HFS, HPS and *Pseudomonas aeruginosa* and Water (Scotland) Group

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

This guidance:

- Is designed to minimise the risk of infection with *Pseudomonas aeruginosa* – the risk however can never be eliminated.
- Is in addition to the extant:
  - The control of Legionella bacteria in water systems. Approved Code of Practice and Guidance (L8).
  - The control of legionella bacteria in hot and cold water systems HSG274 Part 2
  - Water safety for healthcare premises Part A: Design, installation and testing. SHTM 04-01
  - Water sources and potential infection risks to patients in high risk units – revised guidance. CEL 08(2013)
- Includes the information previously issued in Scotland related to *Pseudomonas aeruginosa* (*P. aeruginosa*) and other water-related organisms specifically*: '*Additional information on Pseudomonas aeruginosa and opportunistic water borne pathogens' from Health Protection Scotland (HPS) and Health Facilities Scotland (HFS). [1-3]
- Is due for review in July 2019. In the interim, a draft addendum 'Pseudomonas aeruginosa routine water sampling in augmented care areas for NHSScotland' has been devised to be used along with this guidance.

A multi-disciplinary approach is required for this guidance to work as intended. The actions cannot be left solely to Estates staff: collaboration and participation from Infection Prevention & Control Teams, Clinical staff and domestics as well as Estates & Facilities Teams is required. This is the key to ensuring that infection control risks are highlighted, managed and mitigated.

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Definitions

Hand wash station	A wash hand basin with mixer tap, paper towels and non-antimicrobial liquid soap in a single use container designated for hand washing use only
Sink	A sink into which fluids used on patients may be discarded. After such a procedure hands should be decontaminated as per the National Infection Prevention and Control Manual Chapter 1: Standard Infection Control Precautions.

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A) Introduction

Pseudomonas aeruginosa (*P. aeruginosa*) 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[4]. There have been serious healthcare associated outbreaks mainly in NNUs and ICUs (adult and paediatric) attributed to *P. aeruginosa* where the source of the organism was thought to be tap water[5-9]. In such incidences *P. aeruginosa* at low levels in the water will have formed a biofilm on tap components or parts of the water circulation system. Periodic sloughing of *P. aeruginosa* biofilm will occur when the water tap is operated[10]. In other outbreaks of *P. aeruginosa* the source has been identified as one or more hand wash station drain. However, in such outbreaks the original source may still have been the tap water which subsequently colonised the drain[11]. In a number of cases, sinks have become sources of pathogenic spread after disposal of body fluids or exudates into hand-wash stations[12-14].

This guidance differs from that released in other UK[15-23] countries with respect to the clinical areas where it is directed to be followed, and with respect to some control measures. This is because the application of the control measures including flushing of all tap outlets is considered to have reduced the risk of *P. aeruginosa* infection in general. In addition, ongoing local and national surveillance since the *P. aeruginosa* incidents associated with water was recognised, has not identified any similar clinical incidents in Scotland.

Guidance Presentation

This guidance is designed to minimise the risk of patients developing a *P. aeruginosa* infection by identifying the actions that are required at 6 Critical Control Points. In addition, to support the successful implementation of this guidance at the critical control points, the Organisation Management requirements are specified in the guidance. Although written specifically for *P. aeruginosa* the actions and control measures included will also reduce the risk of HAI from other similar organisms.

B) General Information

Pseudomonas aeruginosa (P. aeruginosa)

P.aeruginosa is a Gram negative organism which is ever-present in the environment being most commonly found in soil and water[4;5]. *P.aeruginosa* can also be part of the normal gut flora and selected out by antibiotics which are not active against it. It is often termed an opportunistic pathogen. Thus there can be infection from a patient's own flora as well as from environmental sources which is the main topic discussed in this document. (An opportunistic pathogen is one which normally only causes an infection in a person with a weakened immune system).

Survival in the environment

Without effective decontamination, P. aeruginosa can survive in any moist environment site indefinitely. For example, P. aeruginosa can survive in a variety of sources such as: topped up fluid containers, hand wash station drains and any other equipment/environment sources [7;11;24;25]. Prolonged contamination of environmental sources can make outbreaks difficult to control. It is the management of the water system before and after the tap, including the correct cleaning of the tap outlet, hand wash stations and the correct discarding of fluids potentially contaminated with P.aeruginosa, that are crucial to reducing the risk to patients.

High Risk Environments

Patients in adult and paediatric intensive care units and babies receiving intensive or high dependency care are at the highest risk of infection with *P. aeruginosa* and similar organisms[4.] This guidance is applicable to NNUs providing all levels of care (1, 2 & 3) as well as adult and paediatric ICUs. In addition, a local NHS board risk assessment should be undertaken to identify any additional clinical settings where patients are extremely vulnerable to infection caused by *P. aeruginosa*. This risk assessment should take account of any previous clinical incidents in individual clinical settings. If additional units are identified as being at increased risk, then these units should be included in the local NHS Board's Water Safety Plan and the recommendations in this guidance followed in these additional clinical settings.(See:Appendix 5).

High-risk procedures

Some procedures involve the cooling of syringes containing infusates in ice-water. This has resulted in outbreaks infections when the ice-water was contaminated[26-28]. Syringes should not be cooled in ways that could contaminate the contents, or the tip of the syringe. The use of ice made from sterile water may be appropriate.

Infections Caused by *P. aeruginosa*

Different infections can arise as a consequence of *P. aeruginosa* or similar organisms. The site of infection depends on the particular patient defence mechanisms that are weakened. The key significant infections are:

- Ventilator Associated Pneumonia (VAP).
- Blood stream infections (BSI) often associated with a vascular catheter or with contamination of an infusate [prepared drug].
- Non-VAP pneumonia.
- Wound infections or surgical site infections.
- Urinary Tract Infections (including catheter associated urinary tract infections (CAUTIs)).
- Insertion site infections around any invasive device. (The presence of invasive devices predisposes immunocompromised colonised patients to *P. aeruginosa* infection).
- As well as the above, neonates are particularly vulnerable to conjunctivitis.

Routes of transmission

P. aeruginosa that does not arise from a patient's own flora can be transmitted in healthcare settings from the environment or from another patient as follows:

Environment-to-patient

The routes of transmission from the *P. aeruginosa* in taps, drains and from any other contaminated environment/equipment source to the patients prior to infection developing, includes:

- Direct contact from contaminated water, or splashes from water outlets,
- Indirect contact, e.g. routes involving contaminated hands, contaminated equipment/environments, such as reusable wash-bowls.

Patient-to-patient

Dissemination of *P. aeruginosa* from colonised patients to the environment or to other patients can occur from any clinical procedure that creates an aerosol from, for example, open suctioning or wound irrigations[5]. *P. aeruginosa* does not give rise to person-to-person cross-transmission as easily as more common HAI pathogens such as MRSA or *Clostridium difficile*.

Incubation Period

There is no defined incubation period for *P. aeruginosa* as patients can be colonised without ever becoming infected. However, if there is a significant patient exposure event, for example, a contaminated infusate, an infection (blood-stream infection (BSI)) can arise quickly usually within 12 hours of the infusion commencing.

Period of Communicability

As long as a patient remains colonised, patient-to-patient transmission within a clinical area is possible. Environment to patient cross-transmission can arise as long as any environmental sources remain contaminated[4;24;29].

C)The SIX CRITICAL CONTROL POINTS TO REDUCE *P.aeruginosa* RISK

Six critical control points have been identified where control measures and actions are required to reduce the risk of *P.aeruginosa* infection in the NNUs and ICUs (adult and paediatric).

1. Critical Control Point 1: The hospital water delivery system

1.1 Estates and Facilities managers must:

- Review site engineering and cleaning protocols to establish that they are in accordance with current guidance including SHTM 04-01*Water safety for healthcare premises*[30], *HSE guidance note L8 Approved Code of Practice*[31], HSE guidance *HSG274 Part 2: The control of legionella in hot and cold water systems*[32] and that manufacturers' instructions with regard to installation and maintenance have been followed.
- Ensure taps and thermostatic mixing valves (manual and automated) have been commissioned (including programming auto flush cycles) and routinely validated, as per the manufacturer's instructions.
- Ensure that water flowing from the taps does not flow directly into the drain holes (to prevent splash back). Waterflow must impact on the basin offset from the drain hole. Flushing (automated or manual) should not result in splashes beyond the hand wash station area.
- Liaise with the Senior Charge Nurse regarding infrequently used hand wash stations or sinks(used and/or flushed once a day) which should be subjected to a documented flushing regime, risk assessed and regularly reviewed for the need for the hand wash station or sink to be still there. (See:Appendix 1 - Number of hand wash stations required in the NNUs and ICUs).
- For automated taps, ensure records of remote flushing are available.
- Remove any redundant branches from circulating mains and provide straight couplings on distribution pipework to eliminate residual dead-legs or blind stub-ends created by plugged Tee-pieces.
- Check the length of any dead-legs and remove any non-compliant pipework. Minimise dead-leg length where possible elsewhere by taking return leg up to hand wash stations and skins.(This should be included in a water risk assessment).
- Before undertaking any modifications to pipework, perform a risk assessment.
- Keep records of risk assessments and modifications made.
- Consider whether thermostatic mixer valve, where such a valve is considered necessary, can be located closer to the outlet.

- Wherever considered necessary, new taps should have integral thermostatic control or be replaced with a thermostatically controlled tap subject to risk assessment.
- Carefully select taps to minimise the formation of aerosols. The water flow profile should be compatible with the shape of the hand wash station. Biofilm can develop on flow straighteners, rosettes and aerators. It is therefore recommended that these are removed. However, the decision to remove flow straighteners, rosettes and aerators should be based on risk assessment, as their removal can create turbulent flow at increased pressure resulting in splashing of surrounding surfaces and flooring. It will be necessary for the engineer to adapt the water distribution system using flow regulating valves to regulate the flow as required. A discharge flow rate from taps of 3 litres per minute will be sufficient to avoid splashing.
- Avoid positioning alcohol based hand rub dispensers such that any drips could fall on to the taps or into the basin of the hand wash station.

1.2 Modifications to the Hospital Water Delivery System

There is no requirement to change taps as a consequence of this guidance. The information here is for when there is a planned replacement/refurbishment, new installation or a recognised need to do so**.**

Installation of taps

It is not possible to have taps 'pre-disinfected'. Disinfection will have to rely on normal flushing and disinfection protocols that would apply to any new installation before commissioning and putting into use. In new build or refurbishment projects this process should be undertaken as close as possible to the system being handed over to avoid pipework being left unused filled with stagnant water and in consultation seek advice from HFS. A daily flushing regime should be put in place until the system is handed over. Automated tap sensors should be positioned away from the tap. Taps should ideally be removable and easily dismantled for cleaning and disinfection. Automated taps have a greater risk of their complex internal surfaces becoming contaminated with micro-organisms and biofilms. Automated taps are therefore not recommended for low-use situations, however, remote flushing can mitigate the risk of biofilm formation.

Thermostatic mixing devices have complex internal structures that can entrap waterborne bacteria and biofilm. Risk assessments should be carried out to determine the potential to replace thermostatic mixing devices in augmented care accommodation where it is unlikely that patients will use wash hand basins.

Sampling of water for *P. aeruginosa*

Routine sampling of water to detect *P. aeruginosa* should not be carried out. This is because little reassurance can be gained from ad hoc samples which can give rise to false negative results.

A procedure for taking water samples for *P. aeruginosa* (when requested by a clinical microbiologist/ICD) is provided in Appendix 2 – Procedure for taking water samples (when requested by a clinical microbiologist/ICD).

NOTE

While the policy of 'engineering out the problem' always applies, there are situations where this may not be easily achieved, or may not be appropriate.

These would include where alterations would create disruption and danger of infection. This will particularly apply to retrospective compliance.

Similarly, where new build or refurbishment projects have already been contracted prior to the publication of updated guidance and contractual implications would inhibit making changes to the employer's requirements, then retrospective modifications to the engineered system may not be practical.

In these situations a risk-based and proportional response should be adopted by assessing risks arising from hazards, identifying the appropriate actions recommended within the guidance, and identifying operational steps to be taken in order to manage, eradicate or minimise the risks.

2. Critical Control Point 2: Flushing taps to reduce the risk of pipework system contamination

2.1 Senior Charge Nurse Responsibilities

- Ensure that **all** non-autoflushed taps in the NNU and ICU patient areas and areas where clinical procedures are prepared or performed are flushed daily, first thing in the morning, at the maximum flow rate that does not give rise to any splashing beyond the basin/sink, e.g. on the floors. The flushing should be for a period of 1 minute and recorded.
- Identify and report any problems or concerns relating to the safety, maintenance, reduced usage, any changes in use and cleanliness of all water outlets to the Infection Prevention and Control Team (IPCT) and Estates and Facilities Departments as relevant.

Splashing created by flushing taps which falls beyond the sink area can create a risk of slippage/falls.

Where outlets are flushed daily; there is no additional requirement for weekly flushing to comply with *Legionella* guidance unless risk assessment specifies a need for more frequency.

In practice this task (flushing of taps)may be assigned to the domestic services department. However, the Senior Charge Nurse should have evidence that this procedure is being performed as specified. This task could be added to the local cleaning matrix/schedule.

3. Critical Control Point 3: Preventing direct water usage colonising/infecting vulnerable patients

The advice in this section is based on the assumption that there are **no ongoing clinical incidents to suggest water system contamination**, and the guidance in Critical Control Points 1, 2, and 4 are being followed.

3.1 Neonatal Care Procedures

Neonatal Care Procedures	
Care Procedure	**Actions**
Washing babies Options include: • Face wash • Nappy change • Top and tail • Bed bath • Immersion bath	• Type and frequency of wash determined by clinical condition and individual need (points to consider include temperature and physiological stability, skin integrity, weight). • Use tap water for washing. • Use small volumes (<50mls) for face wash, nappy change, top and tail and bed bath.
Defrosting breast milk	Options include • Defrost in a designated milk fridge • Defrost outside the fridge at room temperature. Note: Once defrosted and warmed to room temperature milk cannot be returned to the fridge or refrozen. Discard any remaining milk • Defrost using a warming/thawing device designed to ensure no direct contact with the bottle/syringe with non-sterile water. Alternatively, use sterile water which has been warmed in a warming cabinet. • **DO NOT DEFROST FROZEN BREAST MILK BY PLACING THE CONTAINER IN WARM TAP WATER**[33, 34]

Neonatal Care Procedures	
Care Procedure	**Actions**
Warming breast or formula milk	Options include: • Take milk out of fridge one hour prior to use • Warm using a warming device designed to ensure no direct contact with the bottle/syringe with non-sterile water. Alternatively, use sterile water which has been warmed in a warming cabinet • **DO NOT WARM MILK BY PLACING CONTAINER IN WARM TAP WATER**
Use of ICE	Do not use ICE for direct baby care (NNUs all levels) Ice may be directly used for rare but important clinical conditions. This would be under senior medical instruction/supervision and done when the remote risk of P.aeruginosa infection would be outweighed by the clinical benefits of using the ice.

3.2 Paediatric and Adult ICU usage of Tap Water

There is no restriction on the usage of water for washing, drinking or oral hygiene by adults or paediatrics. The guidance on the use of ice remains extant, i.e. the use of ice for consumption by severely immunocompromised patients should not be taken from automatic ice-making machines but should be made with sterile water[35].

4. Critical Control Point 4: Preventing indirect contact with *P. aeruginosa* from colonised/infected patients

This critical control point is divided into 3 sections: 1) Clinical Procedures, 2) Discarding Potentially Contaminated Fluids and 3) Environment/Equipment Decontamination Procedures. This section applies to adult and paediatric ICUs and all NNUs). For clinical procedures including hand washing procedures and the discarding of fluids (blood, body fluid or potentially contaminated fluids), follow the National Infection Prevention and Control Manual[36] including the use of Personal Protective Equipment. NHS Boards should be able to demonstrate compliance with the National Infection Prevention and Control Manual.[36]

1. Clinical Procedures	
Hand Washing/Hygiene Procedures	Use hand wash stations **only** for hand washing. If it is not possible to comply with this instruction then alert the IPCT who will assist/advise in completing a risk assessment. Follow hand washing procedure as shown in Chapter 1 SICPs of the National Infection Prevention and Control Manual[36]. Discard hand hygiene product bottles when empty – never top up.
Aseptic procedures (including IV drug preparation procedures)	Do not **prepare or perform** aseptic procedures in areas where there are concurrent procedures that are generating splashes which could contaminate a sterile surface, e.g. collecting water from a tap. Decontaminate all surfaces on which aseptic procedures are to be performed prior to commencing a procedure – use a detergent or alcohol wipe.
Aerosol generating Procedures	Follow existing guidance for aerosol generating procedures detailed in the national guidance on respiratory tract infections[37]

2. Discarding Potentially Contaminated Fluids	
Small volume fluids	Do not discard small volume fluids (e.g. ET condensate, baby washing water <50mls) into hand wash stations. Empty fluids directly into a clinical waste bag. Alternatively these small volumes may be absorbed by (e.g. cotton wool balls), before disposal into a healthcare waste bag.
Larger volume fluids	e.g. Bed bath fluids/baby bath water/large volume of ET condensate. Safely transport containers and discard in sluice or a sink, which is not a hand wash station. If it is not possible to comply with this instruction then alert the IPCT who will assist/advise in completing a risk assessment.
Suction/chest drain bottles	Seal and discard disposable lined suction containers in a healthcare waste bag or, use solidifying gel prior to discarding in a healthcare waste bag.
3. Environment/Equipment Decontamination Procedures	
(Key) Equipment Decontamination	**Incubators - Follow Manufacturer's Guidance** There is no requirement to use sterile water to clean incubators after use. Tap water and general purpose detergent may be used. Do not use disinfectants that will degrade the incubator material. The critical factor **is the thorough drying** of the mattress and all parts of the incubator. Any moisture left within or on the incubator will encourage microbial growth – including *P. aeruginosa*.
	Humidifiers attached to incubators Use only sterile or distilled water (as per manufacturer's instructions) to fill and top up
	Humidifiers **Reusable** humidifiers must be able to withstand reprocessing in a Central Decontamination Unit as per manufacturer's instructions. If they are not able to withstand reprocessing in a CDU then an alternative method of decontamination as listed in the manufacturer's guidance must be followed.

Hand wash station cleaning	Frequency: minimum daily Procedure for cleaning hand wash stations is provided as Appendix 3.
Storage of equipment	Do not store any equipment items where they may be exposed to splash contamination.
Non-clinical procedures that generate a spray, e.g. cleaning spray bottles	**Do not top up any** fluid containers, e.g. spray bottles used for cleaning. Refillable spray bottles **must not** be used for cleaning solutions. Do not use spray bottles in areas where aseptic procedures are being prepared or are ongoing. Where possible avoid using spray bottles.

5. Critical Control Point 5: Preparedness for Clinical Incidents and Earliest possible detection

5.1 Clinical Isolate Surveillance and Preparedness

IPCTs should:

- Be alert to the possibility that patients in NNUs, ICUs and immunocompromised patients in general are at increased risk of cases/outbreaks of *P. aeruginosa* (or similar type of organism).
- Include *P. aeruginosa* from a blood culture as an alert organism from an adult or paediatric patient.[38] (An alert organism is identified by the microbiology laboratory and referred to the IPCT for assessment of possible healthcare associated acquisition and to identify any possible environmental/equipment sources).
- When assessing alert organisms be mindful that *P. aeruginosa* can be selected for by prior antibiotic usage.
- In a neonatal unit include *P. aeruginosa* from any clinical specimen as an alert organism.
- Ensure they can detect in real time any possible outbreak early through effective local surveillance and monitoring of numbers of cases over time.
- Be able to facilitate early identification of possible source(s), i.e. have a testing protocol in place ready for testing of water outlets for *P. aeruginosa.*
- Have a contingency plan for NNUs and ICUs to enable safe patient care to continue without direct patient/water contact, e.g. use of patient wipes and sterile water in neonatal units.

Testing of water for *P. aeruginosa* is only required if a very specific reason has been identified, e.g. suspected or confirmed outbreak, or a series of sequential cases. Testing of water for *P. aeruginosa* in the absence of a clinical incident may provide little reassurance as a negative result refers only to the single point in time when the specimen was taken.

Further information on microbiological examination of water supplies for *P. aeruginosa* can be found in Health Technical Memorandum 04-01: Addendum. *Pseudomonas aeruginosa* - advice for augmented care units'. (See Appendix 4)

5.2 National *P. aeruginosa* Surveillance and Reporting of Clinical Incidents

The total number of bacteraemias caused by *P. aeruginosa* is published annually as part of the Scottish Antimicrobial Resistance Surveillance Programme. Real-time surveillance of specific alert organisms is a local responsibility for NHS boards. Emerging background monitoring aimed at identifying emerging threats is being reviewed.

Any local outbreak or incident should be assessed using the Hospital Infection Incident Assessment Tool (HIIAT) and reported to HPS if amber or red. In addition, if there is an active ongoing clinical incident, where the source is considered to be tap water, then HPS should also be informed regardless of the HIIAT.

6. Critical Control Point 6: Prompt investigation and control measure application for any clinical incidents

Should local alert organism surveillance identify a possible outbreak caused by *P. aeruginosa*, then the rigour of investigation and control measures must still apply regardless of the considered vulnerability of the patients in the clinical setting. In an area where there may be an immediate risk, the IPCT should work urgently with Estates/Facilities.

When investigating any individual patient's healthcare experience in time, place and person, the IPCT needs to consider:

- The patient's entire inpatient/outpatient journey (all wards where the patient stayed during their current hospitalisation).
- The history of invasive device use, including antibiotic administrations.
- How water is used in the clinical areas where the patient has been cared for and how it was used by the patient.
- How drugs, particularly IV drugs, are prepared in the clinical area.
- All possible reservoirs, e.g. water and environmental where colonisation could have arisen.
- All patient/water/environmental microbiology details.

6.1 Outbreak Control Measures

- Confirm that the existing guidance detailed in Control Points 1 – 4 is being followed.
- Consideration should be given to preventing patients coming into contact with potentially contaminated water until it is confirmed that water is not the source, i.e. water coming into direct patient contact.
- Implement the Pseudomonas Outbreak Checklist and/or Outbreak Checklist if there are situations with an ongoing infection risk. (If an incident arises contact HPS).
- Isolate or cohort neonates with *P. aeruginosa* colonisation or infection. Adult and paediatric ICU patients do not require isolation.

N.B. Seek advice and/or involve Consultant in Public Health Medicine (CPHM), HFS, HPS in incidents.

6.2 Point-of-use tap filters

Routine use of point-of-use filters is not recommended. Point-of-use filters are not a primary preventative measure, or a primary control measure. They may be considered if there is a recognised clinical incident and the role of water in the incident is yet to be identified. Therefore any new taps in NNUs and ICUs should be capable of including a point-of-use filter.

While the installation of point-of-use filters will maximise delivery of safe water supplies there is a danger that their inclusion will lead to a false sense of security and reduce the risk of compliance with primary prevention measures of flushing all frequently used outlets, hand hygiene and the safe discarding of potentially contaminated fluids.

Removal of point-of-use filters would be a clinical decision but the only way to be confident that elimination of potential re-seeding by incoming water supplies has been achieved would be to fit point-of-use filters permanently or to make amendments to plumbing and taps. It should be recognised that their installation will be detrimental to water flow in gravity installations with restricted pressure.

D) Organisational Management

There must be good dialogue and communication between the IPCT, Infection Control Manager Estates and Facilities departments and the NNUs and ICUs.

Chief Executive's Responsibilities

As detailed in SHTM 04-01 and CEL 08 (2013) [1;30] the CEO is ultimately responsible for ensuring:

- Clinical areas where patients at the highest risk of *P. aeruginosa* or similar infection have been identified.
- Clinical Directors and Senior Charge Nurses of these clinical areas have been informed of the risks and the actions in this guidance needed to prevent *P. aeruginosa*.
- Best practice relating to the use of hand washing facilities is consistently and fully applied.
- There is a nominated Responsible Person (Water) for their NHS board. See Section 6 of SHTM 04:01 Part B, paragraph 6.7 http://www.hfs.scot.nhs.uk/publications/1343743141-Version%201.2.pdf
- There are robust systems and documentary evidence of safe water management systems which includes having a Water Safety Group (WSG) responsible for developing and maintaining a Water Safety Plan (WSP), inclusive of risk assessments and actions to mitigate risks.
- A report is provided to the board, at least annually providing assurance that appropriate arrangements are in place and operating in accordance with the requirements of the CEL and supporting guidance, including the status of the Water Safety Plan and Action List.

Organisational Arrangements for the Water Safety Group (WSG)

- As the risks around *P. aeruginosa* infection in hospitals include the fixtures, fittings as well as the use of water in clinical settings and clinical procedures, a medical microbiologist should be on the WSG to advise and lead on these issues.
- The WSG may be led by the Responsible Person (Water) and there must be a clear line of responsibility to the CEO through the Infection Control (or other) Committee. (The Responsible Person (Water) has a duty to link with the ICD and the ICD has a duty to be involved in the risk assessments.)
- The WSG is responsible for ensuring it identifies microbiological hazards, assessing risks, identifying and monitoring control measures and developing incident protocols.
- The WSG should ensure a co-ordinated approach between IPCTs, clinical staff and Estates/Facilities department on all water issues. Involved in developing the Water Safety Plan (WSP) will be: IPCT, Senior Nurses, Estates, Medical Physics (re: incubator, humidifiers etc), Health and Safety and

Domestic Services Managers. See Appendix 5 for the Key Steps of a Water Safety Plan for a Healthcare Facility.

Risk Assessment and identification of actions that are required to reduce or negate *P. aeruginosa* risks:

- Details of the ICUs and other clinical settings that are considered to be at high-risk of *P. aeruginosa* infection based on the patients' immune status and any previous clinical *P. aeruginosa* incidents.
- Confirmation that the Clinical Directors and Senior Charge Nurses in these clinical areas have been informed of the *P. aeruginosa* risk to their patients.
- An assessment in these clinical areas of the suitability of the water distribution system including design, maintenance and configuration of pipework, provision, location and design of thermostatic control devices, design and layout of hand wash stations i.e. position of sensor, soap, gel and angle of lever on operated tap, identifying unused and under-used outlets and hand wash stations and the unnecessary use of flexible hoses and any containing inappropriate lining materials.
- Confirmation that there are sufficient easily accessible hand wash stations that are all being used or flushed at least daily in all NNUs and ICUs and other recognised clinical units. (See Appendix 2).
- An assessment of the clinical practice and ongoing care of invasive devices, cleaning of patient equipment and usage of hand wash stations that could compromise patients.
- The sampling and monitoring that needs to be put in place in the event of an outbreak or incident.
- Those NHS boards with existing robust water management policies for *Legionella* will already have in place much of the integral requirements for developing a WSP.
- The WSP will complement SHTM 04-01[30] Parts A & B.

The Water Safety Plan Action List

As a consequence of the Risk Assessment in the Water Safety Plan a series of actions will be made. The WSG must advise the Infection Control (or other) Committee of the relative importance of these actions and the order in which any remedial action should take place to optimise patient safety.

The Action List should include any training and competency issues required to ensure compliance with this guidance.

Training and competency

Where Healthcare Workers (HCWs) undertake additional actions or carry out a task in a specific way, for example the flushing of a water source, cleaning of a hand wash basin or the installation of soap dispenser, these HCWs must be provided with training and information detailing how to carry out the tasks effectively.

E) Appendices

Appendix 1 - The number of hand wash stations required in the NNUs and ICUs

Regulations on hand wash stations are contained in SHFN 30 and SHTM 04-01[30;39]. In relation to the number of hand wash stations SHFN 30 states:

"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"*

The latest information suggests that the more hand wash stations in any given clinical environment the less the amount of water pulled through from any individual water outlet (tap) and consequently the greater the risk for biofilm formation on pipework[40]. Overall safety from all HAI (*P. aeruginosa* and non- *P. aeruginosa*) risks needs to be balanced. Therefore, a precise number of hand wash stations to beds/cots are not specified in this guidance. SHTM 04-01[30]/SHFN 30[39] is currently being revised in line with the instructions in this section:

- There should be *sufficient*, *easily accessible*, hand wash stations for clinical staff to use to decontaminate their hands.
- What precisely ***sufficient hand wash stations*** means for any given clinical area needs to be determined locally through a risk assessment.
- The IPCT and the clinical team should agree for the local risk assessment whether there are sufficient numbers of hand wash stations and sinks in their NNUs and ICUs.
- Clinical staff should confirm that, given the vulnerability of their patients, the distance from all bed/cot-sides to the nearest hand wash station does not prevent, or inhibit, the HCW taking the opportunity to perform hand washing as required.
- This assessment can be confirmed by hand hygiene audit data which should demonstrate that when hand-washing is required, it is being reliably performed by all staff.
- If it is considered that major works are required as a consequence of the above statements, contact HFS prior to developing plans.

Appendix 2 - Procedure for taking water samples (when requested by a clinical microbiologist/ICD)

- Sampling will only be taken if a clinical incident has occurred.
- The method of water sampling outlined in this guidance differs from the collection of water samples for other purposes e.g. sampling for *Legionella.*
- Sampling should only be undertaken by staff trained in the appropriate technique for obtaining water samples. See SHTM 04-01 - Water Safety for healthcare premises Part C – TVC Testing Protocol http://www.hfs.scot.nhs.uk/publications/1360856813-V1.2%20SHTM%2004-01%20Part%20C.pdf
- Sampling should take place during a period of no use (at least 2 hours or preferably longer) of that outlet, if that is not possible, during a time of lowest usage. This will normally mean sampling in the early morning, through a variety of usage patterns may need to be taken into account.
- The sampling protocol is designed to ensure the best chance of isolating any organism from the tap or outlet. As such the tap should not be disinfected by heat or chemicals or cleaned before sampling. Disinfectants in the water, such as chlorine or chlorine dioxide, will have residual activity and may inactivate bacteria after taking the sample but prior to its processing. To preserve the microbial content of the sample the disinfectant should be neutralised. Neutralisers should be present in the sterile sampling containers.

How to sample

Two sterile containers of 500-1000ml volume containing a suitable neutraliser will be required.

Two separate samples must be obtained from the same outlet:

- A **pre-flush** sample should be taken from the tap/outlet when the tap or outlet has not been used for at least 2 hours.
- The tap should then be run for one minute and a second identical **post-flush** sample taken.

Sample containers should be carefully labelled such that the outlet and the water to be tested (i.e hot, cold or mixed) can be clearly identified, diagrammatic maps indicating numbered outlets to be sampled can be helpful in this respect.

Without touching the screw thread, inside of the cap or inside of the collection container hold the container under the tap and collect approximately the first 450 – 500 ml water.

Replace the cap and invert to mix the neutraliser with the collected water.

If the water feed to the outlet is provided by:

- A separate cold water supply and hot water supply; or
- Separate cold water and a pre-blended hot water supply

The container should be filled with half the sample by running the cold water into the container first. The rest of the sample should then be collected from the hot or blended outlet.

The post-flush sample should be collected in the same way.

The collected water should be processed within 2 hours or refrigerated within 2 hours at 2-8C and processed within 24 hours. Transport may be aided by the use of temperature controlled box.

Further information on microbiological examination of water supplies for *P. aeruginosa* can be found in 'Water Sources and *Pseudomonas aeruginosa* infection of taps and water systems, DH, 31 March 2012' (see Appendix 4)

Appendix 3 - Guidance on cleaning of sinks/basins and taps in ICUs and neonatal units to minimise risk of *P. aeruginosa*

Step 1: Cleaning the surrounding area

All basins, sinks and surrounding areas should be free from clutter and debris:

- Put on disposable gloves and apron.
- Using a new disposable cloth and detergent damp-clean the paper towel holder then the soap dispenser, paying particular attention to the underside of the soap dispensing unit, finishing with the nozzle.
- Then clean the splash-back area, working from top to bottom
- Then clean the underside of the sink/basin working from the higher level downwards.
- Carefully dispose of the cloth into the appropriate waste bag.
- Dry all surfaces with disposable cloth/towel as above.

Step 2: Cleaning the wash-hand basin

- Using a new disposable cloth and 1,000 ppm available chlorine, clean tap(s) first – start at the tap outlet end (**do not put cloth into the tap outlet**), finish at the base and then clean tap handles.
- Using the same cloth clean the accessible part of the overflow or waste outlet to remove visible dirt. Dispose of the cloth in the appropriate waste bag.
- Using a new disposable cloth clean round the inside of the sink/basin from top rim of bowl.
- Rinse as above.
- Carefully dispose of cloth in appropriate waste bag.
- Dry all surfaces with disposable cloth/towel as above.
- Dispose of gloves and apron in appropriate waste bag and decontaminate hands between the cleaning of each sink/basin.

Always ensure that the cleaning product being used is compatible with the surfaces on which it is being used. N.B. Refillable spray bottles **must not** be used for cleaning solutions

Enhanced cleaning

During outbreaks/isolation nursing or terminal clean, the process is the same however the frequency may change. This will be guided by the local IPCT.

Appendix 4 - Microbiological examination of water samples for *P. aeruginosa*

[Source: Health Technical Memorandum 04-01: Addendum. *Pseudomonas aeruginosa* - advice for augmented care units, Department of Health 2013]

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/140105/Health_Technical_Memorandum_04-01_Addendum.pdf

Appendix 5 – Key steps of a Water Safety Plan (WSP) for a Healthcare Facility[41]

- Establish an Environmental Monitoring Committee (or equivalent).
- Document and describe the entire domestic water distribution system including schematic diagrams.
- Carry out a hazard analysis and risk characterisation, assessing the likelihood and impact.
- Assess the risks pertaining to all domestic water, water systems, water uses, routes of exposure and patient risk groups.
- Assess incoming source water quality and composition.
- Identify and evaluate existing control measures.
- Identify and implement additional control measures.
- Carry out scalding risk assessments.
- Enter ongoing risks onto the facility's risk register and manage appropriately.
- Monitor and audit control measures.
- Ensure maintenance is carried out in line with current recommendations.
- Maintain an up-to-date hygiene logbook.
- Develop written policies and procedures.
- Develop a contingency plan for major disruptions to the incoming water supply.
- Establish a communication plan.
- Provide staff training and ensure competency.
- Carry out the necessary validation, verification, and audit processes.
- A WSP is a dynamic document. It is important that it is not seen as a one-off exercise. It must be kept up-to-date. Many factors in the day-to-day running of a facility can affect the risk of water system contamination such as:
    - Planned/unplanned works or maintenance of the water system;
    - Building renovation or refurbishment;
    - Closure and re-opening of the facility or parts of it (planned or unplanned)
    - Change of use of the building, or part of it;
    - Disruptions to the water supply or to the facility;

The WSP should be reviewed on an annual basis and when there are alterations, repairs, changes of use, building works, or critical incidents.

Sites where there are mixed uses such as buildings for direct healthcare provision and buildings for administration are often supplied by the same mains water supply. However, water systems use within both will be substantially different and can negatively impact in either direction. This must be addressed during the development of a WSP and there must be clear responsibility for the safety of water on the site.

The key factors that influence risk and should be incorporated in a healthcare facility's WSP and assessed as part of the risk assessment are:

- Source water quality and characteristics;
- Age, design and size of building;
- Temperatures, pressures and flow;
- Materials, fixtures and fittings;
- Unit/ward design;
- Augmented care units;
- Outlet use;
- Cleaning, maintenance and disinfection;
- Staff training; and
- Audit.

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