant technical standards and guidance:

1. [Health Building Note: Neonatal Settings \(HBN 09-03\) 2013](#)
2. [Health Technical Memoranda: Decontamination of Linen for Health and Social Care \(HTM 01-04\) Management and Provision 2016](#)
3. [National Guidance for Safe Management of Linen in NHSScotland Health and Care Environments For laundry services/distribution. Health Protection Scotland 2018](#)

Question 3: What are the recommended requirements regarding provision of CHWB, toilet and shower facilities for NNU?

Answer:

The number of clinical handwash basins (CHWBs) needs to be determined by local risk assessment – see appendix 1 HPS 2018 (1). This should balance the risks water outlets pose to neonates with the need for sufficient and easily accessible CHWBs for the purpose of clinical staff decontaminating their hands.

[HBN 09-03](#) (2) suggests a minimum ratio of one CHWB to three cots, conflicting with advice from HPS (1) which advocates a risk-based approach. The latter approach is preferred because evidence accrued over the past decade on *Pseudomonas aeruginosa* risk and splash risk from CHWBs may better inform decisions on CHWBs in neonatal units than a fixed ratio.

Scrub-up trough sinks are often installed in neonatal units (1). This is because a variety of procedures might be performed on the neonatal unit, which for some units includes surgical operations. As with CHWBs, a risk-based approach should be taken with placement of any scrub-up trough sinks. Alternatives should be considered for surgical asepsis, such as use of alcohol-based handrub which is supported as an acceptable method by the NIPCM (3).

SHTM 64 includes guidance on acceptable designs of CHWB, scrub-up trough sinks and ancillary parts such as taps (4).

Risk assessment should be undertaken prior to designing any water outlet into a neonatal unit and include justification, assessment and mitigation of risks.

Consideration should be given to splash risk and to design features which may reduce this risk. Sinks should be planned so that patients and care equipment are outside the splash zone.

IPCT should be involved in tap selection and selection of ancillary equipment, for example bins for waste disposal.

WC and/or shower provision may be required for staff and visitors or family (2).

Maintenance requirements should be considered for all outlets planned.

Relevant technical standards and guidance:

1. [Guidance for neonatal units \(NNUs\) \(levels 1, 2, &3\), adult and paediatric intensive care units \(ICUs\) in Scotland to minimise the risk of Pseudomonas aeruginosa infection from water. Health Protection Scotland 2018](#)
2. [Health Building Note: Neonatal Settings \(HBN 09-03\) 2013](#)
3. National Infection Prevention and Control Manual. ARHAI Scotland. [National Infection Prevention and Control Manual: Home \(scot.nhs.uk\)](#)
4. [Scottish Healthcare Technical Memorandum 64: Sanitary Assemblies – Building Component Series 2009](#)
5. Scottish Healthcare Technical Memorandum 04-01: [Water safety for healthcare- Operational management \(SHTM 04-01 Part B\)](#) 2014

Question 4: What air change rate should be provided to a NNU?

Answer:

- 10 air changes per hour – see Table 5, page 80 [SHTM 03-01 part A](#) (1).

Consideration should be given to air mixing.

[HBN 09-03](#) does not comment on air change rate but contains useful advice on temperature control and grille placement in Section 13: Specific engineering considerations (2).

Relevant technical standards and guidance:

1. Scottish Healthcare Technical Memorandum 03-01: [Ventilation for Healthcare - Design and validation \(SHTM 03-01 Part A\)](#) 2022
2. [Health Building Note: Neonatal Settings \(HBN 09-03\) 2013](#)

Question 5: What pressure differentials should be applied to a NNU?

Answer:

- +5 Pascals to corridor - see Table 5, page 80 [SHTM 03-01 part A](#) (1)

Relevant technical standards and guidance:

1. Scottish Healthcare Technical Memorandum 03-01: [Ventilation for Healthcare - Design and validation \(SHTM 03-01 Part A\)](#) 2022

Question 6: What monitoring of ward ventilation pressure cascades should be used in NNU?

Answer:

Neonatal units are considered “critical areas” so control systems to detect failures in ventilation control should be in place (1). These should be simple, robust, and reliable.

Room differential pressure gauges should be mounted directly adjacent to the entry door 1.5m above floor level so at eye line (7.24; p50 SHTM 03-01 Part A) (1). This may be a digital monometer or differential manometer, for example Magnehelic gauge, and should indicate the normal range.

The building management system (BMS) provides monitoring and control of the ventilation system. There should be a ventilation control panel fitted outside critical areas to enable maintenance by the authorised person (see 7.18; p49 [SHTM 03-01 Part A](#)) and there should be a visual indication for staff that the air handling unit is operating within parameters (see 9.229; p120 [SHTM 03-01 Part A](#)) (1).

Relevant technical standards and guidance:

1. Scottish Healthcare Technical Memorandum 03-01: [Ventilation for Healthcare - Design and validation \(SHTM 03-01 Part A\)](#) 2022

Question 7: What level of ward ventilation filtration should be applied to NNU?

Answer:

- Supply filter grade SUP1.

Table 5 SHTM 03-01 (1) links to the SVHSoc02 document (2) which advises on appropriate second filter and need for gas filter depending on outdoor air quality (ODA). This will result in an F7-F9 second filter and either recommendation or requirement for a gas filter depending on ODA. This document explicitly states it is not concerned with infection prevention but rather “breathable” air and advises patients vulnerable to airborne infection may require HEPA filtration in addition to the second filter (2). The second filter is located within the air handling unit and any HEPA filter should be located within a metal terminal housing with airtight seals immediately prior to the grille – see 9.58 and 9.59 p98 [SHTM 03-01 part A](#) (1).

Consideration should be given to HEPA filtration in addition to the second filter – see [question 7](#).

Relevant technical standards and guidance:

1. Scottish Healthcare Technical Memorandum 03-01: [Ventilation for Healthcare - Design and validation \(SHTM 03-01 Part A\)](#) 2022
2. Specialist Ventilation for Healthcare Society: Change in Air Filter Test and Classification standards: [SVHSoc. 02-V1.2 Filter group revisions Nov 18.pdf \(andrewpoplett-enterprises.co.uk\)](#)

Question 8: Are HEPA filters advocated for use in NNU?

Answer:

Local risk assessment should determine whether HEPA filtration is required or not within the neonatal unit. This should be informed by unit activity and whether neonates cared for may be vulnerable to invasive mould infection.

Although SHTM 03-01 does not specify HEPA filtration is required, table 5 page 80 [SHTM 03-01 Part A](#) states that the ventilation system should protect neonates from fungal spores (1), for which HEPA filtration would be necessary.

Relevant technical standards and guidance:

1. Scottish Healthcare Technical Memorandum 03-01: [Ventilation for Healthcare - Design and validation \(SHTM 03-01 Part A\)](#) 2022

Question 9: What is the recommended water and drainage system design for NNU?

Answer:

Design considerations should encompass:

- hot and cold water system components from supply to neonatal unit
- layout of services on the neonatal unit and access requirements for maintenance to components of the water system. Services include hot and cold water distribution, as well as wastewater drainage system
- location of water outlets, associated sanitary assemblies/equipment using water, and drain outlets

Design of safe water and drainage systems is complex, especially for areas with vulnerable patients such as the neonatal unit.

Multidisciplinary expertise should be drawn on with the aim of designing out infection risks and planning management of residual risk. It is crucial this is undertaken early in the project to inform the design brief. All parts of SHTM 04-01 should be considered, including parts B-G focussed on operational use.

Guidance exists for design of sanitary assemblies (2). See [Question 2](#) for further considerations on water outlets.

Relevant technical standards and guidance:

- 1.** Scottish Healthcare Technical Memorandum 04-01 (SHTM 04-01)
 - [Water safety for healthcare- Design installation and testing \(SHTM 04-01 Part A\)](#)
 - [Water safety for healthcare- Operational management \(SHTM 04-01 Part B\)](#)
 - [Water safety for healthcare- TVC Testing Protocol \(SHTM 04-01 Part C\)](#)
 - [Water safety for healthcare- Disinfection of domestic water systems \(SHTM 04-01 Part D\)](#) .
 - [Water safety for healthcare- Alternative materials and filtration \(SHTM 04-01 Part E\)](#)
 - [Water safety for healthcare- Chloramination of water supplies \(SHTM 04-01 Part F\)](#)
 - [Water safety for healthcare- Operational procedures and exemplar \(SHTM 04-01 Part G\)](#)

- 2.** [Scottish Healthcare Technical Memorandum 64: Sanitary Assemblies – Building Component Series 2009](#)

Question 10: How do ventilation systems design and components exacerbate or contribute to an increased infection risk and what design considerations should be taken to reduce those risks within NNU settings?

Answer:

Correct filters need to be selected including the consideration of HEPA filtration. Dilution requires more than adhering to air change rates; consideration should be given to air mixing with grille selection and grille placement which avoids short circuiting/Coanda effect. Consideration should be given to air movement within the unit and impacts of air pressures from adjacent areas. Natural ventilation should be avoided in neonatal units.

Planning operational monitoring and maintenance of the ventilation system from the outset is crucial and oversight should be provided by the Board Ventilation Safety Group. The neonatal unit is a “critical area” so there should be a plan for robust monitoring of air handling unit parameters and pressure cascades. There should be resilience built into the system from the design phase so there is a plan should the ventilation system fail – see 4.15 p27 SHTM 03-01 (1).

Relevant technical standards and guidance:

1. Scottish Healthcare Technical Memorandum 03-01: [Ventilation for Healthcare - Design and validation \(SHTM 03-01 Part A\)](#) 2022

Question 11: Are there any recommendations for installing POU or inline filters as a control measure within NNU?

Answer:

Point of use filters (POUFs) or inline filters may be considered as a control measure during healthcare water-associated infection incident or outbreaks alongside other remedial actions (1). POUFs provide immediate protection where the source of pathogens is the outlet, which is desirable given the vulnerability of this patient population. They are also safe to use in a neonatal setting where some biocides may be hazardous.

Where POUFs are used, splash risk should be assessed and a plan must be made for their ongoing management. This should include cleaning regimens to avoid contaminating the filters, need for replacement at expiry/if removed/contaminated, and criteria for discontinuation. Long-term use of POUFs may be required in some circumstances and the Board Water Safety Group should participate in decision-making and the maintenance plan if this is the case.

Relevant technical standards and guidance:

- 1.** [Prevention and management of healthcare water-associated infection incidents/outbreaks. Health Protection Scotland 2019](#)

Question 12: What maintenance considerations are essential to prevent infection risk in water and drainage systems in NNU?

Answer:

Appropriate operational use, maintenance, and preparedness for clinical incidents are crucial in keeping patients safe. Critical control points for this are stated in HPS guidance for minimising risk of *Pseudomonas aeruginosa* (1).

All water services installed should be incorporated into the Board Water Safety Plan and the Board Water Safety Group should have oversight of this (2).

As with the rest of the hospital, temperature control should be monitored and a risk assessment in place for *Legionella* control – guidance can be found in [SHTM 04-01 part B](#) (2).

Total viable count (TVC) testing should be undertaken quarterly and sampling locations determined by Board Water Safety Group with guidance from [SHTM 04-01 part C](#) (3). Additionally, water testing for *Pseudomonas aeruginosa* is advised at least every six months in neonatal units (4).

Relevant technical standards and guidance:

1. [Guidance for neonatal units \(NNUs\) \(levels 1, 2, &3\), adult and paediatric intensive care units \(ICUs\) in Scotland to minimise the risk of *Pseudomonas aeruginosa* infection from water. Health Protection Scotland 2018](#)
2. Scottish Healthcare Technical Memorandum 04-01: [Water safety for healthcare- Operational management \(SHTM 04-01 Part B\) 2014](#)
3. Scottish Healthcare Technical Memorandum 04-01: [Water safety for healthcare- TVC Testing Protocol \(SHTM 04-01 Part C\) 2014](#)
4. [Pseudomonas aeruginosa routine water sampling in augmented care areas for NHSScotland. Health Protection Scotland 2018](#)

Question 13: What maintenance considerations are essential to prevent infection risk in ventilation systems in NNU?

Answer:

Ventilation systems in the neonatal unit are “critical systems”.

Inspection and annual verification requirements are advised in chapters 4 and 5 of [SHTM 03-01 Part B](#) (1).

All air handling units have an expected life span. It is important that trends are monitored to detect sudden changes in performance requiring urgent remediation and to inform planning for replacement.

Relevant technical standards and guidance:

1. Scottish Healthcare Technical Memorandum 03-01: [Water safety for healthcare- Operational management \(SHTM 04-01 Part B\)](#) 2022

Question 14: What are the commissioning requirements for a NNU?

Answer:

The commissioning process takes the installed environment to operational use; the processes for healthcare facilities in Scotland are described in the Scottish Capital Investment Manual (1). Commissioning is undertaken by an independent company, however local IPCT should be involved in tendering of the company and the commissioning strategy – see KSAR Notes for Boards section on Commissioning KSAR (2).

Engagement from IPCT on commissioning working groups is required throughout the project to ensure a safe handover for both technical and operational aspects (1, 2). Systems of key technical importance for IPCT are ventilation and water. An outline of the technical commissioning process for each can be found in [SHTM 03-01 Part A](#)

chapter 11 (3) and [SHTM 04-01 Part A](#) Chapter 16 (4) respectively. Operational aspects may include consideration of patient pathways and cleaning after handover. Specific to a neonatal unit, commissioning of any local laundry facilities will require IPCT input. General information on commissioning and validation specific to laundry can be found in HTM 01-04 (5) but its application would depend on the equipment procured – see [Question 1](#).

Relevant technical standards and guidance:

1. [Scottish Capital Investment Manual: NHSScotland Commissioning Process. Scottish Government](#) 2017.
2. [Key Stage Assurance Review \(KSAR\): Notes for Board Infection Prevention and Control Teams. National Services Scotland](#) 2023.
3. Scottish Healthcare Technical Memorandum 03-01: [Ventilation for Healthcare - Design and validation \(SHTM 03-01 Part A\)](#) 2022
4. Scottish Healthcare Technical Memorandum 04-01: [Water safety for healthcare- Design installation and testing \(SHTM 04-01 Part A\)](#) 2014
5. [Health Technical Memoranda: Decontamination of Linen for Health and Social Care \(HTM 01-04\) Management and Provision](#) 2016

Question 15: Should chilled beams be used in a NNU?

Answer:

No. These can form condensation which drips into the room and the condensate may be contaminated with waterborne bacteria and fungi, presenting substantial risks in a neonatal unit (1).

Relevant technical standards and guidance:

1. [Inkster T, Peters C, Soulsby H. Potential infection control risks associated with chilled beam technology: experience from a UK hospital](#)

Appendix 1: Summary of relevant guidance

Health Building Note 09-03: Neonatal settings

- [Health Building Note: Neonatal Settings \(HBN 09-03\) 2013](#)

Health Building Note 09-02: Maternity care facilities

- [Health Building Note: Maternity care facilities \(HBN 09-02\)](#)

Neonatal care in Scotland: A Quality Framework

- [Neonatal Care in Scotland: A Quality Framework” Scottish Government March 2013](#)

Bliss Baby Charter Standards

- [Bliss Baby Charter Standards 2020](#)

Health Building Note 00-02: Sanitary spaces

- [HBN 00-02 Mar 2017](#)

Scottish Health Planning Note 4 supplement 1: Isolation facilities in acute settings

- [In-patient accommodation - supplement 1 - Isolation facilities in acute settings \(SHPN 4 sup 1\)](#)

Scottish Health Technical Memorandum 02: Parts A&B Medical gas pipeline systems

- [Medical Gas Pipeline Systems: Design installation validation and verification \(SHTM 02-01 Part A\)](#)
- [Medical Gas Pipeline Systems: Operational management \(SHTM 02-01 Part B\)](#)

Scottish Health Technical Memorandum 03: Parts A&B Ventilation for healthcare

- [Ventilation for Healthcare - Design and validation \(SHTM 03-01 Part A\)](#)
- [Ventilation for Healthcare - Operational and verification \(SHTM 03-01 Part B\)](#)

Scottish Healthcare Technical Memorandum 04-01 (SHTM 04-01)

- [Water safety for healthcare- Design installation and testing \(SHTM 04-01 Part A\)](#)
- [Water safety for healthcare- Operational management \(SHTM 04-01 Part B\)](#)
- [Water safety for healthcare- TVC Testing Protocol \(SHTM 04-01 Part C\)](#)
- [Water safety for healthcare- Disinfection of domestic water systems \(SHTM 04-01 Part D\) .](#)
- [Water safety for healthcare- Alternative materials and filtration \(SHTM 04-01 Part E\)](#)
- [Water safety for healthcare- Chloramination of water supplies \(SHTM 04-01 Part F\)](#)
- [Water safety for healthcare- Operational procedures and exemplar \(SHTM 04-01 Part G\)](#)

Scottish Health Technical Memorandum 06: Electrical services Parts A&B

- [Electrical services supply and distribution: Design considerations \(SHTM 06-01 Part A\)](#)
- [Electrical safety guidance for High Voltage systems \(SHTM 06-03\)](#)

Scottish Health Technical Memorandum 08-03: Bedhead services

- [Specialist Services - Bedhead Services \(SHTM 08-03\)](#)

Scottish Health Technical Memorandum 08-03: Building Management Systems – Parts A-D

- [Building Management Systems: Overview and Management \(SHTM 08-05 Part A\)](#)
- [Building Management Systems: Design Considerations \(SHTM 08-05 Part B\)](#)
- [Building Management Systems: Validation and Verification \(SHTM 08-05 Part C\)](#)

- [Building Management Systems: Operational Management \(SHTM 08-05 Part D\)](#)

Scottish Health Technical Memorandum 54 – 69: Building component series

- [Building component series -User manual \(SHTM 54\)](#)
- [Building component series -Windows \(SHTM 55\)](#)
- [Building component series - Partitions \(SHTM 56\)](#)
- [Building component series - Internal glazing \(SHTM 57\)](#)
- [Building component series - Internal doorsets \(SHTM 58\)](#)
- [Building component series - Ironmongery \(SHTM 59\)](#)
- [Building Component Series - Ceilings \(SHTM 60\)](#)
- [Building component series - Flooring - matrix example xls \(SHTM 61 app 1a\)](#)
- [Building component series - Demountable storage systems \(SHTM 62\)](#)
- [Building component series - Fitted storage systems \(SHTM 63\)](#)
- [Building Component Series – Sanitary assemblies \(SHTM 64\)](#)
- [Building component series - Cubicle curtain track \(SHTM 66\)](#)
- [Building component series - Laboratory storage systems \(SHTM 67\)](#)
- [Building component series - Protection \(SHTM 69\)](#)

Scottish Health Technical Memorandum 81- 87:

- [Fire safety - Precautions in new healthcare premises \(SHTM 81 part 1\)](#)
- [Fire safety - Fire engineering of healthcare premises \(SHTM 81 part 2\)](#)
- [Fire safety - Atria in healthcare premises \(SHTM 81 part 3\)](#)
- [Fire safety - alarm and detection systems \(SHTM 82\)](#)
- [Fire safety - General fire precautions in healthcare premises \(SHTM 83\)](#)
- [Fire safety - Precautions in existing healthcare premises \(SHTM 85\)](#)

- [Fire safety - Risk assessment \(SHTM 86\)](#)
- [Fire safety - Textiles and furniture \(SHTM 87\)](#)

NHSScotland Waste Management Guidance

- [NHSScotland Waste Management Guidance. Scottish Health Technical Note \(SHTN-03-01\)](#)

Scottish Capital Investment Manual

- [Scottish Capital Investment Manual: NHSScotland Commissioning Process. Scottish Government 2017](#)

Key Stage assurance Review

- [Key Stage Assurance Review \(KSAR\): Notes for Board Infection Prevention and Control Teams. National Services Scotland 2023](#)

Health Technical Memorandum 01-04

- [Health Technical Memoranda: Decontamination of Linen for Health and Social Care \(HTM 01-04\) Management and Provision 2016](#)

National Guidance for the Safe Management of Linen

- [National Guidance for Safe Management of Linen in NHSScotland Health and Care Environments For laundry services/distribution. Health Protection Scotland 2018](#)

Guidance for NNU – levels 1,2, & 3

- [Guidance for neonatal units \(NNUs\) \(levels 1, 2, &3\), adult and paediatric intensive care units \(ICUs\) in Scotland to minimise the risk of Pseudomonas aeruginosa infection from water. Health Protection Scotland 2018](#)

Pseudomonas aeruginosa routine water sampling in augmented care areas

- [Pseudomonas aeruginosa routine water sampling in augmented care areas for NHSScotland. Health Protection Scotland 2018](#)

Prevention and management of healthcare water-associated infection/
incidents/outbreaks

- [Prevention and management of healthcare water-associated infection incidents/outbreaks. Health Protection Scotland 2019](#)

National Infection Prevention and Control Manual

- [National Infection Prevention and Control Manual: Home \(scot.nhs.uk\)](#)

Scottish Health Facilities Note Part A - C

- [HAI-SCRIBE Manual information for project teams \(SHFN 30 Part A\)](#)
- [HAI-SCRIBE Implementation strategy and assessment process \(SHFN 30 Part B\)](#)
- [HAI-SCRIBE questionsets and checklists \(SHFN 30 Part C\)](#)