SCOTTISH HOSPITALS INQUIRY

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

Bundle 21 - Volume 5

Responses to Expert Reports of Andrew Poplett and Allan Bennett

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1 Introduction

1.1 The following is a response by Multiplex Construction Europe Limited ("Multiplex") to the expert report prepared by Andrew Poplett titled Independent Expert Report Concerning Domestic Hot and Cold Water Systems ("Expert Report").

1.2 Multiplex is grateful for the opportunity to assist the Inquiry in relation to the Expert Report.

1.3 As noted in its earlier responses to previous expert reports, Multiplex does not consider that a period of 5 weeks has provided Multiplex with sufficient time to properly consider and formulate a response to all of the matters raised in the Expert Report, particularly when this period falls across summer holiday season.

1.4 The above being said, in the limited time made available, and with a view to assisting the Inquiry, Multiplex has prepared the commentary below. Multiplex also refers the Inquiry to the following response already submitted:

1.4.1 **Expert Report of Dr J.T. Walker** – Multiplex Construction Europe Limited – Response 11 June 2024.

1.5 Having regard to Section 2(1) of the Inquiries Act 2005, Multiplex's position set out in this response is provided solely to assist the Inquiry's understanding and is without prejudice to and under reservation of any further submissions Multiplex may make or evidence it may lead in any forum.

2 Commentary

2.1 Multiplex would respectfully direct the Inquiry to the Employer's Requirements (forming part of the construction contract between Multiplex and Greater Glasgow Health Board) which set out the NHS Mandatory, Guidance and Additional Documentation at sections 5.1.2 to 5.14 in relation to the design, installation and testing of the Works.

2.2 The Employer's Requirements go on to provide that "*NHS Publications and other published guidance shall be deemed to mean those in place at the date of signing the construction contract. Any date reference in Table 2 or Table 3, therefore, may be replaced/read as that in place at the date of signing the construction contract.*"

2.3 In the interests of clarity, Multiplex note that Andrew Poplett in the Expert Report makes reference to various versions of guidance that post-date those applicable to the construction contract or to guidance which was not published at the date of signing the construction contract.

2.4 The guidance referred to by Andrew Poplett may be applicable to the maintenance and operation of the QEUH post-handover, however they were not applicable to the works under the construction contract.

2.5 Examples of the foregoing include, but are not limited to, the following:

2.5.1 **SHTM 04-01 Part A Control of Legionella…drinking systems Part A Published 2014 & 2016 –** The version applicable at the date of signing the construction contract was 1.0 December 2008;

2.5.2 **BS EN ISO 13959:2015, BS EN ISO 13958:2015, BS EN ISO 11663:2015, BS EN ISO 26722:2015 and BS EN ISO 23500:2015 –** The versions applicable at the date of signing the construction contract were dated 2009 rather than 205.

2.5.3 **SHTM 04-01 Part E –** This document had not been published at the date of signing the construction contract.

2.5.4 **HBN 00-09 –** This document had not been published at the date of signing the construction contract. This document was first published in March 2013.

2.5.5 **BS8558 –** This document had not been published at the date of signing the construction contract. This document was first published in 2011.

Deadlegs

2.6 Andrew Poplett notes "*dead-legs have been introduced into the systems rather than minimised*"

2.7 Multiplex respectfully submit that this comment does not take proper account of the applicable guidance at the date of the construction contract being signed.

2.8 The applicable SHTM 04-01 Part A 2008 at section 9.49 provides "*the complete length of the spur should not exceed 3 m*."

2.9 The domestic water services design was submitted under the construction contract review process detailing "*The maximum length for the HWS flow dead leg to any fitting shall not exceed - 3.0 meters*", which reflects the terms of the relevant guidance.

2.10 The design drawings were reviewed and approved by GGHB providing a status A.

Flexible connections

2.11 Andrew Poplett notes "*EPDM flexible hoses installed with are contrary to SAN(SC)09/03*" and "*the use of EPDM flexible hoses installed contrary to SAN(SC)09/03*."

2.12 Multiplex notes that there is essential equipment within hospitals which are subject to vibration or articulation where flexible hoses are required for connecting equipment to distribution pipework.

2.13 SHTM 04-01 Part A 2014 introduced section 11.35 considering flexible hoses with alternative lining materials to EPDM.

2.13.1 "*New lining materials are now available such as polyethylene (PE), cross-linked polyethylene (PEX), linear low-density polyethylene (LLDPE) and post chlorinated PVC (PVC-C).*"; and

2.13.2 "*Where flexible hoses must be used for the likes of essential equipment subject to vibration or articulation, such as hi-low baths, consideration would be given to using the above listed alternative lining materials*."

2.14 However, in the version of the SHTM 04-01 Part A document which was current at the time of the construction contract, no such guidance was in place.

2.15 Under the construction contact equipment procurement and installation was categorised by the following groups:

2.15.1 **Group 1** – Equipment is supplied and installed by Multiplex;

2.15.2 **Group 2** – Equipment is supplied by GGHB and installed by Multiplex;

2.15.3 **Group 3** – Equipment is supplied and installed by GGHB.

2.16 Group 1 equipment (with flexible hoses) includes items such as double height sinks, macerators / sluice machines and raise / lower baths.

2.17 Group 2 and 3 equipment procured by GGHB includes items such as dishwashers, vending machines, and water coolers. Multiplex understands that these items were provided with flexible connections.

2.18 GGHB surveys / procurement records should indicate the type of hoses / lining materials procured by GGHB for group 2 and 3 equipment.

Flushing Certification

2.19 Andrew Poplett refers to certification that indicates the flushing of the whole water system was completed on 16 January 2014.

2.20 Multiplex suggest this is a typographical error by Mercury in the preparation of the certificate. The date should read 16 January 2015.

Cold Water Storage

2.21 Mr Poplett advises "*In healthcare, the maximum quantity or volume of stored water should be less than 12 hours at normal usage*."

2.22 SHTM 04-01 Part A advises "*There is a conflict between the water supply authority's desire to have 24 hours water storage and the requirements of HSE L8 which recommends 12 hours…"*

2.23 Multiplex note the Employers Requirements detail 24 hour storage requirement.

2.24 Multiplex proposed a reduction in cold water storage to 12 hours within the contractor proposals which was reviewed and discounted by GGHB.

2.25 The M&E Clarification Log within the construction contract tracks GGHB comments along with the agreed GGHB cold water storage requirements.

2.26 Multiplex is happy to discuss this response with the Inquiry team if it would be of assistance.

Keoghs

Scottish Hospitals Inquiry

[Uploaded via Objective Connect]

Our Ref: RIL.10513091
Your Ref:
Date: 25 July 2024
Please Ask For: Ruth Lawrence / Rachel Blair
Email: [redacted] /
Direct Dial: [redacted] / [redacted]

Dear Sirs

Our Client: **Currie & Brown UK Limited**
Re: **Queen Elizabeth University Hospital, Glasgow**

We write in response to Mr Andrew Poplett's 'Independent Expert Report Concerning Domestic Hot and Cold Water Systems' dated 10 June 2024 ("**the SHI Water Report**") on behalf of our client, Currie & Brown UK Ltd ("**Currie & Brown**"), in accordance with the directions in the Inquiry Solicitor's email of 20 June 2024.

We have responded separately to Mr Poplett's 'Independent Expert Report Concerning Critical Healthcare Ventilation Systems' also dated 10 June 2024 ("**the SHI Ventilation Report**").

References in bold to paragraph numbers below are to the numbered paragraphs of the SHI Water Report. References to Bundle numbers are to the numbered bundles issued by the Inquiry for the Glasgow 3 hearing commencing on 19 August 2024 (unless otherwise stated).

Response to the SHI Water Report

Paragraph 3.20: "*It would appear that the process of managing/agreeing derogations of change within the project at QEUH were restricted to a Project Board Level, and outcomes would suggest that not all interested stakeholders were appropriately or fully consulted on all issues. An example of this can be evidenced by the only seen derogation form for the scheme (provided to date) was for the deviation of air change rates (QEUH DER – V001 dated 18th September 2019). This derogation appears to be a retrospective assessment based on performance since 2015 and an acceptance of non-conformance to the SHTM standards. No other evidence of a pro-active management process of derogations is available, although strong evidence does exist of poor compliance to standards. These include, but are not limited to:*

- *Water systems being 'wet tested' and not consistently flushed*
- *EPDM flexible hoses installed with a contrary to SAN(GC)03/03*"

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1. The only example of a derogation cited by Mr Poplett is the agreed derogation from the relevant recommendation in SHTM 03-01 'Ventilation for Healthcare Premises' to lower the air changes per hour ("**ACH**") in single bedrooms from 6 ACH to 2.5 ACH. This derogation is addressed in Currie & Brown's separate response to the SHI Ventilation Report. As stated in that response,[1] it was and is Currie & Brown's understanding that the process of considering this derogation did indeed involve a pro-active management process, including discussion within a multi-disciplinary team and consultation with the Health Protection Agency, although NHS GGC would be better placed to explain that process.

2. For the avoidance of doubt, the two examples that Mr Poplett cites in the bullet points at the end of Paragraph 3.20.1 do not relate to any derogations from the applicable NHS standards or poor design; if true (which is outside Currie & Brown's knowledge) they would instead be examples of bad practice. It is noted that Mr Poplett goes on to say in **Paragraph 4.1.1** that "*The domestic hot and cold water systems design at QEUH was generally in line with the principles as set out in the guidance at the time (SHTM 04-01)*".

Paragraph 4.1.12: "*The potential capital cost benefit of not including elements such as incoming water filtration and supplementary water treatment systems is unclear and is outside the scope of this technical review, although it is clear that any capital savings/reductions at the design stage have been more than exceeded in the system alterations and improvements*."

3. Currie & Brown is not aware of any instructions by NHS GGC for any capital cost savings in connection with the water system at the design stage or at all. It is unclear how the comments in **Paragraph 4.1.12** sit with Mr Poplett's conclusion in **Paragraph 4.1.1** that "*The domestic hot and cold water systems design at QEUH was generally in line with the principles as set out in the guidance at the time (SHTM 04-01)*".

Paragraph 4.2.1: "*In April 2015 the NHSGGC Board commissioned an independent water risk assessment to identify any potential areas of concern…*"

4. Currie & Brown was not aware of this water risk assessment and was not provided with a copy of the resulting report in 2015 or at all. So far as Currie & Brown is aware, this report was not provided by NHS GGC to the QEUH Project Team for comment or action.

Paragraph 4.2.2: "*In 2017 the water risk assessment process was repeated and demonstrated some significant improvement in the overall level of issues…*"

5. Again, Currie & Brown was not aware of this water risk assessment and was not provided with a copy of the resulting report in 2017 or at all (although by then construction of the QEUH had been completed). So far as Currie & Brown is aware, this report was not provided by NHS GGC to the QEUH Project Team for comment or action.

Paragraph 8: "*Temperature control and checking, for cold water systems this is to ensure no excessive heat gain is experienced within the system (no more than 2°C between incoming water temperature and outlet temperature, this requires all other services to be completed and in operation). For hot water systems this is to ensure appropriate circulation and design water temperatures are present at all outlets within 1 minute of opening/operation).*"

[1] See paragraph 12 of Currie & Brown's response to the SHI Ventilation Report by letter dated 25 July 2024.

6. Whilst Currie & Brown does not profess any technical expertise in M&E design, it is submitted on behalf of Currie & Brown that it is impractical to achieve a temperature difference as low as 2°C between incoming supply and the most distant parts of the cold water distribution system. In practice, the cold water temperature in the tank is likely to be at least 2°C higher than the temperature of the incoming supply, and the temperature at outlets (taps etc.) will be higher still. The key requirements are: (a) to achieve 20°C water from outlets within two minutes of opening and (b) that cold water in tanks and pipes should be maintained below 20°C where possible, with an upper limit of 25°C.

If any further information or clarification is required by the Inquiry, Currie & Brown would be happy to provide this.

Yours faithfully

Keoghs LLP

SCOTTISH HOSPITALS INQUIRY

REVIEW BY NHSGGC

OF

REPORT OF ANDREW POPLETT CONCERNING DOMESTIC HOT AND COLD WATER SYSTEMS AT THE QUEEN ELIZABETH UNIVERSITY HOSPITAL, GLASGOW, AND THE ROYAL HOSPITAL FOR CHILDREN

DATED 10 JUNE 2024

1. INTRODUCTION

1.1. A report by Andrew Poplett entitled *"Domestic Hot and Cold Water Systems at The Queen Elizabeth University Hospital, Glasgow, and The Royal Hospital For Children*" dated 10 June 2024 (the "Report") has been disclosed to Inquiry core participants.

1.2. This document contains NHSGGC's response to the Report. With reference to Scottish Hospitals Inquiry Direction 5, Appendix B at para 2.1, specific questions to be asked of the report's author, and specific comments on the substance of the report, are set out below.

1.3. NHSGGC's questions and comments raise new matters or issues insofar as they relate to matters either not covered or not fully addressed in the report. It is understood that, in terms of Direction 5, the questions and comments below will be considered and addressed by the report's author and that a supplementary report will be prepared thereafter on that basis.

2. KEY THEMES OF QUESTIONS AND COMMENTS ON REPORT

2.1. Subject to the issues identified below, NHSGGC considers that the Report is well written and logically constructed. In respect of the Inquiry's understanding of the hot and cold water systems within the QEUH/RHC, and the steps that NHSGGC consider need to be taken by the Inquiry to address the Inquiry's terms of reference, NHSGGC draw the Inquiry's attention to NHSGGC's detailed response to PPP11 and 12, and the detailed RFI responses provided by NHSGGC RFIs 8, 9, Section 21 Notices 3,8,13,14,19 and 22.

2.2. The Report is a technical report on water systems. It is not a clinical report and provides no assessment on any increased risk of infection. It examines water systems only and not the wider mitigation of infection within a clinical environment.

2.3. NHSGGC's comments are set out under the following themes:

Overall approach and expertise of the author
Evidence and assumptions
Overview of systems;
Installation, commissioning and validation
Maintenance and operation

3. OVERALL APPROACH AND EXPERTISE OF THE AUTHOR

3.1. The Report focusses on technical aspects of hot and cold water systems and the author's assessment of the compliance of the systems with guidance. The author is asked to address 2 questions by the Inquiry. Those are that the author should address:

(a) From the point at which there were patients within the QEUH/RHC were the water systems (including drainage) in an unsafe condition, in the sense that it presented an additional risk of avoidable infection to patients?
(b) Are the water systems no longer in an unsafe condition in the sense that they now present no additional avoidable risk of infection?

3.2. The Report does not reach a conclusion on these questions. Instead, the author focusses on what could be done to comply with guidance. NHSGGC notes that the author does not define what is meant by "unsafe". What is "unsafe" must be considered with reference to the particular environment, and type of patient, including whether that patient is particularly vulnerable to infection. Further, to determine whether the environment is "unsafe" it is necessary to compare it to a base line environment that is considered "safe". Again, no attempt is made to define what is a "safe" hospital environment. In clinical practice, an outbreak is suspected if there is an increase beyond the normally expected numbers of infections. To assess if there is an increased risk of infection, a normal level of risk must be established. This means it is not possible to answer whether the systems were objectively unsafe.

3.3. The Report identifies 5 "issues" [para 2.2.1] in relation to the domestic water system which the author suggests means that the system was in a *"sub-optimal condition*". In reaching this conclusion, the author does not consider the full range of measures within a hospital which mitigate against infection risk. Indeed, whilst elements of the design are described as sub-optimal, the author does not conclude that those issues impacted on patient safety. For example, any perceived shortcoming with commissioning and validation does not

mean that the system was “unsafe”. The author lists issues but does not, and does not have the expertise to, conclude that the built environment within QEUH/RHC created an increased risk of infection for patients. It is essential to appreciate that no hospital can be a fully sterile environment. It is necessary to consider all steps taken to mitigate against risk of infection, not just water in isolation. NHSGGC considers that the question that must be asked and answered is whether the combined systems in the QEUH/RHC, taking into account the accepted background level of infection and all mitigations put in place to manage risk, present an increased risk of infection beyond what would be expected in a comparable hospital environment. Consideration of the nature of a hospital environment and the various steps taken to manage risk is therefore essential, as is an understanding of what is a base level of infection within a comparable hospital environment.

3.4. The Report does not identify any significant issues in the current operational practices for the QEUH/RHC water systems. Indeed, it is concluded at 9.1.2 that the identified issues in connection with control and maintenance are not uncommon within healthcare establishments and that the level of control and maintenance appears to be satisfactory. It is therefore of particular concern that the author hypothesises that clinical activities may need to be suspended in order for non-specified work to take place (for example 2.6.6 and 2.6.9). NHSGGC considers that the author is not qualified to make this statement. His statement is potentially misleading. The author states that 2.6.5 that assessment is required to identify “where water systems are a significant potential risk factor in patient safety”. However, he does not identify those elements of the system, if any exist. It appears to be a general statement that, theoretically, remedial work may require closure. However, there is nothing in his report that suggests that such remedial work be undertaken. Furthermore, it fails to give regard to the full range of mitigations. No water system is entirely sterile, nor can it be.

3.5. The QEUH/RHC has a wide range of mitigation measures in place, as do all other hospitals. Steps taken to manage risk within the QEUH include but are not limited to: use of single en-suite rooms, prophylaxis, PPE, filtering, dosing, testing, cleaning regime, screening and monitoring. Infection control is multifactorial. The combined impact of these features in a hospital environment, particularly one used to treat neutropenic patients, must be understood. Those mitigations are not considered by the author. NHSGGC submits that the QEUH/RHC is an entirely safe environment, by which the environment represents no greater risk than a comparable hospital environment. NHSGGC is aware of no incident or evidence that would require suspension or closure of any clinical facility within the QEUH/RHC. NHSGGC asks the author to specifically state that his analysis does not take into account wider mitigations.

3.6. To suggest wholesale closure of facilities is a significant and serious step. It risks undermining the confidence that patients have in the facility. The author should not be suggesting closure of clinical spaces, particularly where based on non-binding guidance, without clinical expertise and a holistic review and understanding of clinical practice.

4. EVIDENCE AND ASSUMPTIONS

4.1. Assumptions have been made and conclusions reached based on the written documentation without hearing evidence from those with knowledge of the design, build, commissioning and testing processes [see paragraph 1.3].

4.2. Those assumptions pre-empt evidence that the Inquiry is to hear. That includes reaching conclusions in respect of the commissioning, testing, maintenance of the water system and the system for approval of derogations from the design. It is submitted that it is not appropriate to reach any conclusions before the evidence of those responsible has been heard. Much of that evidence will not be heard until the Glasgow 4 hearings in 2025.

4.3. The author notes that *"the review process has involved limited time (four months with substantial evidence produced within only four weeks of report completion) and significant levels of documents and in many cases assessments have been undertaken on a sample basis to establish compliance levels; where no failures or non-compliances have been found I cannot guarantee that none exist, however every effort has been made to ensure that where issues exist they have been considered and appropriately recorded"* [Paragraph 1.4.2]. The author has based his report on a sample of the large volume of documents that NHSGGC has provided to the Inquiry. As acknowledged by the author at paragraph 1.5.1, the QEUH/RHC was a significant project. There is a large volume of documentation in existence in relation to its design, build, commissioning, operation and maintenance. NHSGGC's staff have not yet had the opportunity to give evidence on those issues. However, the report reaches conclusions, and gives recommendations, based on only a sample of documentation provided by NHSGGC to the Inquiry.

4.4. NHSGGC considers that the author will need to revisit his conclusions once evidence is heard. At this stage, NHSGGC asks the author to identify the sample reviewed and how that sample was chosen by him? Where he considers that any conclusion is limited by way of being based on a sample, he is asked to set out the nature of that limitation.

5. OVERVIEW OF SYSTEMS

5.1. NHSGGC has the following specific observations on the author's overview of the design of the system.

5.2. Paragraph 2.2.1, bullet point 1: the author refers to SHTM 04-01 part E when referencing filtration. This document was not published until 2015. The author also suggests when additional filtration was added, it was to a higher standard, which may be taken as inferring there was an underlying reason for this. The initial filtration standard and the newly added filtration unit in 2019 were to the same standard. The change was made for resilience and no other reason. The same point is made at 4.1.1.

5.3. Paragraph 3.2.5 and 5.11.5 contain a technical error. The temperature in healthcare should be 55 to 60 in one minute, as stated in SHTM 04-01 part A July 2014 para.16.34.

5.4. Paragraph 2.5.1: As indicated in the Report, actions from audit reports are not uncommon. All actions were completed by NHSGGC.

5.5. Paragraph 2.6.1: NHSGGC agrees that the issues highlighted in the 2023 AE(Water) report are not uncommon within many healthcare establishments. NHSGGC also notes the author's assessment that, in general, the level of control and maintenance provision appears to be satisfactory.

5.6. Paragraph 2.6.2: "NHSGGC notes that detailed monthly reports are collated and submitted to the Sector Water Safety Group by the relevant deputy RP and RP. "

5.7. Paragraph 2.6.3: NHSGGC notes the author's conclusion that the current water safety plan/policy is appropriate and suitable for the management of the water systems at the QEUH. NHSGGC asks that the author state whether this conclusion also applies to the RHC? NHSGGC considers that work done meets the guidance and, in some cases, exceeds it.

5.8. Paragraph 2.6.5: NHSGGC notes that this is line with requirements of BS8580-2. During 2018/19, the Water Technical Group identified high risk areas and implemented POU filters in these areas, reducing risk. The Infection Control Doctor also requested that Ward 2A drains be dosed with chlorine product every week. However, NHSGGC notes that the conclusion that a review is required appears to contradict the author's assessment that the water safety plan is appropriate [para 6.3]. The water safety plan is an "always live" document and therefore reflects the hospital as it is, it is not a desktop document.

5.9. Paragraph 2.6.12: NHSGGC notes that it does carry out appropriate, and compliant, training.

6. INSTALLATION, COMMISSIONING, VALIDATION

6.1. NHSGGC has the following specific observations on the author's overview of the design of the system.

6.2. Paragraph 3.4.2 is incorrect, the changeover is every eleven hours.

6.3. Paragraph 3.4.9 is incorrect. Hot water should be delivered within 1 minute at the outlet at 55 degrees Celsius.

6.4. Paragraph 3.4.12: PALL carried out a report on risk of back contamination arising from POU filters and concluded that "[t]here was no indication that installation of Pall POU Water Filters led to increasing microbial counts at the water outlets post filter removal."

6.5. Paragraph 3.8.4: NHSGGC notes that the return temp at calorifier is to be 50 degrees, not 55 degrees.

6.6. Paragraph 3.8.5: NHSGGC notes that calorifiers have been set at 65c since at least 2018.

6.7. Paragraph 4.1.10: NHSGGC notes that Renal and Endoscopy have their own filtration/treatment plants which then supply dedicated and separate water systems supplied from the mains hospital water.

6.8. Paragraph 3.8.7: In respect of the use of flow straighteners, NHSGGC asks that the author have regard to the most referent RFI29.

6.9. At paragraph 3.8.7, the author refers to flow "regulator" which is a separate function to flow "straightener".

6.10. Paragraph 4.1.2: The dump valves were part of the design and not fitted as part of the 2015 RA recommendations.

7. MAINTENANCE AND OPERATION

7.1. NHSGGC has the following specific observations on the author's overview of the maintenance and operation of the system.

7.2. NHSGGC asks the author to note at paragraph 5.11.12 that the Scottish Water Bylaws Inspection was campus wide and only 7 incidents were identified in relation to the QEUH and RHC. Of the 7, 4 were completed in 2020, 2 completed in 2021. The last outstanding action was to obtain copies of certification of RPZ valve maintenance and was signed off as compliant with Scottish Water Bylaws in January 2024.

7.3. Paragraph 5.11.25 and 26: NHSGGC notes that issues in the drains were often caused by users and so requires robust guidance. NHSGGC asks the author to clarify what he is suggesting goes beyond the remit described in the SHTM 4. The author is asked to cite the research evidence referred to.

7.4. Paragraph 5.13.4: NHSGGC notes that no bye-law issue has been linked to water quality delivered to patients.

7.5. Paragraph 5.17.17 and 18: In some cases, WRAS approval only applies to the paint or surface in contact with the water and not the part itself and how the part has been painted, which can then lead to corrosion with parts such as valves and meters which are sold as WRAS approved.

7.6. Paragraph 6.6.9: NHSGGC notes that it uses a combination of methods.

7.7. Paragraph 7.6.6: NHSGGC notes that all contractors working on the water system must have completed a competent training course to City and Guilds level and require to be signed of by Water AP. NHSGGC asks that the author provide an evidential basis for the statement that “there is little to no evidence of general staff such as domestic services or contractors being provided with or providing assurance of a general water safety awareness training or assessment process”.

7.8. Paragraph 7.94 and 9.16: NHSGGC asks that the author state the evidence or guidance that he relies upon in suggesting these steps ought to be taken.

7.9. Paragraph 7.9.5: NHSGGC is again concerned that this is an oversimplification by looking only at one dimension of healthcare provision. Engineering risks need to be assessed in conjunction with population risks.

8. CONCLUSION

8.1. The author’s conclusion is broadly that non-compliance with guidance in and of itself represents additional risk and that steps should be taken to ensure compliance. The author acknowledges at 3.11 that debate over the status of these documents can be highly

contentious and generally not definitively defined. The author refers to anecdotal evidence that not following guidance has been used in court proceedings. No details are given. It is submitted that nothing can be taken from this without knowing the full background to each case.

8.2. It cannot be assumed that non-compliance means that the QEUH/RHC is “unsafe”. To make such a statement may undermine patient and public confidence in the hospital without justification. The mitigation of infection risk requires attention to many factors, of which management of water is only one. It is necessary to consider all of the measures in place to determine whether there is any increased risk of infection beyond which would be accepted in a comparable hospital environment.

Peter Gray K.C.

and

Andrew McWhirter, Advocate

25 July 2024

In the Scottish Hospitals Inquiry

Response by IBI Group (UK) Limited to the Expert Report by Andrew Poplett, entitled - Concerning Domestic Hot and Cold Water Systems at The Queen Elizabeth University Hospital, Glasgow, and The Royal Hospital For Children

Introduction

IBI is grateful for the opportunity to assist the Inquiry by providing a brief response to Mr Poplett's report, dated 10 June 2024. Due to the constraints of time, and on the limited information presently available, this response is limited in scope. However, as the Inquiry continues its work, and further evidence is made available, IBI will continue to consider the matters covered within this report and, in the meantime, will be happy to provide further input and clarification as required.

Responses to specific paragraphs in the report

2.2.1 The domestic water systems at the point of handover / patient occupation were in a sub-optimal condition… The commissioning process had failed to follow the requirements of the SHTM...

IBI understands that there would have been an agreed commissioning procedure to validate the water system prior to handover. IBI was not directly involved, or witness to, the testing procedures as this was not within their area of expertise.

General response to comments, in this report and others, about the water system

IBI understands that the water system was designed by TUV SUD, the MEP consultant (taking over that role from ZBP) and that Mercury Engineering, the MEP Subcontractor, also bore Subcontractor design responsibilities. Separately, IBI's understanding is that WSP UK Limited, the Civil & Structural subcontractor, was responsible for below ground drainage.

IBI's position is that its involvement in relation to the water and drainage systems was limited to the specification of materials in areas of sanitaryware (e.g. the pipework in the boxes behind sink and WC units). It therefore notes that the great majority of the Water System Defects were not within IBI's scope of responsibility and that it does not have the knowledge or expertise to comment on those issues. More detail will be provided in due course.

M A MacLeod

Barney Ross, Advocate

Womble Bond Dickinson

SCOTTISH HOSPITALS INQUIRY

QUESTIONS AND COMMENTS

ON THE EXPERT REPORT

CONCERNING DOMESTIC HOT AND COLD WATER SYSTEMS

PREPARED BY ANDREW POPLETT DATED 10 JUNE 2024

SUBMITTED ON BEHALF OF DR CHRISTINE PETERS

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1. INTRODUCTION

1.1 The following comments and questions on the expert report titled "Independent Expert Report Concerning Domestic Hot and Cold Water Systems at The Queen Elizabeth University Hospital, Glasgow, and The Royal Hospital For Children" prepared by Andrew Poplett dated 10 June 2024 ("Poplett Water Report") are submitted on behalf of Dr Christine Peters in accordance with the procedure set out in Appendix B of Direction 5 – in respect of the Hearing Commencing 19 August 2023. References herein to section and paragraph numbers and to defined terms are to such numbers and terms used in the Poplett Water Report unless otherwise stated.

1.2 The following comments and questions do not raise new matters. Instead, their purpose is to seek further clarification or to allow the author to elaborate more fully on points raised in his report.

2. SECTION 1: EXCLUSIONS / LIMITATIONS OF THE REPORT

2.1 **Para. 1.4.2:** Dr Peters notes with concern that the author advises that "substantial evidence [was] produced within only four weeks of report completion". Is there a reason why, nearly 5 years into the Inquiry, this should be the case? What, if any, additional information does the author think is required to make more specific conclusions regarding the current safety status of the hospital?

3. SECTION 2: EXECUTIVE SUMMARY

Design, Installation and Commissioning process

3.1 **Para. 2.2.1**:

3.1.1 The author states "The domestic water systems at the point of handover / patient occupation were in a sub-optimal condition." Can the author specify if "sub optimal" equates to an unsafe condition for high-risk situations such as theatre water, dialysis, ICU, PICU, BMT, renal transplant and endoscopy?

3.1.2 Reference is made by the author to "the pre-occupation risk assessment". Is what is being referred to the April 2015 DMA Canyon report? If so, this risk assessment occurred within days of patients moving in (*i.e.,* on 24 April 2015). Does the author consider this to be an appropriate time scale for a project of this size and complexity, given the number of high-risk issues identified?

Maintenance and Operation of the water system

3.2 **Para. 2.4.2:** The author states "Formal PPM schedules were not in place, and gaps remain to this day in areas such as TMV/TMT maintenance and stabilisation tests following replacement." What are the current safety implications, if any, for the high-risk patient groups mentioned caused by the identified gaps in TMV/TMT maintenance?

Current Condition and Potential Issues and Risks

3.3 **Para. 2.5.1:** Is the author's satisfaction with the current state of affairs commensurate with a 9-year-old building and applicable to all patient groups and activity settings within the hospital? This currently includes ITU and CF clinics without POUFs.

3.4 **Para. 2.5.3:** The author states "The current water safety plan/policy is considered appropriate and suitable for the management of the water systems at QEUH." Does this assessment take into account an analysis of the water testing strategy and results with regard to high-risk patients as well as the existence of bio film throughout the system?

Conclusion and Areas of Potential Improvement to minimise risk of future patient infections associated with water provision

3.5 **Para. 2.6.5:** As a point of clarification, in the absence of a recorded and considered assessment of the patient safety risk profile, please can the author explain why he is still able to conclude that the water safety policy is adequate at the current time?

3.6 **Para. 2.6.7:** To make the statement above, *i.e.,* that the water system is suitable and appropriate, would this not require minimum performance standards to already be agreed and met?

4. SECTION 4: QEUH/RHC DESIGN, INSTALLATION, COMMISSIONING AND VALIDATION (POINT OF OCCUPATION)

Specialised Systems

4.1 **Para. 4.1.11:** Is the absence of risk assessments to this day at odds with the conclusion that the water safety policy is appropriate?

Domestic Hot Water Temperature and Heat Source (Energy Centre)

4.2 **Para. 4.1.15:** It should be noted that the statement that "at no time did the return water temperature fall below 53.2°C" and so controls were adequate is at odds with Mr Walker's report where temperatures are recorded as returning at less than 45°C to the energy centre.

Pre-Occupation Water Risk Assessment (2015)

4.3 **Para. 4.2.3:** Does the author consider the actions by the NHSGCC Board and Estates team at this time to be appropriate for the high risk group of patients and activities already housed in the facility? Does he consider that the actions taken were sufficient to provide a safe system in a prioritised manner? Has he seen evidence that the Board was aware of the work undertaken in response to the 2015 report in order to credit the Board with the positive actions taken in response to it by 2017?

4.4 **Para. 4.2.4:** Please clarify which improvement works are being alluded to, if these works pre-dated the 2017 assessment and if the Board approved them?

Ancillary Considerations

4.5 **Para. 4.3.2:** Is the author satisfied that there is no evidence of ground contamination by any leakage events in the vicinity of sewage piping supplying the sewage works in the years of relevance to the ground works being done for the new buildings? Does he agree that, had there been such leaks, the level of ground bacterial contamination could have been high?

5. SECTION 5: COMMISSIONING AT HANDOVER

TMVs and Thermostatic Mixing Taps (TMT) Commissioning

5.1 **Para. 5.4.1:** There is an error in the footnote. The document "2310 RHC TMV Servicing Clinic 6" is A47843181 (Bundle 20, p. 2112). . In relation to this document, does the author accept that it refers to actions taken in 2023? Further, TMVs should have been serviced from the start. Please can the author be more specific about the areas where TMVs have been serviced and the date(s) this started.

Validation

5.2 **Para. 5.9.8:** How many samples were taken? To what extent did they fail? Is the author satisfied he has seen all the water testing results taken pre-handover? Please can the document being referred to be provided – it does not appear to have been included in Bundle 20.

Automatic Flushing or Dump Valve Description and Purpose

5.3 **Para. 5.11.12:** This paragraph refers to Scottish Water Bylaw contraventions – please can the relevant inspection reports be provided – they do not appear to have been included in Bundle 20. Please can the author expand on the significance of this issue in relation to current water safety assurances and the water safety policy being adequate in the context of high risk patients and high risk activities?

Drainage and Waste Water Systems

5.4 **Para. 5.11.43:** Does the author have information regarding sluice drainage adequacy in terms of standards with regard to angle and diameter?

6. SECTION 7: POST COMPLETION WORKS/IMPROVEMENTS TO ADDRESS IDENTIFIED ISSUE PRESENT FROM HANDOVER

March 2022 RHC Ward 2A/2B

6.1 **Para. 7.3.1:** This paragraph refers to "a revised and updated water systems risk assessment." Is this risk assessment available plus the water testing results and the ASSURE recommendations?

Verification of operation for water systems since handover

6.2 **Para. 7.4.2:** Is the author aware that the hospital was handed over on 26 January 2015 and patients started moving in on 24 April 2015? Would he have expected the DMA Canyon report to be in NHSGGC's possession prior to handover?

6.3 **Para. 7.4.3:** The DMA Canyon reports from January 2015 and April 2015 are not available in the bundles. Please can these be made available?

6.4 **Para. 7.4.5:** With regard to the action plan, is there evidence of IPC involvement and risk assessment with regard to the patient groups affected? If not, what is the author's view on the timescale of the actions given occupation of the building 3 years previously?

6.5 **Para. 7.4.6:**

6.5.1 Which areas were the actions taken for and is this comprehensive enough for the patients at high risk?

6.5.2 What is the author's view about the reassurance that can be taken from the existence of a water management system but the absence of evidence regarding the actual state of the water system?

6.6 **Para. 7.4.12:** Is it the author's view that the yearly audit has adequate infection control assessment regarding delineation of key areas of risk?

NHSGGC Water Safety Group

6.7 **Para. 7.5:**

6.7.1 Is the author suggesting that NHSGGC did not have a Board level Water Safety Group in place before 2017? If so, this is incorrect and minutes of the WSG meetings should be provided by NHSGGC.

6.7.2 If the author is referring to a local Water Safety Group for the QEUH/RHC specifically post-handover – should the establishment of such a group have been an obvious and expected action of the Board level Water Safety Group working with the project team for the new build, to ensure continuity of coverage from the old estate Water Safety Group (which already existed) to the new group? Water Safety reports per sector were submitted to every board level Water Safety Group prior to 2015. These should be available from NHSGGC.

6.7.3 What level of organisational governance would the author suggest should have been in place to ensure the project handover included the appropriate Board structures of water governance?

6.8 **Para. 7.5.2:** Would the author not consider the DMA Canyon assessments to be "external assurance"?

Provision of personnel and resources

6.9 **Para. 7.6.6:** Is the author able to identify the point at which the level of training and awareness reached the appropriate and required standard?

Quarterly WSG Operational Update Report

6.10 **Para. 7.7.1.2:** With regard to exception reporting, does the author consider that the reporting of leaks into high-risk areas, positive water sampling results and resultant infection risks and consequences would be routine? Does the author have evidence of this occurring since 2015 and, if so, how has the incident reporting been validated?

Conclusions relating to the maintenance and operation of the water system

6.11 **Para. 7.8.1:** As a point of correction, it should be noted that there was a south sector Water Safety Group in place (see minutes reporting to the Board level Water Safety Group pre 2015).

6.12 **Para. 7.8.2:** Given the number of defects identified in the DMA Canyon reports, is it the author's opinion that handover should not have taken place? Other than the defects identified in the DMA Canyon reports, is the author aware of any other defects and, if so, what are these?

6.13 **Para. 7.8.3**: Do these defects cover high risk areas such as HDU, ITU, renal transplant, endoscopy, theatres and PICU?

Current condition and potential issues and risks

6.14 **Para. 7.9.1:** Is the author comparing a 9-year-old building to similarly aged buildings that have been managed in an appropriate manner since opening, or to the status of old NHS estate buildings? At what point since 2015 did the system become broadly acceptable in the general terms mentioned by the author?

6.15 **Para. 7.9.3:** Would it be the author's recommendation that the appropriate review/assessment include independent external experts to ensure that confidence can be placed in the findings? What is the author's view of needing a baseline review 9 years after opening a facility that was posited to provide a high-quality clinical setting for immune vulnerable complex patient groups?

7. SECTION 9: CONCLUSION ON CURRENT TECHNICAL MANAGEMENT ARRANGEMENTS AND AREAS OF POTENTIAL IMPROVEMENT TO MINIMISE RISK OF FUTURE PATIENT INFECTIONS ASSOCIATED WITH WATER PROVISION

7.1 **Para. 9.1.2:** Are there any levels of assessment that the AE(W) needs to undertake to ensure high risk water provision can be pronounced as "satisfactory" or can the current level of scrutiny be regarded as adequate?

8. CONCLUSION

8.1 In relation to the above and the Poplett Water Report more generally, Dr Peters would be happy to provide further input, information and/or clarification as required.

Helen Watts KC and Leigh Lawrie, Advocate

On behalf of Dr Christine Peters

24 July 2024

1 Introduction

1.1 The following is a response by Multiplex Construction Europe Limited ("Multiplex") to the expert reports prepared by (i) Andrew Poplett titled Independent Expert Report Concerning Critical Healthcare Ventilation Systems; and (ii) Allan Bennett titled Ventilation Deficiencies at QEUH and RHC and their Potential Impacts ("Expert Reports").

1.2 Multiplex is grateful for the opportunity to assist the Inquiry in relation to these Expert Reports.

1.3 As noted in its response to the expert report of Dr Walker, Multiplex does not consider that a period of 5 weeks to respond has provided Multiplex with sufficient time to properly consider and formulate a response to all of the matters raised in the Expert Reports, particularly when this period falls across summer holiday season.

1.4 The above being said, in the limited time made available, and with a view to assisting the Inquiry, Multiplex has prepared the commentary below.

1.5 Multiplex refer the Inquiry to the responses it has issued to the Inquiry previously on matters relating to QEUH and RHC.

1.6 Having regard to Section 2(1) of the Inquiries Act 2005, Multiplex's position set out in this response is provided solely to assist the Inquiry's understanding and is without prejudice to and under reservation of any further submissions Multiplex may make or evidence it may lead in any forum.

2 Commentary

2.1 Multiplex would respectfully direct the Inquiry to the Employer's Requirements (forming part of the construction contract) which set out the NHS Mandatory, Guidance and Additional Documentation at sections 5.1.2 to 5.14 in relation to the design, installation and testing of the Works.

2.2 The Employer's Requirements go on to provide that "*NHS Publications and other published guidance shall be deemed to mean those in place at the date of signing the construction contract. Any date reference in Table 2 or Table 3, therefore, may be replaced/read as that in place at the date of signing the construction contract.*"

2.3 In the interests of clarity, Multiplex note that Mr Poplett makes reference to various versions of guidance that post-date those applicable to the construction contract.

2.4 The versions referred to by Mr Poplett may be versions applicable to the maintenance and operation of the QEUH post-handover, however they were not applicable to the Works under the construction contract.

2.5 Examples of the foregoing include, but are not limited to, SHTM 03-01 Part A published 2013, 2014 and (Interim Version) February 2022. The version applicable at the date of signing the construction contract was 2009.

2.6 Mr Poplett in section 5 identifies areas within a hospital where the variability of air flow rates is normally acceptable where natural ventilation is used. Mr Poplett has incorrectly omitted 'general wards' (as noted in SHTM 03-01 Part A 2009 Section 2.3) from those areas identified.

2.7 Mr Poplett in section 9.131 identifies that flexible ductwork may be used to make the final connection to a terminal providing it does not exceed 0.5 metres in length. SHTM 03-01 Part A 2009 Section 5.55 provides "[w]*here installed it should take the most direct route and be as short as possible, never exceeding 1 metre in length.*"

2.8 Mr Bennett in section 8.5 advises "[t]*his report will not cover the BMT rooms located on Ward 2A which will be discussed in a further paper.*" A copy of this report was not made available to Multiplex by the date of this response.

2.9 Mr Bennett in section 9.14 relating to sewage works advises "[t]*he impact of proximity to these facilities will be reviewed in a forthcoming report.*" A copy of this report was not made available to Multiplex by the date of this response.

Chilled Beams

2.10 Multiplex note the Employer's Requirements Volume 2/1 Appendix M&E.3 - Plant Strategy & Design Criteria section 2.4.3 provides "[t]*he use of chilled beams should be considered within all ward areas*" and "[f]*an coils shall not be acceptable for use in clinical areas.*"

2.11 The above is consistent with HTM 03-01 Part A 2007; SHTM 03-01 Part A 2009; SHTM 03-01 Part A 2013; and SHTM 03-01 Part A 2014.

2.12 SHTM 03-01 Part A (Interim Version) February 2022 provides "[c]*hilled beams should not be installed in clinical areas without the agreement in writing of the VSG*" and "[p]*atient bedrooms are classed as clinical areas as treatment is often delivered at the bedside rather than in a designated treatment room.*"

2.13 The above major change in the 2022 guidance is acknowledged by Mr Bennett at sections 7.23; 7.52; 7.53; 8.4 and 8.46 within his report.

2.14 Multiplex submitted a sample of the chilled beams to GGHB, which sample was approved.

2.15 Various design packages detailing all the locations of chilled beams were submitted under the construction contract review process to GGHB for approval, including ventilation, chilled water, heating, and reflective ceiling plan drawings.

Thermal Wheels

2.16 Mr Poplett at section 7.51 of his report provides his own recommendation as to the use of plate heat exchangers in lieu of thermal wheels. The Inquiry team should consider the relevant advice provided in the various revisions of the NHS guidance.

2.17 HTM 03-01 Part A 2007 provides "[t]*hermal wheels may be used providing they are fitted with a purge section. The small amounts of air leakage across these devices are not considered significant.*"

2.18 This is consistent with that of SHTM 03-01 Part A 2009; SHTM 03-01 Part A 2013; and SHTM 03-01 Part A 2014.

2.19 SHTM 03-01 Part A (Interim Version) February 2022 reaffirms this as it provides "[f*]or most systems in healthcare premises a plate heat exchanger, "run-around coil" system or thermal wheel would be appropriate. Selection should be based on the relative locations of the supply and extract units, ease of maintenance and practicality*". Furthermore, the SHTM advises "[t]*hermal wheels may be used, as the degree of air transfer from extract to supply is not sufficient to cause aerobiological problems and in any event the air will be filtered before being supplied to the user*."

2.20 During the Works on 21 June 2012 GGHB issued to Multiplex PMI 172 titled Ward Tower Ventilation, which stated "[t]*he Board confirm that following detailed review thermal wheels can be installed in the Adult Ward tower ventilation in lieu of plate heat exchangers to secure the energy reduction benefits identified*."

Ward 4B Ceiling Specification

2.21 Ceiling proposals for Ward 4B were submitted by Multiplex to GGHB for approval as part of the construction contract review process as the design developed.

2.22 For Ward 4B single bedrooms and en-suites, the proposal was 600mm x 600mm mineral fibre tiles within an exposed grid system, which proposal was approved by GGHB.

Ward 5C and 5D

2.23 Mr Poplett notes at 7.24 that "[l]*evel 5 of the QEUH was designed and constructed to a specification of a General Ward*." Level 5 was briefed by GGHB as Generic Wards within the Employer's Requirements / briefing Schedule of Accommodation.

2.24 Similarly, Mr Bennet at sections 6.2; 8.3; and 8.36 refers to Ward 5C and 5D as Infectious Disease Wards.

Wards 7B, 7C and 7D

2.25 Wards 7B, C and D were briefed, designed and constructed as Generic Wards.

HEPA Filtration Ward 2A

2.26 There is no HEPA filtration within the design for single bedrooms in Ward 2A. The ventilation design for this area was approved by GGHB.

2.27 During February 2013 GGHB queried where the provision of HEPA filters was detailed for Schiehallion Ward 2A. GGHB confirmed that all 8 isolation rooms should have the facility and to allow filters in 6 of these.

2.28 The clinical output specification does not provide the level of detail with regards to ventilation as found in the equivalent clinical output specification for Ward 4B in the Adults hospital.

HEPA Filtration Ward 4B

2.29 The design drawings for this Ward details localised HEPA filters within each of the HOW single bedrooms except for 8 no., which aligns with GGHB's PMI 21 dated 21 June 2010.

2.30 GGHB's PMI 21 removed HEPA filtration from 8 no. bedrooms within the Ward 4B Haemato-Oncology Ward and provides "[t]*he Board confirm that 8 No single rooms no longer require Hepa filter air supply as originally specified.*"

2.31 In July 2013 Multiplex received a further instruction from GGHB under PMI 228 titled Change to NSGH Level 4 - HEPA filtration, which instructed Multiplex to stop fit-out works in this area and changed the design based on drawings and information provided by GGHB.

2.32 PMI 228 did not instruct a change for Ward 4B from Haematology Oncology Ward to a Bone Marrow Transplant Ward.

2.33 At handover the ventilation design for Ward 4B had single bedrooms with HEPA filtration at positive pressure to the corridor, extract ventilation in the corridors to remove the cascade air coming from the bedrooms. There was no supply air in corridors and therefore no localised HEPA filters in corridors.

Ward 4C Renal Ward

2.34 Mr Poplett at section 5.35 draws a comparison between a renal dialysis unit and a treatment room, inferring a renal dialysis unit should have 10 ac/hr and 10 pa positive pressure. This interpretation differs from that of John Hood and Peter Hoffmann.

2.35 Multiplex refer the Inquiry team to the correspondence at page 371 of Bundle 22, where GGHB in October 2010 sought clarity on 2.5 ac/hr for renal areas from John Hood and Peter Hoffmann. It appears that they were content with the use of chilled beams and an explanation was provided that 6 ac/hr was for temperature control and not for any infection control issues.

2.36 Mr Poplett at sections 6.11, 6.14, 7.16 of his report and Mr Bennett at section 8.23 refer to Ward 4C as being a Haematology Oncology Ward. Multiplex note this department was a Renal Ward and are not aware of any instruction from GGHB to its designation change.

2.37 Mr Poplett at section 7.16 to 7.20 and Mr Bennett at section 8.23 compare Ward 4C at handover against a Haematology-Oncology Ward and not the briefed and designed Renal Ward.

2.38 Multiplex note changes were instructed by GGHB to Ward 4C by PMI 228 dated 2 July 2013. The changes relating to Ward 4 C were "*Renal Ward - add Hepa filtration to isolation rooms and lobby and ensuite for RENW-046 and RENW-041.*"

Carbon Filters

2.39 Mr Bennett at section 4.4 notes that GGHB accepted removal of activated carbon filtration from the ventilation systems. This was instructed by PMI 157 dated 26 April 2012 titled "*Adult & Childrens Hospital - Carbon Filters*" removed carbon filters from the design. The PMI provided "[d]*elete provision and installation of carbon filters and filter support infrastructure for the Adult and Children's Hospitals. All associated air handling equipment should be re-sized to suit and this may include fan motor size. Please provide associated cost saving.*"

Validation

2.40 Multiplex note that Mr Poplett sets out the validation process at sections 8.8 as defined in HTM03-01 Part A 2021 and not the guidance applicable at the date of the construction contract was signed.

2.41 Mr Bennett acknowledges at section 7.74 the latest versions of HTM / SHTM 03-01 make a clearer distinction between commissioning and validation than in previous versions.

2.42 Multiplex would respectfully direct the Inquiry team to GGHB for records of independent validation and verification. HTM03-01 Part A 2007 provides validation should be carried out by a suitably qualified Authorised Person appointed by the client. This was also confirmed by NHS Lothian during their closing submission for the Edinburgh hospital.

Miscellaneous

2.43 Multiplex is happy to discuss this response with the Inquiry team if it would be of assistance.

Keoghs

Scottish Hospitals Inquiry

[Uploaded via Objective Connect]

Our Ref: RIL.10513091
Your Ref:
Date: 25 July 2024
Please Ask For: Ruth Lawrence / Rachel Blair
Email: [redacted] /
Direct Dial: [redacted] / [redacted]

Dear Sirs

Our Client: **Currie & Brown UK Limited**
Re: **Queen Elizabeth University Hospital, Glasgow**

We write in response to Mr Andrew Poplett's 'Independent Expert Report Concerning Critical Healthcare Ventilation Systems' dated 10 June 2024 ("**the SHI Ventilation Report**") on behalf of our client, Currie & Brown UK Ltd ("**Currie & Brown**"), in accordance with the directions in the Inquiry Solicitor's email of 20 June 2024.

We have responded separately to Mr Poplett's 'Independent Expert Report Concerning Domestic Hot and Cold Water Systems' also dated 10 June 2024.

References in bold to paragraph numbers below are to the numbered paragraphs of the SHI Ventilation Report. References to Bundle numbers are to the numbered bundles issued by the Inquiry for the Glasgow 3 hearing commencing on 19 August 2024 (unless otherwise stated).

Responses to the SHI Ventilation Report

Specification of chilled beams

1. Mr Poplett concludes in **Paragraph 1.2** and **Paragraph 11.1** that the ventilation systems as designed, installed, and commissioned in the Queen Elizabeth University Hospital ("**QEUH**")[1] were "*clearly not fully compliant*" with the "*relevant NHS standards at the time*" due to the "*decision to install chilled beam systems and as a direct result lower room air change rates*".[2]

2. The use of chilled beams was not prohibited by the relevant NHS standards current in Scotland at the time of the design and construction of QEUH. Therefore, the decision to install chilled beams did not amount to non-compliance with those standards at the time:

[1] References in this letter to QEUH include the Royal Hospital for Children.
[2] See also paragraphs 1.3 (1st bullet), 1.4, 1.13, 6.7 (4th bullet), 6.11, 7.46, 7.57, and 11.3 (2nd bullet).

2.1. SHTM 03-01 (January 2009) 'Ventilation for Healthcare Premises' (Draft for Consultation) was in use at the time the Main Contract was executed and was included in the Employer's Requirements. Paragraph 2.38, Part A of SHTM 03-01 (January 2009) permitted, and arguably condoned, the use of chilled beams, as follows:

> "*The use of chilled beams for the provision of heating, cooling and ventilation is increasingly common in healthcare premises. The use of Active Chilled Beams providing tempered filtered air to a heating / cooling device within the room can provide effective local control of environmental conditions.*"[3]

2.2. Paragraph 2.38, Part A of Version 1.2 of SHTM 03-01 (February 2013) and Version 2.0 of SHTM 03-01 (February 2014), which were published three years and four years respectively after construction of the QEUH commenced, contained the exact same wording.[4]

2.3. Mr Poplett has referred in the SHI Ventilation Report to a 2007 edition of SHTM 03-01 (see e.g. paragraphs 1.4, 7.1 and 7.2). We cannot locate any reference to a 2007 edition of SHTM 03-01. There was, however, a 2007 edition of HTM 03-01 which Mr Poplett may be referring to. HTM 03-01 was not applicable in Scotland.

3. Mr Poplett says in **Paragraph 6.11** that "*SHTM 03 01(2013) advises careful consideration should be given to the use and location of chilled beams to the possible risk of cross infection*" [emphasis added]. However, the only words of caution relating to chilled beams in SHTM 03-01 (February 2013) were limited in paragraphs 2.39 to 2.40 to warnings only about the location, and not the use, of chilled beams, as follows:[5]

> "*2.39 Care should be taken in positioning chilled beams to ensure the avoidance of cold draughts particularly when used in the cooling mode. The control settings should ensure that the external elements of the beam are always above dewpoint.*
>
> *2.40 Consideration should be given to the ease with which specific types of chilled beam units can be accessed for cleaning having regard to the need to control the infection risk. The impact of maintenance requirements on room availability should also be considered.*" [emphasis added]

4. It is submitted that paragraphs 2.39 to 2.40 of SHTM 03-01 do not go as far as **Paragraph 6.11** would suggest, and merely provide advice about the positioning of chilled beams in order to avoid draughts and control infection risk. There is no prohibition on, or warning about, the use or specification of chilled beams *per se* in SHTM 03-01.

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[3] Bundle 16, page 371.
[4] Bundle 1 for Hearing commencing 9 May 2022, page 459 and page 643.
[5] See Bundle 1 for Hearing commencing 9 May 2022, page 459. The same wording appears in paragraphs 2.39 to 2.40 of SHTM 03-01 (January 2009) (see Bundle 16, page 371) and Version 2.0 of SHTM 03-01 (February 2014) (see Bundle 1 for Hearing commencing 9 May 2022, page 643).

5. No note of caution about the use (as opposed to the positioning) of chilled beam units in specialist ventilation areas was introduced into the relevant NHS standards in Scotland until Interim Version 3.0 of SHTM 03-01 was published in February 2022,[6] long after the construction of QEUH was completed, as explained in our letter of response to the report of Dr Mumford and Ms Dempster dated 15 July 2024.

6. In **Paragraph 7.46** Mr Poplett says that the 2021 version of HTM 03-01 stated that "*Passive chilled beams…are not considered appropriate within clinical care areas*". HTM 03-01 (2021) did not apply in Scotland (and this guidance similarly post-dated completion of the construction of QEUH by several years), but in any event it is submitted that paragraphs 5.18 to 5.24 of HTM 03-01 (2021) do not go as far as to state that the use of chilled beams is "*not considered appropriate within clinical care areas*". Rather, the effect of paragraph 5.19 is that chilled beams can be installed in clinical areas if agreed in writing by the Ventilation Safety Group (VSG). This same requirement was only introduced in Scotland for the first time in Interim Version 3.0 of SHTM 03-01 published in February 2022.[7]

7. Therefore, contrary to the implication in **Paragraph 1.2** and **Paragraph 11.1**, installation of chilled beam systems in certain areas did not amount to non-compliance with the relevant NHS standards in Scotland at the time of the design, construction, and completion of QEUH.

The derogation from SHTM 03-01 to lower the air change rate in single bedrooms

8. NHS GGC's decision[8] to lower the air changes per hour ("**ACH**") in single bedrooms from 6 ACH to 2.5 ACH was an agreed derogation from the relevant recommendation in SHTM 03-01, not a failure to comply with SHTM 03-01 as Mr Poplett opines in **Paragraph 1.2** and **Paragraph 11.1**.

9. As Mr Poplett states in **Paragraph 9.107**, there can be many good reasons why building owners may seek to derogate from the guidance in SHTMs and other NHS standards. Provided the implications and risks of the derogation are considered and carefully balanced with the benefits, derogations can be sensible and safe, as Mr Poplett recognises in **Paragraph 9.108**.

10. It is submitted that it is not unusual (let alone "*highly unusual*") for derogations from the relevant NHS standards to be sought and (if appropriate) approved on 'new build' projects, contrary to **Paragraph 9.108**.

11. Furthermore, the recommendation of 6 ACH in SHTM 03-01 is merely a recommendation, not a strict requirement. Table A1 in Appendix 1 to SHTM 03-01 (February 2014) allows natural ventilation in single bedrooms;[9] the variability of natural ventilation depending on a range of factors (as explained in **Paragraph 5.19**) indicates an acceptance in the guidance that

[6] Paragraph 5.19, Part A of Interim Version 3.0 of SHTM 03-01 (February 2022) (Bundle 1 for Hearing commencing 9 May 2022, page 839).
[7] Ibid.
[8] As recorded in Item ER 2/1 of the final M&E Clarification Log (provided as document 153 in Currie & Brown's S.21 Request Inventory dated 28 May 2024 in response to the Inquiry's S.21 Notice dated 14 May 2024, Bundle 16 for Hearing commencing 19 August 2024, page 1662).
[9] Bundle 1 for Hearing commencing 9 May 2022, page 756.

achieving certain air change rates will be variable. As Mr Poplett explains at **Paragraph 5.35**, the identification of the appropriate air change rate for any given space can be a matter for discussion between Infection Prevention Control ("**IPC**"), clinicians, microbiologists, and engineers (as indeed happened in the present case, see paragraph 12.1 below).

12. Mr Poplett refers in **Paragraph 1.2** and **Paragraph 11.1** to a "*failure to involve all stakeholders and to ensure a multi-disciplinary review approach*" in the context of the derogation to lower the air change rates. NHS GGC would be better placed to explain the process by which this derogation was considered and agreed, but it was and is Currie & Brown's understanding that this process did indeed involve a multi-disciplinary team. See, for example:

    12.1. With particular reference to this derogation, an email exchange on 21 to 25 October 2010 between members of NHS GGC's Project Team including Dr John Hood (Consultant Microbiologist), Alan Seabourne (Project Director), Fiona McCluskey (Senior Nurse Advisor), Jackie Stewart (IPC advisor), and Craig Williams (Consultant Microbiologist) concerning the proposed derogation from 6 ACH to 2.5 ACH for single bedrooms.[10] This email exchange also demonstrates that NHS GGC consulted the Health Protection Agency ("**HPA**") about the proposed derogation.

    12.2. Dr Hood reported in his email of 25 October 2010 that HPA did not raise any objections or concerns about the proposed derogation from 6 ACH to 2.5 ACH for single bedrooms; on the contrary, HPA advised him that that "*the suggested 6 ACH is really for temperature control and not for any infection control issues (i.e. not dilution and removal…)*".

    12.3. More generally, an email from Mr Seabourne to David Loudon (NHS Director of Estates & Facilities), Douglas Ross of Currie & Brown, and others dated 23 June 2016 which stated that NHS GGC's Infection Control, Microbiology, and Facilities Management teams were involved in "*every aspect of the design*" (provided as document 149 in Currie & Brown's S.21 Request Inventory dated 28 May 2024 in response to the Inquiry's S.21 Notice dated 14 May 2024, Bundle 12 for Hearing commencing 19 August 2024, page 813).

13. In circumstances where HPA, when specifically consulted, did not raise any objections or concerns about the proposed derogation from 6 ACH to 2.5 ACH for single bedrooms, it is submitted that it is not correct to say that the ventilation systems were "*clearly not fully compliant*" with the "*relevant NHS standards at the time*" of their design and construction in 2009 to 2015, as Mr Poplett asserts in **Paragraph 1.2** and **Paragraph 11.1**.

14. Mr Poplett asserts in **Paragraph 1.3** (1st bullet) and elsewhere in the SHI Ventilation Report[11] that this derogation was agreed in order "*to achieve or prioritise BREEAM accreditation*". Multiplex and NHS GGC will be better placed to explain the rationale for the derogation, but it

[10] The emails on 21 to 25 October 2010 were provided to the Inquiry by Currie & Brown on 21 June 2021. Please see page 6 of document 22 under tab '5 Request 1' – Ref Doc DJR_1a Email 20.03.2018 enclosure – Ward Ventilation Strategy – Wallace Whittle (TUV) Report and email chain.

[11] See also Paragraphs 1.4, 1.10, 6.6, 7.30, 7.57, 9.125, 11.3 (2nd bullet), and 12.1.

is Currie & Brown's understanding that the derogation was not sought or agreed in order to achieve or prioritise BREEAM accreditation:

14.1. Currie & Brown understands that NHS GGC (following consultation with external environmental consultants) initially set a low carbon target for the QEUH Project which did not involve any derogation from the air change rate recommended in SHMT 03-01. This was not a BREEAM requirement, rather it was a separate target set by NHS GGC's external environmental consultants.

14.2. To that end, the Employer's Requirements Volume 2/1, Appendix M&E4 'Sustainable Design Considerations' (provided in Currie & Brown's response to the Ventilation PP dated 16 April 2024, Bundle 22 for the Hearing commencing 19 August 2024 at pages 372-407), provided that:

> "*A BREEAM "Excellent" is a fundamental requirement and achievement of the final rating, as defined in later sections, will be part of the building acceptance procedure.* ***Furthermore****, there is a requirement for a* ***Low Carbon design process*** *which will be monitored and evaluated by a Carbon Trust accredited consultant. There are both design and operation energy targets which are to be met as part of the building acceptance procedures*." [emphasis added]

14.3. As this quotation demonstrates, the low carbon target was a further and additional requirement, which was separate from the BREEAM requirement.

14.4. During the tender process for the Main Contract, several bidders highlighted that this low carbon target could not be achieved without use of chilled beams and a reduction in air change rates in various rooms. Ultimately, following consultation NHS GGC accepted a limited derogation to air change rates in standard single bedrooms only (as discussed above).

15. It is implied in **Paragraph 1.4** that the derogation in air change rates applied also to "*specialist areas*" and "*critical clinical care areas*". That is incorrect because, as expressly stated in Item ER 2/1 of the final M&E Clarification Log, the derogation was limited only to single bedrooms.

Commissioning

16. Mr Poplett says at **Paragraph 1.5** that "*The commissioning process was undertaken by specialist contractors under the remit of the contract and no independent validation was completed.*"[12] Currie & Brown was not involved in commissioning, but understands that the NEC Supervisor, Capita Property and Infrastructure Ltd ("**Capita**"), was engaged to witness testing and commissioning of the ventilation system and to check compliance with works information.

The change of use of Ward 4B

[12] Mr Poplett makes the same comment in Paragraph 8.12.

17. Mr Poplett states in **Paragraph 6.12** that:

> "*At handover, there were no HEPA filers installed in the AHU's – is not clear why third level filtration was not provided for in the air handling units, when clearly certain patient groups require this level of filtration. I have assumed that the only ward that had HEPA filtration installed at handover was Ward 4B and in the patient bedrooms only – however the corridor is not HEPA filtered meaning there is a risk of contaminants getting into the room when the door to a patient's bedroom is opened. I consider this assumption to be very likely correct given the absence of information to the contrary…*"

18. As a consequence of the change in use of Ward 4B from a general ward to a specialist haemato-oncology ward by Project Manager's Instruction No. 228 dated 2 July 2013 ("**PMI 228**"),[13] NHS GGC instructed the installation of HEPA filters in patient bedrooms in Ward 4B by Compensation Event 10675 No. 51 dated 2 October 2013 ("**CE 51**").[14]

19. PMI 228 was a significant change, at a late stage of the construction process, which had to be accommodated within the constraints of what had already been constructed. As part of the discussions about PMI 228, Multiplex advised NHS GGC that 10 ACH could not be achieved in the Ward 4B bedrooms due to a restriction on air handling unit ("**AHU**") capacity; the maximum rate that could be achieved was 6 ACH.[15]

20. It appears that NHS GGC accepted this, because it did not instruct the replacement of the AHUs as part of this change: by CE 51, NHS GGC accepted the proposals in PMI 228. NHS GGC's comments on the requirements for HEPA filtration in Level 4 (and on which areas should have HEPA filtration) in response to PMI 228 were set out in the document 'Haemato-oncology – Board Response 250713.pdf' which Currie & Brown provided with response to Provisional Position Paper 12 by letter dated 16 April 2024.

Decision to relocate the Infectious Disease Unit to Wards 5C/5D:

21. Mr Poplett refers in **Paragraph 7.24** to a decision in around August 2014 to relocate the Infectious Disease Unit ("**IDU**"), also known as the Communicable Diseases Unit, from Gartnaval General Hospital to Wards 5C and 5D on Level 5 of the QEUH. Currie & Brown was unaware of any such decision by NHS GGC or of any such relocation at the material time.

22. NHS GGC's design brief for Level 5 of QEUH was for four general medicine wards.[16] The IDU was not part of the QEUH design brief, and no clinical brief for an IDU was provided in the Employer's Requirements. There was no instructed change to alter the design brief for Level 5 from a general medicine ward to an IDU or any specialist function.

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[13] PM1 228, titled 'Change to NSGH Level 4 – HEPA filtration', is in Bundle 16, page 1697.
[14] CE 51, titled 'Adult Hospital – Level 4, Zones 512, 513 & 514 HEPA Filtration', is in Bundle 16, page 1700.
[15] Multiplex explained that Air Handling Unit 31 in Plantroom 31 on Level 3 was at maximum performance achieving 6 ACH in its document 'Ward 4B Multiplex Design Statement.pdf' (which was provided with Currie & Brown's response to Provisional Position Paper 12 by letter dated 16 April 2024).
[16] See the Schedule of Accommodation for Level 5, a copy of which was provided with Currie & Brown's response to Provisional Position Paper 12 by letter dated 16 April 2024.

23. Currie & Brown was also unaware that any concerns were raised about any such relocation by clinical staff in 2014 or at all, as referred to in **Paragraph 7.27**.

If any further information or clarification is required by the Inquiry, Currie & Brown would be happy to provide this.

Yours faithfully

Keoghs LLP

SCOTTISH HOSPITALS INQUIRY

REVIEW BY NHSGGC

OF

REPORT OF ANDREW POPLETT CONCERNING CRITICAL HEALTHCARE VENTILATION SYSTEMS AT THE QUEEN ELIZABETH UNIVERSITY HOSPITAL, GLASGOW AND THE ROYAL HOSPITAL FOR CHILDREN

DATED 10 JUNE 2024

1. INTRODUCTION

1.1. A report by Andrew Poplett entitled *"Critical Healthcare Ventilation Systems at the Queen Elizabeth University Hospital, Glasgow and The Royal Hospital for Children*" dated 10 June 2024 (the "Report") has been disclosed to Inquiry core participants.

1.2. This document contains NHSGGC's response to the Report. With reference to Scottish Hospitals Inquiry Direction 5, Appendix B at para 2.1, specific questions to be asked of the report's author, and specific comments on the substance of the report, are set out below.

1.3. NHSGGC's questions and comments raise new matters or issues insofar as they relate to matters either not covered or not fully addressed in the report. It is understood that, in terms of Direction 5, the questions and comments below will be considered and addressed by the report's author and that a supplementary report will be prepared thereafter on that basis. Many of the comments in this response apply equally to the report of Mr Alan Bennet which has been provided to core participants by the Inquiry and is the subject of a separate response by NHSGGC.

2. KEY THEMES OF QUESTIONS AND COMMENTS ON REPORT

2.1. Subject to the issues identified below, NHSGGC agrees with the author's summary of the role of ventilation and the components within a ventilation system. In respect of the Inquiry's understanding of the ventilation system within the QEUH/RHC, and the steps that NHSGGC consider need to be taken by the Inquiry to address the Inquiry's terms of reference, NHSGGC draw the Inquiry's attention to NHSGGC's detailed response to PPP11 and 12.

2.2. The Report is a technical report on ventilation systems. It is not a clinical report and provides no assessment on any increased risk of infection. It examines ventilation

systems only and has no regard to the wider mitigation of infection within a clinical environment. NHSGGC observes in particular that the Report's conclusions relate to compliance with SHTM03-01 guidance as it now stands but it does not reach any conclusion as to the quantifiable risk, in a healthcare environment, of not complying with that guidance.

2.3. NHSGGC's comments are set out under the following themes:

Overall approach and expertise of the author
Evidence and assumptions
Audit Report
Wards
SHTM03-01
Ventilation Safety Group
Clinical responsibilities
Cryptococcus

3. OVERALL APPROACH AND EXPERTISE OF THE AUTHOR

3.1. The Report focusses on technical aspects of ventilation and the author's assessment of the compliance of the ventilation system with guidance, in particular SHTM03-01. The Report addresses 2 questions set by the Inquiry. Those are that the author should address:

(i) from the point at which there were patients within the Queen Elizabeth University Hospital and the Royal Hospital for Children (QEUH/RHC) were the ventilation systems in an unsafe condition, in the sense that it presented an additional risk of avoidable infection to patients?
(ii) are the ventilation systems no longer in an unsafe condition in the sense that they now present no additional avoidable risk of infection?

3.2. The report concludes [para 1.2] that the ventilation systems as designed, installed and commissioned were not fully complaint with "the relevant NHS standards at the time". However, the author explains that, [t]*he extent of the resulting clinical and infection risk is outside of the scope of this report, however in my opinion the failure to involve all stakeholders and to ensure a multi-disciplinary review approach contributed to a sub-optimal final design."* NHSGGC considers that this is a key limitation of the Report. The author does not answer the questions set by the Inquiry as he does not comment on the

clinical or infection risk arising from what he describes as the "sub-optimal design. NHSGGC have no evidence, except in two isolated cases of which the Inquiry is aware, where there is a link between infection and environment.

3.3. As with Mr Bennet's report, the author does not define what is meant by "unsafe". What is "unsafe" must be considered with reference to the particular environment, and type of patient, including whether that patient is particularly vulnerable to infection. Further, to determine whether the environment is "unsafe" it is necessary to compare it to a base line environment that is considered "safe". Again, no attempt is made to define what is a "safe" hospital environment. In clinical practice, an outbreak is suspected if there is an increase beyond the normally expected numbers of infections. To assess if there is an increased risk of infection, a normal level of risk must be established. This means it is not possible to answer whether the systems were objectively unsafe.

3.4. The Report identifies 9 "areas of concern" [para 1.3] from what is described as a "purely ventilation perspective". It concludes at 1.4 that *"[t]he design was agreed to significantly derogate from normal healthcare ventilation performance parameters and therefore provided a sub-optimal patient care environment from a ventilation perspective".*

3.5. In reaching this conclusion, the author does not consider the full range of measures within a hospital which mitigate against infection risk. The author lists areas of concern at 1.3 but does not, and does not have the expertise to, conclude that the built environment within QEUH/RHC created an increased risk of infection for patients. It is essential to appreciate that no hospital can be a fully sterile environment. Pathogens can enter the environment from a range of sources, including from patients, from non-clinical settings and from other care settings. It is necessary to consider all steps taken to mitigate against risk of infection, not just ventilation in isolation. NHSGGC considers that the question that must be asked and answered is whether the combined systems in the QEUH/RHC, taking into account the accepted background level of infection and all mitigations put in place to manage risk, present an increased risk of infection beyond what would be expected in a comparable hospital environment. Consideration of the nature of a hospital environment and the various steps taken to manage risk is therefore essential, as is an understanding of what is a base level of infection within a comparable hospital environment.

3.6. Steps taken to manage risk within the QEUH include but are not limited to use of single en-suite rooms, prophylaxis, PPE, air filtration, air pressure differential, limiting access to patients, staff vaccination, cleaning regime, screening, testing and monitoring. Infection

control is multifactorial. The combined impact of these features in a hospital environment, particularly one used to treat neutropenic patients, must be understood.

3.7. Of particular note and concern for NHSGGC is that the author concludes at 1.4 that certain (undefined) rectification and improvement works have, in the author's view, failed to address original design deficiencies and a number of systems remain in a "sub-optimal state". NHSGGC submits that this conclusion is not justified and risks misleading patients and the public. The QEUH/RHC has a wide range of mitigation measures in place, as do all other hospitals. Those mitigations are not considered by the author. NHSGGC submits that the QEUH/RHC is an entirely safe environment, by which the environment represents no greater risk than a comparable hospital environment. NHSGGC is aware of no incident or evidence that would require suspension or closure of any clinical facility within the QEUH/RHC. NHSGGC asks the author to specifically state that his analysis does not take into account wider mitigations.

4. EVIDENCE AND ASSUMPTIONS

4.1. The areas of concern raised by the author can broadly be categorised as: (i) compliance with SHTM03:01 including in respect of ACH and HEPA filtration; (ii) testing, commissioning and maintenance; (iii) management of derogations; and (iv) the role of a VSG. The author makes a number of assumptions that underpin his conclusions (see for example 1.5,1.6,1.10,6.6,6.12 and 6.14, 8.12). Assumptions have been made and conclusions reached based on the written documentation without hearing evidence from those with knowledge of the design, build, commissioning and testing processes. That includes a conclusion at 1.7 that a perceived inadequacy in validation potentially exposes patients to an elevated level of risk.

4.2. Those assumptions pre-empt evidence that the Inquiry is to hear. That includes reaching conclusions in respect of the commissioning, testing, maintenance of the ventilation system and the system for approval of derogations from the design (items (ii) and (iii) above). It is submitted that it is not appropriate to reach any conclusions before the evidence of those responsible has been heard. Much of that evidence will not be heard until the Glasgow 4 hearings in 2025. It is submitted that many of the author's conclusions will require to be revisited once evidence has been heard.

5. AUDIT REPORT

5.1. At paragraphs 1.9 and 9.89, the author comments on the “audit reports” and that issues summarised within those reports remained to be addressed and managed. Accordingly, the author casts doubt on those reports. NHSGGC asks that the author provide a full justification for the conclusions reached in these paragraphs including in what manner the executive summary was “overly-reassuring”, the basis for stating that issues were not escalated; and the basis upon which it is said that the speed and extent of improvement was poor. NHSGGC notes that it has used industry standard methodology in respect of its auditing.

6. WARDS

6.1. The report focusses on the differences in ventilation between wards 2A, 2B, 4B, 4C and 6A. However, NHSGGC considers that the Report does not have full regard to the risk profile of the patients on those particular wards.

6.2. Further, NHSGGC notes that the author has used the incorrect date in 7.6-7.8. Upgrade works were completed in March 2022. The author also does not acknowledge HEPA filtered air being supplied to the rooms. NHSGGC wishes the author to note that ward 2A was decanted for drainage works with ventilation work being decided on and implemented after the decant.

7. SHTM03-01

7.1. The author’s conclusion is broadly that non-compliance with SHTM03-01 in and of itself represents additional risk and that steps should be taken to ensure compliance. This lead’s the author to conclude, for example, that chilled beams must be removed. SHTM03-01 is guidance. The author acknowledges at 9.98 that debate over the status of these documents can be highly contentious and generally not definitively defined. The author refers to anecdotal evidence that not following guidance has been used in court proceedings. No details are given. It is submitted that nothing can be taken from this without knowing the full background to each case.

7.2. At 9.105 the author states that “in my professional opinion I believe that the SHTM standards should be treated as an Approved Code of Practice (ACOP) and have similar standing to that of L8 in the management of water systems.” However, that is not the reality. That may be the author’s opinion but SHTM is guidance. Risk can be, and is,

managed with other mitigations. Ventilation specifications represent only one factor amongst many for managing the risk of infection.

7.3. It is of particular concern that the author suggests that clinical activities may need too be suspended in order for work to take place, or in the event that ventilation cannot be upgraded, stopped entirely (for example 1.17). The author is not qualified to make this statement. His statement is potentially misleading and fails to have regard to the full range of mitigations. To suggest wholesale closure of facilities is a significant and serious step. It risks undermining the confidence that patients have in the facility, which for example is fully JACIE accredited and compliant. The author should not be suggesting closure of clinical spaces, based on non-binding guidance, without clinical expertise and a holistic review and understanding of clinical practice.

7.4. NHSGGC notes that whilst SHTM 03-01 guidance is used in many “centres for hematopoietic cellular therapy” there is no clear evidence in the literature to support the conclusion that a SHTM 03-01 compliant ventilation system offers more protection against airborne pathogens than a non-compliant system. SHTM 03-01 specifications represent only one factor amongst many for managing the risk of infection.

7.5. The report makes reference to HTM03-01. The relevant guidance in Scotland is SHTM03-01. There are some differences between the applicable guidance, including the dates that the guidance was released.

7.6. NHSGGC observes that HEPA filtered air cannot be assumed to be sterile. Further air contamination by pathogens introduced by humans and activity within the room will not be prevented by supplying HEPA filtered air.

7.7. In respect of chilled beam units (CBUs), the author does not note that the guidance has changed. At the time that the QEUH/RHC was designed and built, SHTM01-03 did not state that CBUs should not be used in augmented care areas. The current guidance provides that CBUs can be used with approval in writing from the VSG. However, the QEUH/RHC complied with the applicable guidance at the time. The author is particularly critical of the decision to instal chilled beams concluding at 1.2 where he states that “[t]he decision to install chilled beam systems and as a direct result lower room air change rates and the subsequent impact on potential contamination of patient spaces is clear”. However, that does not recognise that chilled beams were compliant with guidance at the time of the design and other mitigations are in place.

8. VENTILATION SAFETY GROUP

8.1. The author is critical of a lack of a Ventilation Safety Group ("VSG"). However, there was no requirement for a VSG prior to the most recent SHTM in 2022. The HTM referred to a VSG in 2021. It was not referred to earlier.

8.2. NHSGGC commenced a specialist ventilation group in May 2019 which met intermittently until established as a quarterly meeting from July 2022.

9. CRYPTOCOCCUS

9.1. NHSGGC notes that the author provides a summary of the position in relation to cryptococcus but reaches no conclusion.

10. CONCLUSION

10.1. The mitigation of infection risk requires attention to many factors, of which ventilation is only one: infection control; isolation with single rooms and en-suite facilities antimicrobial prophylaxis; diagnostic laboratory tests and imaging techniques to aid rapid detection of infection; regular medical and nursing care; written policies with respect to all of these issues and systems to ensure all relevant persons are aware of these policies, all play a part in infection control. This is recognised in the JACIE accreditation of the hematopoietic cellular therapy areas.

10.2. There remains a question about the practical effect of any non-compliance with SHTM guidance from the perspective of infection prevention and control and patient safety. It is necessary to consider all of the measures in place to determine whether there is any increased risk of infection beyond which would be accepted in a comparable hospital environment.

Peter Gray K.C.

and

Andrew McWhirter, Advocate

25 July 2024

Scottish Hospitals Inquiry

NHS National Services Scotland response to the report by Andrew Poplett ('Independent Expert Report Concerning Critical Healthcare Ventilation Systems at the Queen Elizabeth University Hospital Glasgow and The Royal Hospital for Children')

1. In this short response, NHS National Services Scotland ("NSS") responds to the report by Mr Poplett that it received by email on 20 June 2024. The comments made do not seek to raise new issues not covered in the report, but rather to provide any necessary corrections or clarifications per Appendix B to Direction 5.

2. NSS notes that Mr Poplett predominantly refers to "Health Technical Memoranda" guidance within his report, which would typically apply in England. NSS notes that for ventilation systems in Scottish healthcare facilities, "Scottish Health Technical Memoranda" would typically be applicable. The contents of SHTM 03-01 Part A and Part B 2022 are predominantly derived from the English equivalent HTM document.

3. Para. 5.8 refers to "any particulate" expelled by a patient being drawn away and extracted from the room. Ventilation has to work within the bounds of reasonable practicability, and it is unlikely that every single particulate from a patient would be drawn away in this manner.

4. Para. 5.22 refers to "Lidwell's original research". It would be useful to have the reference for the exact paper being referred to.

5. Paras. 9.101 and 9.102 refer to legislation said to be applicable to healthcare providers. NSS notes that this legislation applies in England, but not in Scotland.

National Services Scotland

25 July 2024

In the Scottish Hospitals Inquiry

Response by IBI Group (UK) Limited to the Expert Report by Andrew Poplett, entitled - Independent Expert Report Concerning Critical Healthcare Ventilation Systems at the Queen Elizabeth University Hospital, Glasgow and The Royal Hospital for Children

Introduction

IBI is grateful for the opportunity to assist the Inquiry by providing a response to Mr Poplett's report, dated 10 June 2024. Due to the constraints of time, and on the limited information presently available, this brief response is limited in scope. However, as the Inquiry continues its work, and further evidence is made available, IBI will continue to consider the matters covered within this report and, in the meantime, will be happy to provide further input and clarification as required.

Responses to specific paragraphs in the report

> *"1.2 The ventilation systems as designed, installed and commissioned at QEUH were clearly not fully compliant to all of the relevant NHS standards at the time. The decision to install chilled beam systems and as a direct result lower room air change rates and the subsequent impact on potential contamination of patient spaces is clear. The extent of the resulting clinical and infection risk is outside of the scope of this report, however in my opinion the failure to involve all stakeholders and to ensure a multi-disciplinary review approach contributed to a sub-optimal final design."*

> As previously explained (in the response to Mr Bennett's report), IBI was not in control of choosing which parties were consulted as part of the Brookfield Design Team. The NHS Project Team managed the direct correspondences with their stakeholders. IBI worked closely and collaboratively with the NHS Project Team, and they endeavoured to involve their wider stakeholders. Each department (there were 27 for the Adult Hospital, and 19 for the Children's Hospital) had an extensive list of designated stakeholders organised by the NHS Project Team. IBI understands that the architectural design layouts at 1:200 and 1:50 were subject to a vigorous consultation process and final Design Acceptance Procedure.[1]

> *"1.4 From the reviewed information and subject to any additional information being provided, the overall ventilation strategy for the building was non-compliant to the basic principles of healthcare ventilation as outlined in the Scottish Health Technical Memorandum (SHTM) standard 03-01 (2007). General ward areas were not designed to achieve the minimum standards of 6 air changes per hour and some specialist areas were also not designed to achieve clinically appropriate standards. The overall*

[1] *Example - NHS protocol document 1-200 Design Process Explained - Final*

Example- UGM Tracking Schedule NA-SH-001_14

ventilation design philosophy appears to have been driven by a desire to achieve a certain environmental performance rating (BREEAM), and a lack of understanding of critical clinical risks associated with the ventilation system. The design was agreed to significantly derogate from normal healthcare ventilation performance parameters and therefore provided a sub-optimal patient care environment from a ventilation perspective. The use of chilled beams in critical clinical care areas also influenced the sub-optimal airflow performances and added an avoidable risk to a number of highly vulnerable patient areas. The design was recognised as an issue after occupation as some rectification/improvement works were commissioned, however these failed to address all of the original design deficiencies and a number of the systems remain in a sub-optimal state as outlined in the following sections of this report."

This section of the report echoes the remarks of Mr Bennett (at 10.2) regarding the reduction in air change rates. It will be a matter for the Inquiry to locate, and interpret, all documents that are relevant to this issue, but to provide some limited assistance in this regard, the Inquiry's attention is drawn to the M&E Clarification Log (part of the Contract Agreement) where a change in ventilation design is proposed and agreed.

Whilst IBI are not ventilation specialists, and were not involved in this modification, it is believed that the proposals were designed and accepted by appropriately qualified engineers.

"1.6 Validation is important as it tests the whole system against the design and any derogations to demonstrate that the system is fit for purpose prior to use – it also sets the benchmark for future verifications. Following a review of wards 4B and 4C I have assumed that no validation was completed prior to handover. I consider this assumption to be very likely correct given the absence of validation documentation pre-handover."

and…

"1.7 Without the formal confirmation through the validation process it would not normally be advisable to accept a critical healthcare ventilation system into use and the failure to appropriately undertake the validation process enabled the systems to operate in a suboptimal state, potentially exposing patients to an elevated level of risk."

IBI understands that there was an agreed commissioning procedure to validate the ventilation prior to handover. However, IBI was not directly involved, or witness to, the ventilation testing procedures, as this is an area outwith its expertise.

M A MacLeod KC

Barney Ross, Advocate

Womble Bond Dickinson

SCOTTISH HOSPITALS INQUIRY

QUESTIONS AND COMMENTS

ON THE EXPERT REPORT

CONCERNING THE VENTILATION SYSTEMS AT QEUH/RHC

PREPARED BY ANDREW POPLETT DATED 10 JUNE 2024

SUBMITTED ON BEHALF OF DR CHRISTINE PETERS

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1. INTRODUCTION

1.1 The following comments and questions on the expert report titled "Independent Expert Report Concerning Critical Healthcare Ventilation Systems at The Queen Elizabeth University Hospital, Glasgow, and The Royal Hospital For Children" prepared by Andrew Poplett dated 10 June 2024 ("Poplett Ventilation Report") are submitted on behalf of Dr Christine Peters in accordance with the procedure set out in Appendix B of Direction 5 – in respect of the Hearing Commencing 19 August 2023. References herein to section and paragraph numbers and to defined terms are to such numbers and terms used in the Poplett Ventilation Report unless otherwise stated.

1.2 The following comments and questions do not raise new matters. Instead, their purpose is to seek further clarification or to allow the author to elaborate more fully on points raised in his report.

1.3 Overall, Dr Peters welcomes the fact that the Inquiry will have the benefit of the Poplett Ventilation Report. However, she notes with disappointment that a number of critical ventilation systems at the QEUH and RHC (*e.g.,* those systems located in theatres, Endoscopy, the Burns Unit and the Cystic Fibrosis Unit) have not been the subject of expert assessment, including by the other expert instructed to report on the ventilation systems, Andrew Bennett. A comprehensive assessment of all these systems is required. It may be that the AECOM report contains the results of such a comprehensive assessment. If so, it would be Dr Peters' recommendation that the AECOM report be obtained as it would be of great assistance to the work of the Inquiry and would allow the public to benefit from work already undertaken.

2. EXECUTIVE SUMMARY

Design

2.1 **Para. 1.2:** The author states "The ventilation systems as designed, installed and commissioned at QEUH were clearly not fully compliant to all of the relevant NHS standards at the time." While Dr Peters agrees with this conclusion, no detail is provided in the Poplett Ventilation Report about how this failure would increase risks and to whom. Please can the author expand on these points.

Commissioning and validation

2.2 **Para. 1.6:** The author advises that "Following a review of wards 4B and 4C I have assumed that no validation was completed prior to handover. I consider this assumption to be very likely correct given the absence of validation documentation pre-handover." Can the author comment on whether the absence of validation documentation indicates that the HAI SCRIBE process was not followed? Can the author comment on whether this absence extended to all parts of the hospital and not just wards 4B and 4C?

2.3 **Para. 1.7:** The author states "the failure to appropriately undertake the validation process enabled the systems to operate in a sub-optimal state, potentially exposing patients to an elevated level of risk." On the basis of this statement, please can the author expand on the following points:

2.3.1 Would the author agree that the very high air sampling results in wards 2A and 4B in 2015 and 2017 would indicate, not a potential risk, but a real increase in risk of fungal infections to immune compromised patients? Further, would he agree that placing HIV patients on a ward with TB patients, as happened on ward 5C in around early 2020, represents a real rather than potential risk to patients?

2.3.2 Would the author agree that clean operations such as orthopaedic prosthetic joint placements were put at real risk by the repeated opening and closing of theatre doors throughout procedures during the period 2015/2016?

2.3.3 Would he agree that Cystic Fibrosis patients were put at real risk of Gram-negative infections due to the very low ACH, condensation and installation of chilled beams – rather than at potential risk?

2.3.4 Would he agree that during COIVD, the lack of ACH placed staff at real increased risk (above that of a standard 6 ACH ward) of occupational acquisition of COVID when caring for infectious patients in these settings?

Operational issues and management

2.4 **Para. 1.10:** Has the author been provided with any information from Clinical teams who required critical ventilation for their patient cohorts as to the input they had into the ventilation specification and their satisfaction or otherwise with what was provided? Would he agree that, in the intervening 9 years since opening, this information from the key clinical groups should have been obtained and recorded as a matter of good learning? Is he aware of this being done by NHSGGC, NSS or the Scottish Government?

What could be done to the QEUH/RHC ventilation systems for the whole site to meet the appropriate SHTM-03-01 standards without exception?

2.5 **Para. 1.11:**

2.5.1 It would appear that the author is not aware of all the work that has already been done to address the issues with the ventilation systems at the QEUH/RHC. Why is that? Has NHSGGC not shared a comprehensive summary of such work (which would not be in line with their stated cooperation with the Inquiry process)? In terms of an initial assessment and prioritisation exercise, of particular and vital importance is the AECOM report.

2.5.2 Would the author agree that the only way to assess the utility of all previous actions or inactions would be a full inspection without any limitations of access as was the case for the Edinburgh hospital pre-opening?

2.6 **Para. 1.14:** In the light of the evidence reviewed, does the author consider that NHSGGC has the required level of expertise and commitment to make an appropriate assessment of the ventilation systems and to weigh this against the clinical requirements? To what extent is cost at this stage a reasonable exclusion to the provision of standard meeting healthcare premises for a hospital serving a huge proportion of the Scottish population?

2.7 **Para. 1.16:** Does the author agree that patient representatives should be involved when derogations are discussed as it is patients who bear the infection risks associated with derogations? Given NHSGGC's track record on derogations, what oversight would the author consider to be essential to ensure that derogations are established on sound scientific principles?

3. SECTION 5: OVERVIEW OF HEALTHCARE VENTILATION SYSTEMS

Role of ventilation in hospital setting

3.1 **Para. 5.5:** With regard to bacteria, does the author accept that pathogens generated from non-human sources such as water dispersal can also move through the air and ventilation and, therefore, have a bearing on the bio burden in a clinical space?

Setting performance parameters for specific healthcare environments/rooms

3.2 **Para. 5.36:** The patient placement SOP within QEUH was put in place as a result of Dr Peters' request at the 2017 whistleblow meeting. It was initially rejected as the IPCT stated it was up to the clinicians to decide where to place patients. Does the author agree that an effective patient placement policy requires accurate information about the types of accommodation available, the IPCT assessment of infection risk as well as clinical determinations of the immune status of the patients?

3.3 **Para. 5.37:** The author notes that "HTM03-01 (2007) Part A clearly states that the recommended air change rates for wards and single rooms is 6ACH and for isolation rooms and neutropenic wards is 10ACH and in part B the ventilation system should achieve not less than 75% of the design air-change rate." In relation to the 75% mark, does the author suggest that, at the point of validation of a new build, 75% would be acceptable, or is the 75% mark to allow for deterioration over time? Therefore, 4.5 ACH at first opening would be unlikely to be compliant for long.

HBN 04-01 Supplement 1: Isolation facilities in acute settings

3.4 **Para. 5.47:** The report quotes the following from HBN 04-01 Supplement 1 in relation to the general requirements of isolation room ventilation systems:

> "The system as designed is robust enough to withstand fan failure without significantly compromising the level of protection."

Is the author aware of incidents in QEUH when the supply failed and the lobby was at -20 Pascals to corridor, and another occasion when the extract failed and the lobby was at +20 Pascals to corridor? Would the author agree that this would not be protective to an immune compromised patient in the first instance, nor to corridor from highly infectious patients in the second?

4. SECTION 6: QEUH - THE VENTILATION STRATEGY

Issues with the ventilation strategy

4.1 **Para. 6.7:** Given that the ventilation system was not validated, and in the absence of either the AECOM report, or a full inspection by an independent expert, would the author agree that it is not possible to summarise the key issues with the ventilation system because of the size of the hospital building and the fact that many areas have specialist ventilation requirements?

HEPA filtration

4.2 **Para. 6.12:** The author states "I have assumed that the only ward that had HEPA filtration installed at handover was Ward 4B". Why is this assumption necessary? Has NHSGGC not provided the necessary evidence to establish whether this was the case or not?

Air handling units (AHU)

4.3 **Para. 6.16:** Has the author seen any evidence of an SOP and/or risk assessments which deal with the occasions when the AHUs are turned off? If so, what is his assessment of the adequacy of these with regard to patient group, system and governance?

Air permeability and pressure differentials

4.4 **Para. 6.17:**

4.4.1 Patients who were being given bone marrow transplants and, thus, experiencing immune suppression were located in Ward 4B when it was discovered that suspended ceiling tiles had been installed in bedrooms and en-suites in this ward. During this period, does the author consider the ingress of dust and spores

from the ceiling space to represent a real rather than a potential risk to these vulnerable patients?

4.4.2 Why is it still not clear at this stage of the Inquiry who signed off the works? Have NHS GGC not provided the relevant paperwork?

5. SECTION 7: QEUH/RHC DESIGN, INSTALLATION, COMMISSIONING AND VALIDATION (POINT OF OCCUPATION)

Low air change rates (not compliant with SHTM 03-01 guidance)

General Wards

5.1 **Para. 7.3:** Has the author seen any evidence of an appreciation of the risks posed by CBUs from an infection control perspective when the decision was made to place them in all rooms?

Ward 2A - Haematology and oncology and Teenage Cancer Trust (TCT)

5.2 **Para. 7.6:**

5.2.1 In respect of the validation of the unit, of note is that the "Mechanical Services Specification and Scope of Works for Ward 2A Ventilation Upgrade at Queen Elizabeth University Hospital and Royal Hospital for Children" prepared by WGM Consulting Engineers (at Bundle 20, p. 1024) has a design and project team that omits IPC input. Does the author have a view on this omission?

5.2.2 The design criteria (at p. 1038) states that the en-suites should have ACH >5 when the SHTM is >10 ACH for a single room WC. Has the author seen any evidence that a risk assessment was conducted for this derogation? It is also notable that, according to the design criteria, the TCT rooms are designed to be at 20 Pascals – has the author been provided with any information explaining why such a high pressure regime was required? The joint lobby on the TCT (which is at positive pressure) is a novel design. Has the author seen validation data and assessment of the novel layout with regard to the rooms that utilise a joint lobby? As air sampling is no longer undertaken on the TCT, the air quality which results from the novel design is not known, hence a full understanding of whether the design has been validated is required.

5.2.3 Has the author seen any IPC sign off for the HAI SCRIBE for the ward 2A works, and any evidence to show that air sampling has been done in the unit?

5.2.4 Given the extensive work which has been carried out on the TCT rooms, is it the author's view that, before this work was undertaken, the chilled beams, suspended ceilings, lack of pressure cascade and 3 ACH amounted to a real rather than a potential risk? Further, prior to the placement of HEPA filtration, the fact that the ACH inlet was above a roof play area (Bundle 20, p. 1050) could have allowed ingress of dirty air. What was the level of immune suppression experienced by the teenage patients who were accommodated in the TCT unit – which unit had been paid for by charity funding?

Ward 2B- Paediatric Haematology and oncology - Day Care Unit

5.3 **Para. 7.7:** In relation to the activities carried out within Ward 2B such as IV access and the delivery of chemotherapy, does the author agree with the view that, in terms of risk of infection, it should be considered the same as a public space?

Ward 4B - Adult Bone Marrow Transplant (BMT) - Neutropenic patient group

5.4 **Para. 7.10:** Can the author comment on the adequacy of the specification with regard to detail for the haematology-oncology unit?

5.5 **Para. 7.14:**

5.5.1 Can the author comment on any evidence he has seen regarding the decision to stay with the 6 ACH, despite an assessment of the possibility of increasing to 10 ACH when the patients first moved out in 2015, and whether the time lag involved played a role in the decision not to increase to 10 ACH?

5.5.2 What is the author's view on the adequacy of the current arrangement? Has the author seen and analysed air sampling results since 2015 to date? If so, what are his conclusions regarding the real risk to patients presented by the current air quality in the unit?

Ward 4C - Haematology-oncology (10 beds) - Neutropenic patient group

5.6 **Para. 7.20:** Is the author able to advise if any air sampling of IAQ parameters has been conducted that would indicate the effectiveness (or otherwise) of the HEPAs?

Ward 6A - Rheumatology patient group

5.7 **Para. 7.22:** In the author's opinion, how did Ward 6A ventilation differ from Ward 2A ventilation other than PPVL rooms, including the TCT suite? Was there a difference in risk presented by Ward 6A compared to Ward 2A?

5.8 **Para. 7.28:** With regard to the negative pressure regime, does the author agree that the levels are not consistent when doors are opened as the rooms are all linked with the same supply and extract as well as the very low level of differential? For information, Dr Peters has videos of the rooms being at positive pressure when the next door room door is opened. What is the author's view of the claim which was made in 2020 by NHSGGC that Ward 5C was suitable for COVID patients because it comprised of "all negative pressure rooms"?

Air permeability in isolation rooms

5.9 **Para. 7.36:** What is the author's view of the use of PPVL rooms for a specialist IDU unit and specialist BMT units rather than positive or negative pressure rooms?

5.10 **Para. 7.39:**

5.10.1 In relation to the statement "where approximately 60l/s of contaminated air can travel to areas where Personal Protective Equipment (PPE) against airborne infection is not worn (e.g. hospital corridor)", does the author agree that the factors to take into consideration are: the pathogens and their infectivity and dose response curve, the status of the patients in the immediate vicinity (*e.g.,* the "corridor" in ITU is actually an open space to bed bay), the frequency of admissions (as the ID centre for the West of Scotland, frequent admissions can be expected), as well as the ventilation in the space to which the leak occurs? Has he seen any evidence of such a risk assessment and has BSRIA endeavoured to assist in pointing out these considerations?

5.10.2 Does the author agree that the difficulty with the PPVL neutral pressure design is that leakage from the bedroom to the surrounding area will increase over time

and the lack of consistent pressure will either render the room susceptible to ingress of unfiltered air for the immune suppressed patient, or conversely contaminated air exit from them, *e.g.,* extensively drug-resistant tuberculosis cases?

5.11 **Para. 7.41:** As the air permeability is done when patients in critical care areas are in situ, does the author have experience on the level of HAI SCRIBE that should be in place when this process is carried out?

Use of thermal wheels in areas requiring specialist ventilation

5.12 **Para. 7.51:** Does the author have any evidence about the extent/volume of air leakage from dirty to clean in any of the AHU in QEUH/RHC?

6. SECTION 9: QEUH/RHC OPERATIONAL AND MAINTENANCE

Air sampling test results (if undertaken)

6.1 **Para. 9.31:** Does the author have any evidence regarding the current governance around the air sampling results?

6.2 **Para. 9.46:**

6.2.1 Reference is made at footnote 20 to the AE(V) Audit Report Nov 2016 (which is provided at Bundle 20, p. 94). The 2016 report refers to the 2015 ventilation audit. Has this audit been made available to the author?

6.2.2 Is the author able to advise whether any of the ventilation audits were shared with the IPCT? Dr Peters has not seen the 2015 ventilation audit despite being the site ICD at the time.

6.2.3 Given the current knowledge around non-compliance with SHTM 03-01 and the fact that, by 2016 work had been carried out on the PPVL rooms (albeit with failures (which can be evidenced by emails)), does the author agree that the 2016 ventilation audit failed to:

- identify that the ventilation system did not comply with SHTM 03-01 in key critical areas;

- provide any reason for the withdrawal of the action to provide a standby handing unit for 4B (see Bundle 20, p. 99 which simply states "Action withdrawn");
- identify an infection control risk assessment for the filter issues in NICU AHU; specifically, the audit does not explain how the issue was handled from an infection control perspective; and
- identify that critical ventilation systems had not been validated and record that failure on an infection control risk register.

6.2.4 In the 2016 ventilation audit, in response to the question, "[h]ave there been any accidents, incidents, dangerous occurrences or "near misses" in connection with the ventilation systems?", the answer given is "none reported" (see Bundle 20, p. 103). However, Dr Peters is aware of the following "incidents" (emails evidencing the following can be provided if that would be of assistance):

- **22 December 2015**, theatre 14 ventilation failed;
- **2 January 2016**, theatres 13 and 14, surgery had to be moved to another theatre due to failures in panel and UCV to start up as well as the endoscopy suite – all critical areas;
- **21 January 2016**, software issue caused isolation room pressures to vary in Ward 2A – critical ventilation with patients in situ;
- **11 February 2016**, PPVL being used by ID had failed extract without alarming;
- **18 February 2016**, failure of fans in working theatre 12;
- **18 May 2016**, incidents with theatres 8, 9, 10;
- **08 July 2016**, leakage in ducting into PPVL room occupied by paediatric BMT patients;
- **22 July 2016**, condensation events;
- **25 August 2016**, AHU tripped during procedure; and
- **31 August 2016**, failure of ventilation in theatre.

Does the author agree that the above incidents demonstrate that there are serious issues with the reporting and governance of ventilation issues within the organisation?

6.2.5 In the 2018 ventilation audit (at Bundle 20, p. 136), there is no mention of a significant CL3 Microbiology ventilation failure. Would the author have expected this to be captured by this audit?

7. SECTION 10: CURRENT CONDITION AND POTENTIAL ISSUES AND RISKS

HDU & ICU - Critical care & 10 isolation rooms

7.1 **Para. 10.2:** As a point to be clarified, does this assessment differentiate between PPVL isolation rooms and negative pressure isolation rooms? Both are present in HDU and ICU (see patient placement policy).

7.2 **Para. 10.5:** It is Dr Peters' understanding that it is hard to balance the system because of the number of doors and size and complexity of the air space. The alteration in the pressures of the ICU is likely to have an impact on the PPVL rooms. Has the author seen verification of the PPVL pressures to ensure the bedroom is at neutral pressure to the rest of the ward since the rebalancing? Has the author seen HAI SCRIBE documentation for the works of rebalancing?

7.3 **Para. 10.6:** There are two types of isolation room at the QEUH/RHC. Does this paragraph refer to the negative pressure rooms that have been installed, or to the PPVL rooms? Further, has the assessment of the relevant room included an assessment of the location of the supply, the en-suite pressure differential and ACH, as well as pressure stabilisers, layout, transfer grills and doors?

Ward 2A & 2B Improvement Works Summary

7.4 **Para. 10.43:** Does the author consider the 5 ACH in the en suites to be appropriate and has he seen full validations and air sampling results prior to the re occupation of the ward?

8. SECTION 11: AREAS OF POTENTIAL IMPROVEMENT TO MINIMISE RISK OF FUTURE PATIENT INFECTIONS ASSOCIATED WITH VENTILATION PROVISION

What could be done to the QEUH/RHC ventilation systems for the whole site to meet the appropriate SHTM-03-01 standards without exception?

8.1 **Para. 11.5:** The AECOM report is likely to have information that would be useful for patient safety risk assessments – has the author seen it?

8.2 **Para. 11.10:** The author states, "In some cases it may prove necessary to temporarily or even permanently to suspend clinical services whilst areas are modified to achieve agreed minimum standards." Given his investigations to date, does the author have any examples where he thinks this is the likely scenario?

9. CONCLUSION

9.1 In relation to information not in the bundles, please can ARHAI's comments on the cryptococcus report be provided.

9.2 In relation to the above and the Poplett Ventilation Report more generally, Dr Peters would be happy to provide further input, information and/or clarification as required.

Helen Watts KC and Leigh Lawrie, Advocate

On behalf of Dr Christine Peters

24 July 2024

Keoghs

Scottish Hospitals Inquiry

[Uploaded via Objective Connect]

Our Ref: RIL.10513091
Your Ref:
Date: 25 July 2024
Please Ask For: Ruth Lawrence / Rachel Blair
Email: [redacted] /
[redacted]
Direct Dial: [redacted] / [redacted]

Dear Sirs

Our Client: **Currie & Brown UK Limited**
Re: **Queen Elizabeth University Hospital, Glasgow**

Dear Sirs

We write in response to Mr Allan Bennett's Report on 'Ventilation Deficiencies at QEUH and RHC and their Potential Impacts' dated 5 June 2024 ("**the Report**") on behalf of our client, Currie & Brown UK Ltd ("**Currie & Brown**"), in accordance with the directions in the Inquiry Solicitor's email of 20 June 2024.

References in bold to paragraph numbers below are to the numbered paragraphs of the Report. References to Bundle numbers are to the numbered bundles issued by the Inquiry for the Glasgow 3 hearing commencing on 19 August 2024 (unless otherwise stated).

Responses to the Report

Paragraph 4.23: "*Chilled Beam Units (CBU) are widely used within the QEUH where they are used to provide temperature and humidity control from within the patient's rooms and other areas*…"

1. Chilled beam units provide temperature control, but they do not provide humidity control. Chilled beam units are not capable of providing humidification, as they have no means of introducing moisture into the room.

Paragraph 8.19: "*On the June 2015 handover of the facilities [in Ward 4B] there were the following deficiencies:*

- *Target air change rate of 6ACH was below the SHTM03-01 standard and specification of 10ACH.*
- *Rooms were not at the positive pressure value specified of +4Pa.*
- *HEPA filters were fitted in diffusers in patient rooms but not in the corridors*"

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Belfast | Bolton | Bristol | Coventry | Glasgow | Newcastle | Liverpool | London | Manchester | Southampton

2. In relation to the **first bullet point in Paragraph 8.19**:[1]

   2.1. NHS GGC's decision to lower the air changes per hour ("**ACH**") in single bedrooms from 6 ACH to 2.5 ACH was an agreed derogation from the relevant recommendation in SHTM 03-01, not a deficiency, for the reasons set out in paragraphs 8 to 13 of Currie & Brown's response to Mr Poplett's 'Independent Expert Report Concerning Critical Healthcare Ventilation Systems' dated 10 June 2024 ("**SHI Ventilation Report**") by letter dated 25 July 2024.

   2.2. This derogation was limited to single bedrooms where the recommendation in SHTM 03-01 was for 6 ACH. There was no such agreed derogation from the recommendation for 10 ACH in the neutropenic isolation rooms, or any other specialist rooms, as reflected in Item ER 2/1 of the final M&E Clarification Log.

3. In relation to the **first and third bullet points in Paragraph 8.19**,[2] NHS GGC's decision to instruct the installation of HEPA filters in patient bedrooms in Ward 4B[3] was in response to Project Manager's Instruction No. 228 dated 2 July 2013 ("**PMI 228**").[4] During the process of considering PMI 228, Multiplex advised NHS GGC that 10 ACH could not be achieved in the Ward 4B bedrooms due to a restriction on air handling unit ("**AHU**") capacity and that the maximum rate that could be achieved was 6 ACH.[5] It appears that NHS GGC accepted this, because it did not instruct the replacement of the AHU. This is set out in paragraphs 18 to 20 of Currie & Brown's response to Mr Poplett's SHI Ventilation Report by letter dated 25 July 2024.

Paragraph 8.26: "*It appears that the ward [Ward 4C] was designed to the general specification of a general ward with the 2.5 ACH derogation. On handover unlike the Beatson Unit specification required for these patients the ward had no HEPA filtration, 2.5ACH, neutral or slightly positive pressure rooms. There were also CBU installed and suspended ceilings in the rooms and ensuites. All this is contrary to the COS and requirements of HTM03-01 and SHTM03-01 (2009,2013).*"

4. Long before PMI 228 was issued on 2 July 2013, the original design brief for Level 4 (on which Wards 4B and 4C were located) required one ward to be a sealed ward, with H13 HEPA filtration and positive pressure in the rest of the QEUH: see Drawing No. ZBP-XX-04-PI-524-305, Rev 02[6].

Paragraph 8.36: "*In 2014 a decision was made to move the Brownlee Infectious disease unit from the Gartnavel to QEUH and locate it in ward 5C and D…*"

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[1] Similar points are made in Paragraph 8.78.
[2] Similar points are made in Paragraph 8.81.
[3] By Compensation Event 10675 No. 51, 'Adult Hospital – Level 4, Zones 512, 513 & 514 HEPA Filtration', dated 2 October 2013 ("**CE 51**"): see Bundle 16, page 1700.
[4] PM1 228, 'Change to NSGH Level 4 – HEPA filtration' (Bundle 16, page 1697) instructed a change in use of Ward 4B from a general ward to a specialist haemato-oncology ward.
[5] Multiplex explained that Air Handling Unit 31 in Plantroom 31 on Level 3 was at maximum performance achieving 6 ACH in its document 'Ward 4B Multiplex Design Statement.pdf' (which was provided with Currie & Brown's response to Provisional Position Paper 12 by letter dated 16 April 2024).
[6] Document 1 in Currie & Brown Inventory dated 25 July 2024

5. Currie & Brown was unaware at the time of the decision by NHS GGC to relocate the Infectious Disease Unit ("**IDU**") from Gartnaval General Hospital to Wards 5C and 5D on Level 5 of the QEUH, as set out in paragraphs 21 to 23 of Currie & Brown's response to Mr Poplett's SHI Ventilation Report by letter dated 25 July 2024. The IDU was not part of the QEUH design brief, and no clinical brief for an IDU was provided in the Employer's Requirements. There was no instructed change to alter the design brief for Level 5 from a general medicine ward to an IDU or any specialist function.

Paragraph 8.45: "…*the rationale for the decision to reduce the ACH from 6 and 2.5 seems [sic] was energy efficiency and to contribute to complying with a BREEAM rating*"[7]

6. The agreed derogation from SHTM 03-01 from 6 ACH to 2.5 ACH in standard single bedrooms was intended to help meet a low carbon target set by external environmental consultants appointed by NHS GGC, rather than to comply with any BREEAM rating, as set out in paragraph 14 of Currie & Brown's response to Mr Poplett's SHI Ventilation Report by letter dated 25 July 2024.

Paragraph 8.46: "…*The use of CBU is explicitly forbidden for specialist ventilation facilities in the most up to date copy of SHTM03-01 (2020) but not in the issue current when the QEUH was designed and constructed.*"

7. The specification of chilled beam units to mitigate the derogation from the relevant recommendation for 6 ACH in SHTM 03-01 is addressed in paragraphs 1 to 7 of Currie & Brown's response to Mr Poplett's SHI Ventilation Report by letter dated 25 July 2024. In short:

    7.1. The use of chilled beams was not prohibited by the relevant NHS standard current in Scotland at the time of the design and construction of QEUH, namely SHTM 03-01 (January 2009) 'Ventilation for Healthcare Premises' (Draft for Consultation).

    7.2. No note of caution about the use of chilled beam units in specialist ventilation areas was introduced into the relevant NHS standards in Scotland until Interim Version 3.0 of SHTM 03-01 was published in February 2022,[8] long after the construction of QEUH was completed.

    7.3. Thus the "*major change of attitude to CBUs*" that Mr Bennett refers to in **Paragraph 10.3** took place in or around 2022, not "*between 2007 and 2021*". Version 1.2 of SHTM 03-01 (February 2013) and Version 2.0 of SHTM 03-01 (February 2014), which were published three years and four years respectively after construction of the QEUH commenced, continued to permit the use of chilled beam units: see Paragraph 2.38, Part A of both versions:[9]

[7] The same point is made in Paragraph 10.2.
[8] Paragraph 5.19, Part A of Interim Version 3.0 of SHTM 03-01 (February 2022) (Bundle 1 for Hearing commencing 9 May 2022, page 839).
[9] Bundle 1 for Hearing commencing 9 May 2022, page 459 and page 643

"*The use of chilled beams for the provision of heating, cooling and ventilation is increasingly common in healthcare premises. The use of Active Chilled Beams providing tempered filtered air to a heating / cooling device within the room can provide effective local control of environmental conditions.*"

7.4. In any event, SHTM 03-01 (February 2022) did not 'explicitly forbid' the use of chilled beam units in specialist ventilation facilities. Paragraphs 5.18 and 5.19, Part A of SHTM 03-01 (February 2022) stated that:

"*5.18 Active chilled beams can provide an energy-efficient means of controlling environmental conditions. They are, however, subject to increased maintenance requirements due to the need for regular cleaning if they are to remain working efficiently. Access for this will not pose problems in non-clinical and office areas, but in clinical areas and patient bedrooms, routine access will be a major problem in an operational hospital.*

5.19 Chilled beams should not be installed in clinical areas without the agreement in writing of the VSG."

7.5. SHTM 03-01 did not therefore forbid the use of chilled beam units in clinical areas; rather, the effect of paragraph 5.19 is that chilled beams can be installed in clinical areas if agreed in writing by the Ventilation Safety Group (VSG). Such agreement would require weighing up the individual circumstances and the risks and benefits.

Paragraph 10.3: "*I have assumed from the documents I have seen that no consideration appears to have been given on the need for specialist ventilation in the original design of the hospital. This was either due to an assumption that such facilities were not required or an oversight in the design team.*"

8. So far as Currie & Brown is aware, Mr Bennett's assumption is incorrect. SHTM 03-01 (January 2009) was included in the Employer's Requirements; and the Clinical Output Specifications defined the specialist ventilation needs for the QEUH. It does not follow from the fact that a derogation was later agreed in the final M&E Clarification Log that no consideration was given to the need for specialist ventilation either in the original design or subsequently.

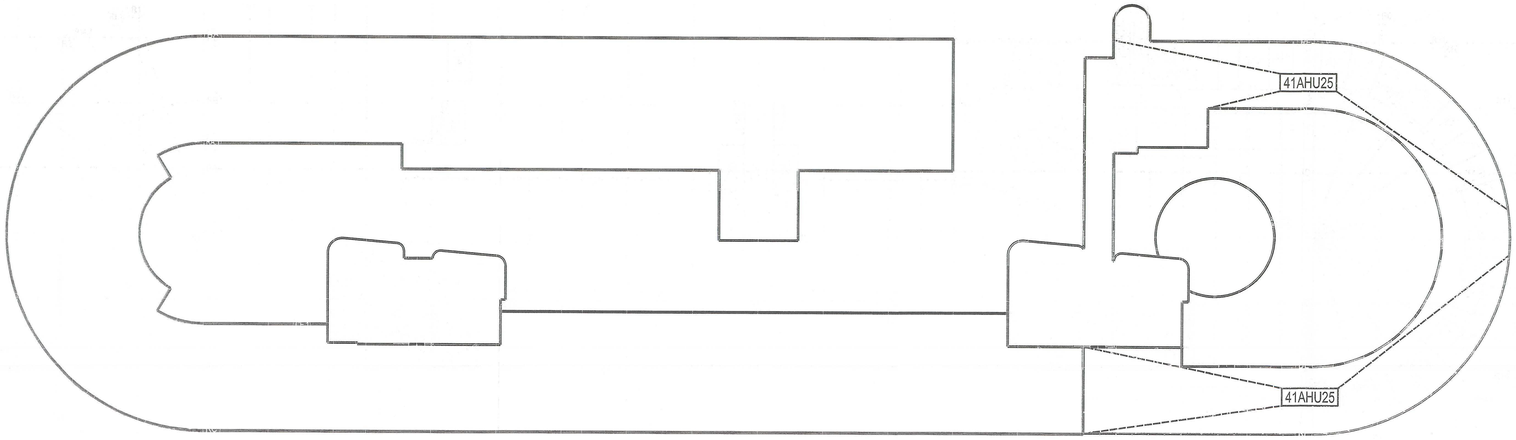
Paragraph 10.13: "*The requirement for dew point control of CBUs has been specified in guidance since 2007 as has the need for regular maintenance/cleaning and access for maintenance/cleaning. However, dew point controls were not installed leading to widespread condensation events in the QEUH.*"

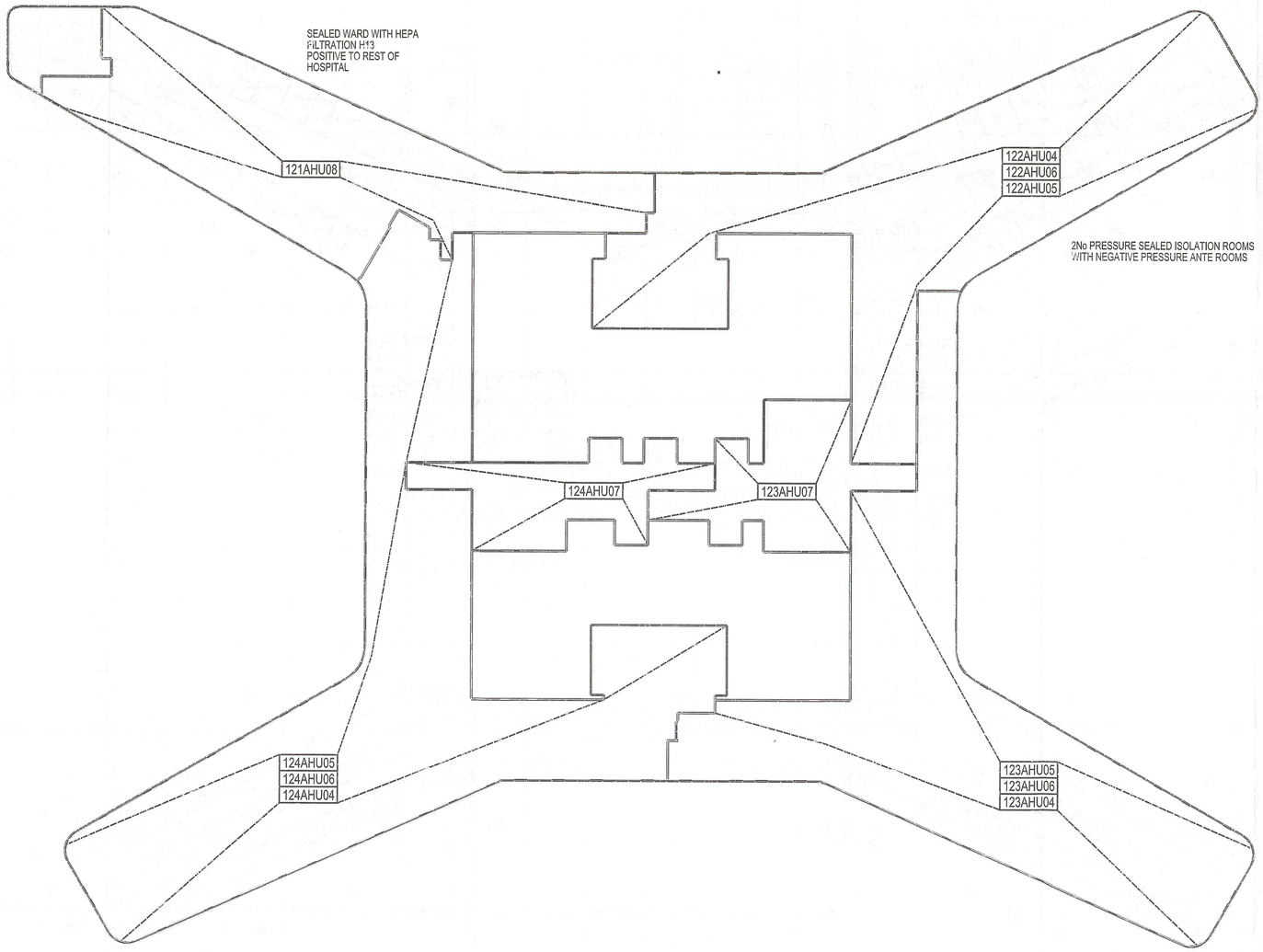
9. The Employer's Requirements, Volume 2/1, Appendix M&E3, Paragraph 2.43 required that the control settings of chilled beam units must ensure that the external elements of the beam are always above dew point. Currie & Brown is not aware of whether that requirement was complied with.

If any further information or clarification is required by the Inquiry, Currie & Brown would be happy to provide this.

Yours faithfully

Keoghs LLP





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No	Design Risk Register

This Drawing corresponds with Architects and Structural Drawings
Architects electronic issue dated as below

Compiled from the following reference files:
X-NA-XX-04-PL-251-WIP-FourthRoofPlan_02 dated 30/07/10
X-NA-XX-04-PL-252-WIP-FourthRoofPlan_02 dated 30/07/10

and Structural Engineers drawing:
X-WSP-SZ-04-PL-280-WIP-STRUCTURAL dated 25/08/10
X-WSP-SZ-XX-PL-280-WIP-GRID dated 25/08/10

Architects to be informed of all discrepancies in dimensions
Contractor to check all dimensions on site

NOTES

1. FOR SYMBOLOGY REFER TO ZBP DRG No. ZBP-XX-XX-DT-S50-001
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL CONTRACT DOCUMENTATION

Rev	Date	Revision Notes	Drn	Chk
02	10.09.10	UPDATED TO SUIT REVISED ARCHITECTS LAYOUT	RTS	
01	21-25-10	ISSUED FOR INFORMATION	MW	AP

NSGH Project (Full Business Case) FBC APPENDIX K

	BROOKFIELD	NSGH BOARD
Name:	D. Rus	P. MOIR
Date:	2/12/10	26.11.10
Sign:	[redacted]	[redacted]
Status: (A or B):	A	A

Client

NHS Greater Glasgow and Clyde

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Project
NEW SOUTH GLASGOW HOSPITALS
(NSGH) PROJECT

Drawing Title
MECHANICAL SERVICES
VENTILATION SYSTEMS
ZONING PHILOSOPHY
FOURTH FLOOR

Job No	Date	Scale@A0
2900	11/01/10	NTS

Status
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Drawing No							Rev
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ZBP	XX	04	PL	524	305		02

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SCOTTISH HOSPITALS INQUIRY

REVIEW BY NHSGGC

OF

REPORT OF ALLAN BENNETT

DATED 5 JUNE 2024

1. INTRODUCTION

1.1. A report by Allan Bennett entitled *"Ventilation Deficiencies at QEUH and RHC and their Potential Impacts*" dated 5 June 2024 (the "Report") has been disclosed to Inquiry core participants.

1.2. This document contains NHSGGC's response to the Report. With reference to Scottish Hospitals Inquiry Direction 5, Appendix B at para 2.1, specific questions to be asked of the report's author, and specific comments on the substance of the report, are set out below.

1.3. NHSGGC's questions and comments raise new matters or issues insofar as they relate to matters either not covered or not fully addressed in the report. It is understood that, in terms of Direction 5, the questions and comments below will be considered and addressed by the report's author and that a supplementary report will be prepared thereafter on that basis.

2. KEY THEMES OF QUESTIONS AND COMMENTS ON REPORT

2.1. NHS GGC consider that the Report is balanced and, subject to the points noted below, reaches a number of fair conclusions, backed up by appropriate academic studies. Where appropriate, the limitations of the available studies are recognised.

2.2. NHSGGC's comments are set out under the following themes:

(i) The overall approach and the expertise of the author;
(ii) Patient risk profile
(iii) Evidence base
(iv) Status of guidance
(v) Use of prophylaxis
(vi) Pigeons
(vii) Location of QUEH/RHC

3. OVERALL APPROACH AND EXPERTISE OF THE AUTHOR

3.1. Subject to the points raised below, NHSGGC accepts the Report's summary of the purpose and effect of ventilation, and the technical mechanisms available for ventilation. In respect of the Inquiry's understanding of the ventilation system within the QEUH/RHC, and the steps that NHSGGC consider need to be taken by the Inquiry to address the Inquiry's terms of reference, NHSGGC draw the Inquiry's attention to NHSGGC's detailed response to PPP11 and 12.

3.2. The Report addresses 2 questions set by the Inquiry. Those are that the author should assess from a microbiological perspective:

(i) from the point at which there were patients within the Queen Elizabeth University Hospital and the Royal Hospital for Children (QEUH/RHC) were the ventilation systems in an unsafe condition, in the sense that it presented an additional risk of avoidable infection to patients?

(ii) are the ventilation systems no longer in an unsafe condition in the sense that they now present no additional avoidable risk of infection?

3.3. These questions are not answered directly by Mr Bennett in the Report. He does not conclude that the ventilation systems were/are "unsafe" and he makes no attempt to define what is meant by "unsafe". What is "unsafe" must be considered with reference to the particular environment, and type of patient, including whether that patient is particularly vulnerable to infection. Further, to determine whether the environment is "unsafe" it is necessary to compare it to a base line environment that is considered "safe". Again, no attempt is made to define what is a "safe" hospital environment. This means it is not possible to answer whether the systems were objectively unsafe.

3.4. The questions asked by the Inquiry relate to whether the ventilation systems within the QEUH/RHC were/are in an "unsafe condition". The Report understandably focusses solely on ventilation. It does not consider the full range of measures within a hospital which mitigate against infection risk. Whilst Mr Bennett comments on increased risk of "exposure". That does not necessarily mean that there is an increased risk of "infection" given the existence of other mitigations. It is essential to appreciate that no hospital can be a fully sterile environment. Pathogens can enter the environment from a range of sources. Accordingly, it is necessary to consider all steps taken to mitigate against risk of infection, not just ventilation in isolation. NHSGGC considers that the question that must be asked and answered is whether the combined systems in the QEUH/RHC, taking into

account the accepted background level of infection and all mitigations put in place to manage risk, present an increased risk of infection beyond what would be expected in a comparable hospital environment. Consideration of the nature of a hospital environment and the various steps taken to manage risk is therefore essential, as is an understanding of what is a base level of infection within a comparable hospital environment.

3.5. Steps taken to manage risk within the QEUH include, but are not limited to: use of single en-suite rooms, prophylaxis, PPE, air filtration, air pressure differential, limiting access to patients, staff vaccination, cleaning regime, screening, testing and monitoring. Infection control is multifactorial. The combined impact of these features in a hospital environment, particularly one used to treat neutropenic patients, must be understood.

3.6. NHSGGC note that Mr Bennett acknowledges that he has no clinical expertise and no experience of day-to-day working in a hospital environment. Mr Bennett recognises that there are other means to mitigate risk but he does not attempt to quantify risk with regard to these mitigations. Such a quantification of risk would fall outwith his expertise. NHSGGC considers that this is a key limitation of the Report. Whilst the Report is of assistance to the Inquiry this limitation must be recognised. In particular, it will be essential for expert IPC experts to provide evidence to the Inquiry to understand whether an additional risk of infection existed within the QEUH/RHC.

4. PATIENT RISK PROFILE

4.1. The report focusses on the differences in ventilation between wards 2A, 4B, 4C and 6A. However, NHSGGC considers that the Report does not have full regard to the risk profile of the patients on those particular wards. In particular, the report is critical of the systems on Ward 6A. Ward 6A was designed as a general ward. It was not designed to care for neutropenic patients.

4.2. Patients that had been cared for on RHC Ward 2A were decanted to Ward 6A and also Ward 4B to allow for works to take place. The decision to decant patients to Ward 6A was made following clinical advice, which was considered in detail at IMT meetings. A risk assessment was carried out. Ward 6A was favoured for the decant due to proximity to the hospital's other services. Steps were taken by NHSGGC, as informed by the Lead Infection Control Doctor and wider IMT, to mitigate against infection risk. Particularly vulnerable patients were moved to the Adult BMT on ward 4B rather than 6A. Portable HEPA filters were installed on Ward 6A in January 2019. Portable HEPA filters are noted as a reasonable supplementary filtration method in JACIE guidance. The decant of patients from Ward 2A was a temporary measure. Following the reopening of Ward 2A,

Ward 6A is a general ward again and accordingly does not require any augmented infection control measures.

4.3. The author notes that he is unaware why patients on Ward 4C require less protection than Wards 2A and 4B. Wards 2A/4B and 4C accommodate patients with different risk profiles. Ward 4C accommodates non-BMT patients. BMT patients who are severely immunosuppressed or neutropenic are cared for on Ward 4B.

5. EVIDENCE BASE

5.1. At paragraph 7.2, the author recognises that the evidence base behind the use of ventilation standards to improve patient outcome in hospitals “is not easy to find”. He notes that work was carried out at least 40 years ago and points to difficulties carrying out studies. Indeed, the study referred to [Lidwell 1972] is over 50 years old. A particular issue raised by the author is that studies show no evidence that HEPA is effective in reducing infections in patients. There is also acceptance by the author that the protective impact of positive pressure rooms has not been quantified.

5.2. NHSGGC asks the author to state what he considers is the impact of the limited evidence base on his conclusions and why, in the circumstances, he is confident in the conclusions he reaches.

5.3. The author specifically refers to the “difficulties of assessing the impact of ventilation as separate to other mitigations”. The studies relied upon are based on model systems that focus on the ventilation and not other mitigations. NHSGGC consider that this is a key limitation of the evidence base drawn on by the author. It is necessary to consider the environment as a whole and ask whether it presents any additional risk to patients beyond what would be expected in a comparable hospital environment. NHSGGC asks whether the author has given consideration to this question?

6. STATUS OF GUIDANCE

6.1. The Report considers the guidance and understanding of ventilation systems at present, albeit acknowledges that post-Covid knowledge has not been taken into consideration. It is important to recognise that the design and build of the hospital took place between 2005 and 2015. Guidance and understanding has changed and developed. In assessing the design and build of the systems (which the Inquiry intends to do in the Glasgow 4 hearings), NHSGGC considers that the guidance at the time must be considered.

(i) SHTM03-01

6.2. Further, SHTM03-01 is guidance. It is not mandatory. Ventilation specifications represent only one factor amongst many for managing the risk of infection.

6.3. The report makes reference to HTM03-01. The relevant guidance in Scotland is SHTM03-01. There are some differences between the applicable guidance, including the dates that the guidance was released, and consequently the guidance relevant at the time must be considered.

6.4. The author's opinion is that, if an area has not been built to SHTM03-01 guidance, then there is a risk, even though the evidence base for some parts of the guidance does not exist. There is no clear evidence in literature or in clinical practice that a SHTM 03-01 compliant system is associated with decreased rates of (airborne) infection or mortality. While SHTM 03-01 guidance standards are used in many centres, NICE and JACIE guidance does not mandate the need of such ventilation systems (NICE Guideline 47 - Haematological Cancers: Improving Outcomes (25 May 2016)).

6.5. The author does not state that a reduction in ACH itself leads to an increased risk of infection. ACH is a factor in temperature and odour control. The author concludes at paragraph 8.57 that he is unable to assess the magnitude of any increased risk resulting from reduced ACH without further analysis. NHSGGC asks that the author clarify what additional analysis requires to be done to address this question. The author suggests that there is an increased risk associated with a reduced ACH. NHSGGC asks whether any consideration has been given to other mitigations in reaching this conclusion and asks the author to provide an evidential basis for that opinion..

6.6. The author comments on most single rooms with en-suite being at "slightly negative pressure" when doors are closed. The author notes at 8.79 that increased risk associated with pressure differential is not easily measured as the protective impact of positive pressure rooms has not been quantified. In the circumstances, NHSGGC queries whether any conclusion can be drawn in relation to any increased risk.

6.7. At paragraph 7.32, the author notes that advice on use of HEPA in guidance is "patchy" and "not helpful for infection control or designers". The value of protective room ventilation, such as HEPA filtration and positive pressure–directed airflow for haemato-oncology patients is unclear. A systematic review in 2006 reported on 16 trials (9 with death as an outcome and 10 with fungal infection as an outcome) that compared HEPA filtration with

non-HEPA filtration. No significant advantages of HEPA filtration were found in the prevention of death among patients with haematological malignancies with severe neutropenia [Eckmanns 2006].

6.8. NHSGGC observes that HEPA filtered air cannot be assumed to be sterile. Further air contamination by pathogens introduced by humans and activity within the room will not be prevented by supplying HEPA filtered air.

6.9. In respect of chilled beam units (CBUs), the author correctly notes that the guidance has changed. At the time that the QEUH/RHC was built, SHTM01-03 did not state that CBUs should not be used in augmented care areas. That guidance has changed. Use of CBU's is not precluded in current guidance. SHTM 03-01 Part A Feb 2022 states that agreement is required in writing from the VSG. However, the QEUH/RHC complied with the applicable guidance at the time.

6.10. NHSGGC notes in relation to paragraph 8,82 that since many of the agents found by Dr Inkster on CBUs are water-associated it would be difficult to ascertain a connection between CBUs and infections as distinct from general water systems. The author notes at 8.63 that it is difficult to put a risk value on exposure caused by CBUs. In the circumstances, NHSGGC queries whether any conclusion can be drawn in relation to any increased risk caused by CBUs.

(ii) JACIE

6.11. JACIE recommends HEPA for high-risk patients but does not state that it is needed. JACIE standards do not mandate the need for a SHTM compliant ventilation system or equivalent. Indeed, JACIE standards provide for the use of rooms that do not meet such standards.

6.12. In the JACIE guidance, no specifications are given for ventilatory requirements. Provision is made for the use of non HEPA rooms and/or a shortage of HEPA-filtered rooms, in particular that, "if HEPA filtration with positive pressure is not available, single patient rooms should be located on a patient care unit where infection control policies can be implemented. NHSGGC notes that it is JACIE accredited.

7. PROPHYLAXIS

7.1. The author notes at paragraph 9.7 that his opinion is that prophylaxis should not be routinely used to protect patients from deficiencies in hospital ventilation systems. The use of antibiotics, antifungals and antivirals to prevent infection is standard in comparable

units worldwide. The policies adopted by HNSGGC are in keeping with published guidance.

7.2. NHSGGC considers that the use of prophylaxis is an important and accepted part of infection control. NHSGGC notes that the author is not a clinician. The author is asked to clarify the basis for his opinion that prophylaxis should not be used.

8. PIGEONS

8.1. The author states that "*reports of dead birds and excreta in service floors and other areas have been common in the QEUH."* However, the evidential basis for that statement is not provided. The author is asked to clarify the basis for this statement.

8.2. At paragraph 9.8. the author further states that "*while not proven, a potential transmission route from environmental air contaminated with bird dropping exists*". NHSGGC questions the basis for this conclusion. The author notes that any link was not proven but then suggests a link.

9. LOCATION OF QEUH/RHC

9.1. The author suggests at paragraph 4.4. that the decision to have a fully sealed and mechanical ventilation system was *"taken at least partially due to concerns about odours from the neighbouring sewage treatment facility."*

9.2 The evidence base for this conclusion is not stated. The decision to have a mechanical ventilation system was part of the design phase and was based on a multifactorial assessment carried out by, in particular, the design and build contractor. It takes into consideration factors such as temperature, humidity, odour and infection control, and overall patient comfort. It is incorrect to assert that the sewage treatment plant was the sole or primary justification for a fully mechanical system. This may be taken as being critical of the decision to construct the QEUH/RHC on the particular site. It is necessary to consider the reasons for the decision to construct the QEUH/RHC on the particular site which NHSGGC understands will be considered in the Glasgow 4 hearings. The author does not himself suggest that the location of the hospital contributed to infection.

10. CONCLUSION

10.1. The mitigation of infection risk requires attention to many factors, of which ventilation is only one: infection control; isolation with single rooms and en-suite facilities; antimicrobial prophylaxis; diagnostic laboratory tests and imaging techniques to aid rapid detection of infection; regular medical and nursing care; written policies with respect to all of these issues and system to ensure all relevant persons are aware of these policies, all play a part in infection control. This is recognised in the JACIE accreditation.

10.2. There remains a question about the practical effect of any non-compliance with SHTM guidance from the perspective of infection prevention and control and patient safety. It is necessary to consider all of the measures in place to determine whether there is any increased risk of infection beyond which would be accepted in a comparable hospital environment.

Peter Gray K.C.

and

Andrew McWhirter, Advocate
25 July 2024

Scottish Hospitals Inquiry

NHS National Services Scotland response to the report by Allan Bennett ('Ventilation Deficiencies at QEUH and RHC and their Potential Impacts')

1. In this short response, NHS National Services Scotland ("NSS") responds to the report by Mr Bennett that it received by email on 20 June 2024. The comments made do not seek to raise new issues not covered in the report, but rather to provide any necessary corrections or clarifications per Appendix B to Direction 5.

2. Para. 4.7 states that "fresh air provision is not currently used as a specification in relevant healthcare guidance." NSS notes that there is a requirement to provide a minimum of 10 litres per second of air per person per SHTM 03-01 Part A 2022 at para.4.22 which states "*In general areas and wards within healthcare premises, odour control is the main reason for providing ventilation. In the absence of other guidance, 10 L/s/person should be taken as the minimum ventilation requirement. Healthcare ventilation systems will normally be "full fresh air" either by natural, mixed mode or mechanical means, with energy recovery from the extracted air*".

3. Para. 4.9 refers to "all air" being extracted through the ventilation system in negative pressure spaces. The premise of negative pressure ventilation systems is to ensure a greater proportion of air is extracted than supplied to a space and in practice, not all the "make up air" will be extracted as it will mix and dilute with existing air within the space.

4. Para. 4.12 refers to HEPA filters as Highly Efficient Particulate Air filters. NSS notes that the common name used is High-Efficiency Particulate Air filters.

5. Para. 8.46 states that "The use of CBU is explicitly forbidden for specialist ventilation facilities in the most up to date copy of SHTM03-01 (2020)". NSS notes that the most recent version of SHTM 03-01 was published in 2022, not 2020. SHTM 03-01 Part A

2022 at 5.19 recommends that “Chilled beams should not be installed in clinical areas without the agreement in writing of the [Ventilation Safety Group].”

National Services Scotland
25 July 2024

In the Scottish Hospitals Inquiry

Response by IBI Group (UK) Limited to the Expert Report by Alan Bennett, entitled Ventilation Deficiencies at QEUH and RHC and their potential Impacts

Introduction

IBI is grateful for the opportunity to assist the Inquiry by providing a brief response to Mr Bennett's report, dated 5 June 2024. Due to the constraints of time, and on the limited information presently available, this response is limited in scope. However, as the Inquiry continues its work, and further evidence is made available, IBI will continue to consider the matters covered within this report and, in the meantime, will be happy to provide further input and clarification as required.

Responses to paragraphs in the report

> *10.3 I have assumed from the documents I have seen that no consideration appears to have been given on the need for specialist ventilation in the original design of the hospital. This was either due to an assumption that such facilities were not required or an oversight in the design team.*
>
> Whilst IBI is unable to comment on the detail, it is understood that the ventilation was designed with consideration to specialised ventilation. It is apparent that various derogations were agreed which resulted in a design that was removed from the original design and doubtless other core participants can explain the reasons for the derogations with regard to the specialist wards. It may be that Mr Bennett's assumption based, as it is, on a paucity of documentation supporting a contrary view, transpires to be overstated.
>
> *10.4 There seemed to be a disconnect between the hospital design team and the cohort of experienced IC professionals with a knowledge of specialist ventilation systems located in the Glasgow area in Yorkhill and the Brownlee unit who I have assumed were not consulted during the design process. I consider this assumption to be likely given the limited information suggesting there was little if any collaboration between the design team and IC professionals during the design phase of the project who appear not have been consulted during the design process for specialist wards such as 2A and 4B.*
>
> It is IBI's understanding that an Infection Control representative from the NHS GGC team was always in attendance during the user group meetings.[1] The NHS Project Team managed the meeting attendees from its own team, and also consulted its wider team on the developing designs as *per* their internal protocols. Whilst IBI is not in a position to comment on how much consultation took place between the NHS Project Team and the wider cohort of IC professionals, it can confirm that, as part of

[1] it is thought that Jackie Stewart was the designated NHS IC representative

the Brookfield Multiplex Design Team, IBI collaborated extensively with the NHS Project Team, including with their designated NHS Infection Control representative.

HEPA filters and Chilled Beam Units

In terms of the HEPA filters, chilled beams and ventilation design, all of which are the subject of comment throughout this report (and that of Mr Poplett), the detail was contained within the MEP design drawings and specifications. Some MEP fixtures would be visible in the architectural ceiling plans; however, this was more for co-ordination purposes. The proposed MEP design solutions were reviewed in MEP design workshops directly with the NHS and their advisors (Brookfield MEP team/ZBP and Mercury). IBI did not attend those meetings. All the drawings were submitted through the contractual RDD process, including ventilation proposals for the HEPA filters and chilled beams.

M A MacLeod KC

Barney Ross, Advocate

Womble Bond Dickinson

SCOTTISH HOSPITALS INQUIRY

QUESTIONS AND COMMENTS

ON THE

EXPERT REPORT PREPARED BY ALLAN BENNETT DATED 5 JUNE 2024

SUBMITTED ON BEHALF OF DR CHRISTINE PETERS

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1. INTRODUCTION

1.1 The following comments and questions on the expert report titled "Ventilation Deficiencies at QEUH and RHC and their Potential Impacts" prepared by Allan Bennett dated 5 June 2024 ("Bennett Ventilation Report") are submitted on behalf of Dr Christine Peters in accordance with the procedure set out in Appendix B of Direction 5 – in respect of the Hearing Commencing 19 August 2023. References herein to section and paragraph numbers and to defined terms are to such numbers and terms used in the Bennett Ventilation Report unless otherwise stated.

1.2 The following comments and questions do not raise new matters. Instead, their purpose is to seek further clarification or to allow the author to elaborate more fully on points raised in his report. In particular, in sections 6 and 7, given his findings and his knowledge of the information available to NHSGGC and, indeed, the work being undertaken by the Board in relation to the ventilation systems at various points, the author is invited to provide his opinion on the public position taken by NHSGGC at the time.

1.3 Overall, Dr Peters welcomes the fact that the Inquiry will have the benefit of the Bennett Ventilation Report, which has been authored by an eminent expert on biological risks and aerosols. However, she notes with disappointment that a number of critical ventilation systems at the QEUH and RHC (*e.g.,* those systems located in theatres, Endoscopy, the Burns Unit and the Cystic Fibrosis Unit) have not been the subject of expert assessment, including by the other expert instructed to report on the ventilation systems, Andrew Poplett. A comprehensive assessment of all these systems is required. It may be that the AECOM report contains the results of such a comprehensive assessment. If so, it would be Dr Peters' recommendation that the AECOM report be

obtained as it would be of great assistance to the work of the Inquiry and would allow the public to benefit from work already undertaken.

2. SECTION 6: PATIENT PLACEMENT AND SPECIALIST VENTILATION AT QEUH

2.1 **Para. 6.8 (PPVL rooms):** It is Dr Peters understanding based on her experience of working at the hospital since it opened that not all PPVL rooms at the QEUH/RHC have been built according to specification. Instead, many of these rooms have several defects. Accordingly, each PPVL room requires to be individually assessed, and not just in relation to ACH and pressure. It would be useful if the author could explain how he has assessed whether each of the PPVL rooms which are the subject of the report conform to specification. Further, what are the author's views on the functionality of a PPVL room if the following features (either alone or in combination with others) are present: (i) the extract is in random and differing places; (ii) there is no en-suite present; (iii) where present, the en-suite is not at negative pressure to the bedroom; and/or (iv) there is a failure to ensure both supply and extract shut down when one fails? Should the existence of these defects be included in any patient placement policy to ensure appropriate risk weighting in different isolation requirement scenarios?

3. SECTION 7: USE OF VENTILATION TO REDUCE AIRBORNE INFECTION – EVIDENCE AND GUIDANCE

<u>Isolation Rooms</u>

3.1 **Para. 7.3 *et seq***: The author has relied on the Lidwell paper (referred to at footnote 23) as part of the evidence base for the use of isolation rooms in hospitals. It is Dr Peter's understanding that the isolation room which is the subject of the Lidwell paper is not a PPVL room as per the national guidance (SHTM03-01) but makes important observations regarding positive pressure in the lobby. In view of this and their use at QEUH/RHC including for high-risk patients, this fact gives rise to the following questions:

3.1.1 Given that the patient room in a PPVL SHTM design is at neutral pressure and the lobby is at positive pressure, and that the Lidwell paper states that contamination introduced into the lobby will be directed into the patient room, can the author comment on the suitability of such a room for very high risk immune compromised patients in contrast to a patient room at positive pressure?

3.1.2 Further, the functionality of the positive pressure lobby for doffing PPE in a highly infectious setting means that contamination will equally be pushed out into the hospital corridor. What are the author's views on whether such rooms should be used in units for HCID (high consequence infectious diseases)?

3.2 **Para. 7.8:** Does the author agree that the PPVL room in the Hambraeus study is significantly different from the PPVL design in the SHTM as it is a positive pressure room design, whereas the SHTM design is neutral pressure? What are the implications of neutral pressure to protection levels?

4. SECTION 8: DEFICIENCIES IN QEUH/RHC WARDS COMPARED TO GUIDANCE

Ward 2A - Haematology & Oncology and Teenage Cancer Trust (TCT)

4.1 **Para. 8.14**: The validation report from February 2022 carried out by Sutton Service International which is referred to in this paragraph does not appear to have been included in any of the Bundles. Please can this be provided.

4.2 Of note is that the patient placement policy (at Bundle 20, p. 201) states that room number 23 in Ward 2A is a "NPVL" room. Is this a typographical error and should refer to PPVL room? If it is not an error, then such a room is not included in the design specification. Has the author seen the validation for this room? Can the author explain the pressure measurements for this room and where these measurements are provided? Can the author describe the room's functionality, *i.e.,* is this a room that is positive pressure to corridor, but negative pressure in lobby? If so, can the author confirm that this room behaves differently from both a negative pressure room and a PPVL and requires separate explanation and monitoring?

Ward 4B Adult Bone Marrow Transplant (BMT) - Neutropenic patient group

4.3 **Para. 8.19**: As a point of clarification, it should be noted that some rooms in Ward 4B were not fitted with HEPA filters at the point of occupation (see emails with Ian Powrie). In the author's opinion, did that omission add to the level of risk experienced by patients occupying those rooms?

Ward 4C - Haemato-oncology (10 beds) - Neutropenic patient group

4.4 **Para. 8.30**: At footnote 140, the author quotes a 2021 risk assessment (A41791142 – Risk Assessment Form Airborne Pathogens – 22nd June 2021).

4.4.1 Of note is that the 2020 risk assessment (at Bundle 20, p. 1428) rated Ward 4C's Risk Level as medium (based on a calculation of Likelihood x Severity = Risk Level, where Likelihood was 3 (possible) and Severity was 2 (minor)). Does the author consider this to be a reasonable assessment of risk given the patient cohort accommodated in Ward 4C? Further, in terms of the additional control measures required, the assessment states "Clinical and Estates management will progress with developing a scheme of works to further enhance the environment to reduce the risk level even further" (at p. 1431). However, there is no mention of PPE which, given the impending COVID pandemic, failed to recognise airborne aerosol risks. Does the author have any evidence of any risk assessment referencing the use of PPE in the context of substandard ACH provision?

4.4.2 Does the author agree that there is an absence of risk assessment in relation to situations where patients would not receive prophylaxis (*e.g.,* due to allergies/interactions/toxicities) and how further mitigations could be considered?

4.4.3 What monitoring process for cases of fungal and bacterial infections does the author consider would have been appropriate given the recognition of the level of risk?

4.4.4 In terms of the control measures then in place, the assessment records at page 1429: "Regular routine surveillance for possibly fungal infection as noted above." Has the author seen records of this surveillance including numbers of cases given treatment doses of Antifungals therapy?

4.4.5 Can the author comment on whether the identification of single rooms in the risk assessment in the NICE recommendations fails to acknowledge the deficiency in the single room provision with regard to ACH and CBU and en-suite ACH and, therefore, fails to identify additional risk in comparison to national standards?

4.4.6 Can the author comment on whether the failure to identify that many fungal species are not covered by posaconazole prophylaxis impacts the level of risk that exists for the high-risk patients (*e.g.,* intrinsic resistance in Fusarium)?

4.4.7 With regard to the 2021 risk assessment (at Bundle 20, p. 1420), the same comments and questions above apply. However, despite the intervention of the camfil HEPAs being in place, the risk appears to be considered higher with the Severity now rated at moderate (3) rather than minor as in 2020. The risk is not added to a risk register and no additional control measures (administration, PPE) are identified. Is this an adequate reflection of risk on the unit in the view of the author?

General Wards - Reduced Air Change Rate

4.5 **Paras. 8.52, 8.53:** The author identifies the increased risks of respiratory infections in staff and patients. Has the author considered COVID, FLU and RSV HAI and staff occupationally acquired COVID data and ward closures in a virtually 100% single room hospital as a means to assess the realisation of that risk?

General Wards - Use of Chilled Beam Unit (CBU)

4.6 **Para. 8.63:** Does the author consider that the identified risks posed by CBUs are applicable to all patients given the procedures which may take place in those rooms (such as cannulation and respiratory physiotherapy) and/or the fact that they may be occupied by other vulnerable patient groups such as those with Cystic Fibrosis or diabetes or those undergoing immune suppressive therapies?

5. SECTION 9: OTHER ISSUES

Thermal Wheels

5.1 **Para. 9.10:** Does the author have any details regarding the volumes of air transferred from dirty to clean under different conditions, *e.g.,* when the ACH were ramped up in Wards 4B, 6A and 4C?

Air Sampling Results

5.2 **Para. 9.11:** Is the author aware that air sampling has not been done in Ward 2A since opening? Does the author know why this is the case and if any sampling was done before the ward re opened? What is his assessment of this situation?

5.3 **Para. 9.12**: Why have the air sampling results not been shared? It seems a vital piece of information to give assurance regarding previous and current air quality.

6. NHSGGC WORKPLACE HEALTH SAFETY AND WELFARE POLICY

6.1 Has the author considered the NHSGGC Workplace Health Safety and Welfare Policy, July 2018 (available at: https://www.nhsggc.org.uk/media/234150/nhsggc-health-safety-policy-workplace-hs-and-welfare-ver-4.pdf) with regard to health care worker safety and whether the QEUH ventilation accords with the statements therein?

7. PUBLIC STATEMENTS

7.1 Can the author comment on the accuracy of the public reassurances regarding ventilation given in the following public statements and media articles:

7.1.1 NHSGGC, Statement on Legal Proceedings, 26 February 2020 (available at: https://www.nhsggc.scot/statement-on-legal-proceedings/).

7.1.2 "Troubled Queen Elizabeth University Hospital in Glasgow told to carry out more safety checks", *The Times*, 28 December 2019 (available at: https://www.thetimes.com/uk/scotland/article/troubled-queen-elizabeth-university-hospital-in-glasgow-told-to-carry-out-more-safety-checks-n00z08bk9). In particular, the following:

"As a precaution it installed mobile Hepa filters in ward 4C in January as part of its control measures when it was investigating infections.

NHSGGC added: "Under Scottish health technical memoranda, general wards do not require to undergo the critical system verification that has been required in the ward 4C improvement notice. In view of this, and the additional safeguards that we have already implemented, we have asked for an early meeting with HSE to discuss the content of the notice in more detail." The meeting is expected to take place early in the new year."

7.1.3 "£50m repair bill for Glasgow's troubled Queen Elizabeth University hospital". *The Herald*, 10 March 2019 (available at: https://www.heraldscotland.com/news/17489840.50m-repair-bill-glasgows-troubled-queen-elizabeth-university-hospital/). In particular, the following:

"A spokeswoman said that the special HEPA filters required in some areas of the hospital were "not generally required throughout hospitals, but only in Bone Marrow Transplant units" and added: "The Bone Marrow Transplant unit in the QEUH has been fitted with HEPA filters. There are no current issues with the ventilation system and the ducting for the general wards within in adult hospital and the children's hospital.

"There is however work currently underway to upgrade the haemato-oncology ward in the Royal Hospital for Children to the latest specification while patients are temporarily relocated to another ward in the QEUH. We have previously announced that this work is being carried out."

8. CONCLUSION

8.1 In relation to the above and the Bennett Ventilation Report more generally, Dr Peters would be happy to provide further input, information and/or clarification as required.

Helen Watts KC and Leigh Lawrie, Advocate

On behalf of Dr Christine Peters

24 July 2024

SCOTTISH HOSPITALS INQUIRY

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

Bundle 21 - Volume 5

Responses to Expert Reports of Andrew Poplett and Allan Bennett

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