SCOTTISH HOSPITALS INQUIRY

Substantive Core Participant Responses to Provisional Position Paper 5

The History of Infection Concerns (HOIC) for the Queen Elizabeth University Hospital Campus

A43700817

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THE SCOTTISH HOSPITALS INQUIRY

COMMENTS ON PROVISIONAL POSITION PAPER 5

FROM CORE PARTICIPANTS: PARENTS AND REPRESENTATIVES OF THE CHILDREN AND ADULTS AFFECTED BY THEIR TREATMENT AT QUEH

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1. INTRODUCTION

1.1 We are invited to comment on Provisional Position Paper 5: The History of Infection Concerns (HOIC) for the Queen Elizabeth University Hospital Campus ('PPP5').

1.2 PPP5 was provided by Counsel to the Inquiry at the time of the Procedural Hearing on 20th March 2023, three days after the production of a List of Topics (identifying Topics for the June Hearings), an associated 'Appendix B: Index of the Hearings Bundle' (identifying Documents in Bundles numbered 1 – 6 and having a bearing upon the June diet of Hearings) and 'Appendix C: List of Witnesses (identifying the witnesses who may be called by Counsel to the Inquiry to give evidence at the June diet of Hearings).

1.3 Bundles 1 to 6 comprise almost 600 documents of undisclosed volume. It seems that a further Bundle 7 will comprise Reports from Health Protection Scotland/Health Facilities Scotland, but the nature and extent of those documents is not disclosed by PPP5.

1.4 A significant amount of work will require to be carried out in preparing for attendance at the June hearing – that work will have to be carried out at the same time as work in preparation for and in attending at the April hearing in

connection with the Royal Hospital for Children and Young People and the Department of Clinical Neurosciences in Edinburgh. Indications were given in PPP5, the List of Topics and at the Procedural Hearing that information would be provided "shortly" or "in early course".

1.5 At the time of drafting this response, we have not yet been provided with any of the documentation referred to in Appendix B. None of the Statements from any of the Witnesses identified at Appendix C have, as yet, been disclosed.

1.6 The June diet commences on 12 June 2023, a little over 7 weeks away.

1.7 We are unable to comment to any meaningful extent on much of PPP5 as it is based on documentation and information that we have yet to be given access to.

1.8 We have not been given a date for the provision of the documentation and Witness Statements by the Inquiry Team and some of the core participants have expressed considerable concern about the facts set out in the Paper. They have also expressed surprise and concern about the fact that their legal representatives have yet to be provided with the relevant documentation, much of which will have come from the QEUH/ GGCHB. In effect the core participants feel that they do not have the same level of access to the documentation as the Hospital/Health Board and believe that they are disadvantaged compared to the Hospital/Health Board in terms of preparing for the June diet of Hearings.

1.9 At Consultation on 18 April 2023, they indicated that they do not consider that to be fair or reasonable.

1.10 Many of the core participants have expressed shock at the matters set out in the Paper relating to the concerns outlined about the built environment (water, drainage and ventilation) that has caused or created a risk of infection to patients. The children of some of them are still being treated at the Hospital to this day. Their concerns continue – is the QEUH a safe environment for their loved ones?

2. COMMENTS ON KEY MATTERS

We have been asked to direct our comments on the paper to five matters as follows:

(1) Whether the narrative is accepted as an accurate history of what occurred (and if not where the narrative is challenged and why)

Comment – Insofar as the parents, relatives and patients are aware, the narrative seems broadly accurate. This is subject to the caveat that we have yet to see the documents and the witness statements of the clinicians involved in the treatment of the affected patients and any documents that may be pertinent.

(2) Whether CPs are aware of other matters that ought to be part of the narrative.

Comment – We appreciate that this paper is not looking at individual cases, however, it is suggested that the time periods mentioned for the neonatal unit/NICU are too restrictive as there is little reference after 2015. For example, Sophia, the daughter of Theresa and Matthew Smith, was in the neonatal unit in April 2017 and William, the son of Carol Ann Baxter, was in the neonatal unit between January and July 2019. It is proposed that those dates be incorporated into the timeline.

(3) An indication of whether CPs were aware of the events at the time that they occurred, and of not when they became aware.

Comment – In light of the lengthy and detailed evidence in 2021 from the parents, patients and relatives, both orally and in witness statements, about their awareness of the serious problems that they faced at the Hospital/Health Board with the water supply, drainage, ventilation and infections, it is assumed that this query is more directed at other core participants, such as the Hospital/Health Board management. The families and patients were all acutely

aware of and lived through the serious problems they encountered on a daily basis. The evidence heard in 2021 suggests that, despite issues being raised with the Hospital/Health Board, information has largely been kept from patients and families who, in many cases, only became aware of the nature and extent of events long after they manifested.

(4) Whether any of the concerns about the safety of the building systems are accepted by CP's as valid (and if not why not).

Comment – This, too, seems to us to be a matter for the Hospital/Health Board to address as the concerns about the safety of the built environment / building systems were repeatedly pointed out to the hospital staff by parents and patients. Clinicians met and discussed these issues with patients/parents and it is hoped that their evidence to be led at the forthcoming diet will cover those discussions and communications.

(5) An indication by CPs of which if any of the suggested links between infection and built environment are accepted (and the basis upon which such links are accepted, or refuted as the case may be).

Comment – This is not something which we are able to constructively comment upon without having seen the further evidence, including expert evidence, about the links between infection and the built environment/building systems.

3. OTHER ISSUES

The Paper refers to infection rates dropping (para 4.12.3) up to December 2019. Over two years have passed since then. The core participants wish to know what has happened with infection rates since December 2019. As stated above, is the Hospital currently safe? That is of great concern to the parents and patients who still use the Hospital and will do so in the future. It is also of course a matter of

much wider public concern as to whether the Hospital is now safe with patients no longer at risk (perceived or otherwise) from the water supply, drainage and ventilation.

Prophylactic medication was prescribed to the children in light of the high rates of infection. The basis for this and the impact on patients is an important part of the consequences of the problems with the built environment – water supply, drainage and ventilation. Was a risk assessment performed prior to the policy decision in 2016 to implement the prophylaxis programme? If so, did that risk assessment consider the long term risks posed to patients in consequence of the administration of prophylactic medication? Who authorised the policy? What decisions were made and by whom about what should be communicated to the families at the point in time it was implemented?

We are grateful for the opportunity to contribute and collaborate to the extent that we can at this time. We remain committed and look forward to working further with the Inquiry Team in this and subsequent substantive hearings, hoping that those we represent will see full investigation, transparency, respect, trust and honesty.

Steve Love KC
Gavin Thornley
21st April 2023

Keoghs

Scottish Hospitals Inquiry

By Email Only: [redacted]

Our Ref: RIL.T10513091
Your Ref:
Date: 21 April 2023
Please Ask For: Ruth Lawrence
Email: [redacted]
Direct Dial: [redacted]

Dear Sirs

Our Client: **Currie & Brown UK Limited**
Re: **Queen Elizabeth University Hospital, Glasgow**
Draft Provisional Position Paper 5 - History of Infection Concerns (QEUH)

We write with reference to the draft working paper 'Draft Provisional Position Paper 5 - History of Infection Concerns (QEUH)' sent under cover of an email dated 20 March 2023. We note that the paper reflects the Inquiry's present understanding based on the material available to it and that the draft working paper was circulated to seek input as to whether the Inquiry's current understanding is correct, and to invite comment and clarification.

Currie & Brown take this opportunity to provide their comments and clarification. We have set out below various paragraphs of the draft working paper, with Currie & Brown's comments directly underneath.

"1.2 Ventilation system concerns:

1.2.1 At various points in 2014/15, the lead ICD raised concerns about ventilation particularly in relation to the Adult BMT unit, the Paediatric BMT Unit and the Infectious Disease Unit."

- Currie & Brown consider that an Infectious Disease Unit was not part of the QEUH project brief. The project brief was to provide isolation rooms as part of an acute hospital to deal with patients who may be infectious (until they can be transferred to a specialist unit) or patients who are susceptible to infection from others.

"1.3 Water system concern: taps

1.3.1 In March 2014, GGC sought guidance from HPS about the taps which had been procured for the new hospitals. The taps were not compliant with NHS Guidance (SHTM 04-01). Nor were they compliant with guidance which had recently been issued by HPS (*Guidance for neo natal units (NNUs) (levels 1,2 and 3) adult and paediatric intensive care units (ICUs) in Scotland to minimise the risk of pseudomonas aeruginosa infection from water*)."

- Currie & Brown have queried why the taps are being stated as not compliant. Currie & Brown had understood that it was the SBAR response to the Northern Ireland issue that considered the taps not compliant but the design / specification of the taps were compliant with the SHTM guidance in place at time of briefing and specification.

"1.3.4 The Horne taps which were ultimately installed on all clinical wash hand basins across the QEUH and RHC were fitted with flow regulators, contrary to the advice within the HPS SBAR."

- Currie & Brown note from the notes of the Early Warning Meeting on 12 June 2014 provide as follows:

  "Pseudonomas in taps – Retrospective guidance post BMCL Contract Guidance. DH noted that there had been a CEL issues relating to Pseudonomas in taps and specifically the flow straighteners in the taps. The NHS had related this back to the NHS Board centrally. It was understood that industry wide this issue is being reviewed. DH enquired if Horne and Shanks are undertaking a review of their design/have any comments about their taps. DH noted that there was no specific action for the Project Team at this time. (16/01/2014) DP advised that he had forwarded the information to Mercury. DH noted that Armitage Shanks have changed the flow straighteners to the Marquick taps. The CEL only relates to high risk areas. The high risk areas will need to be discussed with Infection Control reps. (23/01/2014) DP advised that he was pushing Mercury for a response. Mercury has passed the enquiry to Horne for an update re the current status of design. (30/01/2014) DH requested that Horne be pushed for a response (06/02/2014) DP advised that he is awaiting a response from Horne (13/02/2014) WIP – awaiting feedback from Horne (20/02/2014). 27/02/2014 – Response from Horne noted that taps were compliant and it was a maintenance issue to ensure these are kept clean – IP to contact HFS if appropriate. IPowrie is in discussion with HFS on the way forward (06/03/2014). DP agreed to forward information to IPowrie – looking at a pressure reducer installation – WIP (13/03/2014) DP advised that he had spoken to Steve on 19/03/2014 and Steve has prepared a paper and has scheduled a meeting with Horne. It is suggested that it is not a straightener issue but a moisture issue and that it would be better to retain the straightener so that there is a maintainable part (20/03/2014) DP advised that IP is liaising with HPs an HFS and there is a couple of queries re Steve's paper. DH acknowledged that this is not a contractual issue at the moment. It would be helpful if BMCL could provide the as fitted detail of the Horne taps. (27/03/2014) DP advised that Horne had responded and IP Had raised a couple of queries with Steve (04/04/2014) DL noted that there had been a review undertaken by Health Protection Scotland and there was a meeting scheduled later that day to discuss the HPS review. (10/04/2014) DP noted that meeting is awaited with Horne (17/04/2014) PM noted that there was a meeting being arranged to discuss. Target date 1st May 2014. (24/05/2014) DP advised that the meeting had been held. The next step is for a meeting with HPS through HFS. PM acknowledged that DL Had been in contact with HFS to organize the meeting (08/05/2014) DH advised that a meeting had been set up with HPS, HFS and Horne so that Horne can present their case. IP will attend this meeting as an observer. DP advised that he would also like to attend this meeting as adviser. DS noted that this matter was being driven by HPS and HFS – is not a BMCL/NHS issue. DH noted that it is not a contract issue for BMCL at the moment acknowledging that this matter is due to retrospective guidance (15/05/2014) It was noted that HPS/HFS meeting to be held. DS noted

that it was his view that this should not impact on PC. PM advised that this matter was a Board issue so should not impact on PC (29/05/2014) Following a meeting with HFS the tap issue appears resolved, although the Board will need to draft and implement a management process for the maintenance of the taps in critical care areas. Board to secure a letter from HFS confirming agreement or secure minutes of meeting. (12/06/2014)"

Currie & Brown note that a special meeting convened by Health Facilities Scotland on 5 June 2014 the issues in relation to their earlier guidance was reviewed and it was unanimously agreed (para 5.3) that ,as the taps installed within the new build development had complied with guidance current at the time of its specification and briefing and that the hospital was in the process of being commissioned, it should be regarded as being in the "retrospective" category, not "new build". Accordingly there was no need to apply additional flow control facilities or remove flow straighteners and any residual perceived or potential risks would form part of the routine management process.

"2.2 Ventilation concerns by MB/ICDs

2.2.1 In June 2015, concerns were raised by the lead ICD about the absence of HEPA filtration and that the absence of such would be "potentially unsafe" as regards children presently cared for in facilities with HEPA filtration. Concerns were also raised about the absence of HEPA filtration in transplant rooms."

- Currie & Brown note that HEPA Filtration was part of Ward 4B and in other areas as briefed by the Board. HEPA filters were part of the design for Isolation Rooms in Ward 2A.

"2.4.2 The Ward 4B protective isolation rooms did not achieve the required air pressure differentials or air change per hour (ACH) rates required by the specification (and NHS Design Guidance)."

- Currie & Brown state that due to late change in Board requirements the design / construction was limited by constraints of already installed plant and equipment. The derogated scheme was known and accepted by NHSGG&C.

"3.5 Flow straighteners and Pseudomonas (February 2016)

3.5.1 On 2 February 2016, the Board Water Safety Group (BWSG) meeting minutes record a discussion between the Lead ICD and GGC Senior Estates Manager of 'water and environmental issues'. Discussion had taken place about the risk of Pseudomonas with the use of flow regulators. HPS advice was recorded as being to remove, sanitise, and return the flow straightener to the tap and to replace the plastic components every three months, or alternatively to keep the flow straighteners in place with sampling to be undertaken in high-risk areas."

- Currie & Brown state that as recorded in the Early Waring Meeting notes (see above) the issue with the taps was a maintenance matter. The minutes referred to in paragraph 3.5.1 confirm this and align to the guidance / decision to retain taps.

"3.8.4 Whilst air samples from the chilled beams had been collected and shown to be negative, samples taken from an air handling unit showed fungus, and the IMT indicates that no air sampling programme was in place. The continued absence of HEPA filtration was noted."

- Currie & Brown reiterate that HEPA filters were part of the design for Isolation Rooms in Ward 2A.

"3.9 Portable HEPA filters in Ward 2A (? 2016) *3.9.1 Following the infection of a patient within Ward 2A with Aspergillus, portable HEPA filters were to be placed in the unit. Whilst the air in Ward 2A was filtered, it was not HEPA filtered. The placement of the HEPA filtration units within the ward, and the timescale in which they were provided, is unknown."*

- Again, HEPA filters were part of the design for Isolation Rooms in Ward 2A.

"4.7 Water sampling begins (March 2017)

4.7.1 Water sampling was undertaken in Ward 2A from March 2017".

- Currie & Brown query whether water sampling was undertaken prior to this date as required by Water Safety Management Plans.

"5.43 Concern around levels of dust and ventilation (September 2018)

5.43.1 In addition to the very significant concerns around the water and drainage system, the IMT also had concerns about the general build-up of dust despite increased cleaning, particularly around vents and chilled beams. The fact that the rate of air change per hour (ACH) was only 3 in the RHC (as opposed to 6 in the QEUH) might explain the levels of dust present. Air sampling had been undertaken on chilled beams, the results of which were reported to be negative."

- Currie & Brown note that the rate of air change per hour was 2.5 in general single bedrooms.

"5.49.2 The ventilation system report showed that the system did not have as much capacity as initially thought. The report highlighted problems with pressure and air changes. Air changes were recorded during commissioning but not air pressure. A derogation was made from 6 to 3 ACH, and this was applied everywhere apart from BMT areas. The Project Board did not pick this up. The ward was currently at negative pressure to the rest of the hospital, which was not suitable for immunocompromised patients."

- Currie & Brown note that a derogation was made from 6 to 2.5 ACH.

"6.65 Specialist subgroup formed to consider ventilation in PICU (September 2019)

6.65.1 A specialist subgroup was formed to consider ventilation in PICU. The group included clinicians, IPCT, F&E and the ventilation Authorised Engineer. The PICU was 'non-compliant' as it had a lower number of isolation rooms than required. Following an options appraisal, the group recommended that a derogation be signed off and agreed to allow the unit to operate in its current set up."

- Currie & Brown state that PICU accommodation provided was as originally briefed by NHSGG&C.

If any further information or clarification is required by the Inquiry then Currie & Brown would of course be happy to provide this. We understand that the Inquiry already has copies of the documents referred to by Currie & Brown, but if this is not the case then please let us know.

Yours faithfully

[redacted]

Keoghs LLP

Response by IBI Group (UK) Limited to Provisional Position Paper 5, "The History of Infection Concerns (HOIC) for the Queen Elizabeth University Hospital Campus"

1. IBI is grateful for the opportunity to comment on the Inquiry's fifth Provisional Position Paper (PPP 5).

2. It is hoped that a more comprehensive response might be capable of being provided once the relevant evidence (principally from statements and expert reports obtained by the Inquiry) is distributed and considered. With that qualification, the following responses are made to the questions, asked of Core Participants, within PPP 5:

   Question 1 – IBI accepts the history of what occurred to the extent that it is consistent with IBI's Narrative submitted on 7 May 2021 (the "*IBI Narrative*"). Given the nature of its involvement, IBI does not have a sufficient basis to comment further on the history of what occurred as set out in PPP 5.

   Question 2 – IBI is not aware at this stage of other matters that ought properly to form part of the Narrative.

   Question 3 – Reference is made to the IBI Narrative. This outlines the extent of IBI's awareness of (and, where applicable, involvement in) certain remedial works referenced within PPP 5.

   Questions 4 and 5 – IBI does not have a sufficient basis (either in the evidence available or applying its own architectural expertise) to comment on

   i. Whether concerns about the safety of the building system are valid; or
   ii. The suggested links between infection and the built environment.

Dated this 21 April 2023

Murdo MacLeod KC

Barney Ross

Nicholas McAndrew

Womble Bond Dickinson (UK) LLP

SCOTTISH HOSPITALS INQUIRY

RESPONSE TO PROVISIONAL POSITION PAPER 5 OF THE INQUIRY

ON BEHALF OF

GREATER GLASGOW HEALTH BOARD

1. Greater Glasgow Health Board ('NHSGGC') welcomes the opportunity to comment on Provisional Position Paper 5 ('PPP') of the Inquiry, circulated on 20 March 2023, and notes that, as matters stand, the Paper is a work in progress which may be added to as the Inquiry's understanding of matters develops. In its response, NHSGGC seeks to address the 5 questions as posed by the Inquiry in the PPP and to offer clarity on those matters which it disputes and its reasons for doing so.

2. It is noted that the principal purpose of the PPP is to set out the Inquiry's understanding of events and issues that have been said to indicate concerns about: (i) the incidence of infection within the QEUH campus; (ii) the safety of key aspects of the built environment (notably the water, drainage and ventilation systems); and (iii) the possibility of links between infections and concerns about the built environment. Whilst it is stated that the narrative sets out the Inquiry's present understanding in relation to these matters, there is little or no analysis put forward as to the substance of any of these concerns.

3. In particular, it is common for patients to get infections especially if they are immunocompromised and not all infections are preventable. The PPP does not set out why the "episodes of concern" are outwith what would ordinarily be expected in a hospital environment.

4. With reference to those concerns, NHSGGC does not accept that, on the basis of the evidence currently available, any aspect of the water, drainage or ventilation systems in the new QEUH and RHC buildings ('QEUH') has posed a risk to the safety of patients beyond that which may reasonably be expected in any comparable hospital environment. As hospitals are not sterile environments, in any hospital there will be infections that may be linked to the hospital environment. With the exception of two discrete cases of

paediatric infection in 2016 and 2019, NHSGGC does not accept any suggestion that there was any direct transmission link between the built environment and any infection suffered by a patient within the QEUH in relation to the "episodes of concern".

5. The PPP notes that the paper "is based upon publicly available and other prominent reporting and it also takes into account certain of the Inquiry's investigations across its various work streams." However, the paper does not, on the face of it, appear to have taken into account information submitted by NHSGGC.

Whether the narrative is accepted as an accurate history of what occurred

6. NHSGGC acknowledges that this PPP is a work in progress and will be adapted as the Inquiry's understanding develops. However, at this stage, NHSGGC wishes to emphasise that it considers that the timeline does not give the full picture of its response to the "episodes of concern". In particular, there are gaps in the contextual information presented in the narrative regarding the investigation of what are referred to as "episodes of concern" which may create a false impression that NHSGGC did not respond appropriately to these concerns. To that extent, the narrative is not an accurate summary of events.

7. NHSGGC accepts the narrative in relation to the incidence of infections which patients suffered whilst being treated at the QEUH. However, the narrative is not accepted insofar as it sets out any link, whether explicitly or implicitly, between those infections and the water, drainage or ventilation systems at the QEUH. Whilst there is always some degree of risk from any built environment, the suggestion in the narrative that patients were exposed to an increased risk to their safety by any aspect of those systems at the QEUH, is not accepted by NHSGGC. The basis for NHSGGC's position on these matters is set out in full below.

8. It is clear from the narrative that reliance has been placed upon the timeline which was created by the Oversight Board. NHSGGC does not accept that the timeline created by the Oversight Board was created with full reference to proper source materials. NHSGGC does

not consider the Oversight Board timeline to be either accurate or reliable. In consequence, where the narrative has adopted the terms of the Oversight Board's timeline, there are often inaccuracies and incomplete information.

Whether other matters ought to be part of the narrative

9. The draft narrative as set out in the PPP provides a chronology of certain "episodes of concern". As a general comment, it would assist NHSGGC's verification of the chronology for reference to be made in the narrative to the sources of information or evidence which underpin the issues of concern as put forward in the PPP, in order that those sources of evidence upon which the Inquiry seeks to rely at this stage can be readily identified.

10. As indicated, NHSGGC does not accept that the narrative in its present form is reflective of the true picture of NHSGGC's response to the "episodes of concern". By way of example, reference is made throughout the PPP to meetings that took place following certain "episodes of concern". However, the meetings referenced are only a small number of the meetings that actually took place. Such meetings included meetings at Board level, together with AICC, BICC, AOMG, PAG and WRG meetings. Many of these meetings were attended by clinical specialists and external advisors.

11. Critically, the PPP does not set out the actions that were agreed and implemented as a result of those meetings. For example, it does not detail the input of clinical specialists in identifying, validating and implementing a strategy to manage potential infections. Those strategies included testing and cleaning. The adopted strategies were often devised with input from external bodies such as HPS. Further, the PPP does not detail NHSGGC's investigations in respect of the cause of infections at the QEUH which disavowed any direct transmission link to the built environment in relation to the "episodes of concern". Without this further detail, NHSGGC considers that the timeline provides no more than a partial picture in respect of the "episodes of concern".

12. As a result, NHSGGC considers that the timeline does not accurately reflect the investigation process and remedial work that was instigated as a result of the "episodes of concern".

Whether NHSGGC Health Board was aware of the events as set out in the narrative at the time they occurred

13. As summarised above, NHSGGC accepts the narrative insofar as it identifies the instances of infections. However, NHSGGC considers that it only provides a partial picture of NHSGGC's response to those infections. NHSGGC considers that, without that further detail, the PPP presents an incomplete and, accordingly, inaccurate chronology, both of the actions taken by NHSGGC as well as the time at which it became aware of the various issues raised in the PPP. NHSGGC will provide a chronology of events by issue, including NHSGGC's actions in relation to those issues. The chronology is not intended to be exhaustive but is intended to show where the chronology in the PPP requires further development.

14. The PPP primarily addresses certain "episodes of concern" that arose after the QEUH was handed over to NHSGGC on 26 January 2015. However, there are references in the PPP to matters that took place prior to handover. In particular, it is notable that reference is made to concerns raised by the Lead ICD about ventilation in 2014/2015. The nature of those concerns is not set out in the PPP.

15. The systems were designed with input of clinical specialists. A clinical output specification was prepared that was then captured in Employers' Requirements by the Lead Consultant, Currie and Brown. Those requirements were subject to peer review. The requirements then informed the design of the QEUH/RHC by the main contractor.

16. Clinical specialists were involved throughout the process. NHSGGC considers that that context must be provided in order to give a full chronology of NHSGGC's actions in relation to risk of infection from ventilation and water systems, otherwise it would appear from the PPP that the first clinical specialist involvement was in 2014/2015. That is not the case. The role of each of the entities involved in the design, build and commissioning phases, together with the clinical specialists who informed the design, needs to be understood in order to give the full picture of any concerns raised prior to handover and the validity of those concerns. As such, NHSGGC considers that the PPP is not, as currently drafted,

accurate. NHSGGC cannot therefore comment in this response on the accuracy of the PPP in respect of the times at which NHSGGC became aware of the "episodes of concern".

Whether any of the concerns about safety of the building systems are accepted as valid

17. Given the remit of the Inquiry to explore the extent to which ventilation and water issues impacted adversely on patient safety, these issues are the principal focus in considering the question of whether any concerns about the safety of the building systems can be accepted as valid.

18. At the heart of the consideration of safety of the building systems at the QEUH, as is clear from the PPP and the Inquiry's terms of reference, is the question of whether any aspect of the building systems caused QEUH patients to be exposed to increased risk of infection. With that in mind, NHSGGC seeks to highlight 2 points at the outset.

19. First, it is important for the Inquiry to distinguish facts from impressions and to have regard to evidence rather than speculation. Secondly, it should be acknowledged that no building is, or can be, an entirely sterile environment and hospitals are no exception. Hospital patients do get infections, particularly when such patients are immunocompromised. As hospitals are not sterile, they inevitably can be, and will be, a source of infection, even despite thorough infection prevention and control measures. Micro-organisms in the built environment will come into contact with patients and, as a consequence, in any acute hospital setting, there will always be an unavoidable background rate of infection. Indeed the background rate of infection would also be attributable to factors outwith the built environment. Thus, in general terms, the presence of micro-organisms in the environment, of itself, ought not to amount to an enhanced concern about the safety of the building systems.

20. Against this background, in addressing the question of whether there is validity to any perceptions or concerns about the safety of the building, the Inquiry is invited to consider 2 questions in relation to both ventilation and water systems, namely: (i) whether the design met the relevant standard or guidance, where available at the time; and (ii)

whether testing of the system provided evidence of any widespread issues in the sense of having exposed patients to a risk of infection beyond that which may reasonably be expected in any comparable hospital environment.

Ventilation

21. There has been no factual evidence placed before the Inquiry thus far of any suggested link between ventilation and any known case of infection at the hospital. Further, whilst the PPP sets out a history of ventilation concerns, and makes reference to patients having suffered from airborne infections, there is no material referenced to demonstrate definitively, or even legitimately to imply, a causal link between the ventilation system and any cases of infection.

Standards/ guidance

22. The Inquiry has heard evidence in relation to guidance pertaining to ventilation systems, notably the guidance as set out in SHTM 03-01.[1] It is important to note that, in terms of its status, SHTM 03-01 is peer produced guidance which is there to support, rather than replace, appropriate management and engineering expertise, and compliance with its guidance is not mandatory.[2] It is accepted that general ventilation on wards within QEUH did not comply with SHTM standards in respect of the number of air changes per hour. However, the general ventilation on wards exceeded the guidance in relation to filtration. There remains, however, a question about the practical effect of that non-compliance, if any, from the perspective of infection prevention and control and patient safety.

23. Further, it is important to note that, in evidence, microbiologist Professor Humphries questioned the evidential basis for the standards as set out in SHTM 03-01 from a microbiological perspective. In particular, he questioned in evidence what scientific basis exists for the rate of air changes being as they are in the guidance and advised the Inquiry that there is no precise science of which he is aware that sets rates of air changes per hour as they appear in SHTM. Whilst acknowledging the importance of ventilation in preventing

[1] Scottish Health Technical Memorandum: Ventilation for Healthcare Premises 03:01.
[2] Edward McLaughlin, HFS engineer; statement May 2022 hearing.

infection, he took a more holistic view in relation to infection prevention and control and emphasised that ventilation is just one aspect in what should be a series of measures in place to prevent infection, including the use of prophylaxis. In addition, he noted that the relevant standards appear to have derived from research carried out by Dr Owen Lidwell in 1972, at a time when hospital wards tended to be configured as Nightingale wards and long before the more recent prevalence of single bedrooms on wards, which is how the QEUH is configured, and which is preferred from an infection prevention and control perspective.[3]

24. Reference is made in the PPP to the absence of HEPA filtration on wards throughout the QEUH. HEPA filtration was not a requirement. A safe environment could be achieved through other means, such as rooms at positive pressure in comparison to the corridor; this was confirmed by HPS in 2015.[4]

25. It is far from evident that any deviation from the guidance as set out in SHTM 03:01 would amount to a valid concern about the safety of the building. There is no evidence to support why SHTM proposed minimum ventilation requirements are as they are, and there is nothing to suggest that rates of air changes themselves have any direct impact upon rates of infection. This has been examined specifically in relation to Ward 4C by Dr Samir Agrawal[5] who concluded that, although the ventilation system serving Ward 4C does not meet the SHTM 03-01, there is no evidence of a material increase in the risk of airborne infection as a result, a position which is supported by the low rates of documented airborne infections.[6] The Inquiry is invited to have regard to his report.

Testing of system

26. The design, commissioning and testing of the ventilation system was undertaken by the Main Contractor, Multiplex. There are no standards or guidance on the testing of air quality in hospitals. There are, therefore, no properly considered parameters against

[3] Professor Hilary Humphries statement and parole evidence to Inquiry, May 2022 hearing.
[4] HPS SBAR December 2015.
[5] Consultant haematologist at St Bartholomew's Hospital, London.
[6] Expert Report 18 May 2021.

which the Inquiry can meaningfully assess whether concerns about ventilation systems have any validity in relation to the question of safety of the QEUH building.

27. However, as is highlighted in the PPP, specific concerns were raised by "certain MBs/ICDs" as to the adequacy of ventilation in the QEUH, with particular focus on its role in the infection with *Cryptococcus neoformans* of two patients who died whilst being treated at the QEUH. Following these concerns, ventilation arrangements at the QEUH were subject to intensive and thorough scrutiny, in order to explore any and all hypotheses which could be considered to show a link between the patients' infections and the ventilation within wards 4C and 6A where these patients had been treated within the QEUH.

28. The Cryptococcus IMT Expert Sub-Advisory Group was established and chaired by Dr John Hood, consultant microbiologist. Following extensive work, the group concluded that it was highly unlikely that the 2 affected patients had been infected with *Cryptococcus neoformans* as a result of the hospital built environment: from around 3000 air samples which had been taken from within or near QEUH at that time, no *Cryptococcus neoformans* spores had been identified. Genotyping of the infection of the 2 patients in question showed that their cases were different genotypes. In particular, the hypothesis that *Cryptococcus* spores had been able to enter the air handling unit during a filter change in the plant room, and thereafter travel down duct work to wards 4C and 6A, was deemed to be unfeasible, not least because no filter changes had occurred during their inpatient stay.[7] The Inquiry is invited to have regard to the report of Dr John Hood which gives a detailed description of the sampling regime undertaken in the investigation of these *Cryptococcus neoformans* cases.

29. On this basis, it is the position of NHSGGC that any concerns about the ventilation arrangements in the QEUH lack validity in relation to the question of increased risk to patient safety when the matter is properly considered.

Water

[7] Report from the Cryptococcus Incident Management Team Expert Advisory Sub-Group by Dr John Hood

30. The Inquiry has not yet heard evidence in relation to water systems. The design of water systems is intended to limit the growth of micro-organisms and there are specific requirements on water quality in relation to the water system. It is important to note that the design and commissioning was the responsibility of the contractor, Multiplex. The design was to comply with Employer's Requirements, subject to agreed derogations, which were prepared by the Lead Consultant, Currie and Brown, following input from clinical specialists.

Standards/ guidance

31. The requirements on water testing principally relates to standards of "wholesomeness" at the time of commissioning and monitoring in certain areas of the hospital for particular organisms.[8] Requirements and guidance on water testing are limited to only a few organisms (namely coliforms, *E. Coli*, *Legionella* and *Pseudomonas*) and total viable counts (TVCs). In relation to TVCs, the guidance does not provide any acceptable limits.

32. There is no guidance on whether the presence of other micro-organisms in hospital water systems is acceptable. This means that, where hospital water is tested for a different micro-organism, such as *Cupriavidus pauculus,* and it is found, there is no guidance that would permit the result to be interpreted to show whether or not the water was "unsafe". Water systems, whether in hospitals, office buildings or domestic premises, are not routinely tested to ascertain the range of micro-organisms that are present.[9] As water is not intended to be sterile, it would follow that it should be expected that water-borne micro-organisms would be present and this has been shown to be the case in other hospitals.[10] Therefore, no conclusion as to whether or not the water system was "unsafe" can be drawn merely from the presence of such micro-organisms.

[8] The Public Water Supplies (Scotland) Regulations 2014, SHTM 04-01, and Pseudomonas aeruginosa routine water sampling in augmented care areas for NHS Scotland (Health Protection Scotland, 2018 draft).
[9] ARHAI Report NHSScotland's Approach to Microbiological Water Testing dated July 2022.
[10] *Cupriavidus* spp. and other waterborne organisms in healthcare water systems across the UK; T Inkster et al; Journal of Hospital Infection 123 (2022) 80-86. It is also present in drinking water in Glasgow – Khan et al. 2016, Chemosphere 152:132, and Khan et al. 2016, Environmental Processes 3:541.

Testing of system

33. However, the established guidance on testing can be used as a marker of water quality in considering the question of the safety of the water system. Testing carried out from 2015 onwards does not demonstrate that there is any noteworthy issue with water quality across the QEUH campus. NHSGGC has exceeded the requirements as set out in the available guidance on water testing in relation to the QEUH since its opening in 2015. The Inquiry is invited to refer to the reports of Dr Dominique Chaput in this regard. [11]

34. Further, in relation to water treatment and testing, since 2018, the routine water sampling plan at the QEUH has been expanded and has coincided with the installation of the chlorine dioxide dosing system to reduce bacteria in water. From 2018, all routine water testing now currently carried out across the QEUH exceeds requirements and recommendations set out in national guidance (where such guidance exists) in terms of testing frequency, locations tested (general as well as high risk), types of tests performed and thresholds to trigger action. Much of the routine testing carried out at these sites is bespoke to QEUH itself as there continues to be no formal requirements and recommendations applicable to these tests. As above, reference should be made to the reports from Dr Dominique Chaput. [12]

Case Note Review

35. The PPP places reliance on the Case Note Review and its findings in relation to the likelihood of infections being linked to the built hospital environment. It is not accepted by NHSGGC that anything contained in the Case Note Review can properly justify any adverse inference about the safety of the water, drainage or ventilation systems at the

[11] Summary of legislation and guidance for microbiological water tests carried out at QEUH and RHC, dated 9 Dec 2022; Microbiological testing of Water and Environmental Samples from QEUH 2015- 2020: Overview of sample numbers and test results; and Water Testing Summary for whole of QEUH campus 2015- 2020, both dated 3 March 2023; all by Dr Dominque Chaput

[12] Summary of legislation and guidance for microbiological water tests carried out at QEUH and RHC, dated 9 Dec 2022; Microbiological testing of Water and Environmental Samples from QEUH 2015- 2020: Overview of sample numbers and test results; and Water Testing Summary for whole of QEUH campus 2015- 2020, both dated 3 March 2023; all by Dr Dominque Chaput

QEUH. NHSGGC has challenged the methodology of the Case Note Review and the basis upon which it reached its findings in a number of respects.[13]

36. In particular, the Case Note Review did not take account of Whole Genome Sequencing (WGS) which is of critical importance to the issue of causation of infection being considered by the Inquiry. WGS is a relatively novel tool, but is already recognised as the gold standard for the identification of micro-organisms, and the analysis of possible outbreaks of infection.

37. In relation to the infections at the QEUH in the period with which the Inquiry is concerned, comprehensive investigation, applying WGS and using a considerably more extensive data set than was available at the time of the Case Note Review, was undertaken in which the most common Gram-negative infections identified were examined, and it was found that no direct transmission link could be shown between the built environment and those infections except for a single case of *Cupriavidus pauculus* in 2016. The Inquiry is invited to have regard to the reports of Professor Alistair Leanord and Professor Tom Evans in this regard.

Comparative data

38. There is no evidence to indicate an increased rate of infections from micro-organisms related to the built environment at the QEUH over the period with which the Inquiry is concerned. As above, a background rate of infection within a hospital can always be expected. In considering whether an increased rate can be demonstrated, comparative data can be a useful indicator. Despite the sheer size of the campus, complexity of patient group and other demographic factors, comparisons show that infection rates at the QEUH are, in fact, in line with the rest of Scotland and, indeed, were during the period with which the Inquiry is concerned.

[13] NHSGGC's response to the CNR report was submitted to the Inquiry under RFI 1 6

39. The Advisory Committee on Antimicrobial Resistance and Healthcare Associated Infection (ARHAI) (formerly Health Protection Scotland) collects infection data from all Health Boards in Scotland and has published quarterly reports on the rates of infection for certain organisms since at least Q4 2014.[14] These reports define an expected "normal variation" and demonstrate that from Q4 2014 to Q2 2022 NHSGGC has been within the expected "normal variation" throughout, except for one occasion.[15] The published data relates to NHSGGC as a whole, and is not specific to the QEUH. NHSGGC asked ARHAI for specific information on the performance of QEUH and the response from ARHAI confirmed that the rates were still within these parameters.[16]

40. ARHAI also carry out a periodic national point prevalence survey of HAIs across all of NHS Scotland. The last survey was conducted during September to November 2016. The overall prevalence of HAIs during this survey in the QEUH was 4% and in the RHC 3.6%, both lower than the national rate of 4.5%.[17]

41. The ARHAI Review of NHSGGC paediatric haemato-oncology data [18] carried out a comparison with other health boards and found that the rate of positive blood cultures for the RHC during the period of June 2015 to September 2019 was lower for Gram-positive organisms and that there was no difference for Gram-negative organisms or environmental organisms. The rate was higher for environmental plus enteric organisms, but this is due to a higher rate of enteric (i.e. gut) organisms and not environmental organisms. This may reflect the higher complexity of patients at the RHC who are more prone to developing infections from their gut flora.

42. Accordingly, none of these comparison exercises indicates that, during the period with which the Inquiry is concerned, there was an increased rate of overall infection, or of

[14] Available online at https://www.hps.scot.nhs.uk/publications/. The incidence rates provided are for meticillin sensitive *Staphylococcus aureus* and meticillin resistant *Staphylococcus aureus*, *Staphylococcus aureus* bacteraemias, *Clostridium difficile* infection, and *Escherichia coli* bacteraemias. It should be noted that the methodology used to generate the funnel plots "are based on the same calculations as the control limits in SPC charts" - https://learn.nes.nhs.scot/2470.
[15] *Clostridioides difficile* infection rate in Q2 2019.
[16] Appendix 1 - Summary of Patient Safety Indicators by Sandra Devine.
[17] Appendix 1 - Summary of Patient Safety Indicators by Sandra Devine.
[18] Report dated October 2019. See also Appendix 1 - Summary of Patient Safety Indicators by Sandra Devine.

infection from micro-organisms related to the built environment, at the QEUH. Indeed, the ARHAI comparisons with other health boards found that infection rates at the QEUH are as good, if not better, than those of other NHS boards. NHSGGC collated the information from the varying sources of these indicators, which is attached to this Paper at Appendix 1. Considering the patient population served by both hospitals, a very reasonable inference may be drawn from these findings that the built environment at the QEUH was not in an unsafe state during the period with which the Inquiry is concerned and, in fact, continues to be safe.

43. It should be noted that the Case Note Review did not provide any comparative data on infection rates. The only comparison noted in the Case Note Review was in relation to adverse events and the Paediatric Trigger Tool. In this regard, the Case Note Review concluded that "NHSGGC is comparable with reports from other tertiary care hospitals."[19]

44. On the basis of all of these factors, NHSGGC does not accept that concerns about the safety of the water, drainage or ventilation systems at QEUH have any validity, on any proper reading of the available evidence.

Whether any of the suggested links between infection and the built environment are accepted

45. At para 3.4.1, the PPP narrates that, in January 2016, a patient tested positive for *Cupriavidus pauculus*. Further, it is narrated at para 6.31.1 that, in July 2019, a patient tested positive for infection with *Mycobacterium chelonae*. NHSGGC accepts that these 2 instances of infection were linked to the hospital environment, following typing which demonstrated a positive link between water and patient samples. With the exception of these 2 cases, NHSGGC does not accept that there is any direct transmission link between any case of infection and the water, drainage or ventilation systems at the QEUH.

[19] Sections 3.4.5 and 8.6.2 of the Case Note Review Overview Report

46. As above, NHSGGC does not accept that any concerns about the safety of the QEUH water, drainage or ventilation systems have validity in relation to any bearing upon infection risk to patients. That being so, NHSGGC does not accept that any infections within the QEUH, with the exception of the 2 cases referred to, have any direct transmission link to the built hospital environment. In particular, NHSGGC does not accept that any infections have occurred within the QEUH as a result of any aspect of the water, drainage or ventilation systems posing, or ever having posed, an increased risk of infection to the QEUH patients.

Other matters

47. As referred to in paragraph 13 above, NHSGGC will provide a chronology of events which will include corrections to the timeline in the PPP and to highlight where relevant information has already been provided. NHSGGC has set out examples of inaccuracies in the PPP below.

48. It is stated throughout the PPP that "concerns were raised by ICDs and MBs." It would appear that these references in the narrative have been adopted from the timeline produced by the Oversight Board, the content of which is not accepted by NHSGGC as reliable or accurate, as stated above. It should be noted that, within the remit of the Infection Control Doctor, is to lead investigations into infections where they occur, including directing sampling, and to chair Incident Management Teams (IMTs). Throughout the operation of the various IMTs set up to investigate infection and their potential link with the hospital environment, all sampling for environmental organisms was reactive sampling, directed as a result of the relevant IMT and at the direction of the Chair of the IMT.

49. It is stated in the PPP at para 6.80.1 that the HSE served an improvement notice upon NHSGGC in December 2019. For context, it should be noted that the notice relates to the standard of ventilation on ward 4C. Further, NHSGGC has appealed against the notice and appeal proceedings are currently sisted before the Employment Tribunal.

50. At paras 7.6.1, 7.8.1[20] and 7.13.1, the PPP makes reference to a total of 3 journal articles, from August 2020, February 2021 and May 2021. Whilst the PPP does not state what conclusion is to be drawn from any of these articles, it should be noted that all 3 were authored by the "certain MBs/ICDs", one of whom is on the editorial board of the journal, who had raised concerns about the safety of building systems at the QEUH. Their relevance as independent or objective pieces of analysis requires to be viewed in that context.

51. The PPP states that the taps which were installed on all clinical wash hand basins across the QEUH and RHC were fitted with flow regulators, contrary to advice within the HPS SBAR. That statement does not reflect the true position in relation to these fittings. It should be noted that, upon the issue coming to light, NHSGGC requested a meeting with HPS to review the position. A meeting took place on 5 June 2014 and was attended by representatives of NHSGGC, HPS, HFS, Horne Engineering Ltd and Public Health England including Dr Jimmy Walker (a member of the Inquiry's expert panel). It was unanimously agreed by the representatives at the meeting, including HPS, that, as the taps installed within the new build development had complied with guidance current at the time of its specification and briefing, and as the hospital was in the process of being commissioned, it should be regarded as being in the "retrospective" category, not "new build". It was agreed that there was no need for NHSGGC to apply additional flow control facilities or remove flow straighteners within QEUH and RHC and that any residual perceived or potential risks would form part of the routine management process.

52. The PPP reflects a fundamental misunderstanding as to the formal investigation requirements in relation to *Klebsiella* infections. Paras 2.12, 3.7.1 and 5.4.1 make reference to cases of *Klebsiella* not having been investigated within the QEUH. At the time of the infections referred to, there was no requirement for infections of these types to be investigated, nor is there any such requirement to date. At para 6.16.1, reference is made to *Klebsiella spp* having been added to the list of alert organisms in 2018. This statement is incorrect: sensitive *Klebsiella* is not, and has not been, an alert organism within the National Infection Prevention and Control Manual and there is no requirement for

[20] Also referenced at para 3.4.2 of PPP

infections with such micro-organisms to be reviewed. *Klebsiella* is a normal commensal of the human intestinal tract. It is the second most prevalent Gram negative infection in the UK. *Klebsiella* was only isolated in 3 samples from 10,311 samples (of which 6,183 looked specifically for Gram negative organisms) taken from the water in the QEUH between 2015 and 2020.

53. In relation to para 1.5 of the PPP, the DMA Canyon report was received in 2015 by the former estates manager within NHSGGC. The findings of the report gave rise to the creation of an action plan by the estates manager, the delivery of which was delegated to two members of the estates team. At no time was the existence of the DMA Canyon Report concealed by the estates manager or NHSGGC, and, on its existence and contents being made known for the first time to more senior management in July 2018, it was immediately shared with a number of organisations including HPS, and the Lead ICD in her capacity as Chair of the IMT.

54. With reference to para 2.7.1, it should be noted that, over the period of those infections, 200 environmental swabs were taken within NICU, all of which were negative. In any event, the NICU is part of the retained estate and not part of the newly built hospitals. The NICU's water system is separate to that of the QEUH.

55. With reference to para 4.16.1, it should be noted that *Stenotrophomonas maltophilia* was only added to the National Infection Prevention and Control Manual alert organism list in June 2017. Further, the figure of 12 reported cases of *Stenotrophomonas maltophilia* in 2017 is not correct: the Case Note Review Table 4.2 shows 6 reported cases in 2017.

56. With reference to para 4.30.4, it should be noted that the results of environmental sampling were negative and, in particular, did not isolate *Acinetobacter baumanii.*

57. With reference to para 5.35.1, it should be noted that the spinal injuries unit is part of the retained estate and has a different water system from the new building.

58. The heading at para 6.1 of "CN identified in air samples in Ward 6A (January 2019)" is incorrect as it is known that no *Cryptococcus neoformans* was found in any of the extensive air sampling carried out in Ward 6A.

Conclusion

59. It is the position of NHSGGC that, when the available evidence is set apart from theories and hypotheses as to the safety of the QEUH, notably those put forward by the "certain MBs/ICDs", the suggestion that the built environment of the QEUH is unsafe in the sense that it poses, or has at any time ever posed, an increased risk of infection to its patients, does not withstand scrutiny. The Board took advice from the Lead Infection Control Doctor, and external organisations, predominantly HPS, at all times in responding to all hypotheses which were put forward in relation to infection prevention and control and has conducted more extensive surveillance than any other NHS Board as a result. Each hypothesis advanced by the microbiologists, ICDs, and the IMT as to the risks to patient safety posed by the QEUH built environment has, on thorough and proper investigation, been demonstrated to be unsubstantiated.

60. As will be clear, there is no evidence to demonstrate any increased rate of infections within the QEUH from micro-organisms related to the built environment. When looked at properly and scientifically, the evidence demonstrates that the QEUH is a safe environment for its patients.

Peter Gray KC,

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and

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21 April 2023

RESPONSE TO PROVISIONAL POSITION PAPER 5

ON BEHALF OF CORE PARTICIPANTS

MOLLY AND JOHN CUDDIHY

AND

LISA MACKAY

INTRODUCTION

The Scottish Hospitals Inquiry (SHI) have issued Provisional Position Paper 5 (PPP5). It is stated that the paper sets out the Inquiry's understanding of events and issues that have been said to indicate concerns about the following three matters:
first, concerns about the incidence of infection within the QUEH campus;
second, concerns about the safety of key aspects of the built environment (notably the water, drainage and ventilation systems) and,
third, concerns that there might be links between infections and the concerns about the built environment.

Core Participants have been invited to comment on the draft paper, focussing on:
(1) Whether the narrative is accepted as an accurate history of what occurred
(and if not where the narrative is challenged and why);
(2) Whether CPs are aware of other matters that ought to be part of the narrative;
(3) An indication of whether CPs were aware of the events at the time that they occurred, and if not when they became aware;
(4) Whether any of the concerns about safety of the building systems are accepted by CPs as valid (and if not why not); and
(5) An indication by CPs of which if any of the suggested links between infection and built environment are accepted (and the basis upon which such links are accepted, or refuted as the case may be).

CORE PARTICIPANT RESPONSE

The draft paper is said to be based "upon publicly available and other prominent reporting and it also takes into account certain of the Inquiry's investigations across its various workstreams." It is noted that "the List of Topics" for the hearing commencing 12th June 2023, includes appendices of Bundles amounting to 592 listed documents.

The aforementioned core participants are eager to assist the Inquiry in any way that they can, however, this has been severely limited by the fact that the 592 documents in the Bundles and witness statements have yet to be provided to core participants. Other core participants, who were the authors or involved in/have access to the documentation contained within the bundles will be less impeded in fulfilling the Inquiry's request. In addition, the PPP5 consistently makes reference to documents/events and individuals, however, there is no identification of the document or other source of the information. This problem will not be fully resolved by the evidential bundles being disclosed to core participants as the time and resources available to our team will impede this work being done. Identification of the source materials and individuals being referred to would assist core participants in engaging in reviewing/accepting/challenging the contents of PPP5. Two examples of where this would be beneficial are noted below, however, the request for the identification of individuals referred to and source documentation is required throughout the PPP5 if core participants are to be able to assist the Inquiry.

Examples:
1.2 Ventilation system concerns:
1.2.1 At various points in 2014/15, the lead ICD raised concerns about
ventilation particularly in relation to the Adult BMT unit, the Paediatric BMT
Unit and the Infectious Disease Unit. – identification of the source documents would be beneficial in allowing CPs to read about expressed concerns and thereafter trace whether those concerns resulted from non-compliance with national standards and also trace the response to said concerns and evaluate the effectiveness of that response.

1.4 Water system concern: water testing results
1.4.1.1 In December 2014 and January 2015, the contractor arranged for
testing of the water system. The results showed high Total Viable Counts

(TVCs) and E. coli in the water. Water outlets with high TVCs were disinfected with silver hydrogen peroxide. Some water samples still failed the test after dosing had occurred. There is no evidence that further testing was undertaken. The Lead ICD reviewed the initial water results and water testing methodology, but there is no evidence that the final water testing results were presented to or reviewed by the lead ICD. Who is the ICD being referred to? What is the level of risk at this point? Which governance group signed off on the risk at this point. As water was not in risk register at this time, where was this recorded?

1.4.1.2 - What were the results of this regime and identify locations of water testing?

1.4.1.3 – the locations of the testing that was conducted is significant as children were in wards from June of this year. Did the testing involve children's wards and if so, what were the results/risks?

Despite the limitations outlined, the aforementioned core participants have made their best effort to respond to the Inquiry's request.

RESPONSE TO THE 5 QUESTIONS POSED BY THE INQUIRY

(1) **Whether the narrative is accepted as an accurate history of what occurred (and if not where the narrative is challenged and why);**

Confirmation of the accuracy of the narrative is compromised by the lack of access to the "Bundles". Based on the information that was already known by the core participants, the following observations are made. The narrative in pages 1 to 7 and pages 98 to 117 are accepted as reflections of factual events, conducted in furtherance of the 'crisis' surrounding the hospital. Pages 8 to 98 are challenged in so far as not all 'evidence' has yet been heard or relevant "bundle" documents accessed. It has been observed that the narrative includes verbatim references from documents, which themselves were challenged at the time as being factually incorrect.

(2) **Whether CPs are aware of other matters that ought to be part of the narrative.**

Page 11 Para 1.5.5 – this states that it is not known who within GGC saw or knew of the DMA Canyon report conclusions.

However, from source document DMA Canyon Water Treatment May 2015, it clearly states the names of those from ESTATES who were aware of the findings. The report specifically states- vernal, email and report- to those named individuals within Estates. Further, this information can be found by accessing the email chain initiated by Dr Christine Peters on 25 June 2015 between her and Ian Powrie, one of the named recipients of the DMA report. This email was copied to two other NHS staff. The email was headed "legionella New Southern". The circle of knowledge was then increased to include Tom Walsh, Mary Anne Kane, and Heather Griffen. The circle was widened further on 30 June 2015 to include William Hunter, Pamela Joannidis, Teresa Inkster and Craig Williams. In total 11 members of NHS GGC representing ICD, Senior management and Estates saw or knew of the Report contents.

1.5.6 – Reference is made to it not being known when the Report surfaced but a of it being made public in November 2019. The DMA report was allegedly made known to Senior management in March 2018- some time prior to it being made public. It is important to establish when the report "surfaced" as it relates to disclosures made in Scottish Parliament by Shona Robinson MSP- then Health Secretary- when on 20 March 2018 she responded to questions raised. Either Shona Robinson misled parliament or she herself was misled by NHSGGC. It is imperative to access the report detailing the investigation conducted by GGC and reflect on this report in the context of those emails initiated by Dr Peters.

Page 11 **2 April 2015 Staff from DMA Water Treatment highlighted a recurring issue identified previously and reported to Estates.**

Bypass pipework removed by Mercury/Brookfield on instruction by NHS Estates. Of significant importance was the on-site finding on 02 April 2015 (detailed on page 73 on DMA 2015 report)- "there was bypass pipework set up to run……..This was noted during DMA initial site walk and reported to Estates. DMA again noted this during site survey… on 02 April 2015 and again reported this to estates. DMA were advised in mid-April that this had been removed by Mercury/Brookfield. ***"This line could potentially have introduced debris to the distribution system which would otherwise have been removed by the filtration units and could be a contributory factor to any specification microbiological results".***

Significance

It is vital therefore to obtain all email communication between DMA Water treatment (those specified by name and from company) to those named in NHS GGC Estates, by name and by company; those emails between Mercury and Brookfield and DMA Water Treatment and NHS GGC Estates- in name and organisation. It is also important to request and access the report by Mercury/Brookfield of the work carried out to remove the bypass confirming the date at which this work occurred and any reporting on the findings.

Page 12 **ICD RESIGNATION**

2.3.1 Reference is made to one ICD resigning. It is understood that 4 ICDs resigned due to unaddressed concerns. The timeline should identify how many ICDs resigned their posts between 2015 and 2020; why they resigned and are their resignations letters should be made public if they are available. Further there should be investigations into what action was taken by GGC in response to all concerns raised by the ICDs.

Page 13 **Initial Infection outbreaks in the retained estate.**

2.6.1 Identification of the location of these outbreaks and cross reference to the testing allegedly carried out by Estate in 2015, and results of said testing, will allow an evaluation of the testing conducted and response or lack thereof to the results of testing.

Page 15 **Pseudomonas aeruginosa (PsA) in PICU (December 2015)**

2.10.2 The water safety checklist and action plan referred to should be disclosed to core participants. Neither documents appears to be included in the "Bundles". Sight of both documents is necessary to comment on the timeline and evaluate the action taken in response to infection outbreaks.

GNB infections in Ward 2A (? 2015)

2.12There is refence to infection not being investigated at the time. Why not? Did this comply with local and National guidelines? What should have occurred? Was there ever accountability for these failures to investigate these infections and interrogation of any link to subsequent infections?

Page 16 **Cupriavidus (CU) (unknown location) and the connection to an aseptic sink (January 2016)**

3.4.2 This paragraph refers to an article published in February 2021. Neither the author, title or journal is specified nor the location of the two sinks. Access to this information/article is required by core participants.

Page 17 3.4.3 The location of said patient can and should be verified from patient records.

3.5.1 The 2nd February 2016, the Board Water Safety Group (BWSG) meeting minutes, referred to are not included with the "Bundles". The Minutes should be disclosed to ascertain what discussion took place before and around departure from the initial advice to not install said taps and why HPS advice was regular sanitise and return of flow straighteners etc., rather than replacement of taps. It is also not clear whether the advice of HPS was complied with. It would be useful to identify any record of compliance and if there was no compliance, when that decision was made, by whom and the minutes or emails relating to same.

3.7.1 It is stated that there was no investigations nor IMT into the 9 episodes of Klebsiella infection, affecting 8 patients in Ward 2A. Is the decision not to investigate documented anywhere? Does such a decision comply with local

and national governance of investigation into infection outbreaks?

Page 18 3.8.4 What air sampling programme should have been in place? Under what regulatory documents or principles are sampling programmes mandated or recommended? Why was HEPA filtration not in place from the outset? What is the relationship between the absence of HEPA filtration and the design and commissioning of the hospital?

3.8.5 This paragraph is one of many where there is reference to patients being prescribed prophylaxis. There is no documentation that indicates that patients were appropriately consented nor that the duty of candour was fulfilled. This information can be made available without patient identities being disclosed.

Page 19 3.11.2 Has the use of untrained personnel to sample water been fully investigated? Is the lack of training linked to the situation described here where results of testing have not been recorded? The link between poor testing regime, failure to record and investigate positive results and track spread of infection are critical to identifying the systemic failures that led to cross contamination. See also 4.6 and 4.7 at p.21.

Page 21 **2016- Disclosure of Mycobacterium Chelonae infection identified in a paediatric haemato-oncology patient.**

Note: - This information is contained within CNR 2020 and also within Confidential report from Professor Mike Stevens and addressed to Molly Cuddihy as part of the Case Note Review.

Significance

This contradicts GGC narrative that only four cases of Mycobacterium Chelonae (MC) had been reported in the preceding 10 years, and all in adult population. This demonstrates MC present from 2016 but never disclosed.

Page 23 4.15 Why was Mycobacterium Chelonae not included in the NIPCN?

4.15.2 What, if any, was the guidance for Mycobacterium Chelonae. If there was none, why was that?

Page 24 4.16.25 This is one of a number of instances where there is reference to GGC denying a link between infection and the built hospital environment. How can such a position be adopted when it is now known that untrained personnel were employed to sample water, that there was a failure to record location and result of testing, there is an absence of records which point to a failure to investigate positive results and track spread of infection which together resulted in wide systemic failures that led to cross contamination. See also 4.6 and 4.7 at p.21.

Page 25 4.17.2 Reference is made to ventilation to be "checked and cleaned". What does this mean? Was it carried out? By whom? Was training required? Is there a record of where was checked, what was found and what required to be cleaned?

Page 26 4.20 What qualifies as acceptable results?

Page 26 4.22 **Second DMA Canyon Report.**

This DMA Canyon Legionella Risk Assessment Report followed the on-site survey that was conducted from 08 September 2017 until 24th October 2017. Those conducting the assessment were Allan McRobbie, David Watson, Craig Guyer, Fraser Murray. No NHS staff assisted during the site surveys. The report was provided, in writing to Tommy Romeo however throughout the process he was updated by DMA verbally. Have the records of these updates and action that followed same been obtained? There are significant High Risks identified most notably those risks first identified in 2015, that had not been addressed. This report disclosures significant issues with maintenance and cleaning regimes. To enable the Public Inquiry to fulfil its remit and

produce an accurate timeline, it is submitted that all mainteance and cleaning records require to be accessed and analysed.

Page 27 4.24 **Whistleblowing**

How many whistleblowing procedures have taken place relative to the environment/Infection; what was the basis for the whistleblowing; what was done about it; where are those individuals now and how were they treated.

4.24.2 It is noted that this was not the first time the concerns had been raised. Concerns about emerging environmental risks arising from the hospitals design and construction had been raised since before the formal handover of the new building. A timeline indicating concerns/whistleblowing and response in respect of the environment/infection would facilitate a clearer understanding of date of knowledge, action or inaction and impact.

5.5.1 Who was the clinician who investigated the Step 2 whistle blowing by two consultant MBs in 2018 and on what basis did they conclude and advise the two consultants that there was no increase in the level of infection rates? Was this conclusion based on the flawed testing, recording and investigation regime that appears to have been in place at that time? If so, the conclusions reached must be caveated.

Page 33 5.2.1 **DMA Canyon Report 2017 finalised (31 Jan 2018)**

This section of the timeline requires clarification. The DMA Canyon Report 2017 finalised (31 Jan 2018) is in two separate and distinct parts. The first part relates to the legionella Risk Assessment, commencing on 08 September 2017. As detailed throughout the report, the ultimate recipient NHS GGC and in particular Tommy Romeo, were continually, verbally updated on the progress and specifically that high risk concerns existed, including those identified in the 2015 Report. Therefore F & E had knowledge of concerns from 08 September 2017 but no plan to action the recommendations was formulated until after 31st

January 2018 and the date or timetable that flowed therefrom is not included. Further the 2018 Report makes reference to the 2015 Report, but GGC have advised that the 2015 report did not 'surface' until March 2018. The timeline produced here is not reflective of the facts. In addition, the second part of the DMA report, dated 30 January 2018, by Alanna McRobbie and Craig Guyer was provided to a separate readership cohort. The report has different page numbering from part 1 and is detailed from 1-12. This suggests two separate and distinct reports. Clarity required from DMA Canyon with regards to completion and submission of each report. This should be compared with the 'investigation" conducted by GGC into the 'lost report' to ensure coherence and factual accuracy.

In conclusion when it comes to the DMA Canyon reports, the PI timeline needs to provide clarity with a sequence of events relative to these critical documents. Indeed, they require to overlay the GGC email communications relative to both reports as this will demonstrate the circle of knowledge within GGC. It is also suggested that the internal investigation conducted by GGC into the 'lost' reports be obtained and scrutinised. In addition, the DMA reports lay clear a series of requests for information, especially around maintenance records. They are never produced. Therefore, it is suggested that those records be requested / accessed.

Page 35 5.7 **Water Testing**

The timeline states that water sampling was carried out in wards 2A, 2B and 4 and that testing was carried out in the main water supply and outlets. It is not clear who caried out this testing/sampling. The DMA Reports record that tanks could not be accessed and the tank lids were padlocked with no access to keys. Details of the testing/sampling including the training of the

personnel involved, the location of water sources and the recording of findings and action following thereon should be included within the timeline.

5.8.3 The IMT minute of 6 March 2018 records that concerns raised by members of the IMT over 2 years previously had been communicated higher up and to HPS and that they were dissatisfied with the response by both senior management and outside GCC. The response by both should be detailed within the timeline and the documentation disclosed to core participants.

Page 36 5.9.2 A timeline of help/support seeking by GGC should be compiled or clearly incorporated within this document. This timeline will reveal what was known, who knew and what action was taken. Key is the F&E work plan which if included within the timeline will reveal what was the plan, who had access to the plan, who would discharge the duties and who would scrutinise/review same. In addition, this help/support timeline should reveal whether the communications detailing the concerns raised by clinicians and MBs were communicated to the Scottish Government (SG) and HPS and, if not, why not?

Page 36 5.11 **13th March 2018**

Written note given to parents informing that we could shower in Marion House. 16th March parents advised that water to be shut off again - this time completely.

Page 42 **Easter 2018 - Ward 2A closed to visitors**.

Ward 2A is shut to visitors as a result of unexplained infections. No visitors are allowed for around two weeks. (Obtained from PI following disclosures by Witness S Crighton at PI)

Page 42 **17 April 2018- Room 6 Ward 2A closed due to flooding.**

On this date Molly Cuddihy was occupying this room when the bathroom flooded. Her parents reported this incident and had to move rooms. This is evidence of environmental failings involving, water and drainage.

Significance

Whilst no water samples were taken during 2018, either at the time of this incident or following contraction of bacterial infection Mycobacterium Chelonae (MC), sampling of the ward and indeed this room took place on 14 April 2019 resulting in confirmation of Mycobacterium Chelonae in the shower room- the room that had been flooded. This room was occupied by Molly between 15-17 April 2018.Samples were also taken in rooms 16 and 17. Again proving positive for Mycobacterium Chelonae. Molly occupied room 17 from 1 May 2018 - 5 May 2018. MC was also identified within room 16. All of these rooms are within Ward 2A. For the sake of completeness Mycobacterium Chelonae was also positively identified from samples taken in RHC on 26 June 2019 although the location was not specified.

Page 50 **June 2018 Letter to Dr Catherine Calderwood (then Chief Medical Officer for Scotland) from Professor John Cuddihy**

Note: - letter outlined concerns about outbreaks of infection on Ward 2A in March and May 2018 and also concerns re infection, leadership, risk mitigation, management, communication. (Letter previously submitted to PI)

Significance. This was the first engagement with Senior Management of NHS Scotland and catalyst for strategic

engagement with NHSGGC. This engagement set off a chain of events whereby GGC Medical Director communicated re the water and drainage issues.

Page 50 **23 July 2018- Letter from Dr Jennifer Armstrong- Medical Director GGC to Professor John Cuddihy**

Note: - letter received following communication between Dr Catherine Calderwood and Dr Jennifer Armstrong.

Significance.
It is significant as the Medical Director, Dr Jennifer Armstrong would have been aware of the 'surfacing' of the DMA Canyon reports- allegedly 16 March 2018. Indeed, from information disclosed in this PI timeline GGC had only commissioned the workplan relative to DMA recommendations in January 2019 (para 6.12) with workplan being completed in April 2019 (Para 6.23). The work required to discharge the recommendations and make safe the high risks, was completing, allegedly in December 2019 (Para 6.63). Therefore, the high risks identified with regards to contaminated water were known but not communicated or indeed proactively acted upon at this time. The water was not safe, but they claimed it was. Dr Armstrong gave assurances in the letter that wards 2A and 2B were safe.

This disclosure is even more concerning when the then Cab Sec for Health Shona Robison MSP, spoke to Scottish Parliament on 20 March 2018. She either misled parliament or she was misled by those who briefed her.

Page 50 **July 2018- A large glass panel falls from height close to the entrance of the QEUH.**

Note: - this event occurred as Molly returned to GGC from

radiotherapy treatment at Beatson. The event prompted a letter to be sent to Jane Grant CEO GGC from Prof John Cuddihy. (Letter and response have been made available to PI).

Significance.
The Chief Executive of GGC, Jane Grant, responds to a letter from Professor Cuddihy about this incident reassuring him that "windows" are safe and that what fell was a decorative glass panel designed to shatter on impact. Ms. Grant agrees to let Professor Cuddihy know the outcome of the investigation into the glass panels. No further information was ever provided.

The event provides a horrendous example of the crumbling environment and more over the type of unempathetic response from CEO of GGC. This event led to the closure of the main entrance and considerable remedial building work, requiring patients to take further action to enter the hospital by a 'safe' route.

Page 56

September 2018 – Meeting among Professor Cuddihy, Mr Redfern and Dr Inkster

Note: - meeting held to discuss concerns about a lack of proactive communication and risks posed by the discharge lounge entrance, cladding and glass panels.

Significance
Almost on a daily basis environmental issues were being uncovered with considerable risk to patients. The communication and engagement were limited, even at the time of crisis with no consideration for crisis management or strategic planning. No-one had a grip of the situation. This was requiring of proactivity on the part of patients/families and an extremely emotional and challenging time.

Page 58. **September 2018- Meeting between Prof Cuddihy/Dr Inkster & Mr Redfern**

Note: - Meeting convened to discuss concerns over bacterial infection and general safety of ward 2A/2B.

Significance.
Disclosure that patients were being decanted from ward 2A to ward 6A following an options appraisal. Assurances given as to the safety of Ward 6A. Professor Cuddihy is informed that Ward 6A has a different water supply from Wards 2A and 2B (subsequently found out to be untrue) but that precautions would be taken to prepare Ward 6A to receive Schiehallion patients in any event. He is told that an SBAR has been prepared.

Page 66. **22 June 2018- Intertek reporting**

Note: - GGC commissioned an investigation into contamination of flow straighteners

Significance
The report also considered debris from water tanks; drain traps; sponges; water samples concluding contamination present. In addition, prior to hospital opening advice from amalgam of sources advised against installation of this type of tap and flow straightener due to evidence from Belfast hospital Inquiry that they posed infection risk. Despite the advice, they installed the taps and straighteners.

Page 76. **External Advice on Refurbishment of Ward 2A- (*suspect this is the Independent***
Report into Ventilation by AECOM)

Note: - In May 2019 (date unspecified GGC commissioned independent examination of ward 2A. It should be noted that this follows the report by Innovated Design Solutions (Oct 2018) that disclosed high risks associated with the ventilation system with recommendation for further examination of the site. It is the case that AECOM have carried out work although this report has never been made public with GGC stating that disclosure would be prejudicial to their civil case against Multiplex.

Significance

The significance of this 'advice', namely '……*the as-fitted system was in line with what might be seen in a modern general ward but that "it* ***falls short of what would be considered appropriate*** *for a modern facility designed to meet the needs of immune-compromised patients."* cannot be overstated as it confirms the ventilation system within Ward 2A falls short which supports the report by Innovated Design Solutions, that it exposed patients to increased risk.

What is equally of significance is the decision thereafter- June 2019- by the then Cab Sec for Health, Jeanne Freeman to cancel the opening the hospital in Edinburgh until she was satisfied as to the safety of patients. She sighted ventilation issues as the reason for cancelling the opening. It is important to recognize that the design features of the Edinburgh Hospital were the same as those within the Royal Hospital for children in Glasgow- including ventilation. For further information, please see update below- (page 82)

Page 80. **Duty of Candour Incident June 2019**

Note: - Incident related to non-disclosure of information by Jamie Redfern relative to Mycobacterium Chelonae and commented upon within the actual meeting by senior clinician Dr Inkster- "tell him the truth Jamie"!

Significance

This incident led to a chain of parallel events; Dr Inkster went to BMA to report that she had been encouraged to tell untruths to the family of a patient, which ultimately led to initiation of WB procedures; John Cuddihy (JC) initiated a series of communications with John Brown Chari of GGC Board and Jane Grant CEO of GGC. The full detail is recorded on page 81 to 85 inclusive of JC's written statement to PI. This also led JC to co-authoring a paper on Duty of Candour, published by BMJ, Ethics.

Page 82

Decision by Jeanne Freeman MSP to cancel opening of new Royal Hospital for Sick Children in Edinburgh

Note: - a few days from the opening of the Royal Hospital for Sick Children in Edinburgh, Cabinet Secretary for Health, Jeanne Freeman announced the cancellation of the scheduled opening

She stated at the time *"I have asked that Health Facilities Scotland undertake an investigation to determine how the hospital got to this advanced stage before it was discovered that the* ***ventilation system fell below the standards expected****."* (Note the similarity in language to the advice given to GGC as detailed above.)

Note: - It would be prudent to access this report (accepting that we have not been given access to the next hearing, as it relates to Edinburgh- I believe we have justifiable reasons to request this report.) Indeed, what information did Jeanne Freeman access that enabled her to make such an important decision? Was it the GGC advice relative to the refurbishment of Schiehallion?

She went on *"There is no greater responsibility of the NHS than to ensure the* ***clinical safety of their patients, not least when those patients are children.*** *In order to be absolutely sure that patient safety is*

delivered, I have no choice but to postpone NHS Lothian's planned move to the Royal Hospital for Children and Young People."

Note: - *Re* having no choice but to postpone the opening due to **patient safety** and recognising the decision now within GGC **to replace the air-conditioning system within the Schiehallion unit,** what about the decision making around those immunocompromised children, decanted from ward 2A into ward 6A a general purpose ward? Remember the comment from the unnamed independent advisor above- **it falls short of what would be considered appropriate for a modern facility designed to meet the needs of immune-compromised patients.** Therefore, what was the decision making, risk management plan, communication plan and overall safety plan for those children decanted into this unsafe ward?

Indeed, Jeanne Freeman continued with her statement at the time saying- *"It is vital that patient safety remains paramount, which is why I have asked the health board to stop all moves until **assurances** have been given that the new site is entirely compliant with the relevant health technical standards."*

Note- what assurances were given within GGC to SG that ward 6A was safe, particularly with regards to air-conditioning system and patient safety.

She added: *"While this issue has been caught by the final safety checks, I am disappointed and deeply concerned that this was not identified earlier.*

Her comments at the time were supported by Tim Davison, CEO NHS Lothian "*Following **advice from an independent advisor**, I fully accept the Health Secretary's decision to reschedule the move to the Royal Hospital for Children and Young People. "The air environment is extremely important and can help **prevent the occurrence and spread of infection in patients who are already vulnerable.***

"We are extremely disappointed that we cannot move as planned and I am very sorry for the disappointment this will cause to patients, their families and staff affected by this delay. However, patient safety must always come first."

Note: recognising this approach of openness and transparency, when one compares this to the comments by GGC with regards to the ventilation system in ward 2A and their communication and engagement with patients and families - they stated that they were taking advantage of the ward closure to upgrade the ventilation system. Again, an obvious failure in Duty of Candour.

Page 101

Disclosure Scotland Programme

Note: - On 24 June 2020 BBC Scotland aired 'secrets' of Scotland's Super Hospital.

Significance

The programme led to a number of discussions around lack of communication and subsequent impact and implications for patients, families and staff relative to disclosures by Independent Review team, GGC and others. Written questions were presented to GGC, SG and the Oversight Board with regards to the programme and communication and engagement as detailed in the Subgroup. This clear lack of communication and engagement was after the establishment of the Communication and Engagement Subgroup and despite agreements as to how to move forward in a spirit of trust. GGC were inconsistent with regards to their conduct which caused further trauma to patients and their families.

Page 103.

Briefing Paper for Oversight Board: -

Access to Information enabling informed decisions as to how NHSGGC identified, responded to, communicated and managed water contamination/associated environmental contamination and

outbreak of Mycobacterium Chelonae (MC) between 2015 and 2019.

Note: - This report was compiled by JC following concerns raised at the OB meeting on 04 September 2020. At this meeting the OB timeline was discussed. JC challenged the accuracy of the timeline and was therefore invited by the Chair Fiona McQueen to demonstrate his concern with the production of a report. It was agreed that the report would focus on the bacterial infection Mycobacterium Chelonae as JC considered that this was not reflected in the timeline or given the attention it required.

Significance
This report highlighted- time and dated- the lack of focus/attention and critical action required to pursue the HAI Mycobacterium Chelonae. The report was submitted to the OB and thereafter to the Case Note Review Team. This report has been provided to PI.

Page 111

01 June 2021 Letter from Professor Mike Stevens to Jane Grant, CEO, GGC

Note: - this letter was sent following communication between Dr Christine Peters and Professor Mike Stevens.

Significance.
The letter outlines concern by Prof Stevens and his panel at the fact that microbiologists were unable to access data enabling them to fulfil their role. This, as previously alluded to, reflects concerns in 2015 from microbiologist unable to access data- water samples and typing results/DMA Canyon reporting. This perhaps shows evidence of a lack of progress with an organisation not prepared to implement recommendations made by the CNR. This is also significant as the former Cab Sec Humza Yusef stated, when returning GGC from stage 4 in the escalation table, that they had implemented all recommendations made. This is clearly a

significant example where what they say and what they do, are entirely different things. I have detailed the wording of this letter for ease of reference.

"I am writing at the request of Dr Christine Peters who contacted me last week seeking permission for access to the data generated within NHS GGC and collated for our use as part of the Case Note Review. She explained that she had been told by the Microbiology Management Team that, as the databases concerned were created for the Case Note Review, she would need to approach me for permission from the Expert Panel to access these data.

Neither I nor my colleagues on the Panel understand the necessity for this request and believe these databases should be freely available to staff in NHS GGC who require access to the data for work, including research, relating to patient care and infection control. I understand that Dr Peters is the Clinical Lead for Microbiology at QEUH, and it seems entirely appropriate that she should be able to access all the data generated within NHS GGC that would inform those areas regardless of any prior use for the Case Note Review – including the data on microbiological typing.

You will be aware that, in our report, we were critical of information systems in microbiology and infection control at NHS GGC and that we made recommendations about the further development of such systems to better support the IPC process. The position taken by the microbiology management team suggests a reluctance to engage openly in this endeavor.

This is a concern to the Panel, and I hope you will ensure that Dr Peters and other staff who wish to access these data have permission to do so."

Page 113. **July 2021** **Non-Disclosure of Paediatric Treatment Tool (PTT)**

Note: - On 2 July 2021 a meeting Chaired by Marion Bain involving members of Oversight Sub, NHSGGC, Case Note Review Team and Paediatric Treatment Tool Authors (PTT)- was held resulting in exposure of non- disclosure of PTT

Significance.

The author of the report Dr Patricia O'Callaghan had been commissioned to investigate the events as detailed in the case note review to establish findings and cascade learning. This report was not made public for reasons unknown to the author or Chair of the CNR, Prof Mike Stevens. Considerable concern was expressed by all involved with repeated requests to have the material published as per the Cab Sec instruction (Jeanne Freeman). This was a further example of a lack of openness, transparency and effective governance.

Page 113. **February 2022** **Publication of Duty of Candor and communication during and infection control incident in a pediatric ward of a Scottish hospital: how can we do better?**

Note: -This article, authored by Prof John Cuddihy & Dr T Inkester was published in the British Medical Journal of Medical Ethics.

Significance

This article was authored due to my concern that Duty of Candor was not understand or indeed being implemented in accordance with the faith of the legislation. The report was based on personal experience and considered by the British Medical Journal of Medical Ethics to be worthy of publication.

(3) **An indication of whether CPs were aware of the events at the time that they occurred, and if not when they became aware;**

Lisa MacKay's daughter, whilst she was a patient in Room 6, Ward 2A (referred to at para 3.8 and 3.9) in the timeline contracted Aspergillus. As noted at 3.8.2 and 3.8.3

3.8.2 Neither patient was in a BMT room. A Problem Assessment Group (PAG) meeting took place on 4 August, followed by an Incident Management Team (IMT) meeting on 5 August 2016. The infections were reported externally to HPS on 5 August 2016.
3.8.3 The potentially contributing factors to the infection were identified as: (i) tears in the ventilation ductwork; (ii) the construction/demolition work on site, which was creating dust, and (iii) condensation forming on the chilled beams, this issue having been raised with the main contractor as abnormal. There was also a suggestion of a water leak.

Lisa MacKay was not informed that an IMT had taken place nor that contributing factors to her daughter's infection had been identified and has yet to have sight of the minutes from that meeting. Mrs Mackay only became aware that the infection her daughter contracted in 2016 was part of a larger cohort of infections when she received a letter from John Brown and Jane Grant dated 11th October 2019 which stated:

"You may be aware of our ongoing investigations into a number of uncommon cases of infection in the Elizabeth paediatric University haemato-oncology Hospital. ward which is currently located in Ward 6A of the Queen Elizabeth University Hospital".

Following receipt of the letter, Mrs MacKay searched on the internet and discovered that a newspaper article had been published in the Herald on 26th May 2019, which referred to a child oncology patient contracting Aspergillus in 2016. Mrs MacKay identified this patient as her daughter, although she had not been named in the article. Mrs MacKay subsequently contacted Jennifer Haynes, as invited to do in the letter of 11th October 2019, and thereafter Mr and Mrs MacKay met by telephone with Dr Leonard (Microbiologist), Dr Heaney (Consultant), Pamela Joannidis (Senior Infection Control Nurse) and Jamie Redfern. Jamie Redfern told Mr and Mrs MacKay that whilst they could not confirm that the newspaper article related to their daughter, he said there was a strong suggestion that it was and that the information had been leaked. The Case Note Review report for their daughter stated that only one patient had developed aspergillus in 2016 and agreed that the Herald article must relate to their daughter. No one has confirmed who had leaked the information to the journalist. Mrs MacKay was and is deeply concerned that despite the knowledge of the source of infection in 2016, she was not advised

of this, nor of the subsequent number of infections in patients who also occupied room 6 in Ward 2A. The infection caused her daughter life threatening difficulties at the time and has left a legacy of health problems that impact on her day-to-day life.

The responses above indicate when John and Molly Cuddihy became aware of events.

(4) Whether any of the concerns about safety of the building systems are accepted by CPs as valid (and if not why not);

The concerns expressed about the safety of the building system are accepted by the CPs as valid, however, as noted above there are additional concerns that require to be fully investigated and access provided to CPs of all critical documents.

(5) An indication by CPs of which if any of the suggested links between infection and built environment are accepted (and the basis upon which such links are accepted, or refuted as the case may be).

The CPs accept the link between infection and the built environment. The responsibility of those involved in the construction of the hospitals and the failures in governance by GGC are yet to be fully explored. The timeline provides evidence of multiple failings. There are a number of instances where there is reference to GGC denying a link between infection and the built hospital environment. How can such a position be adopted when it is now known that untrained personnel were employed to sample water, that there was a failure to record location and result of testing, there is an absence of records which point to a failure to investigate positive results and track spread of infection which together resulted in wide systemic failures that led to cross contamination. See also 4.6 and 4.7 at p.21.

OUR REF LOSH/MUL109.84
YOUR REF

FAO Jim Logie
Solicitor to the Scottish Hospitals Inquiry
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By e-mail: legal@hospitalsinquiry.scot

19 April 2023

Dear Mr Logie

MULTIPLEX CONSTRUCTION EUROPE LIMITED ("MULTIPLEX")
PROVISIONAL POSITION PAPER 5 ("PPP5")

We write in connection with PPP5 which was issued by the Inquiry and in respect of which comments were invited by 21 April 2023.

The Inquiry will appreciate that the scope of PPP5 is very broad where it covers a significant range of complex and technical issues, which can be contrasted with provisional position papers one to four which sought to address discrete topics concerning RHSC. Multiplex has reviewed PPP5 and considers that whilst it is unable to assist the Inquiry in relation to (i) the incidence of infection or (ii) links between infections and the built environment, it would (subject to the comments below) be able to assist the Inquiry in relation to the issues identified concerning the built environment.

Multiplex has in the time available therefore been investigating the matters identified in relation to the built environment, but regrettably finds that it is not in a position to offer concluded comments on PPP5 to the Inquiry by 21 April. The reasons for this are the sheer scale of issues covering diverse elements of the built environment all requiring technical input in a limited timeframe in circumstances where Multiplex has not had sight of all of the material the Inquiry has considered in preparing PPP5.

In this context, Multiplex wishes to emphasise that it is mindful of the Inquiry's expectation of co-operation and collaboration from Core Participants. To meet that expectation in relation to PPP5 given its scope, Multiplex would respectfully propose that a similar approach to that which has been adopted thus far in relation to the

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Inquiry's requests for documents concerning QEUH hospital be adopted, where the Inquiry and Multiplex liaise with each other to agree the matters to be investigated along with a timetable for the provision of information. Such an approach would in Multiplex's opinion allow for the provision of narrowly focussed submissions on issues which are of interest to the Inquiry. In that regard, it would greatly assist Multiplex if the Inquiry were able to provide it with the information the Inquiry has referred to in PPP5.

Multiplex would welcome the opportunity to discuss the above with the Inquiry further. In the meantime, Multiplex must necessarily reserve its position on the entirety on PPP5 and all matters contained therein.

Yours faithfully

[redacted]

Signed on behalf of Brodies LLP

SCOTTISH HOSPITALS INQUIRY:
RESPONSE BY NHS NATIONAL SERVICES SCOTLAND TO PROVISIONAL POSITION PAPER 5

Please find below the response of NHS National Services Scotland ("NSS") to Provisional Position Paper 5. The numbers on the left refer to the relevant Provisional Position Paper 5 paragraph numbers.

Glossary	NSS comments that "Not all Kleb are CPE and not all CPE are Kleb." Suggest for clarity removing bracket to make it clear the reference is to Carbapenemase producing Klebsiella
1.3.5	HPS was not aware of this during the commissioning process. It became aware years later through its involvement with the Technical Water Group.
1.4.1.3	HFS did not receive any water tests results until April 2018.
1.4.1.4	The report (August 2018) referred to was a first draft without any quality assurance checks being carried out for this report and was an internal attempt to provide an overall situation assessment. Following this draft a decision was made to separate the reports into HPS and HFS reports which resulted in the final reports. The HPS report was published in December 2018. The HFS report was shared with NHS GG&C in March 2019.
1.56	The said papers were provided to HFS in late April 2018.

2.3.1 NSS understands that the ICD with responsibility for the adult BMT Unit, Dr Inkster, did not resign in 2015, but rather continued in-post until July 2019. It is NSS' understanding that Dr Inkster tendered her resignation in 2015 as a result of ventilation issues but this resignation was not accepted and Dr Inkster remained lead ICD until her resignation in 2019

2.8.1 NSS submitted an SBAR in relation to the flood in the neuro theatre. It was entitled "SBAR QEUH neuro theatres (1, 2, 3, 6 & 7) Visit 6th May 2016". Besides satisfactory air monitoring results, the SBAR made other recommendations.

2.9.1 NSS was not aware of these requirements. They differ from the December 2015 HPS SBAR

3.5.1 HPS advice was not as stated. It remained as per the relevant SBAR. None of the options recommended by HPS involved retaining the flow straighteners.

4.8.1 The report on the facilities was provided by HFS and HPS jointly.

4.11 The 3 cases in March 2017 were formally reported as new incidents rather than continuations of an existing incident

4.12.2 NSS is unable to comment on the accuracy of this paragraph, but if the documents upon which it is based are provided then it will be happy to do so.

4.12.3 NSS is unable to comment on the accuracy of this paragraph, but if the documents upon which it is based are provided then it will be happy to do so.

4.15.2 HPS was informed in July 2017 that some triggers had been set up

4.16.2 HPS received the SBAR as part of the 2019 IMT process.

4.17.1 Guidance was published in the National Infection Prevention and Control Manual The focus of this guidance was on person-to-person transmission, not environmental transmission.

4.20 NSS is unable to comment on the accuracy of this paragraph, but if the documents upon which it is based are provided then it will be happy to do so.

4.21.2 The relevant ward is 1D, not 10D.

4.26.3 NSS is unable to comment on the accuracy of this paragraph, but if the documents upon which it is based are provided then it will be happy to do so.

4.34.3 NSS is unable to identify the source of this figure. If the source is provided then NSS will be happy to comment.

5.2.1 HFS did not receive the DMA Canyon reports of 2015 or 2017 until April 2018. These were provided to HFS (Ian Storrar and Eddie McLaughlan) as part of the investigation into the water system as requested by NHS GG&C. They were provided along with other technical data.

5.38.1 The report (August 2018) referred to in this paragraph was a first draft without any quality assurance checks being carried out for this report and was an internal attempt to provide an overall situation assessment. Following this draft a decision was made to separate the reports into HPS and HFS reports which resulted in the final reports. The HPS report was published in December 2018. The HFS report was shared with NHS GG&C in March 2019.

5.38.4 As above. The report (August 2018) referred to in this paragraph was a first draft without any quality assurance checks being carried out for this report and was an internal attempt to provide an overall situation assessment. Following this draft a decision was made to separate the reports into HPS and HFS reports which resulted in the final reports. The HPS report was published in December 2018. The HFS report was shared with NHS GG&C in March 2019.

5.38.6 The Technical Review was commissioned by NHS GG&C. The focus was on water.

5.8.2 The QEUH RHC 2018 May Initial Report on Page 8 details that a number of workable hypothesis were being explored at this time.

5.8.3 HPS are unaware of the discussions that took place at the IMT on 6 March 2018. They had not been involved by the Board at that stage and have not seen the relevant minutes. If the documents which set out what risks within ward 2A were communicated to HPS in 2015/16 can be provided, NSS will provide comment.

5.9.1 The DMA Canyon reports were provided to HFS (Ian Storrar and Eddie McLaughlan) as part of the investigation into the water system as requested by NHS GG&C in April 2018. They were provided along with other technical data. The Authorising Engineer (Water) Legioenella Control, was commissioned to carry out a review of the water systems as per SHTM 00 by NHS GG&C. That report was also provided by NHS GG&C to HFS as part of the technical review and is cited in the "Technical Review Water Management Issues NHS GG&C QEUH and RCH" paper issued. The Authorising Engineering report, dated May 2017, highlighted similar issue to that found by DMA Canyon.

5.10.1 The National Support Framework was invoked on 20 March 2018, not 26 March 2018. The National Support Framework does not have stages.

5.13.3 Expert advice was also sought from Tom Wafer from Intertek Water Solutions Group. He is Technical and Compliance Director within the company and also an authorising engineer (water) and an expert on Chlorine Dioxide systems.

5.16.3 This was ultimately an IMT decision, not a TWG decision.

5.23.1 NSS is unable to identify the source of this figure. If the source is provided then NSS will be happy to comment.

5.24.1 NSS is unable to comment on the accuracy of this paragraph, but if the documents upon which it is based are provided then it will be happy to do so.

5.25.2 The spelling of the last word in the paragraph should be Elizabethkingia.

5.31.4 HFS has found a reference to debris in water tanks. It has been unable to find a reference to debris in drains.

5.38.1 The report (August 2018) referred to in this paragraph was a first draft without any quality assurance checks being carried out for this report and was an internal attempt to provide an overall situation assessment. Following this draft a decision was made to separate the reports into HPS and HFS reports which resulted in the final reports. The HPS report was published in December 2018. The HFS report was shared with NHS GG&C in March 2019.

5.38.4 As above. The report (August 2018) referred to in this paragraph was a first draft without any quality assurance checks being carried out for this report and was an internal attempt to provide an overall situation assessment. Following this draft a decision was made to separate the reports into HPS and HFS reports which resulted in the final

reports. The HPS report was published in December 2018. The HFS report was shared with NHS GG&C in March 2019.

5.38.5 When an organism is isolated from a patient sample it may be sent to the reference lab for typing to identify some more detail on the organism. If two patients have samples sent for typing and they come back an exact match it is frequently used to support the hypotheses of person to person spread: meaning there is a likelihood that both patients have been exposed to the one source (it may even be one patient was the source for the second patient).

In environmental sampling:if an organism is detected and sent for typing an exact match is more challenging: environmental organisms grow and may speciate particularly those which grow in optimal conditions such as biofilm. When samples are sent for typing only a few isolates from the sampling plate are selected:and the likelihood of selecting the exact organism type that was responsible for a clinical case is not impossible however often unlikely.

Therefore a positive typing result helps support the hypothesis of environmental transmission significantly: no match does not exclude the likelihood of environmental transmission. The organism is still present and capable of transmsission. Therefore we advise typing to include the source of the environment but not to exclude

5.38.6 HPS support was requested with a water contamination incident. There was no remit or request from NHS GG&C for HFS or HPS to provide a detailed analysis/critique of the QEUH or RCH ventilation systems. The literature review did not consider ventilation systems in detail.

5.43.2 HPS has been unable to find any records regarding such a review. It would not generally carry out a technical review of ventilation. If the source of this statement is provided, HPS can consider this further.

5.48.1 The IMT did not “assess the environment.” Its role was to review evidence reported to it.

5.48.3 NSS has been unable to find records of such consideration. If further details are provided then it will be happy to comment.

5.49 NSS is unable to comment on this because it has been unable to identify the report. If the report is provided then NSS will be happy to comment.

5.50.1 NSS has been unable to find records of such an outline scope of work. If further details are provided then it will be happy to comment.

5.53.3 The IMT was closed on 30 November 2018.

5.54.2 NSS is unable to comment on the accuracy of this paragraph, but if the documents upon which it is based are provided then it will be happy to do so.

5.55.1 For the avoidance of doubt, QEUH and RCH had the same water system, not separate systems. They have a common point which splits to serve both. The Chlorine dioxide dosing of the RCH and QEUH started at different times.

5.58.2 HPS did not produce its summary report as a result of any communication with NHS GG&C.

The report (August 2018) referred to in this paragraph was a first draft without any quality assurance checks being carried out for this report and was an internal attempt to provide an overall situation assessment. Following this draft a decision was made to separate the reports into HPS and HFS reports which resulted in the final reports. The HPS report was published in December 2018. HFS report was shared with NHS GG&C in March 2019.

5.58.4 The HPS report covers all cases reported to HPS by GG&C. HPS are not aware of CU in June 2018 and still have no record of this case. The last case of CU reported to HPS/ARHAI is Jan 2018.

5.58.7 The report only covered the period to the end of September 2018.

5.59.3 Narratives regarding these cases have been submitted

5.60.1 NSS is unable to comment on the accuracy of this paragraph, but if the report upon which it is based are provided then it will be happy to do so.

5.61 NSS is unable to comment on the accuracy of this paragraph, but if the reports upon which it is based are provided then it will be happy to do so.

6.1 NSS was not invited to participate in the relevant IMT.

6.2.2 A narrative regarding these cases has been submitted

6.5.1 This incident was reported to HPS, but HPS support was declined.

6.5.2 HPS and HFS belonged to this Sub-Group,. but the members of the Sub-Group were unable to agree on a final report. ARHAI/HFS did not support the findings by GGC. Instead, NHS GGC issued a report as a GGC report and not as a Sub-Group report.

6.10.1 NSS is unclear what group this was. If further details are provided then it will be happy to comment.

6.18.1 This was an HFS report, although HPS contributed to it. The report was produced to NHS GGC in March 2019. The August 2018 report was a draft and the conclusions not finalised and was not for publication.

6.18.2 As above, the report (August 2018) referred to was a first draft without any quality assurance checks being carried out for this report and was an internal attempt to provide an overall situation assessment. Following this draft a decision was made to separate the reports into HPS and HFS reports which resulted in the final reports. The HPS report was published in December 2018. The HFS report was shared with NHS GG&C in March 2019.

6.18.3 The second sentence is inaccurate- the report did not reach any conclusions on a link between organisms within the water system and bloodstream infections.

6.22.1 A number of non-bacteraemia organisms were reported to HPS, including those mentioned in paragraph 6.15.1, Pseudomonas, and Stenotrophomonas.

6.39.1 In addition, condensation was reported on units NHS GG&C advised HFS that dew point control was being installed to prevent this

6.40.1 HPS was instructed to produce this report by the IMT Although there was a time gap between the walk rounds and the finalisation of the report, any initial concerns would have been raised with staff at the time of the walk rounds.
In addition to verbal feedback a summary email with summary of findings was issued to IPC on 27/8/18 with a request to share with SNCs wards 2a/b.

6.40.4 HPS reported on pathogens in the water, not infections.

6.40.5 This report was requested by NHS GG&C. The requested focus of the report was to be the water system rather than the ventilation system.

6.42.1 NHS GG&C later provided an update reporting that the sample from the arjo bathroom had mistakenly been taken from another site

6.44.1 NSS is unable to comment on this because it has been unable to identify the report. If the report is provided then NSS will be happy to comment.

6.48.2 HPS has been unable to find any records regarding such discussions. If more information can be provided then it will be happy to comment.

6.49.1 For the avoidance of doubt, the water system serving the chilled beams is separate from the general water system. NSS is unable to comment further without more information as to the samples.

6.56.3 Different and unique organisms can indicate an environmental source.

6.71.1 The final version of this report was submitted to NHS GG&C on 14 November 2019

6.74.1 The IMT was responsible for this decision, so HPS did not need to give its formal agreement (although it did agree).

7.15.1 The members of the Sub-Group were unable to agree on a final report. Instead, NHS GG&C issued a report

NHS National Services Scotland
21 April 2023

SCOTTISH HOSPITALS INQUIRY:
SUPPLEMENTARY RESPONSE BY NHS NATIONAL SERVICES SCOTLAND TO PROVISIONAL POSITION PAPER 5

This paper supplements the response submitted by National Services Scotland ("NSS") on 21 April 2023. As anticipated in the letter sent to the Public Inquiry Team on that date, further information has now been identified that NSS hopes may assist the Inquiry. NSS sincerely apologises for being unable to send this further information by 21 April 2023.

Matters on page 2 of provisional position paper 5

Whether CPs are aware of other matters that ought to be part of the narrative

NSS respectfully suggests that the matters previously submitted in response to paras. 1.4.1.4 and 6.5.2 might usefully be included within the narrative.

An indication of whether CPs were aware of events at the time that they occurred, and if not when they became aware

NSS has prepared a spreadsheet chronology containing incidents and outbreaks reported to ARHAI Scotland between 2015 and 2021 which may have an environmental link, and for each of them confirmation of whether support was requested by NHS GG&C.

In general terms for additional background information on healthcare infection incidents, outbreaks, data exceedance and reporting requirements please note the following.

Within previously submitted 3246 ARHAI Narrative - V1.0, there is Appendix 1 National Support Framework, Appendix 2 Mandatory NIPCM Healthcare Infection Incident Assessment Tool and Appendix 3 Mandatory Healthcare Infection Incident and Reporting Template which detail relevant reporting requirements, along with Chapter 3 Healthcare Infection Incidents Outbreaks and Data Exceedance in National Infection

Prevention and Control Manual: Chapter 3 - Healthcare Infection Incidents, Outbreaks and Data Exceedance (scot.nhs.uk).

Also within previously submitted 3246 ARHAI Narrative - V1.0, contextual information is provided about the role of ARHAI Scotland in providing reactive support across NHS Scotland; supporting incidents and outbreaks and by being an expert resource and providing evidence to inform practice. Paras 19 to 32 explain in detail how this works in practice. Paras 33 to 36 contain NHS GG&C specific details of reported incidents and outbreaks between 2015 and 2019.

And, as per para. 56, ARHAI Scotland does not hold a formal oversight management responsibility over NHS GG&C and it cannot compel it, or any other NHS Board, to take action.

An indication by CPs of which if any of the suggested links between infection and built environment are accepted (and the basis upon which such links are accepted, or refuted as the case may be.)

In addition to previously submitted narratives and the spreadsheet chronology being supplied with this response to PPP 5, please see previously submitted reports:

- 677 QEUH_RHC 2018 May Initial Report
- 678 QEUH_RHC 2018 Dec Water Contamination Summary of Incident and Findings
- 679b Review of NHSGG&C paediatric haemato-oncology data final draft v1.4_unredacted
- 2019-6-5 ggc 2a 2b report v9 final report embedded within email 4606 2019-06-23 2019-06-23 (10.07 LI - SD) Final Water Report Ward 2A 2B - Att

Further responses to particular paragraphs

1.3.4 NSS was unaware that the advice in its SBAR had been contravened until March 2018.

3.4.4 The initial report published in May 2018 referred to infections linked to the environment, which NHS GGC did not refute. Therefore it is our

understanding NHS GGC had accepted in 2018 that there was an environmental link to infections.

4.17.2 Dishwashers were identified as the potential source in the Healthcare Infection, Incident, and Outbreak Reporting Template. There was no mention of chilled beams, or any other building risk factors. There is no record of chilled beams being raised with NSS as the potential source at this time.

4.23.2 This second case was not reported to or investigated by NSS Health Protection Scotland ("HPS") in 2017. HPS became aware of it in 2018, when there was a third case reported. HPS understand that the Infection Control Doctor was off at the relevant time in 2017, and the incident was not investigated and no water sampling took place.

4.34.4 NSS notes an incident with a possible environmental link which does not seem to be included within the exceptions. This incident, dated 7 March 2017, involved *Aspergillus fumigatus*. It is included within the spreadsheet of incidents provided by NSS.

5.4.1 These infections were not reported to NSS.

5.6.2 NSS was unaware of the two cases of *Stenotrophomonas maltophilia* that had been isolated by 1 March 2018. Accordingly, the cases were not considered in the report which NSS published in May 2018: 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.

5.7.1 NSS are unable to confirm sampling results of pharmacy in January 2018.

5.35.1 HPS records show that there were four cases reported in this period, not three.

5.36.1 NHS GGC reported an Enterobacter indcident in May 2018. No further Enterbacter incidents were reported in July or August 2018.

5.41.4 NSS has been unable to find any records of such previous advice.

6.71.3 The HPS Report titled 'Review of NHSGG&C paediatric haematooncology data,' dated October 2019, should not be read in isolation as it forms part of the overall Incident Management Team ("IMT") investigations. The report was produced to support the IMT and was in response to the following recommendation, which is taken from the HPS SBAR titled 'To support NHSGG&C IMT: Mycobacterium chelonae cases and the incidence of gram-negative bacteraemia (paediatric haemato-oncology)', "Further analysis of positive blood cultures associated with environmental bacteria in other specialities within RAH/QEUH and within other children's hospitals may be beneficial to understanding the epidemiology and risk of environmental exposure in high risk individuals." These reports need to be read in conjunction with the IMT minutes and papers as they are management information and not official statistics and therefore form part of the management information sought/provided to the IMT. The main points from the October 2019 report are:

- There were many data sources being shared with the IMT to explore the hypothesis of increased incidence of GNB.
- The data sources were all providing slightly different numbers – this report set out to explain why there were differences and how significant they were.
- This report aimed to understand the data in context of all reported BSI by reporting using several definitions.
- The report highlights the significant limitations – again this report is for management purposes to provide a rapid review and not official statistics and was never intended for publication.

- Over the course of the IMT a decision had been made to exclude new patients requiring treatment from being admitted to the facility in QEUH, instead all new patients were accessing services in other NHS Boards while historic patients were still receiving treatment at QEUH.
- The report concluded that the risk was no greater to new patients than existing patients: “The data presented in this report do not provide evidence of single point of exposure and there is a need to continually monitor the risk in this patient population. There is no immunity to the organisms under investigation, therefore all patients within this cohort are at risk from developing gram negative bacterium due to their co morbidities and treatment plan. The control measure of restricting clinical services for newly diagnosed patients over existing patients should now be reconsidered.”

6.71.6 NSS is unaware of any “hospital microbiology and pharmacy” group having been involved in the report. It was not a purpose of the report to validate any other study.

NHS National Services Scotland
3 May 2023

Introduction

Background

This document contains incidents and outbreaks reported to ARHAI Scotland by NHS GG&C between 2015 and 2021, each of which has a possible environmental link. A possible environmental link is determined by the pathogen's reservoir i.e. is there evidence this pathogen may be transmitted through systems in a building, such as water and ventilation systems. This means that the organism identified in the patient may also have been present in the environment. Relevant generic information about reporting requirements is as follows:

National Infection Prevention and Control Manual: Appendix 13 - Mandatory - NHSScotland Alert organism/Condition list

National Infection Prevention and Control Manual: Appendix 14 - Mandatory - NIPCM Healthcare Infection Incident Assessment Tool (HIIAT) (scot.nhs.uk)

National Infection Prevention and Control Manual: Appendix 15 - Mandatory - Healthcare Infection Incident and Outbreak Reporting Template (HIIORT) (scot.nhs.uk)

For any entries in the chronology plus previously submitted narratives, ARHAI are happy to provide any further information as requested

Example entry

Date	Description	ARHAI Scotland Support?
Date	Hospital Name ARHAI Scotland reference number. Red, amber or green status based on scoring method in the Appendix 14 of the National Infection Prevention & Control Manual Appendix 14 Location of ward within the hospital Infection category Name of organism	Was support from ARHAI Scotland either not requested or provided.

Glossary

Term	Meaning
BSI	Bloodstream Infection
HIIAT	Healthcare Infection Incident Assessment Tool
HIIORT	Healthcare Infection, Incident and Outbreak Reporting Template
INS	Institute neurological sciences
INS	Institute neurological sciences
ITU	Intensive Care Unit
QEUH	Queen Elizabeth University Hospital
NICU	Neonatal Intensive Care Unit
NNU	Neonatal Unit
PICU	Paediatric Intensive Care Unit
RHC	Royal Hospital for Children
SCBU	Special care baby unit
SSI	Surgical SIte Infection
UKN	Unknown
VRE	Vancomycin Resistant Enterococci

Chronology re QUEH/RHC PPP 5

Date	Description	ARHAI Scotland Support?
29/10/2015	RHC HIIAT Log: O15.43 HIIAT: Red Ward: Neonatal - NICU Infection Category: BSI and Colonisation Organism: Serratia	Provided.
24/05/2016	QEUH HIIAT Log: O16.31 HIIAT: Green Ward: Literature review request Infection Category: Respiratory Organism: Mycobacterium abscessus	Provided.
16/06/2016	RHC HIIAT Log: G16.29 HIIAT: Green Ward: Aseptic Unit Infection Category: BSI Organism: Cupriavidus pauculus	Not requested.
21/06/2016	QEUH HIIAT Log: G16.34 HIIAT: Green Ward: ITU Infection Category: Respiratory Organism: Aspergillosis	Not requested.
29/07/2016	RHC HIIAT Log: O16.35 HIIAT: Green Ward: Maternity - NNU Infection Category: Mixed/various Organism: Serratia	Not requested.
05/08/2016	RHC HIIAT Log: O16.37 HIIAT: Amber Ward: Schiehallion Infection Category: Respiratory Organism: Aspergillus	Not requested.
24/08/2016	QEUH HIIAT Log: G16.52 HIIAT: Green Ward: N/A Infection Category: Decon incident - endoscope Organism: None	Not requested.
23/09/2016	RHC HIIAT Log: G16.59 HIIAT: Green Ward: PICU Infection Category: BSI Organism: Pseudomonas aeruginosa	Not requested.
07/10/2016	QEUH HIIAT Log: G16.70 HIIAT: Green Ward: ITU Infection Category: BSI Organism: Pseudomonas	Not requested.

28/07/2016	RHC HIIAT Log: O16.48 HIIAT: Amber Ward: NICU Infection Category: Other Organism: Serratia	Not requested.
06/02/2017	RHC HIIAT Log: G17.010 HIIAT: Green Ward: PICU Infection Category: Colonisation Organism: Serratia	Not requested.
03/03/2017	RHC HIIAT Log: G17.023 HIIAT: Green Ward: NICU Infection Category: Other Organism: Serratia	Not requested.
03/03/2017	RHC HIIAT Log: G17.025 HIIAT: Green Ward: Haemotology oncology Infection Category: BSI Organism: Elizabethkingia miricola	Not requested.
03/03/2017	RHC HIIAT Log: G17.026 HIIAT: Green Ward: Haemotology oncology Infection Category: BSI Organism: mixed	Not requested.
07/03/2017	RHC HIIAT Log: O17.09 HIIAT: Red Ward: Haemato oncology Infection Category: Mixed/various Organism: Aspergillus fumigatus	Not requested.
10/03/2017	RHC HIIAT Log: O17.10 HIIAT: Amber Ward: Critical Care Infection: BSI Organism: Serratia	Not requested.
16/06/2017	QEUH HIIAT Log: G17.050 HIIAT: Green Ward: Neurosurgery Infection Category: SSI Organism: Enterobacter	Not requested.
26/07/2017	RHC HIIAT Log: O17.17 HIIAT: Red Ward: Oncology Infection Category: BSI Organism: Stenotrophomonus	Not requested.
02/08/2017	RHC HIIAT Log: G17.068 HIIAT: Green Ward: PICU Infection Category: BSI Organism: Pseudomonas	Not requested.
03/08/2017	QEUH. HIIAT Log: G17.O69. HIIAT: Green. Infection Category: Colonisation. Organism: Stenotrophomonus	Not requested.

14/09/2017	QEUH HIIAT Log: G17.080 HIIAT: Green Ward: NICU Infection Category: Respiratory Organism: E.coli (gent resistant)	Not requested.
22/09/2017	QEUH HIIAT Log: G17.084 HIIAT: Green Ward: INS South Glasgow Infection Category: Respiratory Organism: Acinetobacter baumannii complex	Not requested.
11/10/2017	RHC HIIAT Log: G17.089 HIIAT: Green Ward: NICU Infection Category: Colonisation Organism: Acinetobacter baumanii	Not requested.
13/10/2017	RHC HIIAT Log: G17.088 HIIAT: Green Ward: Ward 3a General Medicine Infection Category: Colonisation Organism: Acinetobacter baumanii	Not requested.
27/10/2017	RHC HIIAT Log: G17.093 HIIAT: Green Ward: NICU Infection Category: Respiratory Organism: Probable invasive fungal infection	Not requested.
27/10/2017	QEUH HIIAT Log: G17.094 HIIAT: Green Ward: Ward 10D Infection Category: Pseudomonas Aeruginosa Organism: SSI	Not requested.
03/11/2017	QEUH HIIAT Log: O17.22 HIIAT: Red Ward: Orthopaedic (QEUH and GGH) Infection Category: Other Organism: CRO Pseudomonas	Not requested.
15/11/2017	RHC HIIAT Log: G17.104 HIIAT: Green Ward: PICU Infection Category: SSI Organism: Acinetobacter baumanii	Not requested.
01/12/2017	RHC HIIAT Log: G17.115 HIIAT: Green Ward: PICU Infection Category: SSI Organism: Acinetobacter baumanii	Not requested.
05/01/2018	QEUH HIIAT Log: G18.04 HIIAT: Green Ward: Neurosurgical Infection Category: SSI Organism: CPE Klebsiella	Not requested.

23/01/2018	QEUH HIIAT Log: O18.10 HIIAT: Amber Ward: Paediatric ITU Infection Category: Mixed/Various Organism: Pseudomonas aeruginosa	HPS support through water incident, not for this individual incident.
05/02/2018	RHC HIIAT Log: G18.35 HIIAT: Green Ward: Aseptic pharmacy Infection Category: BSI Organism: Cupriavadis	HPS support through water incident, not for this individual incident.
13/02/2018	QEUH HIIAT Log: G18.038 HIIAT: Green Ward: Spinal injuries rehab - Philipshill Infection Category: Colonisation Organism: Klebsiella	Not requsted.
01/03/2018	RHC HIIAT Log: O18.11 HIIAT: Red Ward: Paediatric Haemato-oncology Infection Category: BSI Organism: Pseudomonas aeruginosa Cupriavidus pauculus Stenotrophomonas Enterobacter cloacae Acinetobacter & Panetoea	Provided.
18/05/2018	RHC HIIAT Log: G18.67 HIIAT: Green Ward: 2a Infection Category: BSI Organism: Enterbacter cloacae	HPS support through water incident, not for this individual incident.
18/05/2018	RHC HIIAT Log: O18.17 HIIAT: Red Ward: Paediatric Haemato-oncology Infection Category: BSI Organism: Gram negative	Not requested.
20/06/2018	QEUH HIIAT Log: O18:21 HIIAT: Amber Ward: Spinal injuries – Philipshill edenhall Infection Category: Mixed/Various Organism: CPE Klebsiella	Not requested.
29/06/2018	RHC HIIAT Log: G18.081 HIIAT: Green Ward: PICU Infection Category: Colonisation Organism: Acinetobacter baumanii	Not requsted.
20/07/2018	RHC HIIAT Log: G18.088 HIIAT: Green Ward: Haemotology Oncology (2a) Infection Category: Respiratory Organism: Aspergillus fumigates	Not requested.
15/08/2018	QEUH HIIAT Log: G18.102 HIIAT: Green Ward: Maternity – NICU Infection Category: BSI Organism: Serratia	Not requsted.

05/09/2018	RHC HIIAT Log: G18.113 HIIAT: Green Ward: Haematology - 2a Infection Category: BSI Organism: UNK Mixed	Provided.
04/10/2018	QEUH HIIAT Log: G18.118 HIIAT: Green Ward: Maternity NICU Infection Category: Colonisation Organism: S Maltophilia	Not requsted.
10/10/2018	QEUH HIIAT Log: G18.120 HIIAT: Green Ward: Maternity NICU Infection Category: Colonisation Organism: P.aeruginosa	Not requested.
25/10/2018	QEUH HIIAT Log: G18.123 HIIAT: Green Ward: Theatres Infection Category: Colonisation Organism: P.aeruginosa	Not requested.
20/12/2018	QEUH HIIAT Log: O18.31 HIIAT: Red Ward: Ward 6a, 1D and 4C Infection Category: BSI Organism: Cryptococcus neoformans	Provided.
22/01/2019	QEUH HIIAT Log: O19.03 HIIAT: Red Ward: ITU Infection Category: Respiratory Organism: Mucoraceous Mould	Not requested.
31/01/2019	RHC HIIAT Log: G19.015 HIIAT: Green Ward: SCBU Infection Category: Colonisation Organism: Serratia marcescens	Not requested.
08/02/2019	QEUH HIIAT Log: G19.020 HIIAT: Green Ward: Maternity – NICU Infection Category: Colonisation Organism: Serratia	Not requested.
25/02/2019	QEUH HIIAT Log: G19.028 HIIAT: Green Ward: NICU Infection Category: Colonisation Organism: Serratia	Not requested.
18/03/2019	QEUH HIIAT Log: O19.17 HIIAT: Amber Ward: Renal Infection Category: BSI Organism: Acinetobacter baumanni	Not requested.

14/05/2019	RHC HIIAT Log: G19.080 HIIAT: Green Ward: NICU Infection Category: Colonisation Organism: Malassezia	Not requested.
04/06/2019	QEUH HIIAT Log: G19.072 HIIAT: Green Ward: Temporary paediatric haemato-oncology ward Infection Category: BSI Organism: Mixed	Support not requested, but HIIAT escalates as per HIIAT Log: O19.24 and then support provided.
20/06/2019	QEUH HIIAT Log: O19.24 HIIAT: Red Ward: Temporary paediatric haemato-oncology ward Infection Category: Mixed/various Organism: Gram Negative Bacteria and Mycobacteria chelonae	Provided.
13/09/2019	QEUH HIIAT Log: G19.115 HIIAT: Green Ward: INS Neurosurgery Infection Category: SSI Organism: Klebsiella pneumoniae and S. Aureus	Not requested.
05/11/2019	RHC HIIAT Log: G19.132 HIIAT: Green Ward: PICU Infection Category: Colonisation Organism: Acinetobacter baumanii	Not requested.
19/11/2019	RHC HIIAT Log: G19.136 HIIAT: Green Ward: PICU Infection Category: Colonisation Organism: Pseudomonas aeruginosa	Not requested.
28/11/2019	RHC HIIAT Log: O19.44 HIIAT: Amber Ward:1D/ PICU Infection Category: BSI Organism: Serratia marcescens	Not requested.
20/12/2019	RHC HIIAT Log: G19.165 HIIAT: Green Ward:NICU Infection Category: Colonisation Organism: Serratia marcenscens	Not requested.
17/03/2020	RHC HIIAT Log: G20.037 HIIAT: Green Ward: Ward 6A (paeds) Haemo-onc Infection Category: Colonisation Organism: VRE	Not requested.
09/04/2020	RHC HIIAT Log: O20.87 HIIAT: Amber Ward: Ward 6A Oncology Infection Category: BSI Organism: Klebsiella pneumoniae, Enterbacter cloacae	Not requested.

17/04/2020	QEUH HIIAT Log: O20.85 HIIAT: Amber Ward: Intensive Care Critical Care Unit 6 Infection Category: BSI Organism: Enterobacter aerogenes	Not requested.
18/06/2020	QEUH HIIAT Log: O20.102 HIIAT: Green Ward:10B, 11B, 10D Infection Category: BSI Organism: Burkholderia stabilis	Not requested.
18/06/2020	QEUH HIIAT Log: O20.103 HIIAT: Green Ward:NICU and SCBU Infection Category: Mixed/Various Organism: Stenotrophomonas maltophilia, Acinetobacter baumanii, E.coli, Serratia marcescens	Not requested.
02/07/2020	QEUH HIIAT Log: O20.92 HIIAT: Green Ward:6A InfectionCategory: Other Organism: Cryptococcus	Provided.
16/07/2020	RHC HIIAT Log: O20.066/020 95 HIIAT: Green Ward: NICU Infection Category: BSI Organism: Acinetobacter ursingii	Not requested.
28/07/2020	RHC HIIAT Log: O20.101 HIIAT: Green Ward: NICU Infection Category: BSI Organism: Klebsiella oxytoca	Not requested.
28/07/2020	RHC HIIAT Log: O20.102 HIIAT: Green Ward: NICU Infection Category: Colonisation Organism: Enterobacter cloacae	Not requested.
07/08/2020	QEUH HIIAT Log: O20.109 HIIAT: Green Ward: BMT Infection Category: BSI Organism: Vancomycin Resistant Enterococci	Not requested.
31/08/2020	QEUH HIIAT Log: G20.090 HIIAT: Green Ward: NICU Infection Category: BSI Organism: Serratia marcescens	Not requested.
07/09/2020	QEUH HIIAT Log: G20.094 HIIAT: Green Ward: 10B Infection Category: BSI Organism: Burkholderia stabilis	Not requested.

10/09/2020	RHC HIIAT Log: G20.112 HIIAT: Green Ward: PICU Infection Category: Colonisation Organism: Acinetobacter nosocomialis. Enterobacter cloacae complex	Not requested.
08/10/2020	QEUH HIIAT Log: O20.145 HIIAT: Green Ward: 4C Infection Category: BSI Organism: Stenotrophomonas maltophilia	Not requested.
15/10/2020	RHC HIIAT Log: O20.142 HIIAT: Green Ward: NICU Infection Category: Colonisation Organism: Serratia marcescens	Not requested.
26/10/2020	RHC HIIAT Log: HIIAT2020-GGC-Paediatrics-300 HIIAT: Green Ward: NICU (Maternity Building) Infection Category: Colonised Organism Name: Pseudomonas fluorescens	Not requested.
03/11/2020	QEUH HIIAT Log: HIIAT2020-GGC-South-300 HIIAT: Green Ward: Theatre and vascular ward Infection Category: SSI Organism Name: E.coli - Klebsiella pneumoniae	Not requested.
09/11/2020	RHC HIIAT Log: HIIAT2020-GGC-Paediatrics-305 HIIAT: Green Ward: 1D PICU Infection Category: Respiratory Organism Name: Pseudomonas aeruginosa, Klebsiella pneumoniae	Not requested.
23/11/2020	RHC HIIAT Log: HIIAT2020-GGC-Paediatrics-306 HIIAT: Green Ward: 6A Infection Ccategory: BSI Organism Name: Serratia marcescens Klebsiella pneumoniae	Not requested.
26/11/2020	RHC HIIAT Log: HIIAT2020-GGC-Paediatrics-307 HIIAT: Green Ward: 1D Infection Category: Respiratory Organism Name: Klebsiella pneumoniae	Not requested.
15/12/2020	RHC HIIAT Log: HIIAT2020-GGC-Paediatrics-312 HIIAT: Green Ward: 1D (PICU) Infection Category: Colonised Organism Name: Klebsiella pneumoniae, Enterobacter cloacae	Not requested.

12/01/2021	QEUH HIIAT Log: HIIAT2021-GGC-South-300 HIIAT:Red Ward: Ward not stated Infection Category: N/A Organism Name: Acinetobacter gyllenbergii / Psudomonas fluorescens	Not requested.
15/01/2021	RHC HIIAT Log: HIIAT2021-GGC-Paediatrics-300 HIIAT:Green Ward: NICU Infection Category: BSI Organism Name: Klebsiella oxytoca	Not requested.
25/01/2021	RHC HIIAT Log: HIIAT2021-GGC-Paediatrics-301 HIIAT: Amber Ward: Ward 1D Infection Category: Infected and Colonised Organism Name: Klebsiella varicola, Sphingomonas paucimobilis	Provided.
28/01/2021	QEUH HIIAT Log: HIIAT2021-GGC-South-306 HIIAT: Green Ward: Ward 11A Infection Category: Colonised Organism Name: Burkholderia stabilis	Not requested.
11/03/2021	RHC HIIAT Log: HIIAT2021-GGC-Paediatrics-306 HIIAT: Red Ward: RHC PICU/NICU and Victoria Infirmary NHS Fife post natal ward and NICU Infection Category: Mixed Infected Organism Name: Rhizopus	Provided.
17/03/2021	RHC HIIAT Log: HIIAT2021-GGC-Paediatrics-307 HIIAT: Green Ward: 1D Infection Category: Colonisation Organism Name: Serratia marsescens, Acinetobacter nosocomialis, E coli	Not requested.
30/03/2021	RHC HIIAT Log: HIIAT2021-GGC-Paediatrics-308 HIIAT: Green Ward: 1D Infection Category: Colonisation Organism Name: Acinetobacter nosocomialis, E coli, Stenotrophomonas maltophilia and Klebsiella pneumoniae	Not requested.
15/04/2021	RHC HIIAT Log: HIIAT2021-GGC-Paediatrics-310 HIIAT: Green Ward: NICU Infection: N/A Organism Name: Serratia marcescens	Provided.

26/04/2021	RHC HIIAT Log: HIIAT2021-GGC-Paediatrics-312 HIIAT: Green Ward: NICU Infection Category: Colonisation Organism Name: Enterobacter cloacae	Not requested.
06/08/2021	RHC HIIAT Log: HIIAT2021-GGC-Paediatrics-327 HIIAT: Amber Ward: 6a Infection Category: BSI Organism Name: Enterobacter cloacae, Enterobacter cancerogenus, Klebsilella pneumoniae	Provided.
04/11/2021	QEUH HIIAT Log: HIIAT2021-GGC-South 339 HIIAT: Green Ward: 4B (BMT), 6A Haemonc (Paediatric), IAU, 5D (Medical), 7D Respiratory, 8A (Older Peoples), 9A (Surgical), 10A (Ortho), 11C (Vascular) Infection Category: Environmental Incident Organism Name: NA	Not requested.
15/11/2021	RHC HIIAT Log: HIIAT2021-GGC-Paediatrics-330 HIIAT: Green Ward: NICU Infection Category: BSI Organism Name: Burkholderia contaminans	Provided.

Provisional Position Paper 5

The History of Infection Concerns (HOIC) for the Queen Elizabeth University Hospital Campus

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Purpose of the Paper

As Lord Brodie explained at the official launch of the Scottish Hospitals Inquiry on 3 August 2020, the Inquiry was set up against a background of concerns over patient safety at the QEUH campus. He explained that patient safety, and the need for there to be public confidence that the QUEH did not compromise patient safety, would be at the heart of the Inquiry's work. The purpose of this paper is to set out the Inquiry's present understanding of that history of concern about patient safety: the history of concern that led to the Inquiry being instituted in the first place and any evidence of further or ongoing concern beyond that point.

This paper sets out in a chronological narrative the Inquiry's present understanding of the various issues and events said to indicate a concern that aspects of the built environment within the QEUH have caused, or created a risk of, infection to patients. The Inquiry's key questions are concerned with assessing whether there was or continues to be an objectively valid basis for the concern. But first the Inquiry must identify what the concern actually is. That is the purpose served by this paper.

The paper sets out the Inquiry's understanding of events and issues that have been said to indicate concerns about the following three matters: first, concerns about the incidence of infection within the QUEH campus, secondly, concerns about the safety of key aspects of the built environment (notably the water, drainage and ventilation systems) and, finally, concerns that there might be links between infections and the concerns about the built environment.

This paper is based upon publicly available and other prominent reporting and it also takes into account certain of the Inquiry's investigations across its various workstreams. It should be seen as being a work in progress. It may be added to as the Inquiry's understanding of things develops. In due course, Lord Brodie may be asked to make factual findings on matters covered by the finalised paper. CPs are therefore being given the opportunity to comment upon the paper. They should direct themselves to five matters:

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(1) Whether the narrative is accepted as an accurate history of what occurred (and if not where the narrative is challenged and why);

(2) Whether CPs are aware of other matters that ought to be part of the narrative;

(3) An indication of whether CPs were aware of the events at the time that they occurred, and if not when they became aware;

(4) Whether any of the concerns about safety of the building systems are accepted by CPs as valid (and if not why not); and

(5) An indication by CPs of which if any of the suggested links between infection and built environment are accepted (and the basis upon which such links are accepted, or refuted as the case may be).

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Acronym/ Abbreviation	Definition
A	Aspergillus
AARG	Advice, Assurance & Review Group
AB	Acinetobacter baumanii
AC	Achromobacter spp
ACFG	Area Clinical Governance Forum
ACH	Air Change per Hour
AECOM	Architecture, Engineering, Construction, Operations, and Management
AHU	Air Handling Unit
AICC	Acute Infection Control Committee
ARHAI	Antimicrobial Resistance & Healthcare Associated Infection
ARU	Acute Receiving Unit
BBAL	Blind Bronchoalveolar Lavage
BICC	Board Infection Control Committee
BMT	Bone Marrow Transplant
BSI	Blood Stream Infections
BWSG	Board Water Safety Group
CA	Cryptococcus albidus
CCGC	Clinical and Care Governance Committee
CD	Chlorine Dioxide
CDU	Clinical Decision Unit
CEO	Chief Executive Officer
CF	Cystic Fibrosis
CFD	Computational Fluid Dynamics
CH	Chryseomonas
CHWB	Clinical Hand Wash Basins
CICD	Co-ordinating Infection Control Doctor
CLABSI	Central Line Acquired Blood Stream Infection
CN	Cryptococcus neoformans
CNO	Chief Nursing Officer
CNR	Case Note Review
CNR OR	Case Note Review Overview Report
CPE (Klebsiella)	Carbapenemase-producing enterobacteria (Klebsiella)
CPs	Core Participants
CU	Cupriavidus
CVL	Central Venous Line
DA	Delftia acidovorans
DSR	Domestic Service Room
E.coli	Escherichia coli
EA	Enterobacter aeromonas

Commented [CM1]: https://www.gov.scot/binaries/content/documents/govscot/publications/corporate-report/2021/03/queen-elizabeth-university-hospital-nhs-greater-glasgow-clyde-oversight-board-final-report/documents/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019/govscot%3Adocument/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019.pdf

Acronym/ Abbreviation	Definition
EC	Enterobacter cloaecae
ECOSS	Electronic Communication of Surveillance in Scotland
EM	Elizabethkingia miricola
F&E	Facilities and Estates
GGC	Glasgow and Greater Clyde NHS Health Board
GNB	Gram-negative bacteria
GOSH	Great Ormond Street Hospital
GPB	Gram-positive bacteria
GRI	Glasgow Royal Infirmary
HAI	Healthcare Associated Infection
HaN	Hospital at Night
HEPA	High Efficiency Particulate Air
HFS	Health Facilities Scotland
HH	Hand Hygiene
HIIAT	Hospital Infection Incident Assessment Tool
HPS	Health Protection Scotland
ICD	Infection Control Doctor
ICNET	Clinical Surveillance Software
ICU	Intensive Care Unit
IMT	Incident Management Team
IPCN	Infection Prevention Control Nurse
IPCT	Infection Prevention Control Team
IPS	Integrated Plumbing System
IR	Independent Review
LIMS	Microbiology Laboratory Information System
MA	Mycobacterium Abscessus
MB	Microbiologist
MC	Mycobacterium chelonae
MD	Medical Director
MDT	Multidisciplinary Team
NICU	Neonatal Intensive Care Unit
NIPCM	National Infection Prevention and Control Manual
NNU	Neo Natal Unit
OB	Oversight Board
PAG	Problem Assessment Group
Pan	Pantoea
PanS	Pantoea septica
PICU	Paediatric Intensive Care Unit
PMI	Project Manager Instruction
PO	Pseudomonas oleovorans
PPVL	Positive Pressure Ventilation Lobby

Acronym/ Abbreviation	Definition
Ps	Pseudomonas spp
PsA	Pseudomonas aeruginosa
PsP	Pseudomonas putida
QEUH	Queen Elizabeth University Hospital
RCA	Root Cause Analysis
RHC	Royal Hospital for Children
SBAR	Situation, Background, Assessment, Recommendation
SCN	Senior Charge Nurse
SCWSG	South Clyde Water Safety Group
SGHD	Scottish Government Health Directorate
SHTM	Scottish Health Technical Memorandum
SICPs	Standard Infection Control Precautions
SLWG	Short Life Working Group
SM	Serratia Marcescens
SOP	Standard Operating Procedure
SPC	Statistical Process Control (Charts)
spp	species (plural)
STM	Stenotrophomonas Maltophilia
SU	Schiehallion Unit
TBPs	Transmission Based Precautions
TCT	Teenage Cancer Trust
TCV	Temperature Control Valve
TVC	Total Viable Count

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1. EPISODES OF CONCERN THAT TOOK PLACE OR COMMENCED PRIOR TO HANDOVER OR PATIENT MIGRATION

1.1 Timeline

1.1.1 The hospital was handed over on 26.1.15. Patients were moved to the hospital from 24.4.15 to 7.6.15 in the case of adults and from 10.6.15 until 14.6.15 in the case of children

Commented [CM2]: Info verified from HPS report Summary of Incident and Findings of the NHS Greater Glasgow and Clyde: Queen Elizabeth University Hospital/Royal Hospital for Children water contamination incident and recommendations for NHSScotland

1.2 Ventilation system concerns:

1.2.1 At various points in 2014/15, the lead ICD raised concerns about ventilation particularly in relation to the Adult BMT unit, the Paediatric BMT Unit and the Infectious Disease Unit.

1.3 Water system concern: taps

1.3.1 In March 2014, GGC sought guidance from HPS about the taps which had been procured for the new hospitals. The taps were not compliant with NHS Guidance (SHTM 04-01). Nor were they compliant with guidance which had recently been issued by HPS (*Guidance for neo natal units (NNUs) (levels 1,2 and 3) adult and paediatric intensive care units (ICUs) in Scotland to minimise the risk of pseudomonas aeruginosa infection from water*).

1.3.2 The cause of the non-compliance was the incorporation of 'flow regulators' in the design. The revised guidance was published because of the implication of flow regulators in a Pseudomonas outbreak in Northern Ireland in 2012, which resulted in neonatal deaths and prompted a review of policy in this area.

1.3.3 HPS produced an SBAR, dated 9 April 2014, which set out various ways to address the problem, and recommended in that SBAR that GGC either install the procured taps without the flow regulators in high-risk areas, or,

alternatively, instruct the contractor to install new compliant taps (i.e., not including a flow regulator in the design) in high-risk areas.

1.3.4 The Horne taps which were ultimately installed on all clinical wash hand basins across the QEUH and RHC were fitted with flow regulators, contrary to the advice within the HPS SBAR.

1.3.5 The taps which were installed were not compatible with the use of silver hydrogen peroxide, which was to be used in the commissioning process to sanitise the water system.

1.4 Water system concern: water testing results

1.4.1.1 In December 2014 and January 2015, the contractor arranged for testing of the water system as part of the normal water system commissioning. The results showed high Total Viable Counts (TVCs) and E. coli in the water. Water outlets with high TVCs were disinfected with silver hydrogen peroxide. Some water samples still failed the test after dosing had occurred. There is no evidence that further testing was undertaken. The Lead ICD reviewed the initial water results and water testing methodology, but there is no evidence that the final water testing results were presented to or reviewed by the lead ICD.

1.4.1.2 Between the end of January and June 2015, a flushing regime was instituted by GGC F&E staff, as well as agency staff, to ensure turnover of water prior to patient occupation.

1.4.1.3 Between April and December 2015 NHS GGC conducted testing of water outlets for Legionella only (in line with national requirements). The testing was carried out by two F&E managers with no training in taking samples. Sampling was taken from 500-600 sentinel points throughout the campus. The April test results showed positive results for Legionella species in certain areas. Between April and December 2015, some water samples were positive for legionella spp and had high TVCs. Where

positive samples were found, the area/outlet was disinfected until 3 consecutive samples were negative.

1.4.1.4 There is a suggestion (by some MB/ICDs) that Stenotrophomonas Maltophilia (STM) was isolated in water samples before or around the time that the hospital opened. That suggestion is supported by HPS, who reported that Cupriavidus, Pseudomonas and Stenotrophomonas Maltophilia isolates were identified in water samples in October 2015.

1.4.1.5 There is a suggestion by certain MBs/ICDs that concerns were raised about 'the water system' prior to the hospital opening.

1.4.1.6 That concern appears to be echoed in the report of the Independent Review, which records: "*the early occupation of the hospitals in 2015 accompanied concerns about […] missing information particularly about water quality and management, and infection risk*".

Commented [CM3]: QEUH Review Report June 2020 - https://webarchive.nrscotland.gov.uk/20200903233023/https:/www.queenelizabethhospitalreview.scot/queen-elizabeth-university-hospital-review-review-report/

1.4.1.7 There is a suggestion that GGC refused to accept handover of the hospital until sanitisation of the water supply was undertaken, standing concerns about the high level of TVCs. It is not known what action was taken in relation to this.

1.5 Water system concern: DMA Canyon report

1.5.1 DMA Canyon are a water specialist consultant. DMA produced a report, entitled "Legionella Risk Assessment", dated 29 April 2015. The report was received by NHS GGC in early-May 2015.

1.5.2 The report identified several significant concerns with the water system at that point including temperature control of the water system; installation of flexi-hoses and the associated risks of bacterial growth, and the lack of effective management, notably regarding communication and control of contractor activity at the point of handover. There was no formal

management structure, written scheme or protocols in relation to the management of the water system.

1.5.3 The report made a number of recommendations relating to the water system. In particular, the report recommended: (i) adjustments to water temperature control; (ii) the removal of 'dead legs' in the system, and (iii) the removal of debris from the water storage tanks.

1.5.4 The DMA report records that a sampling programme (testing for TVC, E. coli, coliforms and Legionella) was being conducted and that daily flushing and local disinfections were underway where positive results were found. Neither the sample results, nor the disinfection process was provided to DMA to review.

1.5.5 It does not appear to be disputed by NHS GGC that the DMA Canyon report was received in early-May 2015. It is not clear who within GGC saw or knew of the report's conclusions following its receipt; the author of the OB Timeline indicates that they understood GGC to say that the report had not been shared with "the senior management team or the F&E team or with IPCT".

1.5.6 The recommendations made within the report were not actioned prior to 2018. It is not clear why that occurred. The report (and possibly others) is said to have "surfaced" when papers were being provided to HPS/HFS. The report was not disclosed publicly until November 2019.

1.6 <u>Other concerns: risks posed by demolition works</u>

1.6.1 Prior to patient migration, concerns were repeatedly raised about the risks posed by treating immunocompromised patients at the new hospital due to the ongoing demolition and building work.

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2. EPISODES OF CONCERN THAT TOOK PLACE OR COMMENCED IN 2015 AFTER PATIENT MIGRATION

2.1 Timeline: patient migration April-June 2015

2.1.1 Patient migration commenced with the Southern General Hospital Outpatient department move to the new campus on 27 April 2015. Migration of patients from the Western Infirmary, Victoria Infirmary, Mansion House Unit, and Gartnavel General Hospital commenced on the same date. On 1 May 2015, the Inpatient departments of the Southern General Hospital moved to the new campus.

2.1.2 On 10 June 2015, the Royal Hospital for Sick Children at Yorkhill moved in to the new RHC campus.

2.1.3 By 14 June 2015, the move by all units and hospitals to the new campus was complete.

2.2 Ventilation concerns by MB/ICDs

2.2.1 In June 2015, concerns were raised by the lead ICD about the absence of HEPA filtration and that the absence of such would be “potentially unsafe” as regards children presently cared for in facilities with HEPA filtration. Concerns were also raised about the absence of HEPA filtration in transplant rooms.

2.2.2 On 6 July 2015, the Acute Infection Control Committee (AICC) minutes record discussion “*around HEPA filters and the need to ensure air pressures are correct as the MB had reported there were some issues around slightly positive air pressures*”. One Microbiologist (MB) advised “*there are issues with ventilation in QEUH in a couple of areas and one room in particular*”.

2.2.3 There appears to be a dispute about the accuracy of the minute of the AICC meeting of 6 July 2015, and some dispute about the nature and extent of the issues which were raised.

2.3 ICD resignation (9 July 2015)

2.3.1 On 9 July 2015, the ICD with responsibility for the adult BMT Unit resigned. She explained that she had "major concerns regarding the specialised ventilated areas within QEUH and RHSC and the impact on patient safety". ICDs had concerns about the availability of information relevant to the safety of the as-built ventilation and water systems.

2.4 Ventilation in Ward 4B (adult BMT)

2.4.1 In June 2015 the adult BMT had 'high particle counts' so the Unit was moved back to the Beatson in July 2015 whilst extensive refurbishment took place. The particle readings indicated that the isolation rooms intended for adult haemato-oncology patients (including potential BMT patients) were unsatisfactory and showed potential risk of infection by the airborne route. The readings demonstrated an increase in fungal counts, including Aspergillus.

2.4.2 The Ward 4B protective isolation rooms did not achieve the required air pressure differentials or air change per hour (ACH) rates required by the specification (and NHS Design Guidance).

2.4.3 By around July 2015, clinical staff were of the view that the adult BMT unit was not fit for purpose.

2.4.4 On 27 July 2015, the Board Infection Control Committee (BICC) minutes record that BMT patients have been transferred to the Beatson as the unit was not built to the correct specification. The main contractor had agreed to fund the rebuild for this area (Ward 4B). At the same meeting, concerns were again expressed about the continued treatment of

immunocompromised patients due to the scheduled demolition of the surgical block in September 2015.

2.4.5 Non-transplant patients remained at the Beatson for several weeks. BMT patients remained at the Beatson for over 2 years before returning.

2.5 PMI 424 (July 2015)

2.5.1 GGC issued a Project Manager Instruction, PMI 424, to Multiplex in July 2015, which required Multiplex to implement an air change rate of 10-12 changes per hour, and achieve a pressure differential of +5 to +10 pascals in Ward 4B. The pressure differential is not in line with NHS Design Guidance, which requires a pressure differential of +10 pascals.

2.6 Initial infection outbreaks in retained estate (July~~? late~~ 2015)

Commented [CM4]: FMQ Brief - Serratia infection - Neonatal Intensive Care Unit - QEUH - updated 24 December 2015

2.6.1 Several 'infection matters' and the first 'outbreaks' of infection took place in buildings of the 'retained estate' of the hospital site, in the Neonatal Intensive Care Unit and the Neurological Sciences building.

2.7 Serratia Marcescens (SM) in NICU (July-Dec 2015)

2.7.1 Between July and November 2015, a total of 13 cases of Serratia Marcescens (SM) occurred in patients in NICU. The infections were reported to HPS, following the death of an infant with sepsis caused by SM on 31 October 2015, and against a background of an increasing number of cases over the previous months.

2.8 Work carried out on Ward 4B BMT

2.8.1 On 5 October 2015, the BICC meeting minutes record that the rooms in the 'adult Tower' had been completed, with the exception of two rooms. Alternative routes into the QEUH for immunocompromised patients were being found during the period of demolition of the surgical block. A

significant flood had occurred in the neuro theatre, which was closed for approximately 6 weeks, but was now in use following satisfactory air monitoring results.

2.8.2 On 30 November 2015, the BICC meeting minutes record that adult BMT patients were due to transfer to the QEUH on 19 December 2015. The co-ordinating ICD (CICD) advised that there was no national standard for testing BMT rooms. It is not clear what testing, if any, had taken place in the refurbished Ward 4B. The planned return of patients was postponed.

2.8.3 The mechanical ventilation system to Ward 4B of the adult hospital was upgraded in December 2015. The works included: installing metal frame plasterboard ceilings (MF ceilings) to reduce air permeability; applying sealant to various areas and replacing sealed lighting units. The measures were designed to improve the pressure differential between the rooms and the corridors on the ward. HEPA filtration was also installed.

2.8.4 Advice was received by way of SBAR from HPS and from Public Health England on the Adult BMT unit in December 2015.

2.9 PMI 471 (December 2015)

2.9.1 Following receipt of the HPS SBAR, GGC issued a PMI (PMI 471) to Multiplex to carry out further work on the ventilation systems in Ward 4B. The PMI required Multiplex to achieve 6 air changes per hour; room pressures of +2.5 to +8 pascals; the corridor to be HEPA filtered, and the entrance to the ward to be air locked using double door at the front entrance.

2.10 Pseudomonas aeruginosa (PsA) in PICU (December 2015)

2.10.1 On 24 December 2015, an IMT meeting took place following the isolation of Pseudomonas aeruginosa (PsA) in the respiratory specimens of two patients in Ward 1D, the Paediatric Intensive Care Unit (PICU). The

samples were taken on 17 December 2015. According to the OB Timeline, the samples identified two different strains of PsA.

2.10.2 This is the first infection of concern recorded in the OB Timeline. In light of the infections, a “water safety checklist” was completed. An SBAR on the cases was issued to the Senior Charge Nurse (SCN). An ‘action plan’ was agreed in respect of these cases.

2.11 Clinician concerns in 2015

2.11.1 On 9 November 2015, two consultation MBs wrote to the medical director of GGC/the QEUH to raise certain concerns. The concerns they raised included: (i) lack of involvement on the part of the ICT in relation to the design of the hospital; (ii) in relation to the adult BMT unit, the absence of environmental monitoring prior to patients moving in and the non-availability of information regarding specification and validation reports; (iii) a concern that despite monitoring of the air in the children’s BMT unit disclosing evidence of fungal spores and there being holes in the ceiling of rooms, children were moved in and transplants proceeded. The two clinicians said they did not consider that their concerns were being addressed.

2.12 GNB infections in Ward 2A (? 2015)

The Case Note Review retrospectively identified that, during 2015, there were 2 instances of GNB infection (1 patient with blood stream infection caused by Klebsiella and 1 patient with a blood stream infection caused by Pseudomonas) in paediatric haemato-oncology patients, which do not appear to have been investigated at the time.

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3. EPISODES OF CONCERN THAT TOOK PLACE OR COMMENCED IN 2016

3.1 Timeline: ongoing work by contractors (January- December 2016)

3.1.1 Throughout 2016, work to address the issues being identified with the hospital continued.

3.2 Ongoing work on Ward 4B (adult BMT) (January 2016)

3.2.1 On 25 January 2016, the BICC meeting minutes record that discussions about the specifications for the adult BMT Unit were ongoing, but 'all ventilation issues' were now complete. The key issue was the HEPA filtration of corridors, and the compliance of what was in place with the 'guidance'.

3.3 Patients move from Beatson to Ward 4B

3.3.1 At a date currently unknown (possibly early 2016), patients moved from the Beatson to Ward 4B.

3.4 Cupriavidus (CU) (unknown location) and the connection to an aseptic sink (January 2016)

3.4.1 In January 2016, a patient tested positive for Cupriavidus pauculus (CU). An investigation determined that the patient had received parenteral nutrition which had been reconstituted in the aseptic pharmacy. A sample taken from a tap on a wash hand basin in the aseptic pharmacy also isolated CU. Typing of both isolates were found to be the same. The wash hand basin was subsequently removed.

3.4.2 There is a suggestion (by certain MB/ICDs) that the investigation was prompted by a raised TVC in a sample taken from the aseptic pharmacy unit, with the patient case being retrospectively identified. The MB/ICDs considered that the matching of the typing demonstrated a link between

water and the case of CU in the patient. An article published in February 2021 indicates that high TVCs were found in two sinks.

3.4.3 There is doubt about the location of the patient and whether or not they were in ward 2A.

3.4.4 This is the first of two instances of infection which NHS GGC appear to accept are linked to the hospital environment (the second being an instance of Mycobacterium chelonae in 2019).

3.5 Flow straighteners and Pseudomonas (February 2016)

3.5.1 On 2 February 2016, the Board Water Safety Group (BWSG) meeting minutes record a discussion between the Lead ICD and GGC Senior Estates Manager of 'water and environmental issues'. Discussion had taken place about the risk of Pseudomonas with the use of flow regulators. HPS advice was recorded as being to remove, sanitise, and return the flow straightener to the tap and to replace the plastic components every three months, or alternatively to keep the flow straighteners in place with sampling to be undertaken in high-risk areas.

3.6 Acinetobacter baumanii (AB) in PICU (June 2016)

3.6.1 In June 2016, two patients tested positive for Acinetobacter baumanii (AB) in Ward 1D (PICU). Both patients had undergone cardiac surgery. The hypothesis at least at the time of the OB Timeline was that the time was that cross-transmission had occurred (patient to patient).

3.7 Klebsiella in Ward 2A (June- November 2016)

3.7.1 Between June and November 2016, there were 9 episodes of Klebsiella infection, affecting 8 patients in Ward 2A. No investigation into these infections took place at the time and thus no IMT.

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3.8 An increase in Aspergillus (A) cases in Ward 2A (August 2016)

3.8.1 On 25 July a patient in Ward 2A tested positive for Aspergillus (A). A second paediatric haematology patient was identified as a probable case was identified on 4 August, although this was subsequently found not to be Aspergillus infection. There is a suggestion of one of the patients also having had Pseudomonas.

3.8.2 Neither patient was in a BMT room. A Problem Assessment Group (PAG) meeting took place on 4 August, followed by an Incident Management Team (IMT) meeting on 5 August 2016. The infections were reported externally to HPS on 5 August 2016.

3.8.3 The potentially contributing factors to the infection were identified as: (i) tears in the ventilation ductwork; (ii) the construction/demolition work on site, which was creating dust, and (iii) condensation forming on the chilled beams, this issue having been raised with the main contractor as abnormal. There was also a suggestion of a water leak.

3.8.4 Whilst air samples from the chilled beams had been collected and shown to be negative, samples taken from an air handling unit showed fungus, and the IMT indicates that no air sampling programme was in place. The continued absence of HEPA filtration was noted.

3.8.5 An increased programme of cleaning, and cleaning of the chilled beams was implemented in response to the infection. High risk patients were prescribed prophylaxis (the IMT refers to AmBisome or Posaconazole).

3.8.6 In addition to the above, there is a suggestion that there were 2 cases of A in QEUH Critical Care in June 2016; and that water ingress was suspected as a cause.

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3.9 Portable HEPA filters in Ward 2A (July ? 2016)

Commented [CM5]: HAI - Outbreak - Aspergillus - Royal Hospital for Children - NHS Greater Glasgow and Clyde - Submission to CabSec - 5 August 2016

3.9.1 Following the infection of a patient within Ward 2A with Aspergillus, portable HEPA filters were to be placed in the unit. Whilst the air in Ward 2A was filtered, it was not HEPA filtered. The placement of the HEPA filtration units within the ward, and the timescale in which they were provided, is unknown.

3.10 Ongoing work in paediatric BMT rooms (September 2016)

3.10.1 On 5 September 2016, the AICC meeting minutes record that the Adult BMT and Paediatric BMT rooms fell below the standards implemented in other units. Work was ongoing in the paediatric BMT unit to achieve the required specification.

3.11 Serratia Marcescens (SM) in PICU (Sept/Oct 16)

3.11.1 In September/October 2016, 6 patients were reported to have SM in PICU. One patient with a positive result had transferred from Neonatal Intensive Care Unit (NICU). An IMT was held on 27 September, which recommended the implementation of Standard Infection Control Precautions (SICPs).

3.11.2 The environment was screened as negative for SM and Pseudomonas. Water sampling results were undertaken, but the results are unknown. The practice of washing equipment in sinks was thought to be a potential source of contamination in the environment.

3.12 Retrospectively identified GNB infections in Ward 2A (? 2016)

3.12.1 During 2016, there were a total of 26 instances of bacteraemia amongst the haemato-oncology patients in Ward 2A (including the 9 cases of Klebsiella identified above).

3.12.2 None of these infections appear to have been investigated at the time (although one of two cases of Elizabethkingia which occurred in 2016 appears to have been considered in February 2017 when two further patient infections had occurred). These infections were retrospectively identified by the CNR.

4. EPISODES OF CONCERN THAT TOOK PLACE OR COMMENCED IN 2017

4.1 Ongoing work by contractors (January- December 2017)

4.1.1 Throughout 2017, work to address the issues being identified within the hospital continued.

4.2 Serratia Marcescens (SM) in PICU (February 2017)

4.3 In February 2017, an unknown number of patients in NICU/Ward 1D developed SM infection. The focus of the response was on domestic cleaning, especially “pendants”. Chlorine cleaning of the bed spaces took place. The isolates were typed, and timelines were created.

4.4 Elizabethkingia miricola (EM) in Ward 2A (September 2016- February 2017)

4.4.1 Three cases of EM were isolated from patient line cultures between September 2016 and February 2017. All were unique strains.

4.4.2 A PAG took place on 3 March 2017. The action plan prompted a focus on the environment. There was a suspicion of a connection to the water supply or to condensation from chilled beams. F&E undertook a review of vent cleaning and maintenance, as well as sampling of vents, chilled beams and water outlets. All samples were negative. The IPC Nurse carried out a visual inspection of the environment. The incident was closed on 27 March 2017.

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4.5 Increasing number of unusual bacteraemias (July 2016- February 2017)

4.5.1 Between July 2016 and February 2017, there was a gradually increasing upwards trend in bacteraemia rates amongst paediatric-haematology patients. Multiple organisms were identified.

4.5.2 It does not appear that any further steps were taken by GGC in response to the trend of increasing numbers of unusual bacteraemias amongst this patient cohort. The precise numbers and types of organisms responsible are unknown.

4.6 Concern emerging about increased bacteraemia rates (March 2017)

4.6.1 In March 2017, concern began to emerge within GGC about increased bacteraemia rates in paediatric haemato-oncology patients. The first Problem Assessment Group (PAG) for a Gram-Negative environmental bacterium (GNB) was convened.

4.7 Water sampling begins (March 2017)

4.7.1 Water sampling was undertaken in Ward 2A from March 2017.

4.8 Unsuitability of QEUH isolation rooms (March 2017)

4.8.1 On 6 March 2017, the AICC meeting minutes record that the QEUH isolation rooms had been found to be unsuitable for airborne infectious disease patients. A report on the facilities was provided by HFS. The rooms were out of use: any patients were to be transferred to GRI or Monklands.

4.9 Aspergillus (A) in Ward 2A (March/April 2017)

4.9.1 In March 2017, three patients in Ward 2A contracted Aspergillus infection. Following the HIIAT red report, the infections were reported to HPS. IMTs took place between 7 March and 28 April 2017, when the incident was closed.

4.9.2 A number of investigations into the outbreak took place, some of which considered the environment as a potential source of infection: the IPC team reviewed the level of dust from ongoing works on site; a leak into the ceiling void was identified and found to be causing mouldy ceiling tiles; an inspection of cooling beams (which leaked periodically) took place; air and water sampling was carried out (results were negative), and hand hygiene audits (85% score) were carried out.

4.9.3 The control measures which were put in place included the removal of mouldy tiles and ceiling void repair; a full terminal clean of the ward; anti-fungal prophylaxis being given to all patients; ongoing surveillance by clinical teams “to alert IPCT as lab testing unreliable”, and the development of a water damage policy by ICD and Facilities & Estates (F&E).

4.10 Serratia Marcescens (SM) in PICU (March 2017)

4.11 The SM incident in PICU, which began in February 2017, continued into March 2017. At least 3 cases occurred in March 2017.

4.12 CLABSI working group set up (May 2017)

4.12.1 In May 2017, a working group on CLABSI (Central Line Acquired Blood Stream Infection) met for the first time to develop measures to attempt to reduce the rate of infection. It appears that the group was formed in response to concerns about the increasing rate of unusual bacteraemias in Ward 2A between July 2016-early 2017.

4.12.2 By June 2017, the initial rate of CLABSI had doubled.

4.12.3 The measures were ultimately successful: the median rate of line acquired infection reduced from 6.33 in June 2017 to 1.34 in December 2019.

4.13 Ongoing work in Ward 2A (May 2017)

4.14 On 8 May 2017, the AICC meeting minutes record that work was underway in Ward 2A to change the pressure in two isolation rooms from 'negative' to 'positive' pressure (incorrectly described as positive to negative in minutes).

4.15 Change to NIPCM to include 4 environmental organisms (June 2017)

4.15.1 In June 2017, the National Infection Prevention and Control Manual (NIPCM) was updated to include 4 environmental organisms: Pseudomonas aeruginosa (PsA), Acenitobacter baumanni (AB), Stenotrophomonas maltophilia (STM) and Serratia marcescens (SM). Alert organisms for gram-negative bacteria (GNB) and gram-positive bacteria (GPB) were added to Appendix 13.

4.15.2 On 3 July 2017, the AICC meeting minutes recorded that no changes were required within GGC as IPCT already included the extra organisms as alerts within the system. Whilst no guidance was provided in the NIPCM on how to manage the organisms or implement surveillance, the ICD had developed triggers for these organisms based on 'available scientific literature'. An SBAR was issued by GGC to IPCTs advising of the update to the list in August 2017.

4.16 Stenotrophomonas maltophilia (STM) in Ward 2A (July 2017)

4.16.1 There were a number of identified cases of Stenotrophomonas Maltophilia (STM) in 2017. The overall number is unclear. There were two cases in July 2017. The OB timeline indicates that MB/ICDs considered SPC charts to show a marked increase in cases beyond these 2. It has been

suggested that there were two cases in the early part of 2017. It has also been suggested that inquiry by MB/ICD staff at the time of the two July cases showed either a further 5 cases having occurred in recent months or showed a total of 5 cases (as having occurred after a long period of none).

4.16.2 The CNR OR indicates that they were aware of something in the order of 12 cases in 2017 among the cohort of patients that they were considering.

In November 2019, an SBAR addressing STM cases in 2017 was prepared by a GGC clinician. It was said to have been prepared as part of an IMT process. The SBAR indicates that that process involved a retrospective review of STM cases in 2017.

4.16.3 Control measures put in place as a result of the infections included: terminal clean of the 2 rooms occupied by the affected patients; ongoing review of line care (CLABSI group); additional staff and parent education, and a 'review of the environment' led by the Lead Nurse for IPC, Senior Charge Nurse and Domestic Manager.

4.16.4 A PAG was convened on 26 July 2017. The MB dealing with this incident sought information on recent cases. That produced the information that there had been a further 5 cases (or a total of 5 cases).

4.16.5 The MB requested water testing in July 2017. This was eventually carried out in September 2017. GGC is understood to consider that this testing demonstrates there is no link between cases of STM and the built hospital environment.

4.16.6 The CNR concluded, without indicating which years in particular their finding covered, that the frequency of STM was "higher than would be expected". They appeared also to consider that there was a clustering in time and of place as regards STM cases. They considered that the chances of this having occurred by chance was small. Again without indicating which particular years their findings covered, the CNR

concluded that 14 cases of STM were “most likely” to have been “associated with the environment".

4.17 Infections affecting the Cystic F brosis Population: July & September 2017

4.17.1 On 20 July an IMT took place to discuss cases of Mycobacterium Abscessus (MA) within the CF patient population. According to the OB Timeline, a meeting of the BICC took place on 31 July 2017, and the minutes record a number of cases of MA. Genome sequencing results confirmed these were linked. IPC were unclear of route of transmission and HPS were involved.

4.17.2 A further meeting took place on 22 September 2017 to consider cases of Exophilia among the CF population. Among the issues discussed was a requirement to check and clean ventilation in the area including the chilled beams.

4.18 Klebsiella in Ward 2A (July- December 2017)

4.18.1 Between July and December 2017, there were 9 episodes of Klebsiella infection, affecting 7 patients. It is unclear what investigation of these was made at the time. An IMT (which appears to be wrongly) dated 13.2.17 indicates some consideration of 11 Klebsiella infections between August and December 2017 in relation to infections in the Philipshill ward which is part of the adult hospital, but is in a building separate to the main QEUH building. The CNR OR states that “there was no investigation into an increasing number of Klebsiella bacteraemias encountered between 2016 and 2018”.

4.19 Fungal counts in Ward 2A

4.20 High fungal counts were recorded in cubicles within Ward 2A, and the TCT area. Following the cleaning of the affected areas, re-sampling confirmed acceptable results.

4.21 Pseudomonas spp (Ps): in PICU (August 2017); and in Ward 10D QEUH (November 2017)

4.21.1 In August 2017, two cases of Ps were identified in NICU: one patient with a Ps positive blood culture and the other patient with a colonisation. There was an 'epidemiological link' between the two. A PAG was held on 2 August 2017. The control measures which were implemented in response included a full terminal clean of the unit, completion of a 'water checklist' with practice issues identified and reported to the SCN, and ongoing monitoring.

4.21.2 On 3 November 2017, an IMT was held in relation to cases Ps on Ward 10D.

4.22 DMA Canyon Report (September 2017)

4.22.1 According to the OB Timeline, in September 2017, work on a report by DMA Canyon dated from the same month began. It is unclear what report that was or what work was involved.

4.23 Cupriavidus (CU) in Ward 2A (September 2017)

4.23.1 A patient in Ward 2A tested positive for Cupriavidus pauculus (CU) in September 2017, 17 months after a patient had tested positive for CU which had been matched to an isolate in a water sample taken from a sink in the aseptic pharmacy (i.e., a confirmed environmental link between the environment and patient infection).

4.23.2 This was the second instance of patient infection with CU. This case was similarly linked to the isolation of CU bacteria in a clinical handwash basin within Ward 2A, which could not be removed but which was disinfected at the time, although it is unknown whether typing of the isolates confirmed a match. This suggests that water sampling investigations into the source of this infection took place, although these are not documented in the OB Timeline and the HPS reporting suggests that no sampling took place.

4.24 Step 1 whistle blowing procedures (September 2017)

4.24.1 In September 2017, three consultant MBs raised Step 1 of GGC's whistle blowing procedures. The concerns they had included patient placement, issues with ventilation, a lack of information about commissioning and validation, issues with the water system and concerns about water testing. They were asked to submit an SBAR setting out the issues of concern.

4.24.2 This was not the first time the concerns had been raised. Whilst the format (SBAR) was new, the concerns about emerging environmental risks arising from the hospitals design and construction had been raised since before the formal handover of the new building.

4.25 SBAR (October 2017)

4.25.1 The matters of concern raised in the SBAR related to the facilities in the QEUH and RHC, as well as the structure of the IPCT service within NHS GGC.

4.25.2 In particular, the five main concerns raised were:

4.25.3 Building design, including ventilation concerns about isolation rooms for patients with infectious diseases, apparent flaws in the construction of the hospital and the effect of those flaws on accommodating particular patients;

4.25.4 Specific building problems and infections in Ward 2A of RHC;

4.25.5 Water quality (taps having temperature control valves (TCVs), concerns about water testing and reporting of results, and the fact that ICDs required to request water testing relating to Ward 4B of the adult hospital in light of recent water test failures and the vulnerable patient population;

4.25.6 Standards of cleaning; and

4.25.7 The skill set and leadership of the Board Infection Control Team.

4.25.8 Additional concerns were raised about plumbing in the neurosurgical block and decontamination of respiratory equipment.

4.25.9 The likely patient impacts predicted in the SBAR of September 2017 went on to occur in the manner in which the medical microbiologists predicted.

4.26 GGC Action Plan to address SBAR (October 2017)

4.26.1 On 4 October 2017, a meeting took place to discuss the concerns. A 27-point action plan was developed to address the concerns, which was 'ratified' by the CCGC on 5 December and noted by the Board on 20 February 2018. Work to address the action plan is extensive and was still ongoing in 2021 (as recorded in the OB Timeline).

4.26.2 The extent to which the action plan represents an agreed course of action amongst the MBs is disputed. It is suggested in the OB Timeline that certain MBs maintain that they had raised concerns with their consultant colleagues in relation to the number of infections, including unusual infections at RCH.

4.26.3 HPS were requested to provide support to GGC whilst the action plan was compiled.

4.27 Serratia Marcescens (SM) in PICU (October 2017)

4.27.1 In October 2017, at least 4 patients were colonised with SM in PICU. A PAG was held on 6 October 2017. The control measures put in place included a terminal clean of the affected patient bay, and a hand hygiene audit. No further action was to be taken unless new cases were identified.

4.28 Ongoing concern around ventilation in QEUH/RHC (October 2017)

4.28.1 In a meeting of the BICC on 9 October 2017, the minutes record the receipt of emails concerning "*the ventilation and negative pressure rooms in QEUH and RHC*" and a meeting held by the Medical Director (MD) a week previously to progress matters on those issues (it is unclear whether this is a reference to the Stage 1 whistle blowing/SBAR by three consultant MBs).

4.29 Aspergillus (A) in Ward 2A (October 2017)

4.29.1 A single patient identified with an Aspergillus infection following a Bronchoscope procedure on 23 October 2017. A PAG was held on 27 October 2017. HPS were advised of the infection on the same date. The patient had been prescribed anti-fungal prophylaxis since 20 October 2017 (although the minutes of the AICC meeting of 6 November 2017 doubt whether the patient had anti-fungal prophylaxis).

4.29.2 The control measures which were put in place included the risk assessment of all Ward 2A patients by the clinical team before anti-fungal prophylaxis was prescribed; twice weeks IPCN visits to the ward to monitor the environment, cleaning and practice, and ongoing cleaning of the ward with chlorine-based detergent.

4.30 Acinetobacter baumanii (AB) in various locations of RHC (October- November 2017)

4.30.1 A number of cases of Acinetobacter baumanii (AB) occurred in various locations of the RHC/QEUH in September/October and November 2017.

4.30.2 In October 2017, a new case of AB was identified in Ward 3A. It was identified as being of the same strain as two previously colonised cases on the ward (identified in September) at that time. A fourth case, a patient colonised with AB since 2016, who returned to the ward after the new HAI occurred, also had the same strain of AB. Control measures put in place were SIPC measures and monitoring of Ward 3A for onward transmission (the theory appears to have been patient to patient transmission).

4.30.3 In November 2017, two new cases of AB colonisation occurred, one in Ward 1E and the other in PICU. A third patient with AB colonisation was also in PICU (believed to be one of the cases from Ward 3A in October 2017). There was a time and place link for all three cases: the same bed bay (location unknown). Two of the cases from October 2017 were also associated with the same bed bay.

4.30.4 The control measures put in place were: 'TBPs around bed spaces'; hand hygiene audit and environmental sampling undertaken (results unknown), and ongoing IPCT investigations and monitoring. There is no suggestion of consideration of an environmental link.

4.31 Ongoing work in Ward 2A (November 2017)

4.31.1 By November 2017, 4 of the PPVL rooms in Ward 2A had been converted to positive pressure rooms. At a meeting of the AICC on 6 November 2017, the minutes record that significant expenditure would be required to convert the rest of the rooms to positive pressure rooms.

4.32 Ongoing CLABSI work (November 2017)

4.32.1 The CLABSI working group had caused infection rates to decrease through a series of changes including staff practice; new equipment (including the Curos port protector tip), and ensuring staff adhered to decontamination/line care.

4.32.2 From December 2017, every CLABSI was to be subject to 'rigorous review' utilising what is described as Event Cause Analysis methodology within 72 hours of a reported case.

4.33 Conclusion of work by contractors (December 2017)

4.33.1 By December 2017, the works ongoing by contractors in the hospital since handover were said to be completed.

4.34 Retrospective view of GNB infections in Ward 2A (? 2017)

4.34.1 During 2017, there were a total of 51 episodes of infection amongst the haemato-oncology patients in Ward 2A considered by the CNR. This included: 6 instances of Stenotrophomonas (including the 2 instances identified above); 10 instances of Klebsiella (including the 9 cases identified above); and 8 instances of Enterobacter. It also included 6 instances of Acinetobacter; 3 instances of Pseudomonas, and 1 case of Serratia marcescens. Infections caused by these latter three bacilli were identified in patients in other areas of the RHC/QEUH during 2017, in respect of which PAG/IMTs took place.

4.34.2 The infections also included the case of Cupriavidus in September 2017, an unusual organism which had previously been identified in a water sample from a sink in an aseptic pharmacy in January 2016, and which prompted widespread testing of the water system when it was found again in a patient in January 2018.

4.34.3 A total of 27 different species of organism caused bacteraemias in 2017, more than in any other year between 2015 and 2019.

4.34.4 With the following exceptions, none of these infections appear to have been investigated at the time. They were retrospectively identified as having occurred by the CNR.

4.34.5 The exceptions are a PAG which took place following the identification of 2 cases of Elizabethkingia in February 2017; a PAG which took place in September 2017 following the identification of 2 cases of Stenotrophomonas (and the death of one of those patients); and a PAG which took place in March 2017 to consider the increase in unusual Gram-negative bacteraemias in the Schiehallion Unit between mid-2017 and February 2017. No further action appears to have been taken to investigate the infections or to consider an environmental link.

4.34.6 The IR described the infections occurring during 2017 as "*an emerging picture of very unusual organisms causing blood stream infections"*.

4.35 Water sampling results consistently negative (2017)

4.35.1 Between 7 March 2017 and 17 November 2017, 151 water samples were collected. All tested negative for Elizabethkingia; coliforms; Pseudomonas spp; Legionella, and Stenotrophomonas maltophilia within the water system.

5. EPISODES OF CONCERN THAT TOOK PLACE OR COMMENCED IN 2018

5.1 HPS Report on ventilation in Ward 2B (January 2018)

5.1.1 In January 2018, HPS issued a report entitled "*Ward 2B NHS GG&C SBAR Final HPS/HFS January 2018*". The report advised GGC on the appropriate design to provide protective isolation to hematopoietic stem cell transplantation (HSCT) patients, namely HEPA filtered, positively

pressured patient rooms with a pressure cascade system, designed to comply with SHTM 03-01 Ventilation for healthcare premises Part A- Design and validation (2009). The use of PPVL rooms for immunocompromised patients was considered unsuitable by HPS/HFS.

5.2 DMA Canyon Report 2017 finalised (31 Jan 2018)

5.2.1 By 31 January 2018, a report by DMA Canyon for 2017 is said to have been completed and finalised. In response to the report, F&E is said to have formulated a work plan to action the recommendations.

5.3 Pseudomonas aeruginosa (PsA) in PICU (January 2018)

5.3.1 In January 2018, 2 cases of PsA were identified in PICU. Those cases were said to be linked in place and time to another two cases on the unit (long-term colonisation). The cases were at opposite ends of the ward, and typing was said to have confirmed different strains so there was no evidence of cross-transmission.

5.3.2 In response, water and environmental sampling was undertaken. The results are said to have been negative. A review of the cleaning practice of sinks and drains was undertaken.

5.4 Klebsiella in Ward 2A (January- May 2018)

5.4.1 Between January and May 2018, there were 5 patients identified with a blood stream infection caused by Klebsiella in Ward 2A. These infections were not investigated at the time.

5.5 Step 2 whistle blowing procedures activated (February 2018)

5.5.1 In February 2018, two consultant MBs raised Step 2 whistle blowing procedures due to their concerns that the issues raised in September 2017 were not being addressed. Around this time, GGC was looking to recruit

external advice in relation to its ventilation systems. The MBs who instigated the whistle blow were, in May 2018, advised by the clinician appointed to investigate it that there was no increase in levels of infection rates.

5.6 Various Gram-Negative Bacteria in Ward 2A (26 January-1 March 2018)

5.6.1 At the end of January 2018, a patient on Ward 2A contracted a blood stream infection caused by Cupriavidus (CU) bacteria.

5.6.2 Throughout February and March 2018, further bacteraemias occurred in Ward 2A. By 1 March 2018, in addition to the CU case, one case of Pseudomonas (Ps) and 2 cases of Stenotrophomonas maltophilia (STM) had been isolated. By March 2018, a further 4 cases of STM had occurred, in patients in various locations of the hospital: 1 patient in Ward 2A; 1 patient in PICU; 1 patient in Ward 2B for line care, and 1 patient in Ward 3C (renal ward).

5.6.3 In addition to the bacteraemias, in March 2018, two patients in Ward 2A had pyrexia (high temperature) as a result of possible fungal growth. Further potential cases were identified in Ward 3C, and IPCT commenced an investigation.

5.7 Water testing results confirm contamination (March 2018)

5.7.1 As a result of the identification of CU, an unusual bacterium which had previously been identified in the water supply on two previous occasions, an investigation into a possible environmental source was commenced. The investigation involved water sampling in the aseptic pharmacy (the site of the previous CU case in January 2016). The results of that are said to have been negative.

5.7.2 Water sampling was carried out in other locations in Wards 2A, 2B and 4A. The main water supply was tested, as well as various outlets: taps (including, in particular, flow straighteners) and shower heads.

5.7.3 The main water supply tested negative for isolates. However, there were positive tests for various GNB (different strains) and fungal growth in various locations in the QEUH/RHC, including Ward 2A, 2B and 4B. The MBs prepared a report setting out the investigation findings.

5.8 Water Incident Management Team (IMT) commences (March 2018)

5.8.1 IMTs in relation to the 'water incident' were held between 2 – 27 March.

5.8.2 The hypothesis was that the outlets were the source of infection, particularly when flow straighteners had been linked to other outbreaks as they are prone to biofilm growth.

5.8.3 The IMT minute of 6 March 2018 records that concerns raised by the clinical team about risks from the environment in Ward 2A were communicated 'higher up' and externally to HPS over two years previously. Members of the IMT were dissatisfied with the response by senior management and 'outside of GGC'.

5.8.4 The IMT minute of 23 March records the possibility of contamination of the water system points at the time of commissioning of the hospital.

5.9 GGC request support from HPS (March 2018)

5.9.1 Following the discovery of microbiological contamination of water outlets, GGC requested support from HPS and HFS on 16 March 2018. Included within the papers provided to HFS was a copy of the DMA Canyon 2015 report. The recommendations of the 2015 DMA report were similar to those in the 2017 DMA report, and were included in the work plan created by F&E to action the latter.

5.9.2 In addition to seeking support from HPS/HFS, GGC also engaged the support of the Scottish Government, Public Health England and water experts.

5.10 National Framework: stage 3 (26 March 2018)

5.10.1 On 26 March 2018, the Scottish Ministers invoked the National Support Framework, which offers additional support to Health Boards in responding to HAI incidents/outbreaks and to ensure assistance from HPS. Stage 3 of the framework required HPS to lead an investigation of the infections at the hospital and to provide support.

Commented [CM6]: Info verified from HPS report Summary of Incident and Findings of the NHS Greater Glasgow and Clyde: Queen Elizabeth University Hospital/Royal Hospital for Children water contamination incident and recommendations for NHSScotland

5.11 Remedial steps taken vis water supply (March 2018)

5.11.1 As a consequence of the discovery of microbiological contamination in the water outlets, a number of remedial steps were taken by GGC in March 2018:

5.11.2 Water dosing was performed, but was successful only in reducing (as opposed to removing) the organism counts, so taps were replaced and sanitised;

5.11.3 Point of use filters (POUFs) were fitted to taps in areas with high-risk patients (not throughout the entire hospital), with the filters to be changed every 25 days and taps to be tested weekly;

5.11.4 Sinks in the Prep and Treatment rooms are said to have been removed;

5.11.5 Patient contact with the water supply was limited, through the provision of mobile wash hand basins and bottled/sterile water for washing and drinking;

5.11.6 CU and STM were added to the IPCT alert organism software system;

5.11.7 Patients were to be prescribed Ciprofloxacin prophylaxis and additional line protection measures were introduced;

5.11.8 An increased hand hygiene and cleaning regime was implemented, and

5.11.9 A Technical Water Group (TWG) was created to consider and come up with both short and long term solutions to the problem.

5.12 IMT closed (27 March~~?~~ 2018)

5.12.1 The IMT was closed at the end of March 2018. On 13 April 2018, a full IMT report was produced detailing the incident and the actions which were taken as a consequence of it. The final case count was 1 instance of CU; 1 instance of Ps, and 5 cases of STM. A debrief meeting in relation to the IMT took place on 15 May 2018.

5.12.2 This initial cohort of infections formed the basis for the investigation by HPS, which resulted in their initial report in May 2018.

5.13 Technical Water Group (April 2018)

5.13.1 A Technical Water Group (TWG) was established in April 2018. The first meeting of the TWG took place on 6 April 2018, and meetings continued throughout April 2018.

5.13.2 The TWG directed a programme of water sampling to investigate the extent of the water contamination. Discussions were held with the tap manufacturer (Horne) who advised that issues with Pseudomonas in flow straighteners were known, but not other organisms, and that the flow straighteners would require to be decontaminated and replaced as required.

Commented [CM7]: https://www.gov.scot/binaries/content/documents/govscot/publications/corporate-report/2021/03/queen-elizabeth-university-hospital-nhs-greater-glasgow-clyde-oversight-board-final-report/documents/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019/govscot%3Adocument/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019.pdf

Commented [CM8]: HAI - Outbreak - Aspergillus - Royal Hospital for Children - NHS Greater Glasgow and Clyde - Submission to CabSec - 5 August 2016

Commented [CM9]: https://www.gov.scot/binaries/content/documents/govscot/publications/corporate-report/2021/03/queen-elizabeth-university-hospital-nhs-greater-glasgow-clyde-oversight-board-final-report/documents/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019/govscot%3Adocument/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019.pdf

5.13.3 External advice was sought from a water expert, Susanne Lee, and a further expert, Tom Makin.

5.13.4 The TWG considered reviewing information on water temperature to identify trends, but were advised that the majority of water temperature data had been lost due to a system failure. The existing records were not extensive.

5.14 Susanne Lee's Report on water supply 25 April 2018

5.14.1 GGC commissioned advice and received reporting from Dr Susanne Lee, a consultant clinical scientist. She considered issues in relation to the water system. She is understood to have concluded that it is likely that the system was contaminated before handover and that fluctuations in the water temperature experienced since opening of the hospital were also a likely contributing factor; and that fungus in the water system was likely due to the dust levels around the site during construction and demolitions.

5.14.2 Dr Lee considered the question of whether evidence that environmental strains did not match patient isolates permitted a conclusion that water could be ruled out as a potential source of infection. She said, "It is likely that water was the source and cannot be ruled out because the [isolates] do not match."

5.15 Further testing of water system (April 2018)

5.15.1 Following POUF being fitted in areas with high-risk patients, further testing of the water system uncovered a more systemic problem: widespread contamination of the water system across the hospital.

5.15.2 In order to understand where the bacteria were located within the water supply, samples were taken from all parts of the water system. Results showed that all floors had some contamination, indicating that the problem was widespread.

5.15.3 Positive results were also returned from water coolers (maintained by a third party), which were disinfected.

5.16 TWG considers longer term solutions for de-contamination (April 2018)

5.16.1 The TWG discussed the formation of biofilm and how long it takes to develop: opinions varied from a short period to up to a year.

5.16.2 The TWG discussed long term solutions to de-contaminate the water system. Options included: shock dosing; thermal cleaning and chemical cleaning (including Chlorine Dioxide (CD)). Whichever option was selected would require a full risk assessment and consideration of what would cause minimum disruption to patients.

5.16.3 The TWG were agreed that POUF would only be fitted to high-risk areas rather than the whole campus.

5.17 Acinetobacter baumanii (AB) in PICU (April/May 2018)

5.17.1 In April 2018, three patients were identified as being colonised with AB in PICU. In May 2018, a further two colonised patients were identified. PAG/IMT meetings took place in relation to the incident between 11 May and 6 June 2018. The IMT retrospectively identified a further case colonised in February 2018, bringing the total to 6 cases. The earlier patient remained in the unit.

5.17.2 Two of the patients were in adjacent bed spaces, and a domestic audit identified cleaning concerns. All isolates were sent for typing. IPCT raised concerns over ‘TBP’ adherence, and a review of TBPs in the unit was undertaken. IPCT continued to monitor for new cases.

5.17.3 The hypothesis appears to have been that these infections were due to direct contact between patients.

Commented [CM10]: Minor point but cross transmission can occur without direct contact (e g transmission by fomite)

5.18 TWG: map the extent of the contamination (May 2018)

5.18.1 By 16 May 2018, the TWG had instructed over 2000 water samples to be taken and mapped to floor plans of the hospital and within schematic diagrams. The conclusion was that there was a biofilm build up in the water system which required to be eradicated and which would require preventative measures to be put in place to prevent re-occurrence.

5.18.2 By May 2018, the BICC, AICC and CCGC were all aware that the problem with water contamination was extensive and involved both RHC and QEUH.

5.19 TWG: Tom Makin advice (?date)

5.19.1 Dr Tom Makin, Senior Consultant with Legionella Control International, provided advice to the TWG, at a meeting on [ ]. The advice was that Chlorine Dioxide (CD) was the best option to strip biofilm from the water system.

5.20 Intertek report (? 2018 date unknown)

5.20.1 GGC commissioned a report from Intertek. They undertook examination of flow straighteners within the hospital and tested for various microbiological pathogens.

5.21 TWG: formulate a plan for decontamination of water supply (May 2018)

5.21.1 The TWG continued to meet during May 2018. Relying on the advice of Tom Makin, the group had determined by May 2018 that chemical cleaning with Chlorine Dioxide (CD) was the best choice to strip the biofilm

from the water system. The plan was to start with continual dosing of the water supply, followed by a shock dose and then to revert back to continual dosing.

5.21.2 Flow straighteners on taps were to be replaced on a 3 monthly basis and taps were to be steam cleaned and put back with POUFs in place. Until taps were replaced, caution was required to ensure that the taps did not "re-seed" the system. Only taps in Wards 2A and 4B were to be replaced- the rest of the QEUH/RHC was to be monitored.

5.22 HPS Initial Summary Report (31 May 2018)

5.22.1 On 31 May 2018, Annette Rankin, Nurse Consultant Infection Control at HPS produced an initial report on the 'water contamination incident' at the QEUH/RHC (the HPS Initial Report).

5.22.2 The report identified 3 organisms of concern (CU; Ps and STM), which caused infections in a cohort of 7 patients between January and March 2018. The report records that the clinical aspect of the incident was closed, given that no new cases had been identified since 3 April 2018.

5.22.3 The report records that HPS, HFS and GGC had initiated a detailed investigation into the contaminated water system within the hospitals, and that the results from ongoing water testing appeared to confirm that '*regressional seeding of contamination*' continued to occur and supported '*the theory that a whole system remedial approach is required*.' Water sampling had revealed not only the 3 organisms associated with the incident, but '*numerous additional gram-negative bacilli and fungal species*.'

5.23 Various gram-negative bacteria (GNB) in Ward 2A (May-June 2018)

5.23.1 Between 28 April and June 2018, there were a total of 17 cases of patient infection with GNB bacteria in Ward 2A, with some patients displaying

multiple organisms. A total of 23 organisms were isolated in patients' samples:

5.23.2 A single case of Pantoea (Pan) was identified in May 2018;

5.23.3 Two cases of Acinetobacter baumanii (AB) were identified in June 2018;

5.23.4 A single case of Cupriavidus (CU) was identified in June 2018;

5.23.5 Nine cases of Stenotrophomonas maltophilia (STM) were identified in May/June 2018;

5.23.6 Six cases of Enterobacter cloaecae (EC) were identified in June 2018 (including one patient that was infected twice and 2 isolates in separate patients on the same day), and

5.23.7 Four cases of Pseudomonas (Ps) were identified in June 2018.

5.24 'Water Incident' PAG/IMT re-commences (18 May- 21 June)

5.24.1 Following an initial PAG on 18 May, IMTs were held between 29 May and 21 June in relation to the ongoing water incident.

5.25 IMT: investigations and water testing results (May/June 2018)

5.25.1 The IMT carried out a number of investigations and testing.

5.25.2 Drain swabs revealed a variety of GNB of different strains, including all of the GNB organisms contracted by patients (the 23 cases listed above), as well as Sphingomonas, Klebsiella oxytoca, and Elizabethakinga.

5.25.3 Visual inspection revealed black grime in the drains of the hospital (both QEUH and RHC). Dissection of a sink waste pipe showed exposed metal parts with biofilm present.

5.25.4 A review of the cleaning regime in Ward 2A was undertaken and additional resource was allocated following certain issues being identified.

5.25.5 Ongoing analysis was being carried out by HPS to assess whether the number and level of infections was unusual. GGC continued to consult HPS and other water experts during this time. Two water experts (Susanne Lees and Tom Makin) had visited the site to advise on long term solutions to the 'water incident', including the use of Chlorine Dioxide (CD) to dose and decontaminate the water system.

5.26 IMT hypothesis: drains thought to be the cause (June 2018)

5.26.1 In June 2018, the hypothesis of the IMT was that the drains were the source of patient infection. The water supply was believed to be 'clean'. Biofilm may have formed in the drains, resulting in 'aerolisation' of the biofilm (and contamination of the sink area) when the taps were turned on.

5.26.2 The IMT hypothesis is difficult to reconcile with the conclusions of TWG, who had determined that there was widespread contamination of the water system on the basis of the 2000 samples which had been taken and mapped.

5.27 IMT: Remedial steps taken (May/June 2018)

5.27.1 The number of visitors to the ward was restricted, and parent information was provided to prevent the build-up of clutter in patient rooms.

5.27.2 The following remedial steps were taken to address the perceived problem with the drains: drains were cleaned and then decontaminated with Hydrogen Peroxide Vapour in Wards 2A, 2B, 7A, 7D, PICU and elsewhere on site; waste pipes and sink drains were replaced, and enhanced hand hygiene measures, involving the use of alcohol gel after washing, was introduced.

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5.28 IMT 15 June 2018: cases of Mycobacterium chelonae

5.28.1 At an IMT to discuss the water system incident, a clinician raised a concern about a mycobacteria infection. This was a very unusual infection. Although it had been queried as an environmental case and reported to HPS and SGHD no water testing was reported as having been done. It was also reported that a patient from the Beatson had the same sort of infection. That patient had not been an inpatient at RHC or QEUH but they had attended the latter for clinics.

5.29 Patient treatment impacted

5.29.1 During the decontamination of the drains, patient chemotherapy and BMTs were delayed/stopped altogether. Admissions to the ward were restricted. Patients were prescribed prophylactic Ciproflaxacin.

5.30 Concerns by clinicians

5.30.1 During May and June 2018, ongoing meetings took place with clinicians who expressed their concern that the IMT was not in control of the environment as there had been ongoing issues since the ward opened.

5.31 TWG: remedial work carried out to water system (June/July 2018)

5.31.1 The TWG identified a replacement tap (Marwick with Bio Guard) for high-risk areas, which required the flow straightener to be replaced every 3 months.

5.31.2 Raw and bulk water tanks and one section of the filtration plant were sanitised in June 2018, with the rest to be completed in July. Debris found in a tank, which looked like sponges, was sent for analysis.

5.31.3 The cleaning of drains and replacement of flow straighteners in high-risk areas was ongoing. Water coolers had been removed from Wards 2A and 2B.

5.31.4 HFS had been informed of the debris found in drains, which was a potential 'national issue'. Whilst cleaning of drains was against national policy, it was agreed that this should continue in high-risk areas.

5.32 TWG: water sampling results (July 2018)

5.32.1 Flow regulators that were sampled were said to show counts [of isolates?] but no biofilm.

5.33 Implementation of DMA Canyon report recommendations (July 2018)

5.33.1 A work plan to address the recommendations of the 2 DMA Canyon reports (2015 and 2017) was understood to have been completed in July 2018. The actions were allocated to members of the F&E team and work was understood to have commenced in July 2018.

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5.33.2 All actions to address the recommendations of the DMA Canyon reports were reported to the OB as having been completed by December 2018.

5.33.3 Members of the F&E team were said to have received formal training as an Authorised Person for water in May/June 2018. Prior to that point, the individuals did not hold that certification.

5.34 Water system: placed on IPC 'risk register' ('summer' 2018)

5.34.1 At some point during the summer of 2018 (date unknown), the water system was placed on the IPC risk register.

5.35 Klebsiella in Acute Spinal Injuries Unit (July 2018)

5.35.1 During June/July 2018, 3 cases of Carbapenemase-producing enterobacteria (CPE) Klebsiella occurred in patients in the spinal injuries' unit of the QEUH. The infections were reported to HPS.

5.36 Enterobacter cloacea in Ward 2A (July- August 2018)

5.36.1 During July and August 2018, a further two instances of patient infection with Enterobacter cloacae occurred. No investigation appears to have taken place in relation to these infections, which were retrospectively identified by the CNR.

5.37 TWG: investigations and plan for decontamination develops (August 2018)

5.37.1 The TWG continued to consider the options to treat the contaminated water system. Shock dosing of the system would be difficult to deliver given the extent of disruption to the hospital, so the plan was to be for continual dosing, with increasing amounts of CD being injected into the system and the results monitored over a 3-month period. If the results were not within limits, a risk assessment would be required.

5.37.2 Testing of flow straighteners showed that biofilm had built up after a month.

5.37.3 Water testing of the tank room showed that water was mostly negative post-filtration, but the raw water tanks had positive results from drain connections which were not capped or sanitised. Bulk storage tanks also had positive results- which were attributed to environmental conditions- namely the presence of cockroaches, fungal odour, room not ventilated, water ingress and dried algae present on the floor**.** The area was to be disinfected, repainted with anti-fungal paint, repairs made and pest control called in, with testing to be done once work had been completed.

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5.38 HFS/HPS Draft report (August 2018)

5.38.1 In August 2018, HFS/HPS produced a draft report on their findings of the investigation into the contaminated water system, entitled “Technical Review Water Management Issues NHS GGC QEUH and RHC”. The report was produced by Mr Storrar of HFS and Ms Rankin of HPS.

5.38.2 The main focus of the report was on the technical aspects of the water systems within QEUH, and explaining and exploring possible mechanisms of contamination of the system. The report concluded that contamination of the water system in the hospital had occurred, either (i) during the construction phase and through lack of adequate maintenance, leading to build up of biofilm and consequently the proliferation of GNB, or (ii) that biofilm had built up in the tap flow straighteners and regressed back into the water system. HFS recommended that GGC implement the recommendations set out in the DMA reports.

5.38.3 At some point the focus by HPS (as seen in the initial report produced in May 2018) upon CU, STM and Ps had been broadened to include “*all gram-negative bacteria which had been identified within the water/drains*”.

5.38.4 According to the August 2018 report, between 29.1.18 and 31.5.18, 17 patient infection cases had been identified in Wards 2A/2B. Little specification of these is provided. It is difficult to reconcile the infection numbers reported by GGC with the HPS report. The report records that there had been no new reported cases since 31.5.18. It may be that HPS were unaware of the infections which occurred in June 2018 (i.e., after 31 May 2018).

5.38.5 HPS reported that “exact link” between “patient cases and the water system” was said not to have been made. It is unclear what the authors intended to suggest here, and the report proceeds to hypothesise a link between “environmental and person contamination” and *Enterobacter* within the drains.

5.38.6 There was widespread contamination of the hot and cold water systems within QEUH, the hypothesis being that this had occurred at one or more times during installation. Although, ventilation systems were considered during a literature review, the report identifies no investigation of, or consideration being given to, the QEUH ventilation systems at this point.

5.39 Ongoing problems with contaminated drains in Ward 2A (August 2018)

5.39.1 On 29 August 2018, thick black and yellow grime was visible in the drains of Ward 2A, following the cleaning regime which had been implemented only 4-6 weeks prior.

5.39.2 Swabs taken from the drains revealed: coliforms; Delta acidovarons; Chryseomonas indologenes; Cupriavidus, Pseudomonas aeruginosa and Klebsiella oxytoca.

5.40 Further Gram-Negative Bacteria (GNB) cases in Ward 2A (September 2018)

5.40.1 Between 5 August and 5 September 2018, a further 3 instances of patient infection with GNB occurred in Ward 2A. All three of those cases were caused by gram negative organisms which had been isolated from the drains. It appears that the three patient infections were caused by: Chryseomonas indologenes, Stenotrophomonas maltophilia, Klebsiella oxytoca, and Enterobacter cloacae.

5.40.2 Two out of three of the cases matched swabs taken from the drains.

5.40.3 During September 2018, a further four patients contracted GNB infection, including one case of Serratia marcescens (SM) and one case of

Stenotrophomonas maltophilia (STM) (the other two patients are described as having unspecified 'GNB' infection).

5.41 IMT re-commences (September 2018)

5.41.1 An IMT was convened on 5 September 2018.

5.41.2 Prior to September 2018, IPCT had initially been visiting Ward 2A daily, but those visits had reduced to twice weekly, following the implementation of environmental and equipment cleaning regimes. There were less people and clutter on the ward and both environmental and domestic audits had scored well.

5.41.3 In light of the drain swab testing results and patient infections, the IMT carried out further investigation of drains and trough sinks within the hospital. The investigations revealed that only some drains and trough sinks were affected. The issue was thought to be confined to the RHC only (and not the QEUH).

5.41.4 HPS had previously advised that drains should not be subject to regular cleaning, so cleaning had ceased. Further guidance was awaited from HPS.

5.41.5 The hypothesis was that there were more GNB cases than usual, that the TWG were doing a lot of work to investigate the source of the infections, but that despite that the IMT was no closer to identifying the source of the infections which were occurring. The feeling was that the wards ought to close.

5.41.6 At least at Board level, the assumption was that the cases in September 2018 were associated with the drains and not the water supply.

5.42 TWG: investigations and de-contamination plan progresses (September 2018)

5.42.1 Air sampling in the tank room found fungi. A leak was found in one tank and one manhole cover, which was repaired. HEPA filters had been installed.

5.42.2 A timeline was agreed for the CD system. Shock dosing of the water supply was ruled out after discussion with clinicians due to smell, effects on pipework and the need to decant the hospital. The TWG noted that it might take 3 years for CD to be effective, but as the pipework was new it would not provide any resistance to CD so the effect may be quicker. Taps may need to be removed and cleaned separately.

5.42.3 Discussion was held on the need for work in Ward 2A/2B with regard to pipework, drains and ventilation. The potential cause of the issues was discussed and whether they were being caused by water/drains/ventilation, a combination or simple hand washing. A decant of the ward would allow full investigation to take place. It was noted that only haemato-oncology (and not BMT) patients were affected even though biofilm was found in both areas.

5.43 Concern around levels of dust and ventilation (September 2018)

5.43.1 In addition to the very significant concerns around the water and drainage system, the IMT also had concerns about the general build-up of dust despite increased cleaning, particularly around vents and chilled beams. The fact that the rate of air change per hour (ACH) was only 3 in the RHC (as opposed to 6 in the QEUH) might explain the levels of dust present. Air sampling had been undertaken on chilled beams, the results of which were reported to be negative.

5.43.2 HPS was reviewing ‘ventilation’ in Wards 2A/2B.

5.44 Control measures to address concerns (September 2018)

5.44.1 The IMT recommended the reinstatement of weekly cleaning of sinks and shower drains. Patient pathways were recorded to/from theatres with a view to identifying sinks/drains in those areas for review. A drain survey and a ventilation survey were commissioned.

5.44.2 On 17 September 2018, an Executive Management meeting rejected the idea of decanting the patients from Ward 2A until the results of a drain survey were known. Clinicians were concerned about the decision, and a paper was sent to the Director for Women and Children requesting that the decant go ahead.

5.44.3 The drain survey did not reveal any issues with the drains.

5.45 Decision to close ward (18 September 2018)

5.45.1 Patient admissions to Ward 2A had continued throughout the water incident, but were restricted and judged on a case by case basis.

5.45.2 On 18 September 2018, the TWG made the decision to decant BMT patients in Ward 2A to Ward 4B in the QEUH.

5.46 Preparation of Ward 4B and 6A for decant (September 2018)

5.46.1 Ward 4B and 6A in the adult hospital were inspected by F&E and IPCT and made ready for patients.

5.46.2 Steps taken included: repairs being made; full deep cleans (including of the drains and vents) and POUF being fitted to taps and showers.

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5.47 Closure of wards 2A/B (26 Sept 2018)

5.47.1 On 26 September 2018, Wards 2A/2B were closed. BMT patients were transferred to Ward 4B in the QEUH (adult BMT unit). All other patients were moved to Ward 6A QEUH.

5.48 IMT continues (October 2018)

5.48.1 The IMT meetings continued during October 2018. The IMT continued to assess the environment.

5.48.2 Consideration was given to whether it was possible to create a 'waterless ITU' in the BMT setting, but this was not thought to be possible.

5.48.3 Consideration was given to changing the roles of the prep and treatment rooms.

5.49 TWG: ventilation survey (October 2018)

5.49.1 The TWG received a report on the survey of the drainage and ventilation system.

5.49.2 The ventilation system report showed that the system did not have as much capacity as initially thought. The report highlighted problems with pressure and air changes. Air changes were recorded during commissioning but not air pressure. A derogation was made from 6 to 3 ACH, and this was applied everywhere apart from BMT areas. The Project Board did not pick this up. The ward was currently at negative pressure to the rest of the hospital, which was not suitable for immunocompromised patients.

5.49.3 In addition, dirty and clean extractor fans were connected, which means that dirty air could be re-circulated, potentially 'causing the problem with bacteria'.

5.49.4 Extensive work would be required to address these deficiencies. A specialist ventilation expert was to be engaged to complete a design feasibility study, which would delay the move back to Wards 2A/B.

5.50 TWG: communication with IMT (October 2018)

5.50.1 The TWG provided the IMT with an outline scope of the work to be undertaken in Wards 2A/2B to address the contamination of the water system. The water supply was to be dosed with Chlorine Dioxide CD), taps and wash hand basins were to be changed, and elements of plumbing were to be replaced.

5.51 Internal changes: procedure and personnel (October 2018)

5.51.1 On 1 October 2018, a new director of F&E took up post.

5.51.2 As a result of the 'water incident', the Compliance team began to review and develop the Standard Operating Procedures (SOPs) for sector estates offices to ensure consistence and appropriate quality of work is performed. This coincided with a review of the Water Policy. This work continued throughout 2019.

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5.51.3 A new SOP was issued by GGC entitled "*Environmental Organisms in High-Risk Areas*". The SOP refers to Appendix 13 of NIPCM and appears to replace a SOP which was circulated but then withdrawn in August/September 2017.

5.51.4 A register of assets was received from the main contractor in late 2018, some 3 years after maintenance schedules were requested. The F&E constructed more appropriate maintenance schedules for all hospital systems in the following 2-3 months.

5.52 Pseudomonas aeruginosa (PsA) in Theatre 6, RHC (October/November 2018)

5.52.1 On 25 October 2018, a PAG was held, followed by an IMT being set up on 2 November 2018, to investigate 5 cases of PsA isolated from patients who had all had appendectomies in the same theatre during October 2018.

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5.52.2 Sampling of drains identified PsA growth in the anaesthetic trough in the theatre.

5.52.3 All drains throughout theatre were cleaned. An excessive amount of debris, including nail picks, was found in u-bend traps of the drains.

5.52.4 The IMT was closed on 14 November in the absence of any further cases.

5.52.5 At a later date (January 2019), GGC were proceeding on the basis that there was no evidence of a link between the anaesthetic trough and the patient infections, with the cases instead being attributed to a 'normal background level of PsA'.

5.53 'Water incident' IMTs ongoing (November 2018)

5.53.1 The IMT meetings continued throughout November 2018. Following the decant of patients to Wards 6A/4B, there had been a marked reduction in bacteraemia.

5.53.2 Work was underway in Wards 2A/2B. The design of the ventilation system for all patient rooms (except BMT rooms) stipulated that the rooms were to be neutral/slightly negative pressure. Ventilation in all rooms (other than BMT rooms) ought to be positive pressure. An option appraisal was requested from a specialist ventilation engineer on what is required 'to rectify and bring the system up to standard'.

5.53.3 The IMT was closed on 30 November 2019.

5.54 Refurbishment of Ward 2A (November/December 2018)

5.54.1 On 10 December 2018, the minutes of the ACGF meeting record that the investigation into the 'water issues' in Ward 2A "*uncovered a ventilation issue which may require significant infrastructure work and prolong the current decant arrangements*". It is assumed that this is a reference to the fact that patient rooms were neutral/slightly negative pressure, as opposed to the standard of positive pressure, described in the IMT minutes from November 2018.

5.54.2 By 11 December 2018, the installation of the Chlorine Dioxide (CD) dosing plant was complete, with a further 12 localised dosing sites to be installed. Ongoing reviews of the efficacy of the dosing were to be undertaken. HPS/HFS 'and external advisors continue to investigate' the 'cause' of the issues with the water supply.

5.54.3 Further remedial work being undertaken in Wards 2A/2B included: replacement of basins, taps, and drainage outlets, as well as additional work to replace the flooring, décor, entry systems, lighting and ventilation. Work was required to replace one of the air handling units, which would mean that the ward would be out of use for 'some months'.

5.55 Chlorine Dioxide (CD) dosing of water supply in RHC/QEUH (November/December 2018)

5.55.1 On 22 November 2018, continuous dosing of the water supply to the RHC with Chlorine Dioxide (CD) began. CD dosing continues to the present day.

5.55.2 In December 2018, continuous dosing of the water supply to the QEUH with chlorine dioxide (CD) began. CD dosing continues to the present day.

5.56 TWG: water samples in Ward 2A following initial dosing with CD (December 2018)

5.56.1 The first set of water samples were returned with good results: no legionella was returned, and all results were within parameters. Samples had been taken from the tank room, sentinel points at the start and end of the ward, and shower points. The TWG considered that this indicated that it has been the taps that held the biofilm.

5.56.2 Water samples later in the month indicated fungi, although not in Ward 2A/2B, which appeared to have increased from the first samples, but fungi can be difficult to overcome, and CD would take longer to take effect.

5.57 Completion of DMA Canyon recommendations (December 2018)

5.57.1 By 16 December 2018, the actions to implement the recommendations of the 2015 and 2017 DMA Canyon reports were said to have been completed.

5.58 HPS 'summary report' (December 2018)

5.58.1 On 20 December 2018, HPS produced a report entitled "*Summary of Incident and Findings of NHS Greater Glasgow and Clyde Queen Elizabeth University Hospital/Royal Hospital for Children water contamination incident and recommendations for NHSScotland*" (HPS Summary report). The report is a summary of the investigations carried out by HPS during the period between 29 January 2018 and 26 September 2018.

5.58.2 The report is largely a summary of the HPS element of the Draft report which was produced by HPS and HFS in August 2018. The HPS Summary report was produced in light of concerns expressed by GGC about the length of the former report.

5.58.3 The report's recommendations refer to those made in the August 2018

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HFS/HPS report: namely to implement the recommendations of the 2015 and 2017 DMA Canyon reports.

5.58.4 The HPS Summary Report advised that by this stage (26 September 2018) GGC had reported to it 23 cases of BSI relative to 11 different organisms potentially linked to water contamination covering the period 29 January 2018 to 26 September 2018. Appendix 1 of the Summary report includes a timeline of cases. It is difficult to reconcile this timeline with the cases which are reported by GGC. The timeline does not appear to include the patient infection with CU bacteraemia, as well as patient infections with STM and Ps in June and September 2018.

5.58.5 The report stated that testing had confirmed widespread contamination of the water system. The report described the 23 cases as "*probable linked cases of bloodstream infections associated with wards 2A/2B RHC*". Under reference to infections detected/reported in/up to April 2018, HPS said that "*all cases [were] considered to be linked to the water system*". Between April and June 10 cases (5 Enterobacter, 3 mixed GN, 2 STM) had been reported. These organisms were also said to be present in drain samples within 2A/B. In addition to the organisms linked to water and to infections, there was "*evidence of fungal growth in the water system*".

5.58.6 Impacts from infections linked to the environment could be stated: "*This incident has resulted in a number of children requiring additional intervention and some delays in chemotherapy treatment, however, there was no associated mortality*."

5.58.7 No cases of infection had been reported since the decant of children to 6A on 26.9.18.

5.58.8 The HPS Summary Report was published in February 2019.

5.59 Retrospective view of GNB infections in Ward 2A/6A (2018)

5.59.1 During 2018, a total of 48 episodes of blood stream infection caused by bacteria associated with the environment (either GNB or M. chelonea)

occurred in haemato-oncology patients in Ward 2A and latterly 6A. This total number of infections was retrospectively arrived at by the CNR following a review of patient blood results and other data. Some but not all of these infections were identified and investigated at the time at which they occurred.

5.59.2 The infections included: 10 episodes of infection caused by Enterobacter; 7 caused by Klebsiella; 6 caused by Pseudomonas, and 12 caused by Stenotrophomonas.

5.59.3 The episodes of infection also included 2 cases of Mycobacterium chelonae (MC). It is unclear what if any investigation of these was made at the time (although 1 case was said to have been retrospectively identified in June 2019 when a further case of MC occurred which was said to have prompted further comprehensive water sampling as a result of the rare nature of the organism.)

5.60 'Hospital microbiology and pharmacy report' (? 2018)

5.60.1 A report from a 'hospital microbiology and pharmacy group' [date and title unknown] analysed the rate of paediatric bacteraemia between June 2014 and 2018. The report observed that whilst there was an initial decrease in bacteraemias occurring in paediatric haemato-oncology patients following the move to RHC in June 2015, that was followed by a rise in Gram-positive bacteraemia commonly associated with CVL infection, and then a 'steady rise' in Gram-negative bacteraemias. The microbes being identified were of many types, and often bacteraemia results showed multiple results in the same sample. The most likely explanation was that the pattern of infection could be linked to environmentally derived sources.

5.61 Descriptive analysis of five year trends in bacteraemia

5.61.1 On 1 October 2018, a consultant clinician within GGC produced a report that set out analysis of trends of bacteraemia rates for the patient cohort

within the RHC for certain Gram negative organisms. The report was based on descriptive epidemiological analysis. The period covered was five years, so that it compared trends before and after the move to RHC.

5.61.2 The report concluded that there had been a clear increase in selected GN infections in 2017 and 2018 compared to previous years, and that there was also an increase in 2016 with the magnitude less clear. The report stated: “The other obvious change over the time period is the increase in the number of blood cultures for multiple organisms. Again, consideration should be given to potential causes for this change.”

5.61.3 A further report was done by the same clinician in July 2019.

5.62 Innovated Design Solutions reporting: October/November 2018

5.62.1 GGC commissioned an investigation into aspects of the ventilation system within the hospital from Innovated Design Solutions.

5.63 Cryptococcus neoformans (CN) in Ward 6A (December 2018)

5.63.1 On 18 December 2018, a PAG took place following the identification of the second of two cases of Cryptococcus neoformans (CN) on 17 December 2018. An IMT was set up on 20 December 2018. The cases are described as ‘isolated’ and occurred in one paediatric patient and one adult patient. Each patient had a different ‘type’ of CN.

5.63.2 CN is a fungal infection. The fungi is found in soil and pigeon droppings. It is a rare organism.

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6. EPISODES OF CONCERN THAT TOOK PLACE OR COMMENCED IN 2019

6.1 CN identified in air samples in Ward 6A (January 2019)

6.1.1 On 16 January 2019, air sampling was said to have found Cryptococcus albidus (CA) in Ward 6A. No CN was said to have been identified in air samples. Out of 1,800 samples taken (over a period that is unclear), 10 were said to have identified CA and none to have identified CN.

6.1.2 Around this time there were various hypotheses around the source of the two cases of CN within the hospital. Contamination of the air from pigeon droppings was among these hypotheses. The potential source of the fungi was thought to be the plant room on the roof of the adult hospital, as pigeon droppings were found there. Pest control were called to remove the pigeon droppings~~[pigeons?]~~ and the area was said to have cleaned.

Commented [CM14]: NHS GGC - ou break - cryptococcus neoformans - QEUH and RHC Wards 2A/6A and 4C - incoming updated HIIORT - 3 January 2019

6.1.3 Air sampling results from the plant room was said not to support the hypothesis that the plant room was the source of infection. But there was concern about the validity of the sampling results. There was a suggestion that the air samples were taken after the pigeons had been removed and the plant room had been cleaned.

6.1.4 As a consequence of the infections and associated investigations, high risk patients were prescribed antifungal prophylaxis.

6.1.5 On 8 January 2019, a senior clinician raised a concern with senior management within GGC around the safety of ward 6A and the use of prophylaxis.

6.2 Mucor in adult hospital (January 2019)

6.2.1 In January 2019, a patient in the adult hospital died with a diagnosis of multi-system disorder. A rare Mucor organism was isolated from the patient during their final illness.

6.2.2 There is a suggestion that there were 2 cases of Mucor in patients between 21 January and 18 February 2019.

6.3 External expert advice on ventilation advice (? Early 2019)

6.3.1 GGC took advice from external consultants on the ventilation system around this time.

6.4 Queseda Solutions Ltd Report (?January 2019)

6.4.1 The F&E team commissioned an independent company, Queseda Solutions Ltd, to undertake Computational Fluid Dynamics (CFD) simulations to test the hypothesis that the ventilation system was contaminated by droppings from pigeons roosting below the hospital helipad on the South West tower being drawn into the ducts of the system.

6.4.2 The report determined that the air arriving at the four Air Handling Unit (AHU) air intake points on each of the four towers of the adult hospital, and those on the children's hospital, did not originate from the region beneath the helipad. It was therefore unlikely that debris or particles from the helipad area was being carried into the hospital ventilation system.

6.5 The Cryptococcus Incident Management Team Expert Advisory Sub- Group

6.5.1 The CN incident had first been reported to HPS on 20 December 2018. The incident had been declared over on 15 February 2019. The last IMT took place on that date. The IMT was stood down on 20 February 2019. Among the actions of the IMT was to commission a review by experts of all possible hypothesis regarding routes of transmission.

6.5.2 It is not known when the Sub-Group first or finally reported. A "draft final" report was produced on 5 April 2022.

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6.6 Establishment of Independent Review (January 2019)

6.6.1 Following the deaths of the three patients identified above (2 cryptococcus deaths and 1 Mucor death), the Independent Review was established.

6.7 Mould in shower rooms in Ward 6A (January 2019)

6.7.1 During the course of the investigation into the source of the CN, a further issue was identified relating to the sealant in some of the shower rooms in Ward 6A, which had developed a large volume of black mould. The cause of the mould was thought to be water hitting a defective join and causing water damage to the surrounding areas, which were supposed to be waterproof, but which were not.

6.7.2 In order to perform remedial work to those areas, some patients were moved to Ward 4B with other moved to the Clinical Decision Unit (CDU) in RHC.

6.8 Patients decanted from Ward 6A (22 January 2018)

6.8.1 Paediatric haemato-oncology patients were transferred out of Ward 6A due to concerns relating to Cryptococcus and the sealant used in the ensuite shower rooms. Patients were returned to Ward 6A on 11 February 2019.

6.9 Provision of HEPA filters in Ward 6A (January 2019)

6.9.1 Following the completion of the shower room repairs in Ward 6A, the air sampling results confirmed that the air quality was ‘optimal’. HEPA filters were placed in all rooms, corridors and treatment rooms in Ward 6A ‘as a precaution’.

6.10 Short Life Expert Advisory Group convened (January 2019)

6.10.1 A Short Life Expert Advisory Group was convened in January 2019 to investigate the source of the CN infections. The group consisted of representatives from GGC, HPS, HFS and 'UK experts on ventilation'.

6.11 'Ongoing work' to create isolation rooms which meet requisite standard [in Ward 6A?] (January 2019)

6.11.1 The IMT minutes for the CN incident refer to "*ongoing work to create more protection isolation rooms which are sealed, under positive pressure and with HEPA filtered air*".

6.12 DMA Risk Assessment Report 2018 (January 2019)

6.12.1 In January 2018, the 2018 DMA Risk Assessment Report was said to have been finalised, and a work plan was created to address the recommendations which it made.

6.13 TWG: testing results and ongoing refurbishment of Wards 2A/2B (January 2019)

6.13.1 Upgrading of the ventilation system in Ward 2A which was required to bring the ventilation up to standard for immunocompromised patients was estimated to take a further 12 months to complete.

6.13.2 Water testing results for Ward 2A/2B showed some out of spec, some very low-level counts (deemed acceptable), some fungal counts and 4 CU counts. Pre CD dosing counts had been much higher. One consultant room in Ward 2B and treatment rooms continued to show higher counts. The playroom wash hand basin and sink showed positive results on cold water. The TWG agreed to address the issues, retest and if there was still an issue to increase CD dosing level.

6.13.3 By late-January 2019, CD dosing was embedded in RHC and the cold-water system for the rest of the campus. It was to be introduced next to the hot water system in the QEUH.

6.13.4 Across the [whole?] campus, 240 water samples were taken with only 30 said to be showing issues. It was said that both hot and cold systems were being tested to indicate where the issues were and to allow those areas to be targeted.

6.14 TWG: water testing results and POUFs (February 2019)

6.14.1 In early February 2019, out of a total of 142 water tests, 12 were positive for fungal yeast. In late-February, 'good results' were seen, but there were 3 positive legionella samples which may have been attributable to biofilm being removed.

6.14.2 Water sampling results showed Ward 2A had CU in certain rooms. This ward had received the most exposure to CD but was the only one showing CU. CD dosage was to be increased for this area.

6.14.3 A TVC (total viable count) protocol document was agreed setting out when POUFs could be removed: after 4 weeks of consecutive clear tests, then moving to monthly and then quarterly for 3 continuous acceptable results to confirm control values are maintained long term. Monthly checks were to remain in high-risk areas for Legionella and Pseudomonas.

6.15 GNB in PICU (January/February 2019)

6.15.1 Between 5 January and 3 February 2019, a total of 5 cases of GNB were identified in patients in PICU: 2 Pseudomonas (Ps); 2 Acinetobactor baumanni (AB), and 1 Serratia marcescens (SM).

6.15.2 A PAG took place on 7 February 2019, which identified 'environmental issues'.

6.16 Klebsiella in Ward 6A (? 2019)

6.16.1 During 2019, there were 2 instances of patient infection with Klebsiella spp. The timing of the infections is unknown. Despite the fact that Klebsiella spp was added to the list of alert organisms in 2018, neither of these infections had a case created on ICNet, raising concern that the alert was not active.

6.17 Internal reviews and the External Independent Review (February/March 2019)

6.17.1 At the Board meeting on 19 February 2019, the CEO announced that 3 work streams were to be commissioned as a result of the 'recent issues' at the QEUH/RHC. The workstreams included a 'review of the Estates, Facilities and environmental issues at the QEUH and RHC'.

6.17.2 The Board was also advised that the Cabinet Secretary had announced an independent external review of the QEUH and RHC.

6.18 HPS/HFS Report (March 2019)

6.18.1 The HPS/HFS Report, entitled "*Technical Review Water Management Issues NHS GGC QEUH and RHC*" is finalised but it is unclear whether it was published. The March 2019 report appears to comprise the HFS contribution to the Draft report, which was produced in August 2018, i.e., the technical aspects of the contamination of the water systems within the QEUH.

6.18.2 The report does not say whether any further information regarding the incidence of infections had been provided to HPS/HFS. On the basis that the report is said to be based on information provided up to 25.7.18 by GGC it is assumed not.

6.18.3 The HFS report confirmed widespread problems with the water system, on the basis of extensive sampling of water and drains. The report considered that organisms within the water system were linked to bloodstream infections associated with ward 2A. Extensive sampling of the water system and sink drains disclosed the widespread presence of these organisms. It had taken a significant amount of time to establish the extent of the contamination because the GGC laboratory had been "*swamped with requests for rest results and the sheer volume of results and data was problematic to manage*".

6.18.4 Although this observation is more relative to other Inquiry papers, it should be noted that HFS concluded that contamination of the water system was thought to have occurred at one or more times during installation, and that best practice had not been followed in design, installation, handover, operation or maintenance of the water system. Indication – in the form of test results – of "system-wide contamination" had been present in 2015. The presence of flow regulators on the Horne taps had allowed certain bacteria to grow, particularly Cupriavidus and Pseudomonas. The contamination of the tap body and components was widespread; and biofilm may have caused retrograde contamination back into the water system.

6.18.5 The report concluded that by July 2018 sufficient remediation work had been done to describe the level of risk to patients as "reduced".

6.19 TWG: testing results and ongoing de-contamination of water supply (March 2019)

6.19.1 Water test results from March showed only one sample was positive for legionella from over 200 counts. Complaints had been received about the odour and taste of the water, which may be attributable to biofilm breakdown.

6.19.2 Water sampling showed 16 fungal results, but the TWG considered that CD dosing would eliminate this over time. High TVCs had been recorded in the ARU.

6.19.3 General results for RHC were good, apart from certain areas in Ward 2A: Hospital at Night (HaN) room tested positive for Enterobacter in cold water system and TCT rooms 3 and 6 routinely recorded fungal counts and Cupriavidus pauculis respectively. 2 water coolers, dead legs and a little used wash hand basin had been removed from the HaN room and automatic flushing of water outlets was installed.

6.20 Remedial work in Ward 2A (March 2019)

6.20.1 The taps and sinks in Ward 2A were changed.

6.20.2 The POUF on taps in Haematology were to be kept in place for the long term as fungi was identified there.

6.20.3 Discussions continued as to whether the taps should be removed ~~[~~and replaced~~?]~~ in other critical care areas.

Commented [CM15]: QEUH HPS Water Report 2018-19 - Summary of Incident and Findings of the NHS Greater Glasgow GGC

6.21 Enterobacter cloacae isolated in water samples (27 March 2019)

6.21.1 On 27 March 2019, Enterobacter spp was identified in a water sample from an anaesthetic kitchen and a basement water tank.

6.22 Completion of CD dosing on both sites (March 2019)

6.22.1 Installation of continuous (low level) chlorine dioxide (CD) water treatment system across both hospital sites in hot and cold-water systems was complete by March 2019. There had been no cases of bacteraemia associated with water since September 2018.

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6.23 Implementation of 2018 DMA report (April 2019)

6.23.1 In April 2019, the work plan to address the recommendations made in the 2018 DMA report was said to have been completed, and implementation by the F&E team began.

6.24 Cryptococcus: air sampling results (April 2019)

6.24.1 Over 800 air samples had been taken in relation to Cryptococcus neoformans, however, Cryptococcus was said not to have been identified in air sampling since the end of January 2019. Air sampling continued.

6.25 GNB in Ward 6A (April/May 2019)

6.25.1 During April and May 2019, there were 4 cases of GNB in Ward 6A: 2 cases of Stenotrophomonas maltophilia (STM); 1 case of Pantoea septica (PanS), and 1 case of Enterobacter cloacae (EC).

6.25.2 On 3 June 2019, a PAG took place to review the 4 infections. Water samples had been collected from Ward 6A, and the provisional results found no GNB, but full results were awaited (full results were ultimately reported to be negative).

6.25.3 Further investigations are said to have included the construction of patient timelines to identify areas of the hospital that patients had visited, and to test those locations and to visually inspect the drains for grime and test if grime present.

6.25.4 Ward 6A was determined to be safe for new admissions. Some high fungal counts had been recorded on the ward, but no water or moisture sources had been found to explain the high counts.

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6.26 Acinetobacter baumanii (AB) in PICU (April 2019)

6.26.1 On 16 April 2019, a PAG took place in relation to two instances of infection with Acinetobacter baumanni, identified in patients in PICU on 21 February and 9 March 2019. One patient had died, but AB was not listed on the death certificate. The PAG concluded that there was no link between the two cases. Surveillance monitoring by IPCT was ongoing.

6.27 Acenitobacter baumanni in Ward 4D and 4A (March-May 2019)

6.27.1 Between March and May 2019, a total of four patients in ward 4A and 4D QEUH tested positive for AB. The index case tested positive on admission to the Ward. The infections were reported to HPS. The hypothesis was that cross-transmission had occurred, due to a failure of SICP measures.

6.28 External advice on refurbishment of Ward 2A (May 2019)

6.28.1 On about 8 May 2019, GGC received advice regarding the ventilation system on Ward 2A. It said that the as-fitted system was in line with what might be seen in a modern general ward but that "it falls short of what would be considered appropriate for a modern facility designed to meet the needs of immune-compromised patients."

6.29 Further cases of environmental bacteria in Ward 6A (June 2019)

6.29.1 On 6 June 2019 a patient tested positive for Enterobacter cloaecae (EC), and a separate patient tested positive for Mycobacteria chelonae (MC) on the chest wall around the CVL site.

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6.29.2 MC is a very rare pathogen, with only 4 adult cases and no paediatric cases being reported by GGC in the ten years prior to 2019. There had been a case of MC during the 'water incident' in Ward 2A in May 2018. The patient that contracted MC had no contact with unfiltered water.

6.29.3 An IMT was set up to consider the six infections which had occurred since April 2019.

6.29.4 The investigation considered the areas of the hospital that the patient had visited outwith Ward 6A, as well as Ward 6A. Visual inspection of the drains and trough sinks in the theatre which the patient had visited were found to be clean, but there was visible grime in the hand wash basins in the anaesthetic room, and the clean and dirty prep rooms. The drains from the theatre grew unique strains of stenotrophomonas maltophilia ~~'steno' [STM?],~~ Enterobacter and other organisms. The drains in Ward 6A were dosed with Hysan disinfectant regularly and were found to have no grime.

Commented [CM17]: HCAI - Weekly Report - June 14 2019 and HCAI - Weekly Report - June 28 2019 - with QEUH IR launch update

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6.30 MC isolated in the water supply in Ward 6A (June 2019)

6.30.1 Water samples from theatres and Ward 6A were collected. The results revealed that, with POUF removed, the water was positive for MC in several areas, including three shower heads and Domestic Service Rooms (DSR).

6.30.2 Overall, there was a significant reduction in GNB noted in the water samples. With the filters removed, the samples showed fungal growth in the water. The theatre water samples were negative.

6.30.3 The hypothesis was that the patient that contracted MC had contact with unfiltered water. Certain areas within A&E, outpatients and theatres did not have POUF fitted to clinical hand wash basins.

6.31 Typing confirms MC isolate from patient line site and water supply match (June 2019)

6.31.1 In June 2019, typing of the isolates extracted from water samples and the patient colonised by Mycobacterium chelonae were confirmed to be a match. This appears to be the second instance of infection which GGC appear to accept can be definitively linked to the hospital environment.

6.32 TWG: investigation of MC source (June 2019)

6.32.1 In late-June 2019, the TWG were advised of the identification of STM and MC in water samples in Ward 6A. The TWG agreed that water samples from both filtered and non-filtered outlets, as well as areas of the hospital visited by the patients affected, ought to be taken and analysed. A small increase in the CD dosing was proposed. Whilst a large dose to be added to the bulk water storage tanks was possible, it would render the water undrinkable and may damage the pipework. That step was only to be taken if the water system was confirmed to be the source.

6.32.2 If the CD dosing was killing off bacteria in the water system, it may be breaking up the biofilm, and allowing more resistant bacteria (including M. chelonae) to grow. It could take 3 or 4 years for the water testing results to be clear.

6.33 Fungal growth in water tanks and sprinkler tap room (June 2019)

6.33.1 Fungi continued to be identified in water tanks, but there was a suspicion that cross-contamination may be occurring during the sampling process. The sprinkler tap room smelled musty, and air sampling results showed fungus. The area was to be cleaned and sanitised, and the water tanks repaired and sealed to the floor.

6.34 Corrosion of water system (June 2019)

6.34.1 A review of all water system apparatus demonstrated that items made of cast metal, or which had paint treatment, showed signs of corrosion and biofilm. The affected products required to be replaced. HFS were asked to provide advice.

6.34.2 DMA Canyon were later commissioned to carry out a survey of all cast iron and paint treated products in the water system.

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6.35 Mould in Ward 2A (June 2019)

6.35.1 High levels of mould and lead leachate had been found in integrated plumbing system (IPS) panels and water samples respectively in Ward 2A. This was thought to have been exacerbated by the automatic flushing of outlets, which was discontinued as a consequence.

6.36 Enterobacter spp isolated in patient rooms on Ward 6A (24 June 2019)

6.36.1 Enterobacter cloacae was isolated from toilets in 3 patient rooms in ward 6A on 24 June 2019.

6.36.2 The ward samples were obtained within 12 days of two patients with Enterobacter cloacae bacteraemia, although there was no co-location with the rooms in which these patients had been nursed.

6.37 Remedial steps vis a vis water supply (June 2019)

6.37.1 The dosage of Chlorine Dioxide (CD) in the water system was to be increased. POUFs were to be fitted in theatres, interventional radiography and OPDs. Water sampling in Ward 6A was to continue, with and without POUF fitted. Handwashing was to be followed by gel sanitisation. Drains in theatre were cleaned.

6.37.2 Replacement taps in high-risk areas had been identified and authorised, and the programme of replacement would take 12 months to complete.

6.38 Reflection on significance of rare organism (MC) (June 2019)

6.38.1 MC was added to the IPCT alert organism list.

6.38.2 Previous water sample results were to be checked for MC.

6.38.3 HPS were asked to research what other instances other health boards have of MC in order that GGC could compare its own figures.

6.39 Concern and investigation of leaking chilled beams (June 2019)

6.39.1 During the MC investigation, concerns were noted about mould which was evident on ceiling tiles in Ward 6A, following recent leaks from chilled beams in the ventilation system. Leaks were thought to have been caused by a boiler failure and leaking pipe with ingress to the ceiling void.

6.39.2 The chilled beams were to be sampled. F&E were to review all leaks within Ward 6A within the month prior to identify any commonality with patients.

6.40 HPS Report (June 2019)

6.40.1 HPS produced a report, entitled "*Situational Assessment Wards 2A/B RHC NHS GGC*", in June 2019. It is not clear from the terms of the report when it was commissioned or what the purpose of the report is. It appears that the report is based on data for a 5-year period between June 2013 and June 2018. The report records that 'observational assessment walk rounds' of Wards 2A/B took place on 18-22 June, 2 July and 8 August 2018, making the findings significantly out of date by the time the report was produced (June 2019).

6.40.2 The June 2019 report appears to have been based on two sources of data on infection. The first was the Healthcare Infection Incident Assessment Tool (HIIAT) reporting relative to wards 2A/B from GGC. Based – it would appear – on the HIIAT data set and the investigation around/prompted by that, HPS said the following: around May 2017, in response to noted increase in line infections, a CVL quality improvement group had been formed; a reduction in CLABSI figures had followed "outwith the BSIs identified as part of the water incident". This indicates that although issues about CVL care might have made a contribution to overall rates of

infection it did not provide a complete answer. The investigations of HPS and GGC had identified a higher-than-expected level of healthcare associated incidents linked to wards 2A/B.

6.40.3 The second data set on which HPS relied was extracted from the Electronic Communication of Surveillance in Scotland (ECOSS) system. Analysis of this data indicated that "*the overall incidence of Gram-negative, Gram-positive and environmental bacteria blood cultures increased in [what was described as] the 2A/2B Group after the move to RHC*".

6.40.4 Overall, the HPS report appears to support the link suggested in the other reporting of HFS/HPS between infections and the water system. The report says: "*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*."

6.40.5 Whereas earlier HPS/HFS reports focused on concerns to do with water systems, this report postulated a contribution from the ventilation system: "*It could be hypothesised that ventilation may have been a contributory factor in several incidents*". The report said that this could not be confirmed pending a "*full ventilation review*".

6.41 2 further GNBs in Ward 6A (July 2019)

6.41.1 By July 2019, two further instances of GNB infection (Pseudomonas putida (PsP)) had occurred in patients located in Ward 6A, taking the total of GNB patient infections to 8. Both were considered to be HAI.

6.41.2 An IMT meeting took place on 3 July 2019. The hypothesis was that it was unclear whether the GNB infections reflected the normal background rate or were related to the environment. For the MC cases, the hypothesis

was that patients/staff had access to unfiltered water in another area of the hospital.

6.42 Control measures in light of further instances of GNB infection (July 2019)

6.42.1 Water sampling in Ward 6A continued, and a sink with a filter in the 'arjo bathroom' was found to be positive for MC. This sample was subsequently found to have been mislabeled at the lab. The arjo bath was removed as a consequence.

Commented [CM18]: https://www.gov.scot/binaries/content/documents/govscot/publications/corporate-report/2021/03/queen-elizabeth-university-hospital-nhs-greater-glasgow-clyde-oversight-board-final-report/documents/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019/govscot%3Adocument/nhs-ggc-qeuh-oversight-board-timeline-incidents-period-2015-2019.pdf

6.42.2 POUFs were to be fitted at all locations along patient pathways, and drain cleaning was also to take place at all patient locations. Sinks in the DSR in Ward 6A which were not compatible with POUF were to be replaced as a preventative measure, following discussions with the manufacturer to see if a POUF could be retrofitted.

6.42.3 The TWG was investigating whether to use a higher dose of Chlorine Dioxide (CD) to shock dose the water supply.

6.42.4 Water testing was to continue for the entire ward over the course of the next month to give an 'overview of all water outlets in the whole ward'.

6.43 TWG: water samples positive for MC (July 2019)

6.43.1 In July 2019, pre-filter water samples in Ward 6A continued to test positive for Mycobacterium chelonae. The theory for the re-appearance of MC was that it was resistant to chlorine, that the introduction of chlorine dosing had killed off the other types of organisms, letting this more unusual bacteria grow. The dose of Chlorine Dioxide (CD) in the water system was to be increased from the rate of 0.5ppm to 0.7ppm. An increase to 1.2ppm was considered, but this was not considered feasible based on 'engineering challenges and potential impact on services'.

6.44 Descriptive analysis of trends in bacteraemia rates for selected gram negative organisms (July 2019)

6.44.1 The clinician who provided the report on bacteraemia trends on 1.10.18, provided a further report in July 2019. He explained that his report was a response to the increase in rates among haemato-oncology patients within the RHC. He reported an improvement in rates since his first report.

6.44.2 Once again, the report was descriptive in nature and advised that causality could not be assumed. However, the report hypothesised a contribution to the improvement in rates from the following: the decanting of patients from 2A/B, chlorine dioxide (CD) dosing, education and other measures to ensure high practice standards, and the introduction of point of use filters.

6.45 4 further GNB positive patients in Ward 6A (August 2019)

6.45.1 Between 3 July and 1 August 8 August 2019, a further 4 patients with a link to Ward 6A tested positive for at least one type of GNB, as follows: 1 case of Chryseomonas (CH) who also developed Pseudomonas a week later; 1 case of Enterobacter cloaecae (EC) and Elizabethkingia miricola (EM); 1 case of Stenotrophomonas, and 1 patient with Enterobacter aeromonas (EA) who previously had Pseudomonas (Ps). The last patient was an inpatient at Raigmore in Inverness, but was linked to Ward 6A due to post-transplant care at the RHC.

6.45.2 The total number of instances of infection since April 2019 now totalled 11, with the Raigmore case a possible further case (12).

6.46 IMT meetings continue (August 2019)

6.46.1 IMT meetings took place on 1, 8, 14 and 23 August.

6.46.2 Water testing was carried out throughout August 2019. Tests were performed on taps with POUFs in Ward 6A and elsewhere, and the results

were negative. A water sample from a plant room (not know if pre-or post-filter sample) tested positive for Klebsiella and Psuedomonas Putida.

6.47 TWG: water samples positive for Ps and coliforms (August 2019)

6.47.1 Water samples from the main water tank room tested positive for Pseudomonas (Ps) and coliforms, as well as for mould and yeast. The 'ongoing issues' with mould and yeast in the basement plant room required to be investigated, including by air sampling.

6.48 Focus on ventilation (August 2019)

6.48.1 During August 2019, focus shifted to the chilled beams in the ventilation system and the fact that they suffered from leaks and condensation.

6.48.2 Discussions between GGC and HPS took place on where samples on chilled beams should be taken from.

6.49 Isolates identified in sampling of chilled beams (August 2019)

6.49.1 Samples show Pseudomonas oleovorans (PO) and Pseudomonas aeruginosa (PA) in the cold water. It is unclear whether this was part of the investigation into the chilled beam system or a reference to the water system.

6.49.2 Swabs of the grills on the beams showed small growths of Acinetobacter, Klebsiella and Pantoae species.

6.49.3 Air samples from patient room ensuites showed small counts of Aspergillus.

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6.50 Clinician concern about chilled beams (August 2019)

6.50.1 Clinicians express their concerns that immunocompromised patients were in rooms with chilled beams, but all rooms in the hospital were the same apart from Ward 4B. Possible options discussed included: use of beds in Ward 4B; a further decant, and use of a temporary mobile unit.

6.50.2 There was disagreement amongst MBs about the reliability of swabbing and whether the level and nature of GNB infections being seen was unusual.

6.50.3 The hypothesis for the ongoing GNB infections was that the patients had either had contact with unfiltered water or that the chilled beams were either leaking or dripping condensation onto patients.

6.51 Restriction of admissions to ward 6A (2 August 2019)

6.51.1 As a consequence of the level of concern over the GNB infections, admissions to ward 6A were restricted from 2 August 2019 and new patients were diverted to other health boards.

6.52 Remedial work to address contamination of chilled beams/ventilation of rooms (August 2019)

6.52.1 A number of control measures were put in place. Biocide was introduced to the chilled beam system, and subsequent testing was negative. The cleaning of grills on the chilled beam system was increased from 3 monthly to every month/6 weekly. F&E were instructed to draw up a ‘dedicated action plan’ for chilled beams in Ward 6A to address how issues/services were to be managed.

6.52.2 HEPA filtration units were to be installed within the ceiling void of patients’ ensuite bathrooms.

6.53 Additional control measures in place (August 2019)

6.53.1 Clinicians spoke to the Medical Director regarding alternative accommodation for the patients in Ward 6A. A review was to be done to see which patients could be moved to Ward 4B.

6.53.2 All patients were receiving ciprofloxacin prophylactically.

6.53.3 The dosage of Chlorine Dioxide (CD) within the water supply was to be increased.

6.53.4 The sink in the DSR was to be removed as it had no POUF and this could not be retrofitted.

6.54 3 further cases of GNB in Ward 6A (September 2019)

6.55 Three further instances of GNB infection occurred in patients during September 2019: a patient admitted on 2 September had a positive culture for multiple GNB organisms the next day; on 22 September 1 patient tested positive on admission for Achromobacter spp (AC), and on 29 September 1 patient tested positive for Stenotrophomonas maltophilia (STM). The total cases were now 14 cases and 1 possible case.

6.56 Ongoing IMT (September 2019)

6.56.1 The IMT continued to meet throughout September 2019.

6.56.2 Environmental sampling in Ward 6A and “Beatson” [MD- Ward 4B?] was said to be negative.

6.56.3 Typing of the GNB organisms collected from sampling and those found in patients revealed that the isolates were different and unique.

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6.57 MBs SBAR (August/September 2019)

6.57.1 At the IMT on 6 September 2019, MBs submitted an SBAR (dated 26 August 2019) outlining a number of concerns about Ward 6A, including air changes and pressure; use of HEPA filtration; infection risks from chilled beam technology; existence of pathogenic fungi; exposure to unfiltered water; risk from toilet plume; ceilings not solid; lack of play area; door entry; sinks, and prep room.

6.58 F&E visit to GOSH (September 2019)

6.58.1 F&E visited Great Ormond Street Hospital to look at their water and ventilation systems and were to produce a report on their findings.

6.59 Options paper on alternative accommodation for patients (September 2019)

6.59.1 Clinicians prepared an options paper identifying alternative accommodation which patients could be moved to if required. That paper was submitted to the Executive committee, MD and CEO of GGC. It would be used if further problems occurred.

6.60 Discussion about the epidemiology of the infections (September 2019)

6.60.1 A number of epidemiology reports are said to have been produced by certain MBs within GGC and by HPS on the numbers and types of infections being found in the patient cohort, as compared to other hospitals. That particular group of MBs were said by the OB Timeline to have concluded that the environment was safe but there was debate over the methodology used and whether the measures used were appropriate.

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6.61 Control measures put in place (September 2019)

6.61.1 The remedial work outlined in the IMTs in August was completed, with the exception of the installation of the HEPA filters, which was due to take place within 6 weeks.

6.62 Changes to IPC procedures and SOPs (September 2019)

6.62.1 From September 2019 onwards, a full microbiological analysis and root cause analysis (RCA) was to be performed on all cases.

6.62.2 A SOP was developed for obtaining regular water, environmental and chilled beams sampling. HPS were to have input into this.

6.62.3 Central line infection triggers were to be put in place so if reached then action could be taken.

6.62.4 Consideration was to be given to the appropriate threshold for an IMT to be triggered: either 2 cases of the same infection in a 2-week period (proposed by GGC) or 2 infections regardless of type (proposed by HPS).

6.63 DMA Canyon 2018 report implemented (September 2019)

6.63.1 By September 2019, the work to address the recommendations of the 2018 DMA report was said to have been completed.

6.64 TWG: water sampling results (September 2019)

6.64.1 Water samples which had showed positive results were reviewed. There had been an initial increase in positive samples, followed by a steady decrease over the following weeks. The samples (unknown location) were showing yeast and moulds. Initial samples had shown coliforms and E. coli, but no Legionella of Pseudomonas.

6.65 Specialist subgroup formed to consider ventilation in PICU (September 2019)

6.65.1 A specialist subgroup was formed to consider ventilation in PICU. The group included clinicians, IPCT, F&E and the ventilation Authorised Engineer. The PICU was 'non-compliant' as it had a lower number of isolation rooms than required. Following an options appraisal, the group recommended that a derogation be signed off and agreed to allow the unit to operate in its current set up.

6.66 Delftia acidovorans (DA) in Ward 6A (October 2019)

6.66.1 1 patient who had a line inserted on 24 September returned for treatment on 1 October and tested positive for Delftia acidovorans (DA). The total number of cases was now 15 with 1 possible case.

6.67 Ongoing IMT (October 2019- 14 November 2019)

6.67.1 IMTs continued throughout October and into November 2019, finally closing on 14 November 2019. No further cases of GNB infection were said to have been identified following the case of DA in early-October. Scottish Government (SG) representatives attended the first IMT in October due to concerns about the lifting of the ongoing ward restrictions.

6.68 Water sampling continues (October 2019)

6.68.1 Water sampling continued to be undertaken, and the results were reported by the TWG. August sampling results showed both very low and very high levels of coliforms, but sequence testing was negative. September results showed DA and STM, but retest results were awaited.

6.68.2 There was a new hypothesis in the IMT as a result of RCA methodology that infections may be from Smart Site Hubs which allow needleless injections of medication into the patient line. As a consequence, Smart Site

Hubs were to be tested, and to be replaced when contamination spotted, as opposed to weekly.

6.69 TWG: water sampling results (October 2019)

6.69.1 Testing of flow straighteners for the previous 3 months showed no Pseudomonas or biofilm formation. The chlorine dioxide (CD) dosing appeared to be keeping the flow straighteners clean. Periodic testing should continue to allow any changes to be identified and actioned.

6.69.2 Testing of the basement tanks post-filter showed Delftia in one tank and room: Pseudomonas in the drain points, and high TVCs in certain lines of the raw water tank.

6.69.3 Out of 142 samples taken from the campus, only 1 showed bacteria. The samples over August and September continued to become clearer and clearer.

6.70 GGC seek external support from HPS (October 2019)

6.70.1 In October 2019, GGC requested support from HPS to review the data being used to inform the risk assessment and decision making in relation to Wards 6A and 4B at QEUH.

6.71 HPS Epidemiological Analysis (Oct 2019)

6.71.1 The request resulted in the HPS report, entitled "*Review of NHSGG&C paediatric haemato-oncology data*" in October 2019.

6.71.2 The October 2019 report states its key objective was to assess GGC's datasets and to investigate the suspected increase in environmental Gram-negative blood cultures in the paediatric haemato-oncology patient population. The review compared different sources of data on positive blood samples from haemato-oncology patients. Blood samples were

divided into four groups- Gram-negative; Gram-positive; environmental bacteria and environmental bacteria including enteric bacteria (those found in the gut). Analysis covered the period between July 2013 and September 2019. The patient cohort appears to have been “patients less than 18 years of age cared for in the paediatric haematology oncology speciality in NHSGG&C (including new and existing patients)”.

6.71.3 On the incidence of infection within QEUH, precisely what should be taken from the HPS epidemiological investigation requires further investigation. But overall, HPS summarise their findings as indicating variation in expected infection rates for the cohort of patients. Statistical Upper Warning Limits were exceeded for Gram-negative cases in August 2017, March 2018, May 2018 and September 2019; for “environmental group” cases in March and June 2018 and March 2019; and in Gram-positive cases in July 2016 and May, November and December 2017. It is not clear what should be taken from the comparison between QEUH and other sites.

6.71.4 The report concluded that the analysis did not provide evidence of a single point of exposure causing blood stream infections. It is not clear what this was intended to indicate. Analysis of some different types of bacteria showed some changes, but given the small numbers in each group, the significance of the changes was not fully understood and should be part of the ongoing monitoring.

6.71.5 The report recommended that GGC should consider lifting the restrictions on admissions as based on HPS review of the data there was no evidence to support their continuation.

6.71.6 There is a suggestion that the HPS October 2019 report ‘validated the study’ carried out by the ‘hospital microbiology and pharmacy group’ in 2018, although this study is not referenced in the report itself.

6.72 IMT closed (14 November 2019)

6.72.1 On 14 November, the ongoing IMT in relation to the infections in Ward 6A was closed.

6.72.2 The new procedure for cases was agreed as: RCA to be done for all cases; PAG to be set up if there were 2 GNB cases in 30 days or upper warning limits on SPC charts were met; escalation to IMT would be based on Board's standard outbreak procedures; if immediate source was not identified, external advice will be sought early; findings of PAG to be reported to Clinical Review Group, a 'data collection form' developed with the assistance of HPS, was to be used by a MDT to collect the relevant data.

6.73 Water results are 'pristine' (November 2019)

6.73.1 Water results were reported as being 'pristine' with very low TVCs.

6.73.2 Increased water testing continued, for the purpose of providing reassurance to patients and families.

6.74 Ward 6A re-opens to new patients (21 Nov 2019)

6.74.1 In light of the conclusions of the HPS October 2019 report, HPS gave their formal agreement to lift restrictions on admissions to Ward 6A. A SBAR was prepared by a GGC staff on 14 November 2019. Ward 6A re-opened to admissions on 21 November 2019.

6.75 HPS Report published (29 November 2019)

6.75.1 On 26 November 2019, HPS published its report: Review of NHS GGC Paediatric Haematology Oncology Data.

6.76 Ventilation in PICU upgraded (October/November 2019)

6.76.1 In October/November 2019, work to upgrade the ventilation in all 4 bedded rooms in PICU was said to be completed. Only a few cubicles were still to be completed.

6.77 Escalation to level 4 Framework (22 Nov 2019)

6.77.1 On 22 November 2019, Malcolm Wright, Director General of the Scottish Government's Health and Social Care Management Board made the decision to escalate NHS GGC to 'Stage 4' of its escalation ladder and a new Oversight Board, led by the CNO, Professor Fiona McQueen, was established.

Commented [CM19]: Interim Report – The QEUH/NHS GGC Oversight Board – Progress Findings – December 2020

6.77.2 Stage 4 represents a level where there are "*significant risks to delivery, quality, financial performance or safety, and senior level external transformational support [is] required*".

6.77.3 The OB was set up to address three broad areas that led to escalation to Stage 4: (i) infection,prevention and control; (ii)Governance; and (iii)Communications and engagement.

Commented [CM20]: The QEUH/NHS GGC Oversight Board – Final Report – March 2021

6.77.4 The OB's aim was to "*review and address the set of critical issues relating to the operation of infection prevention and control (IPC), governance and communication and engagement with respect to the Royal Hospital for Children (RHC) and the Queen Elizabeth University Hospital (QEUH) and the handing of infection incidence affecting children, young people and their families within the paediatric haemato-oncology service of NHS GGC*".

6.77.5 The OB consisted of a group of experts and representatives drawn from other Health Boards, the Scottish Government and the affected families themselves. It was chaired by Scotland's Chief Nursing Officer, Professor Fiona MacQueen. The work of the OB was split into three subgroups:

"Infection Prevention and Control and Governance"; "Technical Issues"; and "Communication and Engagement".

6.77.6 The IPC and Governance subgroup was tasked with examining whether appropriate IPC and IPC governance was in place across NHS GGC in relation to the incidence of infections affecting children, young people and their families within the paediatric haemato-oncology service of GGC, and "*to recommend how to strengthen current approaches to mitigate avoidable infection harms*".

6.77.7 The Technical Issues Subgroup was focused on the 'technical operations' of the hospitals in question, "*with a particular focus on key infrastructure issues, including the Board's approach to water safety*".

6.77.8 The Communication and Engagement Subgroup was to consider "*effective communication with the children, young people and families of the paediatric haemato-oncology service of NHS GGC, as well as whether a wider, robust, consistent and reliable person-centred approach to engagement has been evident*".

6.78 Multiple cases of GNB in PICU (November/December 2019)

6.78.1 On 5 November 2019, a PAG was held following the identification of 3 cases of Acinetobacter baumanii (AB) in PICU during a 12-day period in October 2019. Two patients were in the same bed bay, so cross-transmission was suspected.

6.78.2 On 12 November 2019, a PAG was held following 2 cases of Pseudomonas aeruginosa (PsA) in PICU, the first was thought to be community acquired (identified on 21 September 2019), and the second was a HAI (identified on 7 November 2019).

6.78.3 On 19 November 2019, an IMT took place to assess if the 2 PsA infections were HAI or not. The medical history of the patients led to both cases

being classified as HAI. Patient 1 had been transferred from NHS Ayrshire and Arran and no samples had been taken prior to transfer, so it was unclear where the infection was acquired by that patient. Typing results for the two patients did not match, however, both patients had treatment on an ECMO machine on 21 September and 7 November respectively. ECMO has disposable circuits and is sterilised weekly and after each patient use. The water in the machine is tested after each patient and the results are negative. Both patients had also used a hemofiltration unit which uses disposable circuits. It is not clear whether this had been tested.

6.78.4 The ECMO machine was out of use pending results of water samples being obtained. Water samples were also to be taken from NICU and Theatre 8 as patient 2 was in both of those locations.

6.78.5 No ‘domestic or water checklist issues’ were highlighted.

6.78.6 On 21 November 2019, a PAG took place following the identification of a further case of PsA, this time by a bronchoscope investigation to gain a sample from lower airways (blind bronchoalveolar lavage (BBAL)). The patient had been transferred from NHS Ayrshire and Arran on 29 September 2019. Water samples taken on 14 November 2019 were negative, and no domestic or water checklist issues were identified.

6.78.7 On 24 November 2019, a patient in PICU tested positive for Serratia marcescens (SM). The patient sadly died on 25 November and as the cause of death was unknown, it had been reported to the Procurator Fiscal. The patient had been transferred from NHS Highland.

6.78.8 On 27 November 2019, an IMT was convened to review the single case of SM, as well as the 3 cases of AB and 3 cases of PsA which had been identified since October 2019. Water samples taken with POUFs removed were negative. The only connection between cases identified so far is that 2 of the PsA patients were treated in theatre 8. Theatre 8 had tested

negative for isolates. Environmental sampling of frequently touched surfaces was underway.

6.78.9 On 10 December 2019, a second case of SM was reported from a BBAL sample. The typing was different from any seen in the hospital so far. The patient had been transferred from NHS Ayrshire and Arran. The clinical team considered that the case was not HAI.

6.78.10 A fourth case of AB was identified in a BBAL sample on 23 December 2019. Environmental samples (including drains) taken on 11 and 19 December were negative. The hypothesis was that this was a sporadic case, as there was no overlap in time and place or equipment with the earlier cases. No AB had been isolated in environment, water, Theatre 8 or in the specific rooms tested. No further IMT was arranged, but one was to be held if any further cases occurred to activate the trigger. F&E were to survey PICU to check for leaks and dampness. Water samples of all outlets in 4 bedded areas and room 17 to be undertaken.

6.79 Prospective and retrospective investigation (December 2019)

6.79.1 SG directed GGC to investigate the last three incidents (i.e., all instances of GNB in PICU since October 2019) together prospectively and retrospectively using the HPS definition (2 GNB positive results in 30 days).

6.79.2 The initial hypothesis was possible water transmission for PsA in Theatre 8, and possible water transmission of SM. AB was thought to be cross-transmission between patients.

6.79.3 Water samples were taken from PICU, Theatre 8 and NICU. All were negative for isolates.

6.79.4 Weekly swabbing of POUFs, drains, CHWBs and water sampling for GNB was to continue for a four-week period. Monthly water sampling for

Mycobacterium was to continue. Drains were to be dosed with Hysan weekly.

6.79.5 All water sample tests in Theatre 8 were negative. All water sources were tested against PsA, SM and AB including inside filters, trough sinks and HH sinks in peripheral rooms. As a result, the water hypothesis for transmission of PsA in Theatre 8 was closed.

6.79.6 An environmental screen picked up a number of organisms in drains including SM in a trough sink adjacent to the bed space of the patient with SM. Whilst the water hypothesis was closed, there was a new hypothesis about colonisation from the drains as a positive sample was found in the room that the patient was nursed in.

6.79.7 No further IMTs took place in relation to this incident.

6.80 HSE Improvement Notice (Dec 2019)

6.80.1 It is understood that around 20 December 2019, the HSE served a notification of contravention and improvement notice on the chief executive officer of GGC. This was received on 24 December 2019 and published on the NHS Scotland website.

6.81 Retrospective view of episodes of infection in Ward 6A (? 2019)

6.81.1 During 2019, there were a total of 28 episodes of patient blood stream infection with bacteria commonly linked with the environment in the Schiehallion Unit patient cohort, according to the CNR. This included 4 episodes of infection caused by Stenotrophomonas; 4 caused by Pseudomonas, and 8 caused by Enterobacter.

6.81.2 It appears that some but not all of these infections were identified and investigated at the time at which they occurred.

7. EPISODES OF CONCERN AND ASSESSMENTS OF CONCERN FROM 2020 TO DATE

7.1 Ongoing water sampling (January 2020-)

7.1.1 Regular water sampling is reported as having been ongoing across the hospital site. F&E were taking 142 samples (2 samples from each of 71 designated points throughout QEUH and RHC). The results are recorded on a 'sample matrix'.

7.1.2 Between January 2020 and April 2020, a total of 1111 samples were collected. If a sample is 'out of spec', for Legionella or TVCs, it is added to a further spreadsheet and actions are taken to address it. The identification of other bacteria in water samples (apart from Legionella and TVCs) are passed to ICD for review.

7.1.3 There was a total of 39 'out of spec' samples between January and April 2020 (although 83 samples had not yet been reported).

7.2 Case Note Review (CNR): announced (28 January 2020)

7.2.1 On 28 January 2020, as part of the work of the OB, the Cabinet Secretary for Health and Sport announced in Parliament the plans for a Case Note Review CNR).

7.2.2 The CNR team were to review the case notes of Haemato-oncology paediatric patients in the RHC and QEUH from 2015-2019 who have had a Gram-negative environmental pathogen bacteraemia (and selected other organisms) identified in laboratory tests.

7.3 CNR: commenced (24 February 2020)

7.3.1 The work of the Expert Panel carrying out the CNR commenced on 24 February 2020.

7.3.2 The purpose of the CNR was to undertake a review of the medical records of all children diagnosed with a qualifying infection, cared for at the RHC between 1.5.15 and 31.12.19, to establish the number of immunocompromised children likely to have been put at risk because of the hospital environment, and to assess how any infections may have influenced their health outcomes.

7.3.3 The selection criteria for cases to be included in the review was: all patients cared for in the Paediatric Haemato-oncology service at the RHC who had at least one positive blood culture of a Gram-negative bacterium associated with the environment (Group 1) or at least one positive culture of an atypical Mycobacterium spp (acid-fast environmental bacteria) (Group 2). One patient that did not meet these criteria, but who experienced severe infection with a Gram-negative environmental bacterium (without proven bacteraemia) was included at the request of the family (Group 3).

7.3.4 The initial cohort consisted of 85 patients (although the number of infection episodes was higher as some patients had multiple episodes). Of those 85 patients: 81 patients were in Group 1; 3 patients (2 with bacteraemia and 1 with a skin infection) were in Group 2, and 1 patient was in Group 3 (that patient also had an infection with Aspergillus).

7.3.5 Patients were identified using the combined dataset used by HPS in preparing their report of October 2019, with the data extract being extended to December 2019, comprising: HPS Electronic Communication of Surveillance in Scotland (ECOSS) data; GGC Central Line Associated Blood stream Infection (CLABSI) surveillance system data; GGC's ECOSS data, and GGC's microbiology laboratory information system (LIMS).

7.3.6 The CNR attempted to assess the likelihood of the hospital environment being the source of each patient's bacteraemia, using information provided by GGC in the form of patient, clinical, infection prevention and control,

microbiology, local investigations (including Datix and IMTs where available and hospital environmental data.

7.3.7 Episodes of infection were to be categorised into four levels of likelihood that the hospital environment was the source of the bacteraemia: Unrelated; Possible; Probable or Definite. For the hospital environment to be classified as a Definite source, not only was 'time, place and person' data required to confirm the opportunity for the infection to be derived, but bacterial typing data was required to match the patient blood culture isolate to the same microorganism recovered from water or surface samples.

7.3.8 For cases to be considered as Unrelated, there had to be a relative lack of opportunity to acquire bacteria from the hospital environment over a period of time consistent with the development of bacteraemia, and/or a strong alternative hypothesis about the origin of the bacteraemia.

7.3.9 The CNR considered the question of how to distinguish whether the hospital environment was a Possible as opposed to Probable source. For a Probable finding, the CNR required that the information available supported the view that the environment was the likely source (on the grounds of probability) using a standard IPC assessment of the available data/information. Clustering of cases caused by a bacterial species was a key factor in reaching a Probable conclusion, as well as: multiple opportunities for contamination of intravascular catheters; bacteria that are uncommon causes of bacteraemia, and repeated recovery of the same bacterial species from hospital environment samples around the time of the bacteraemia occurring (particularly if taken close to where the patient was managed).

7.3.10 The CNR observed that the ability to identify a bacteraemia as linked to the hospital environment may depend on how commonly/systematically the environment was sampled, as well as whether the samples were targeted specifically at a particular microbe or more generally. Not finding

a bacterium in the hospital environment did not exclude the possibility that the environment was the source of patient infection.

7.4 Independent Review Report published (June 2020)

7.4.1 The Independent Review Report was published on 15 June 2020.

7.4.2 The IR identified multiple failures in relation to key buildings systems (water and ventilation) during the design, build, commissioning, and maintenance stages of the project. In so far as relevant to the instance and occurrence

7.4.3 of infections, the detail has been included in this timeline.

7.4.4 The report considered that the QUEH and RHC "*now have in place the modern safety features and systems that we would expect of a hospital of this type. The general population of patients, staff and visitors can have confidence that the QEUH and RHC offers a setting for high quality healthcare*".

7.5 SHI: TOR published (15 June 2020)

7.5.1 On 15 June 2020, the TOR were published for the Independent Inquiry into the construction of the QEUH, Glasgow and the Royal Hospital for Children and Young People and Department of Clinical Neurosciences (RHCYP/DCN), Edinburgh.

7.6 Article on chilled beams August 2020

7.6.1 On 14 August 2020, the Journal of Hospital Infection published an article by T Inkster et al entitled *Potential infection control risks associated with chilled beam technology: experience from a UK hospital*. Among other things, the paper reported that surface swabs from chilled beams in the QEUH had grown multiple organisms including fungi, enteric organisms and environmental Gram-negative bacteria.

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7.7 Oversight Board Interim Report (Dec 2020)

7.7.1 The QEUH/NHS GGC Oversight Board published its Interim Report on 21 December 2020.

7.7.2 The interim report set out some of the initial findings and recommendations of the OB on the following matters: the processes, systems and approach to improvement of Infection, Prevention & Control (IPC); communication and engagement with patients and families; an update on the work of the CNR, and an update on the work of the Technical Review group.

7.7.3 The interim report narrates the background of concern about instances of infection in the hospital, by adopting the narrative provided by HPS in their Summary report published in February 2019: a handful of infections occurring in 2016 and 2017, followed by 23 infections caused by 11 different organisms in 2018, followed by water testing which revealed contamination of the water system and drains.

7.7.4 The interim report also records that concerns about the potential environmental risks of the building, and the link to emerging infections, had been raised consistently by several clinicians since completion and handover of the building. Some clinicians felt that their particular concerns about the water and ventilation systems, and the potential impact on vulnerable patients, had not been addressed.

2021

7.8 Article on the 2018 “water incident” (February 2021)

7.8.1 On 2 February 2021, an article was published in the Journal of Hospital Infection by T Inkster, C Peters, T Wafer (of the Water Solutions Group), D Holloway (of Intertek) and T Makin (of Makin and Makin Consultancy). The

article described events connected to an outbreak of infections within the QEUH/RHC between February and September 2018. The article reported that no fatalities had occurred as a result of the incident.

7.8.2 The article said that water testing had revealed widespread contamination of the water and drainage system. Outlets were said to be heavily contaminated.

7.8.3 The authors said: “The exact route of transmission is not possible to determine but all our patients had Hickman lines, thus direct contact with water via showering or splashing seems likely.”

7.8.4 The authors also said: “Due to the extent of the contamination in our hospitals it is likely to take years for control to be achieved and point of use filters remain in situ.”

7.9 CNR: completed (January 2021)

7.9.1 The review of cases and episodes within the Case Note Review was completed in January 2021.

7.10 CNR Report (published March 2021)

7.10.1 The CNR Overview Report was published in March 2021.

7.10.2 Review of all available patient data led the Expert Panel to conclude that 84 haemato-oncology paediatric patients suffered a total of 118 episodes of infection during the period between 15 May 2015 and 31 December 2019. One patient, with a single episode of bacteraemia caused by Moraxella catarrhalis, was excluded from the initial cohort of 85 patients, as that bacterium is not considered to be environmental and spreads predominantly by person-to-person droplet contamination.

7.10.3 The findings of the Expert Panel on frequency of infection by organism (species level) are contained in Table 4.3 of the Report (Appendix 1).

7.10.4 The CNR concluded that the frequency of GNB caused bacteraemias appeared to be higher than expected, particularly for the infections caused by Enterobacter spp and Stenotrophomonas spp. The pattern was less clear for Klebsiella spp and Pseudomonas spp, which were the second and third most common GNB causing blood stream infections. The second notable point was the clustering of infections in time, as well as in place (by virtue of the patients being treated together in Wards 2A/B and latterly 6A/4B). Whilst neither of those conclusions proved that the bacteraemias had hospital environment sources, the observations were consistent with that hypothesis.

7.10.5 The CNR noted that, following retrospective review of a large database of logs and documents provided by GGC relating to the maintenance of the clinical environment with a focus on Wards 2A/2B/6A/4B, there were a large number of requisitions for Estates and Facilities department interventions, particularly in relation to plumbing and drainage. The problems included blocked toilets or drains; leaking showers and taps; and the management and maintenance of chilled beams following reports about leaks or condensation, or both, and where additional cleaning was required for control of dust. The CNR were unable to ascertain exactly what planned programme of planned inspection and preventative maintenance existed or was actually undertaken, particularly regarding the chilled beam system.

7.10.6 The CNR considered that their ability to link the hospital environment with the patients' infections was affected by the fact that hard surface samples were infrequent, and when taken at all, were not taken in a systematic way. Overall, the CNR was unable to conclude that GGC had a systematic approach to hard surface environmental sampling, either in the context of a specific unusual infection or during an outbreak of a more commonly seen infection.

7.10.7 In relation to water sampling, the CNR noted that both HFS and the Independent Review had each confirmed that there were serious issues about the design and commissioning of the water system. The CNR found that there was a lack of a robust water testing strategy from the point at which the new hospital building was commissioned, including assurance that the system was fit for purpose. There did not appear to be a systematic water sampling process in place, or a consistent water system related response to clusters of infections caused by (often unusual or uncommon) Gram-negative bacteria. The lack of a clear step change in GGC's approach to water sampling, testing, reporting and strategy in the face of increasing concern that the bacteraemias in the Schiehallion Unit patient cohort was of concern to the CNR. Water sampling data which the CNR were provided with frequently did not specify the precise location from where the sample was obtained, and/or precisely which bacteria were sought and identified in the laboratory. Searching once or only occasionally for a specific bacterium, and from only a limited number of sites, limited the confidence that a bacterium of concern was not contamination a water point/system and was the source of the patient infection. The CNR could not confidently exclude the water system as potential point sources for bacteraemias caused by GNB that are known to be associated with such environments.

7.10.8 The Expert Panel concluded that out of the 118 infection episodes: 1 they were unable to determine; 8 (7%) were unrelated to the environment; 76 (64%) were possibly related to the environment, and 33 (28%) were probably related to the environment. Overall, the CNR concluded that just under one third (31%) of the total number of patient infection episodes were 'most likely' linked to the hospital environment. In the 'most likely' group, there was a striking excess of Stenotrophomonas infection (14 episodes out of a total of 44).

7.10.9 The absence of systematic testing results for either hard surfaces or water samples impacted the ability of the CNR to assess environmental link

between patient and infections and the hospital systems, and particularly to identify the infections as definitely linked, standing the tight criteria of microbiological typing to confirm a match between the blood sample and environmental isolate.

7.10.10 The CNR also addressed the impacts of blood stream infections on patient outcomes, as well as considering communication with patients and families.

7.10.11 The CNR also made a number of further observations about areas of concern identified in the review. These included: substantial and varied concerns about the availability of data and its quality across multiple systems; the management, investigation and reporting of infection outbreaks; microbiology and IPC information systems; the completeness of clinical records; the accuracy of patient location records; Adverse Event reporting; the adequacy of Morbidity and Mortality reports; Central Venous Line care; and the use of antimicrobial prophylaxis and the impact of the organisational response on clinical care.

7.10.12 In relation to the management, investigation and reporting of infection outbreaks, the CNR reviewed the PAG and IMT reports covering incidents between 2016 and 2019 (none being available for 2015) and concluded that not all outbreaks which may appear relevant retrospectively were investigated at the time, and not all incidents/outbreaks progressed to IMT status. As an example, the CNR records that no investigation into an increasing number of Klebsiella infections took place between 2016 and 2018, despite a total of 22 patient infections occurring, with 9 episodes occurring between June and November 2016; 9 episodes occurring between July and December 2017; and 5 episodes between January and May 2018. The CNR expressed concern that earlier opportunities to investigate the problems may have been missed because of too great an emphasis on ‘standard’ outbreak definitions.

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7.11 OB Final Report (March 2021)

7.11.1 In March 2021, the OB published their final report, entitled "*The Queen Elizabeth University Hospital/NHS Greater Glasgow and Clyde Oversight Board Final Report*" (OB Final Report). The purpose of the OB Final Report was to set out the "findings, conclusions and recommendations" arising from OB's programme of work from its establishment in Dec 2019-March 2021.

7.11.2 The OB Final Report narrates the context of the escalation of GGC to Stage 4 of the Framework: "*a background of a series of infection issues affecting children and young people in the paediatric haemato-oncology service at the QEUH and RHC over a number of years, combined with rising concerns about the source(s) of those infections and how they were being handled*".

7.11.3 One of the key aspects of the OB's work was to examine IPC and IPC governance within GGC in relation to the incidence of infection amongst the paediatric haemato-oncology patient cohort, with a view to assessing whether current IPC processes were fit for purpose. In other words, the OB was considering IPC national standards and good practice with a view to answering the question of whether within GGC "*the current approaches that are in place to mitigate avoidable harms, with respect to infection prevention and control, are sufficient to deliver safe, effective and person-centred care*". The OB appear to have approached this task by commissioning the compilation of a detailed chronology of the 'issues and incidents' which occurred between 2015-2019 within a specific patient cohort, to appraise what happened in IPC terms with potentially relevant infections during that period.

7.11.4 The OB Final Report included, at Annex F, a timeline of "infections and governance", which was commissioned as a special report by the OB, and which purports to provide a timeline of incidents in which a Gram-negative or other unusual bacteria were identified in blood cultures of patients

located in Wards 2A/2B RHC, and latterly in Wards 4B/6A QEUH ("the OB Timeline").

7.11.5 The OB Timeline was compiled from written evidence provided by GGC, as well as from interviews with members of GGC staff. The written evidence which is said to have been taken into account includes: (i) minutes of the Incident Management Team (IMT)/Problem Assessment Group (PAG) meetings which were set up to investigate each incident; (ii) minutes and papers of the GGC Board and various associated committee meetings which demonstrate the escalation of the incidents; (iii) papers provided by Facilities & Estates (F&E) team in relation to water risk assessments, audit and compliance documents; (iv) minutes of meetings of the Technical Water Group (TWG), established in April 2018, and the other GGC water groups which relate to the QEUH/RHC (Board Water Safety Group (BWSG) and South Clyde Water Safety Group (SCWSG)); (v) three reports produced by HPS/HFS (published in February 2019; March 2019 and October 2019 respectively), and (vi) two reports by DMA Canyon, entitled "Legionella Risk Assessment " and "Legionella L8 Risk Assessment 2017" dated 2015 and 2017 respectively.

7.11.6 Whilst the OB Timeline is said to be the product of a '*paper based review of documentation supplied by GGC*' and not the product of detailed or extensive interviews with staff members, it is said to take into account interviews with the GGC Infection Prevention Control Team (IPCT) to understand how *'incidents associated with GNB and fungi'* were reported to 'the Board, HPS and Scottish Government' and with F&E to '*understand the procedures around water risk assessments, audit and compliance of water systems and water testing'*.

7.11.7 The OB Timeline expressly records that the only infections and colonisations which are included relate to the paediatric patient population of the Schiehallion Unit. The Timeline does not include instances of infection in the adult hospital, or within the adult hospital population, with

the exception of infection incidents in SU patients when that group of patients were moved to Wards 6A and 4B of the QEUH.

7.11.8 In its Interim report, the OB had said that among the questions that it would be addressing was this one: "To what extent can the source of the infections be linked to the environment and is the current environmental risk?"

7.11.9 In relation to the first part of this question, the OB Final Report concluded that "*in the absence of definitive sources, the strong possibility of a link has been- in the Oversight Board's view- undeniable*". In the context of GGC saying that an "exact source" of infection had not been proved "beyond doubt", the OB said that it had been "evident" that the source of infections had related to water; and it rejected the suggestion that the HPS reporting in November 2019 supported the view that what was happening as regards infection patterns was not unusual compared to other hospitals.

7.11.10 It is not clear what if any answer the OB came to on the second part of the question: current environmental risk. It did however note "*there continue to be unusual environmental bacteria incidents at different points in the site*". The source for that statement is unclear.

7.11.11 Following publication of the final report, GGC remained in Stage 4 of the National Performance Framework.

7.12 QUEH Advice, Assurance & Review Group (AARG) (March 2021?)

7.13 Article on two cases of Mycobacterium chelonae ("MC") (May 2021)

7.13.1 On 1 May 2021, an article was published in the Journal of Hospital Infection by T Inkster et al. The article was entitled "*Investigation of two cases of [MC] infection in haemato-oncology patients using whole-genome sequencing and a potential link to the hospital water supply*."

7.13.2 Of the two cases under consideration, the authors concluded that in one case the patient's MC infection was "closely related to environmental isolates from water outlets." Of the other case, the authors noted that as no contemporaneous water results were available, "a water source in the hospital [as the source of the infection] cannot be excluded completely."

7.13.3 The authors also noted: "Water systems which are being treated with disinfectants may be of particular risk as they remove competing organisms and enable atypical [MC] to proliferate."

2022

7.14 Re-opening of Wards 2A/B (9 March 2022)

7.14.1 On 9 March 2022, Wards 2A/B RHC were due to reopen after extensive refurbishment. The refurbishment works included replacement of the ventilation system, with the installation of 11 new air handling units.

7.14.2 The Inquiry continues to investigate the basis upon which decision makers decided to reopen the ward and to consider in particular what assurance had been provided to decision makers as regards patient safety.

7.15 Final Draft Report from the Cryptococcus Incident Management Team Expert Advisory Sub-group

7.15.1 A report was issued by the CN Sub-group on 5 April 2022. It considered 7 hypotheses as regards the question of how patients within the QEUH/RHC had become infected with CN.

7.15.2 The first was whether CN spores had got into the relevant Air Handling Unit during a filter change. This was deemed to be unfeasible. Reference was made to sampling of the plant room in question which was said not to have identified CN spores. Reference was also made to sampling of air

(referred to in the report as “outside air”) on different levels of the QEUH and in a different building in which evidence of SN spores was found.

7.15.3 The second hypothesis was that the absence of HEPA filtration on certain wards may have permitted CN spores to get into the air circulating in the wards. Noting the presence of CN spores in the so-called “outside air”, this hypothesis was said to be possible.

7.15.4 The third was a lack of protective isolation. This was a reference to an absence of HEPA filtration in certain areas and to issues with air control. In particular, reference was made to the following: on Ward 4B, the presence of HEPA filtration but a lack of air control; on Ward 4C, an absence of HEPA filtration (but good air control); on Ward 6A an absence of HEPA filtration and poor air control . The third hypothesis was considered possible, particularly for the patient who had spent time on Ward 6A but less so for the one who had not.

7.15.5 The fourth hypothesis concerned the cylinder room in PICU. This was considered possible but very unlikely for one patient and inexplicable for the other.

7.15.6 The fifth involved a contribution from the helipad. This was rejected as unlikely.

7.15.7 The sixth involved the pneumatic tube system. This was deemed unlikely.

7.15.8 The seventh hypothesis was that the patients themselves had brought their CN infections into the hospital: i.e. the infections had been dormant until their immune systems had been sufficiently compromised [from illness and treatment it is assumed]. The report said this of the seventh hypothesis: “VERY POSSIBLE for BOTH cases but likely to be VERY DIFFICULT TO PROVE.”

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7.16 De-escalation within the National Performance Framework

7.16.1 On [around 13 June 2022] the decision was taken to move GGC to stage 2 of the National Performance Framework. The Cabinet Secretary for Health said that this was a positive step forward and highlighted the significant progress made by GGC to meet all recommendations made in previous reviews.

7.16.2 The Inquiry continues to engather and investigate the evidence understood to that statement. In particular, the Inquiry continues to engather and investigate evidence bearing on the question of whether key building systems present no risk to patient safety.

7.16.3 HIS undertook inspections and reported on 7-8 and 20 June 2022.

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Annex to the History of Infection Concerns Paper

Overview of the Infection Control Team, Infection Reporting and the Microbiologists/ICDs

The following is intended to be a brief overview of the structure of Infection Prevention and Control Team in NHS GGC and the procedure for reporting infections, incidents and outbreaks.

1. The Infection Prevention and Control Team in NHS GGC

1.1. Within NHS GGC there is an Infection Prevention and Control Team (IPCT) which consists of an Executive Level Director, and Associate Nurse Director, a Nurse Consultant, a Business Manager, a Local Board Hand Hygiene Coordinator and Administrators.

1.2. There are then local IPCTs which sit within each sector of NHS GGC, which are: Clyde, North, South (adults) (covers QEUH), South (paediatrics)(covers RHC), Health and Social Care Partnerships (HSCPs).

1.3. The local IPCTs consist of a Lead IPC Nurse and a combination of Senior Infection Control Nurses and Infection Control Nurses (ICNs). There is also a dedicated Surveillance Team which supports the IPCT.

1.4. The IPCT is also supported by Infection Control Doctors. There is a Lead Infection Control Doctor (ICD) supported by Sector ICDs who cover the sectors as noted above. The primary role of the IPCT is the prevention of Healthcare Associated Infections (HAI).

1.5. All ICDs within NHS GGC are Consultant Microbiologists. As such, they all have a clinical role as a Microbiologist with sessions dedicated to Infection Control.

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2. ICD Reporting Structure

2.1. The sector ICDs work closely with the ICNs and Surveillance Team to deal with any infection control issues in their particular sectors. The sector ICDs report to the Lead ICD, who, in turn reports to the Director of Infection Prevention and Control, (formerly known as the Infection Control Manager (ICM)). The Director of IPC reports directly to the HAI Executive Lead, who is a Medical Director sitting on the Board.

2.2. The Lead ICD, Director of IPC and the Associate Nurse Director of IPC make up the IPC Senior Management Team (SMT) and attend Acute Infection Control Meetings (AICC), Board Infection Control Meetings (BICC) and Clinical and Care Governance Meetings.

2.3. Sector ICDs attend a monthly IC SMT meeting along with the Lead ICD, Director of IPC, Lead surveillance Nurse and sometimes a Public Health Consultant. The purpose of these meetings is to report issues within the sector, and receive updated from the SMT about any national or local policy changes.

3. Infection reporting and Outbreaks and Incidents

3.1. The National Infection Prevention and Control Manual (NIPCM) which is produced by Antimicrobial Research and Healthcare Associated Infection (ARHAI) (previously Health Protection Scotland (HPS)) outlines a nationally agreed minimum list of Alert Organisms or Conditions which, if detected, require further investigation by the IPCT.

3.2. ICNs will generally deal with any alerts initially and escalate to the ICDs if they require any further input or advice. The ICD or antimicrobial pharmacist would provide advice on the appropriate antibiotics for example.

3.3. There is a surveillance system in place called Infection Control NET (ICNET). This has been in place since 2014 and links information from different

departments in the hospital meaning there is real time information on every patient and their history. If they have one of the alert organisms or conditions then this will appear directly from the lab on ICNET and will alert members of the IPCT so that they can take action.

3.4. Chapter 3 of the NIPCM was published in 2015 and provides a definition of an incident or outbreak, a tool to assess the incident or outbreak, a list of those who should be considered to attend an Incident management Team (IMT) meeting and the agenda for those meetings.

3.5. If there is a suspected incident/outbreak, then the ICD may choose to convene a Problem Assessment Group (PAG) which undertakes an initial assessment of the situation. The PAG considers whether it is necessary to convene an IMT and this would be done using the Healthcare Infection Incident Assessment Tool (HIIAT) which is contained within Appendix 14 of the NIPCM.

3.6. The HIIAT scores incidents and outbreaks as Green, Amber or Red. If the score is Amber or Red, this is entered on the Healthcare Associated Infection Reporting Template (HAIRT) is presented to the AICC, BICC and the Care and Clinical Governance Committee.

3.7. If an incident is assessed as Green then this is submitted to ARHAI for information purposes only.

3.8. If an incident is Amber or Red then the IPCT must complete a Healthcare Infection, Incident and Outbreak Reporting Template (HIIORT).

3.9. If Amber then the HIIAT is reviewed and reported at least twice weekly or as agreed between the IMT and ARHAI.

If Red, the HIIAT is reviewed and reported daily or as agreed between the ARHAI and the IMT.

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SCOTTISH HOSPITALS IN UIRY

SCOTTISH HOSPITALS INQUIRY

Substantive Core Participant Responses to Provisional Position Paper 5
The History of Infection Concerns (HOIC) for the Queen Elizabeth University Hospital Campus

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