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 22 - Core Participant Responses to PPPs

Volume 1

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Responses to Provisional Position Paper 11 - Water

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1 Introduction

1.1 The following is a response by Multiplex Construction Europe Limited ("Multiplex") to:

1.1.1 Provisional Position Paper 11 titled: *"Potentially Deficient Features of the water system of the QEUH/RHC"* ("PPP11"); and

1.1.2 Provisional Position Paper 12 titled: *"Potentially Deficient Features of the ventilation system of the Queen Elizabeth University Hospital And the Royal Hospital for Children"* ("PPP12").

1.2 Multiplex notes the terms of PPP11 and PPP12, where the Inquiry highlights the importance of Core Participants understanding the factual basis on which the Inquiry is proceeding and having the opportunity to correct any misunderstandings or misapprehensions. Multiplex is grateful for this opportunity to assist the Inquiry.

1.3 The above being said, the breadth and depth of issues covered in each of PPP11 and PPP12 cannot be underestimated, where PPP11 encompasses the entire water system (including drainage) and PPP12 encompasses the ventilation systems relating to General Wards, Wards 2A, 2B, 4B, 4C and 6A. The Inquiry will recall that the S21 Notices initially issued in early 2023 relating to water and ventilation at QEUH were similarly broad and Multiplex advised that it would take between 6 and 12 months to comply with those notices as drafted. In the event, the S21 Notices were varied so as to considerably narrow the scope, but still resulting in a time for compliance of 3 months for each. Standing that, a period of 3 weeks (largely running concurrently) to respond to each of PPP11 and PPP12 has not allowed Multiplex sufficient time to investigate the whole factual background and formulate a response to the matters raised in each of PPP11 and PPP12.

1.4 In the limited time made available, and with a view to assisting the Inquiry, Multiplex has prepared the commentary below which seeks to generally place matters of ventilation and water systems at QEUH in context.

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 On the matter of the design parameters which Multiplex were to deliver under its contract with GGHB, Multiplex would direct the Inquiry to "*Response to Provisional Position Paper 5 of the Inquiry on behalf of Greater Glasgow Health Board*" dated 21 April 2023:

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

2.1.2 "*The design, commissioning and testing of the ventilation system was undertaken by the Main Contractor, Multiplex*." (paragraph 26)

2.1.3 "*The design* [of the water system] *was to comply with Employer's Requirements, subject to agreed derogations, which were prepared by the Lead Consultant, Currie and Brown, following input from clinical specialists.*" (paragraph 30).

2.2 Multiplex concurs with the above quoted extracts, noting that Multiplex had limited and restricted engagement with the clinical specialists, that being a matter between GGHB and the specialists.

2.3 GGHB's parameters were then initially set out in the Employer's Requirements which formed part of the contract between GGHB and Multiplex dated 18 December 2009 (for Stage(s) 1 and 2). There then followed a period of approximately one year of design development where GGHB's design parameters were refined, which culminated in a Notice to Proceed being issued by GGHB to Multiplex on 16 December 2010 (for Stage 3). The Employer's Requirements were also supplemented by various 'logs' including the ME Clarifications Log; BIW Log; RFI Log; Clarification Log; Laboratory Log and the Sustainability Log, which 'logs' recorded the agreed position between the parties in relation to certain technical matters.

2.4 The design development phase referred to above was described as follows at paragraph 5.14 of the Employer's Requirements:

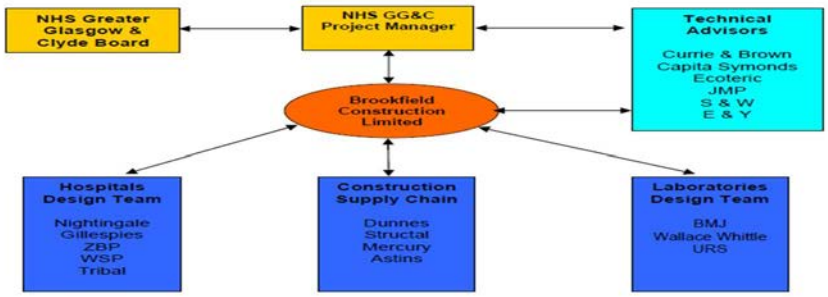
2.4.1 "*5.14.1 The bid period has specific bid return requirements (detailed in Volume 3 of the ITPD) with regard to written and drawn design information. Once the Contractor is appointed, the period to Full Business Case (FBC) approval comprises design development of the Contractor's Proposals in relation to the Hospitals, concurrent with the design and construction of the Laboratories. The design development to FBC will be fully programmed and demonstrable in a priced Activity Schedule forming an aspect of the bid returns from bidders.*"

2.4.2 "*5.14.2 The procedure for the review of design development will be agreed with the Contractor prior to the return of bids and the commencement of the design development.*"

2.4.3 "*5.14.3 The Contractor shall, as a minimum requirement, provide the information detailed in Appendix K (Design Development) as an output of Stage 2 (Hospitals Detailed Design to FBC). The satisfactory production of completed Appendix K information to the Board is one of the preconditions to the approval to proceed to Stage 3. More information relating to Stages 2, 3 and 3A are contained in Volume 1 of the ITPD.*"

2.5 The design development process was managed via a Project Execution Plan ("PEP") prepared by GGHB, which at paragraph 3.3 envisaged the following communication links between the various parties:

In order to guide parties on the appropriate communication and information distribution links the following table has been prepared.



In general the Project Manager is to be included in **ALL** communications.

2.6 Further, at Appendix A the PEP set out the following management structure:

NEW SOUTH GLASGOW HOSPITALS PROJECT CONSTRUCTION MANAGEMENT

Group	Project Steering Group	Project Management Group	Commercial Group	Construction Interface Group	Technical Design Group	Design and Healthy Environment Strategy Group *(Sub-group of Technical Design Group)*	Joint Commissioning Group	Medical Planning Groups	IT Group	Equipment Selection Group
Remit (refer to Group remits paper)	- On a monthly basis identify key Strategic Drivers for the coming quarter. - Carry out a monthly review of Project Strategic Drivers providing direction to the Project management Group as required. - Carry out a monthly review of project issues (reported from sub groups via the PMG) that have not been cleared at sub group level. - Provide direction to the sub groups on the resolution of issues. - Monitor and identify any shortfalls in Project resources. - Monitor critical path of Project Programme	- Manage change control - Monitor short term design, procurement and construction programmes - Monitor project administration ie diary, document control, meetings -Oversee work of sub groups - Monitor sign off progress of sub groups - Monitor Community Benefit progress - Unblock sub group issues - Report key issues to Steering Group	- Manage Changes to Brief - Manage Payment Process - Manage valuations and costs - Manage Risk Register - Manage Early Warning/Compensation Event process - Report key issues to Project Management Group	- Identify short term works on site particularly any that may impact upon the hospital activities - Identify short term Hospital activities that may impact upon the construction works - Communicate construction activities to relevant 3rd parties - Monitor impact of works on surrounding area - Report key issues to the Project Management Group	- Ensure that planning Applications are submitted on time - Ensure that Planning Conditions are discharged on time - Ensure that Building Warrant application is submitted on time and all queries closed out - Monitor design compliance with the ER's and CP's. - Monitor design sign off - Monitor progress of key design strategies – fire, access control, acoustics etc - Manage any derogations from ER's and CP's - Manage any clarifications required against ER's and CP's - Monitor design programme - Manage Mock up and samples programme and signoff - Report any key issues to the Project Management Grp	- Review how art can best be incorporated into the scheme - Agree Project Art Strategy - Advice the design process of opportunities for art - Advise the design process and spatial and technical requirements for art - Report any key issues to the Technical Design Group	- Monitor the production of a Project Commissioning Plan - Monitor the production of a Project Commissioning Programme including operational commissioning - Review the design for "commissionability" - Manage specialist validations required ie pharmacy, CSSD, mortuary - Ensure equipment installation programme co-ordinated with main commissioning programme - Report any key issues to the Project Management Group	- Monitor the Medical Planning Programme and clear any blockages - Monitor resource levels required to meet programme - Monitor the medical planning sign off process and identify any critical delays - Ensure that other sub groups ie IT and Equipment feed into the medical planning process - Manage mock ups for functionality sign off - Monitor production of Room Data Sheets - Report changes to the Project Management Group	- Produce Project IT Strategy in sufficient time to inform the main design - Ensure that IT spatial requirements are co-ordinated with the main design - Ensure that IT technical requirements are incorporated into the design - Ensure that Equipment IT requirements are identified sufficiently early to inform the main design - Report any issues to the Technical Design group	- Monitor the inclusion of Equipment spatial and technical information on the Loaded Plans and Room Data Sheets - Ensure that Equipment spatial and technical information is provided to meet the design programme - Ensure that Equipment selection and procurement is carried out in time to meet the design and construction programme - Manage the approval of Equipment Selection - Manage change control in relation to Equipment provisions - Ensure that Equipment installation and commissioning is integrated into the Joint Commissioning Group - Report key issues to the Project Management Grp
Member-Ship (Leads indicated in red)	**Alan Seabourne** Alan McCubbin David Hall Douglas Ross Peter Moir Chris Lovejoy Ed McIntyre Neil Murphy Ross Ballingall Steve Pardy Tim Bicknell	**Alan Seabourne** David Hall Peter Moir Douglas Ross Mark Baird Mark McAllister Ross Ballingall Paul Serkis David Bower Darren Smith Ed McIntyre Tom Allan	Alan McCubbin Alan Seabourne **Douglas Ross** Peter Moir Paul Serkis Eric Napier Tom Allan	Hugh McDerment Sam Suddese Shiona Frew Estates Dept Facilities Dept Health & Safety Supervisor **Alan Keeley** Dave Jordan Kevin Graham Dave Bower Norman Sutherland	Alan Seabourne David Hall Frances Wrath Heather Griffin Hugh McDerment Jackie Stewart Karen Connelly Mairi Macleod Peter Moir Supervisor **Darren Smith** Manny Ajuwon Chris Lovejoy Ed McIntyre Emma White Alastair Leighton Tony Duddy	Alex McIntyre **Anna Baxendale** Dan Harley David Hall Dorothy Cafferty Frances Wrath Heather Griffin Jackie Sands Kate Munro Louise Watson Mairi Macleod Peter Moir Darren Smith Neil Murphy Liz Petrovitch Tom Littlewood	**Fiona McCluskey** Frances Wrath Heather Griffin Karen Connelly Mairi Macleod **Peter Moir** Supervisor C&B Support Ross Ballingall Chris Lovejoy Ed McIntyre Dave Bower Ron King	Alan Seabourne David Hall Fiona McCluskey Frances Wrath Heather Griffin Mairi Macleod Mark Baird Jackie Stewart Karen Connelly **Darren Smith** Emma White Paul Britton Dave Bower	**Alan Seabourne (tbc)** Alasdair Finleyson David Hall Frances Wrath Fiona McCluskey Hugh McDerment Karen Connelly Kenny Birney Lorraine Pebbles Mark Greig Marion Stewart Chris Lovejoy Tony Duddy Ed McIntyre Steve Pardy Michael Frain	Frances Wrath Hugh McDerment Isobel Ferguson Karen Connelly Lorraine Pebbles Peter Moir **Robert Stewart** C&B Support Dave Bower Darren Smith Manny Ajuwon Chris Lovejoy Steve Pardy Michael Frain
Attendees	To be identified as required	To be identified as required	To be identified as required	TA Advisers as required	TA Advisers as required	To be identified as required	Clinical reps/ Technical Advisers as required	To be identified as required	To be identified as required	To be identified as required
Frequency of Meetings	Monthly – Last Tuesday of each month 4pm	Every 2nd Tuesday 12.30pm	Every Tuesday 9am	Every Thursday 2pm	Every week - to be scheduled out	By Agreement	1 per month - to be scheduled out	Every week - to be scheduled out	1 per month - to be scheduled out	3rd Friday of every month 1pm (TBC)
Reports to:	Acute Services Strategy Board through Alan Seabourne	Project Steering Group	Project Management Group	Project Management Group	Project Management Group	Technical Design Group	Project Management Group	Project Management Group	Technical Design Group	Project Management Group

The agenda of the Project Management Group may expand to create a separate Construction Group

These groups will merge at some point

2.7 Multiplex understood that Mr Alan Seabourne referred to in the above table (acting on behalf of GGHB) was an experienced NHS delivery manager who for this project put in place a reporting and action strategy copied from his previous position. Mr Seabourne desired a partnership approach between GGHB and Multiplex. Each of the management teams were therefore joint between designers, Multiplex, GGHB and overseeing positions, all feeding into an overall management committee. Paragraph 1.4 of the PEP reflected this by providing "[t]*he NEC3 Contract has embedded within it the ethos of working in partnership and this has to be extended across the entire project delivery team, both client and contractor to maximise the inherent benefits and realise optimum value.*"

2.8 In turning to the commissioning phase of the works, Multiplex would respectfully refer the Inquiry to the oral evidence of Mr Stephen Maddocks, who in response to a question by Mr MacGregor KC "*What's validation and how does it differ from commissioning?*" answered "*Commissioning is undertaken by the contractor. As part of his brief and as part of his tender, he will be asked to commission the systems and prove that they meet the design requirements. In other words, if a room, such as we are in today, has got X many litres per second, he will be required to demonstrate that. Validation is an independent third party proof that he's done what he said he's done, and certain areas of a hospital require validation for legal purposes and for third-party verification. As an example, a pharmacy that produces drugs is controlled by the Medicines Health Regulatory Agency. They will go in and validate a pharmacy to prove that that pharmacy meets their guidance. So that's another set of guidance documents that the design has to be considered. So validation is really a third party verification of a system or facility*." (Transcript day 3 page 34)

2.9 Multiplex concur with the above, in that for QEUH Multiplex carried out commissioning of the ventilation and water systems. The purpose of such commissioning being for Multiplex to demonstrate that the ventilation and water systems complied with the contractual requirements. Multiplex was not involved in, nor did it carry out, validation of the ventilation and water systems, those being matters for GGHB.

2.10 The Stage 3 Works (Adult & Children's Hospitals) were, subject to a schedule of incomplete works, certified as complete under the contract on 26 January 2015. Thereafter, a Final Defects Certificate was issued dated 15 February 2017. Multiplex note it is GGHB's position that it "*does not accept that concerns about the safety of the water, drainage or ventilation systems at QEUH have any validity, on any proper reading of the available evidence.*" (paragraph 44 of the "*Response to Provisional Position Paper 5 of the Inquiry on behalf of Greater Glasgow Health Board*" dated 21 April 2023). GGHB did not provide a focussed resource to work with Multiplex in connection with completion of the Stage 3 Works.

2.11 Multiplex would note that notwithstanding the above there were activities undertaken by it at QEUH post completion, which activities are described in its responses to the Inquiry dated 3 July, 9 June and 9 November 2023. Those activities were carried out under the direction of GGHB. At no time was Multiplex given direction or disclosure on the processes and procedures to be undertaken by GGHB with regards to validation.

2.12 Multiplex continued to respond to issues post completion and had a clear desire to satisfy GGHB. Multiplex would note this was a difficult process where GGHB appeared unclear as to its requirements, seeking to sometimes assign blame to Multiplex and not provide Multiplex with full and complete information.

2.13 Insofar as activities of GGHB post-completion are concerned, Multiplex note the terms of the gap analysis dated 8 March 2016 carried out by DMA Water (page 1014 of Bundle 15 – Water PPP) which identified that a number of regular reviews and checks had "*not been happening to date*" and the reference to works carried out by GGHB which are described in the report by DMA Canyon dated January 2019 (page 1170 of Bundle 15 – Water PPP).

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

16 April 2024

For the attention of Inquiry Team
Scottish Hospitals Inquiry

By e-mail only – legal@hospitalsinquiry.scot

Our Ref: AVIV/1/17

Direct e-mail: [redacted]

Dear Sir or Madam,

TUV SUD Limited/Wallace Whittle Limited (TSWW)
QEUH and RHC Glasgow
Response to Provisional Position Paper 11 – Potentially Deficient Features of the water system of the QEUH/RHC

TSWW welcomes the opportunity to comment on Provisional Position Paper 11 (PPP 11), setting out the Inquiry's review of the material available on the water systems in the new hospitals.

Core Participants are directed to confine their comments to those matters requiring material clarification or correction, particularly in relation to matters of fact.

With that direction in mind, we are pleased to provide the following comments, on behalf of our client TSWW, following the order and paragraph numbering of the PPP11.

In introduction we feel it is important to reiterate previous comments made about TSWW's involvement in this project. The building services design for QUEH/RHC was originally carried out by Zisman Bowyer & Partners LLP ("ZBP"). ZBP ceased trading in 2013 and Multiplex (MPX) appointed TSWW to assist in completing the project, at a point after the detailed design phase. The ability of TSWW to consider and comment upon certain issues raised in PPP11 is limited. TSWW does, however, have access to ZBP design records and will support the Inquiry as best it can using this information.

In line with that background our clients have provided comments on technical issues but are not best placed to contribute directly on design construction or operational issues.

Commentary on Issues raised within PPP 11
Bypass pipes

5.4 – 5.9

The original design information indicates no bypass pipework was provided. There were emergency connections shown on the drawings. It is not clear to our clients who installed these by-pass pipes.

Double check Valves

5.13

Our clients' review of the designers' design information identified a non-return valve on the design drawing [ZBP-FM-B1-PL-500-061 (revision F)]. The provision of a double check valve is a suitable protection for the incoming mains supply. Double check valves were to be provided to each department on each supply.

Drain Points and Low Turnover

5.16

Our clients have noted that ZBP appear to have made early submissions to GGHB with regard to Water Storage tank sizing where they proposed lower capacities to assist with turnover.

Reconfiguration in event of fault

7.6

Our clients note that the design drawings available indicate both filtration pipes entering a header pipe to supply both bulk tanks. This arrangement, if installed as per the design drawing, should allow for the reconfiguration suggested. Thus our clients do **not** consider this to be a potentially deficient feature from a design perspective.

Bypass of the Filtration system

7.10

On our clients' review of the original design information, there was no bypass pipework indicated. There were emergency by-pass connections shown on the drawings ZBP-XX-XX-SC 500-001 (revision B); ZBP-FM-B1-PL-500-061 (revision F).

Deadlegs of pipework and insufficient backflow protection

8.8 – 8.13

Our clients agree that any identified deadlegs and lack of backflow protection are a potentially deficient feature. Our clients are not aware of the locations identified in PPP 11.

Single cold water supply

10.2 – 10.7

Our clients note that on review of original design information [ZBP-FM-B1-PL-500-061 (revision F)], there is a single bulk storage facility which is in line with SHTM at the time. Dozing plant was not included as part of the original design information which means our clients cannot comment on works completed after original design.

Cold Water Temperature

10.8 – 10.15

This appears to relate directly to an operational issue rather than a design issue and so our client provides no commentary.

Water temperature

11.2 – 11.7
Our clients confirm that SHTM offers guidance that the temperature at the most distant tap or outlet should be at minimum temperature of 55 degrees C. Our clients understand and expect the BMS should monitor the operational temperatures and initiate an alarm should thresholds be compromised.

Deadlegs in the hot water system

11.8 – 11.11

SHTM 04-01 Part A version 1 2011 notes that “the complete length of the spur without circulation should not exceed 3 metres”.

Our clients have reviewed the original design information [see for example note 12 on ZBP-FM-B1-PL-500-061 (revision F)] and note the drawing information states “the maximum length for the HWS flow deadleg to any fitting shall not exceed 3 metres”. On this basis this does not appear to be a non-compliance in terms of design.

Calorifiers

12

The original design information appears to show the calorifiers in parallel. Our clients agree that the temperature issues noted in PPP 11 appear to relate to the operation of the system.

Expansion vessels

13.1 – 13.9

This appears to relate directly to an operational issue rather than a design issue and so our client provides no commentary.

Chilled Beam Units (“CBUs”)

14.1 – 14.5

Our clients comment that the use of CBUs (in this case Active Beams) was and remains an acceptable method of cooling and heating.

Control measures other than temperature control

15.13 – 15.16

Our clients consider that the comment contained in paragraph 15.16 in relation to the absence of a multiple barrier water safety plan is an operational issue and thus not for their comment. They consider there is no supportive evidence for that to relate to the original design.

It is noted that dozing plant was not included as part of the original design information and thus our clients cannot comment on works completed after original design was signed off.

Temperature Control

15.17 - 15.19

Our clients comment that with particular regard to the Hot Water it is apparent from the designs that the heating system operating temperatures and plant selection both for heating and hot water generation appear to reflect appropriate guidance values.

Taps, flow straighteners and point of use filters

16.3 – 16.8 and 16.25 – 16.36

The issues arising here relate to the fittings and sanitaryware. According to the hot and cold water supply specification the particular fittings were specified by the Architect.

Overprovision of outlets

18.26 – 18.30

The number of specified outlets was determined by the Architect and is not a design issue for the original Building Services Provider.

Insufficient backflow protection (showers)

18.37 – 18.38

Once again our clients note that the shower units were specified by the Architect.

Insufficient backflow protection (Baths)

19.1 – 19.9

The Arjo baths were not specified by ZBP, and we believe backflow protection is usually integral to the bath.

Water Coolers

20.1 – 20.12

ZBP did not specify the water coolers

Dishwashers

21.1 – 21.6

Dishwashers were not specified by ZBP.

Energy Centre

22

Our clients comment that with particular regard to the Hot Water it is apparent from the designs that the heating system operating temperatures and plant selection both for heating and hot water generation reflect appropriate guidance values. Where these values are not being achieved they suggest, again, that this points to an Installation, Manufacturer or Operator Issue.

PPP 11 Conclusion

25

Our clients note that the issues arising from the review of the water system it appears that PPP11 focuses on Installation, Maintenance or Operational matters and do not involve the original design.

Dr J T Walker's Expert Report (January 2024)

From a separate review of Dr Walker's report we note that he addresses major failings in both the installation of the plant and subsequent repeated operational and maintenance shortcomings. Our clients have no comment to make on that from a design perspective.

We trust these responses to PPP 11 are helpful to the Inquiry's continuing work.

Yours faithfully,

[redacted]

Laura J Donald
Consultant
For and on behalf of BTO Solicitors LLP

SCOTTISH HOSPITALS INQUIRY:
RESPONSE BY NHS NATIONAL SERVICES SCOTLAND TO PROVISIONAL POSITION PAPER 11

Please find below the response of NHS National Services Scotland ("NSS") to Provisional Position Paper 11. The key questions in para. 1.10 are addressed first, before setting out a number of other miscellaneous points.

Key Questions in para. 1.10
NSS notes that it was only involved with the water system insofar as requested by NHS GGC or by the Scottish Government. Accordingly, the scope of its involvement was limited. That is the context to the below answers.

[1] Whether the description of the water system (including drainage) contained within the PPP is accepted as being correct and if there are any points in respect of which the Core Participant challenges the description of the system, specifically what the points of disagreement are and what evidence exists to support the position taken by the CP?
Given the limited nature of NSS's involvement, it does not have enough information to comment meaningfully.

[2] Whether the description of any Potentially Deficient Feature is accurate notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense?
We understand that generally the provision of outlets was in line with the requirementsof policy (CEL(2008)48 / CE(2010)27) and guidance at the time (e.g. SHPN 04-01). A reduction from policy/guidance requirements would have to be clinically reasoned by a Health Board through their business case.

[3] Where the PPP describes the date or dates upon which a Potentially Deficient Feature became known to a particular person or organisation whether the Core Participant accepts that date of knowledge or offers an alternative date notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense?
The dates are accepted as being correct to the best of NSS's knowledge.

[4] Whether there are any other features of the water system (including drainage) which should be considered by the Inquiry to be Potentially Deficient Features and what evidence exists to support that conclusion?
NSS is unaware of other features which should be considered.

Miscellaneous points
The numbers on the left refer to paras. in PPP 11

2.27 and 2.28- **NSS considers that there is other guidance not referenced here or in the sources section as relevant to water systems. See below in the response to para 4.1.**

[We can provide that information, however it would be helpful to understand that we have not misunderstood the purpose of the paper. It may be helpful to have discussion with the inquiry to that regard.]

4.1 **The list of "Guidance" omits SHFN 01-02, version 5 ('The NHS Scotland National Cleaning Services Specification'). Amongst other things, this includes cleaning regimes for sanitary fittings such as wash hand basins and shower heads.**

4.1 **The list of Guidance also omits the SHFN 30 guidance documents Parts A, B, and C, 2007 and 2014-15 ('HAI-SCRIBE'). SHFN 30 provides a framework for identifying, managing, and mitigating, issues in the built environment that affect infection prevention and control. It also seeks confirmation that there is compliance with other technical guidance**.

6.5 **Footnote 26 refers to an alert at page 812. In fact, the alert referred to seems to be at page 688.**

16.16 **Despite the unanimous agreement documented in the minute, we believe that the recommendations in the SBAR (footnote 231) remained unchanged.**
We first submitted information about taps to the Scottish Hospitals Inquiry as part of NSS response to Information Request 1 10 Feb 2021 reference 1922. This is currently being updated by NSS with additional information and will be submitted as v1.2.

16.16 **Footnotes 223 and 234 refer to the minute of the meeting to discuss Opitherm taps, which is at page 692 of the bundle, not page 816.**

20.5 **PPP11 notes "Dr Inkster observed that draft HFS Guidance SUP 05 (Provision of drinking water) highlights NHS responsibility to protect from waterborne bacteria in drinking water and water dispensers, and advises against free standing bottled water coolers due to infection risk.". NSS would note that the SUP (Standard Unified Procedures) were a suite of draft documents produced in collaboration with health boards, that health boards could utilise, if they wished, as templates to be adapted into local health board specific procedures. The SUPs only ever existed in draft form and were formally withdrawn on 19th December 2022 following discussions between NHS Scotland Assure and SETAG.**

21.23 **Footnote 316 refers to an email at page 842. In fact, the email referred to seems to be at page 718. If so, the "Dr Storrar" referred to is NSS's Ian Storrar – an engineer, not a medical doctor.**

NHS National Services Scotland
12 April 2024

THE SCOTTISH HOSPITALS INQUIRY

GREATER GLASGOW HEALTH BOARD

RESPONSE TO PROVISIONAL POSITION PAPERS 11 AND 12

1. INTRODUCTION AND SUMMARY

1.1. This document is Greater Glasgow Health Board's ("**NHSGGC**") combined response to Provisional Position Paper 11 ("**PPP11**") and Provisional Position Paper 12 ("**PPP12**"). PPP11 concerns the water system (including drainage) within the Queen Elizabeth University Hospital ("**QEUH**") and Royal Hospital for Children ("**RHC**"). PPP12 concerns the ventilation system within the QEUH and RHC.

1.2. NHSGGC welcomes the opportunity to comment on PPP11 and PPP12. NHSGGC wishes to reiterate that, on the basis of the evidence currently available it does not accept that of the water, drainage or ventilation systems in the QEUH or RHC has stage posed a risk to the safety of patients beyond that which may reasonably be expected in any comparable hospital environment. Based on evidence currently available, NHSGGC does not accept, and its investigations have not demonstrated, that there is any link between incidents of infections and the built environment beyond what would be ordinarily present in a comparable hospital environment. With the exception of two discrete cases of paediatric infection in 2016 and 2019, the details of which have already been shared with the Inquiry. NHSGGC does not accept, and its investigations to date have not demonstrated, that there was any causal link between the built environment and any infection suffered by a patient within the QEUH.

1.3. Whilst NHSGGC recognises the work done by the Inquiry to prepare PPP11 and 12, it submits that it is premature to consider any feature of the ventilation or water system as "potentially deficient" or connected with incidents of patient infection. NHSGGC considers that further evidence, particularly expert evidence of microbiologists and epidemiologists must be heard in order to reach any conclusions on a risk posed by the water and ventilation systems within the QEUH/RHC. The existence or non-existence of any link between the built environment and any incident of infection is a matter for expert evidence.

1.4. Further, the Inquiry has not yet heard any evidence from those responsible for design, build, commissioning, system testing, epidemiologists, microbiologists, infection control and those responsible for communication policy and implementation. Such evidence will be critical to answering the Inquiry's terms of reference. In particular, such evidence is essential in understanding what specification NHSGGC sought for the ventilation and water systems and whether the as-built systems complied with those requirements. NHSGGC wishes to remind the Inquiry that it is presently pursuing civil proceedings in the Court of Session against some of those responsible for, amongst other things, the design and build of the water and ventilation systems.

1.5. Within this response NHSGGC has provided an overview of the design, build and commissioning of the relevant system in order to assist the Inquiry and give context to the features of the water and ventilation systems. However, NHSGGC submits that the Inquiry should not look at features of the ventilation and water systems in isolation. It is key to answering the Inquiry's terms of reference that the Inquiry consider whether those features had any impact on delivery of patient care. In order to assist with that process NHSGGC has also provided detail of its response to each incident of infection within Annex 3 to this response.

2. STRUCTURE

2.1. This document is structured as follows:

Section	*Title*
3.	Design and construction
4.	Ventilation System
5.	Water System
6.	Conclusion
Annex 1:	Detailed response to PPP11
Annex 2:	Detailed response to PPP12
Annex 3:	NHSGGC's response to identified incidents of infection

2.2. The Inquiry has asked 4 questions. Those are:

QUESTION 1: Whether the description of the relevant system contained within the PPP is accepted as being correct and if there are points in respect of which the Core Participant challenges the description of the system, specifically what the points of

disagreement are and what evidence exists to support the position taken by the Core Participant;

QUESTION 2: Whether the description of any "Potentially Deficient Feature" is accurate notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense;

QUESTION 3: Where the PPP describes the date or dates upon which a Potentially Deficient Feature became known to a particular person or organisation whether the Core Participant accepts that date of knowledge or offers an alternative date notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense; and

QUESTION 4: Whether there are any other features of the relevant system which should be considered by the Inquiry to be "Potentially Deficient Features" and what evidence exists to support that conclusion.

2.3. Where possible, NHSGGC has endeavoured to answer those questions within this document. Section 4 (ventilation) and section 5 (water) of this document address the position in respect of the systems at a higher level. A detailed response setting out particular areas of disagreement and areas for further investigation is contained in Annexes 1 (water) and 2 (ventilation).

2.4. NHSGGC has not had the opportunity in the time available to consider all of the features of the relevant system. NHSGGC therefore may require to supplement this response once further evidence is heard by the Inquiry.

3. DESIGN AND CONSTRUCTION

3.1. It is understood that the design and construction of the QEUH and RHC will be considered in detail in a future PPP and at a future hearing. However, NHSGGC submits that the full details of the assessment of site choice, design, build, commissioning, validation and testing needs to be understood in order to give context to the features of the ventilation and water system identified in PPP11 and 12. These phases also need to be fully understood in order to objectively validate the perceptions of the patients, families and clinicians who have given evidence at the Glasgow hearings to date. The features of the system cannot, and should not, be looked at in isolation from the design, build, commissioning and maintenance phases.

3.2. The design and construction of the QEUH and RHC was a significant and complex infrastructure project. NHSGGC commissioned external advisors to advise it throughout each of the phases. What follows is a high-level summary of those involved and the key dates and actions undertaken.

3.3. NHSGGC appointed Davis Langdon LLP in 2005 to act as technical advisor. Davis Langdon produced a Public Sector Comparator ("**PSC**") which was captured in a Design Solutions Report in 2007. That report detailed clinical criteria and footprint for the QEUH including aspects of the ventilation and water systems. This document was used to inform the Outline Business Case approved by the Scottish Government in April 2008. It was prepared with expert clinical input, including from specialists in infection control and treatment of neutropenic patients.

3.4. In September 2008, Currie & Brown were appointed as Lead Consultant. Currie & Brown were appointed to undertake a wide-ranging role including the development of the PSC into the full Employer's Requirements, management of the detailed development including testing the main contractor's proposals against the Employer's Requirements and acting as Employer's Agent providing Contract Administration on site.

3.5. The Employer's Requirements were informed by a Clinical Output Specification with input from experienced clinical specialists within NHSGGC and externally. An exemplar design was produced by Currie & Brown and issued to bidders in May 2009. The Employer's Requirements included clinical input into ventilation and water system requirements for areas of the QEUH to be used for immunocompromised patients. Ventilation specifications also stated that HEPA filtration was to be installed in the Haemato-Oncology ward in the QEUH.

3.6. The Employer's Requirements, incorporating the Clinical Output Specification, were issued to bidders in May 2009. Following a competitive procurement process, Brookfield Europe ("**Multiplex**") were appointed as main contractor on 18 December 2009. In terms of the contract between Multiplex and NHSGGC, Multiplex took on the full design and construction responsibility. Multiplex's bid included its Contractor's Proposals which contained detail on the ventilation and water systems. Any difference between the Employer's Requirements and the Contractor's Proposals were captured in a series of "logs". However, all designs were to comply with all relevant UK and EU standards in respect of, amongst other issues, infection prevention and control.

3.7. Multiplex were initially awarded the contract in respect of Stage 1 and 2 only. This included detailed design of the QEUH through to full business case submission. From appointment,

Multiplex developed its design with input from clinical specialists within NHSGCC and external specialists.

3.8. The Lead Consultant role was updated and site inspection and the sign off of the technical commissions were excluded from Currie & Brown's remit on the basis that an NEC3 Supervisor would be appointed separately to act independently. A tender process to procure an NEC3 Supervisor was undertaken, with Capita Symonds being selected and instructed in March 2010. The appointment of an NEC3 Supervisor was in accordance with the terms and conditions of the HFS Consultants framework in place at the time, and in line with NEC3 standard appointments. The scope of the NEC 3 Supervisor included the requirement to: (i) monitor Multiplex's activities; and (ii) witness the testing of the building services.

3.9. Authorisation was issued by NHSGGC to Multiplex to proceed with the construction phase on 16 December 2010. Stage 3 (construction) commenced on 28 March 2011. Throughout the construction phase clinical specialist input was provided. This included input from the Infection Control Team in respect of ventilation requirements and the number and specification of isolation rooms. Changes to the design were instructed through Project Manager Instructions (PMIs).

3.10. Multiplex's responsibility was to manage all technical commissioning via an Independent Commissioning Engineer, along with its specialist sub-contractors. Multiplex managed all aspects of testing and commissioning of the QEUH. The Project Supervisors witnessed a proportion of the commissioning activities, and these are noted in their monthly reports.

3.11. On 26 January 2015, the QEUH was handed over to NHSGGC. Patient migration commenced when the Southern General Hospital Outpatient department moved to the new building on 27 April 2015. Migration of patients from the Western Infirmary, Victoria Infirmary, Mansion House Unit and Gartnavel General Hospital commenced at that time. On 1 May 2015, the Inpatient departments of the Southern General Hospital moved to the new campus. On 10 June 2015, the Royal Hospital for Sick Children at Yorkhill moved in to the new RHC campus.

4. VENTILATION SYSTEM

4.1. The Inquiry suggests in PPP12 that two issues require to be understood. Firstly, what aspects of the ventilation system require to be considered by the Inquiry and secondly the extent to which any such feature is or was *"in an unsafe condition, in the sense that that feature presented an additional risk of avoidable infection to patients".*

4.2. Subject to the clarifications set out in this document, NHSGGC accepts that the identified features were present in the ventilation system. NHSGGC also accepts the content of PPP12 insofar as it describes the operation of the system, subject again to any clarification in this response. However, NHSGGC submits that the key question for the Inquiry is the impact, if any, those features had. It is submitted that the Inquiry cannot and should not look at these features in isolation and ask whether each feature was "potentially deficient". The Inquiry must look at the ventilation system as a whole and decide whether that system presented any additional risk of avoidable infection to patients over what would be expected in a comparable hospital environment. NHSGGC does not accept, based on available evidence, that the ventilation system, presented an increased risk to patients when compared with a comparable hospital environment.

4.3. Further NHSGGC submits that the Inquiry should not proceed upon the basis that "*any feature of the wards …that does not appear to conform to the statutory regulation and other applicable recommendations, guidance, and good practice should be considered for the purposes of the Inquiry to be a "potentially deficient feature' and is identified as such*." Deviation from recommendations, guidance and good practice does not, of itself, make something defective. It is essential to ascertain whether any such deviation has any impact on patient care. This is an issue for expert evidence which the Inquiry is yet to hear. As stated above, the ventilation system ought to be considered as a whole, rather than separate features of it in isolation, to determine whether there is any impact on patient care.

(i) Pre-handover

4.4. In June 2013, a change control request was raised to make changes to the Haemato-Oncology and Renal ward area. The justification was to move Bone Marrow Transplant patients from the Beatson WOSCC to a site with full ITU and HDU support 24/7 and to meet accreditation and clinical standards. The decision to move was approved on 9 July 2013 after being agreed to by the Quality and Performance Committee which was tasked with oversight of the hospitals' project. Construction of the QEUH was well established at this point and therefore PMI 228 was issued requesting Multiplex to stop the fit out works in the area and develop a design to meet the board's requirements. Plans were developed to retrofit the area to environmental standards acceptable for the care of patients requiring Bone Marrow Transplant. The Project Team met with the User Group to agree the physical ward layout (preferred option) which was returned to the contractor in late July 2013. A Compensation Event, CE 051, was raised on the 2 October 2013 confirming NHSGGC's acceptance of design and instructing Multiplex to proceed.

(ii) Handover and migration

4.5. RHC Ward 2A consisted of single patient rooms, 8 positive pressure ventilated lobby (PPVL) isolation rooms, offices, clinical rooms and service support rooms. The ward was served by 2 ventilation systems which covered the single patient rooms and supporting areas while each of the 8 isolation rooms had their own dedicated ventilation system. The ventilation systems serving the single rooms and support areas were commissioned in September 2014 and the systems serving the 8 isolation rooms were commissioned in December 2014. The commissioning results for the isolation rooms were received by Multiplex from their sub-contractor, H&V. The commissioning of the isolation rooms took place without HEPA filters present in the supply terminal.

4.6. In late June 2015 an air sampling programme was implemented in QEUH Ward 4B patient rooms and the corridor. High particle counts were recorded on the initial test and subsequent re-tests with some of the rooms recording particle counts above the recommended maximum levels. It was also stated that the Ward 4B patient rooms could neither demonstrate the required positive air pressure differentials from room to corridor nor the required air change per hour rates required by the specification agreed between Multiplex and NHSGGC. Following a review of the situation, BMT patients were returned to Beatson West of Scotland Cancer Centre on 8 July 2015. The contractor was not required to undertake particle counts as part of the commissioning process however the testing of the HEPA filters located in the patient rooms should have been undertaken.

4.7. On 3 July 2015, the NHS Deputy Project Director issued Multiplex with PMI 424 requesting that Multiplex proceed with re-design of the ventilation system in QEUH Ward 4B. The performance specification was: 10-12 air changes per hour, positive pressure differential between single bedrooms and corridor of 5-10 Pascals, and between ward corridor and adjacent stairwells and atrium of 2-3 Pascals. Multiplex provided their proposals to the PMI 424 to NHSGGC for approval. The proposal was that a solid plasterboard ceiling would be installed within the 24 bedrooms in Ward 4B. The ceiling would be taped, filled, and painted and sealed at all interfaces with adjoining walls and services. All light fittings were to be replaced and sealed. The ensuite rooms had a grid and tile type ceiling which would be retained but with the services and tiles silicon sealed in position. The air handling unit (AHU) motors were to be upgraded. NHSGGC provided approval for works to proceed on the basis of that revised specification.

4.8. Multiplex accepted that there had been non-compliance with requirements relating to the ventilation system and air quality in QEUH 4B as built. These are summarised in the "Briefing note on Design of the Unit" dated 9 July 2015[1].

4.9. In respect of QEUH Ward 4B, in October 2015, air permeability tests were undertaken by Multiplex's subcontractor RSK. Test results were provided following the completion of these tests. The formal report received in November 2015 indicated that all rooms listed as tested within the report complied with the required criteria laid down in HBN 04 Supplement 1. On completion of the works and subsequent validation by H&V, Infection Control consultants remained dissatisfied with the unit on the basis of air sampling results, and requested and obtained a design specification for the unit from Health Protection Scotland (HPS).

4.10. Advice was received by way of SBAR from HPS in December 2015. Following receipt of the HPS SBAR and internal discussion, NHSGGC issued PMI 471 in March 2016. This instructed Multiplex to undertake a feasibility study with estimated costs for a programme of works to achieve 6 air changes per hour; room pressures of +2.5 to +8 pascals, and the entrance to the ward to be air locked using double door at the front entrance. NHSGGC issued Compensation Event 173 in April 2016 to Multiplex for the costs of design proposals in relation to PMI 147. NHSGGC did not instruct Multiplex to undertake any further works within Ward 4B.

4.11. NHSGGC instructed an alternative contractor, to replace the en-suite ceilings with solid plasterboard in September 2017. The work was completed in November 2017. A further SBAR was issued by HPS in December 2017 which recommended an extended period of air sampling prior to allowing patients to return to Ward 4B. Patients returned from the Beatson in June 2018 following a series of satisfactory air sampling results.

4.12. In respect of ongoing demolition work at handover, AICC and BICC minutes from May 2015 and BICC minutes from July 2015 note concerns around demolition on the site following the opening of the QEUH. Identified actions to be taken included seeking assurance from contractors as to concerns around the control of dust during the demolition of buildings and the associated risk to patients.

4.13. Prior to migration into RHC ward 2A, it was identified that the 8 isolation rooms had not been provided with HEPA filtration. Ward 2A was for the use of BMT transplant patients and included both patient rooms and isolation rooms. The isolation rooms had the capability of being HEPA filtered but the filters had not been fitted. When this was

[1] H7 Haemato oncology update 090715 provided under SHI Section 21 Number 1 Question 2

identified, filters were sourced, and they were fitted and tested by H&V commissioning and witnessed by Multiplex. This work was completed on 6 and 7 June. The Lead Infection Control Doctor ("LICD") confirmed the unit was safe for transplant patients thereafter.

4.14. In RHC Wards 2A/B (the children's Haemato-oncology wards), air sampling was carried out in July 2015 which identified high particle counts. Aspergillus was detected in some samples and, as a precaution, light fittings in the BMT isolation rooms were sealed before further sampling. Bone marrow transplantations proceeded following advice from the LICD. Advice concluded that the presence of fungal spores at the detected level did not translate to an increase in Aspergillus infection and that fungal spores detected were in line with published literature.[2]

4.15. HPS issued an SBAR entitled "Royal Hospital for Children (NHSGGC) Ward 2b" in January 2018"[3]. This report advised GGC on the appropriate design to provide protective isolation to hematopoietic stem cell transplantation patients in isolation rooms. The report acknowledged work was already underway in converting 4 PPVL rooms to Positive Pressure Isolation Rooms (PPIR). HPS recommended HEPA filtered, positively pressured patient rooms with a positive pressure cascade system from room to corridor, designed to comply with SHTM 03-01 Ventilation for healthcare premises Part A- Design and Validation (2009). In Feb and March 2018, 4 of the PPVL isolation rooms within ward 2A were re-configured and are now classified as PPIR rooms. These were completed and validated by March 2018 to the required standard.

(iii) RHC 2A/2B Decant

4.16. A summary of the decant from RHC wards 2A and 2B to Wards 4B and 6A in the QEUH is described below. The decision to decant was taken due to concerns raised in respect of the drainage systems. The decant would allow work to be undertaken on the replacement of sanitary ware and taps within the wards. The decision to decant was taken on the advice of the LICD and IMT. The re-location of patients from Ward 2A and Ward 2B was undertaken on Wednesday 26 September 2018.

4.17. In October 2018 NHSGGC commissioned a feasibility study from Innovated Design Solutions regarding increasing ventilation air change rates for the non-isolation rooms on Ward 2A. The review highlighted improvements that could be undertaken to increase pressure differentials and room air change rates and provide HEPA filtration to the entire

[2] Summary written by Prof Williams on 15/09/2015
[3] The document title stated 2B but the study is primarily in connection with Ward 2A

ward. Significant work would require to be undertaken to improve the ventilation system in these wards including increasing the air changes per hour.

(iv) Wards 4C and 6A

4.18. From the end of 2018, the ventilation systems serving QEUH wards 4C and 6A were the subject of IMT discussions amid concerns that 2 patients had contracted Cryptococcus neoformans while inpatients on these wards. Precautionary measures were implemented in corridors and rooms within Wards 4C and 6A. This initially involved the provision of portable HEPA filtration units being sited within both the patient rooms and corridors in these wards. This was then supplemented by the installation of ceiling mounted HEPA filtered air scrubbers within the en-suites in ward 6A in January 2019. In March 2019, the secondary filters within the AHUs were upgraded from F7 to F9 grade rigid filters. Further controls were implemented in ward 4C in January 2020 when ceiling vent grilles were removed and in October 2020 when the installation of recirculation air scrubbers was undertaken in the en-suites within each patient room. The investigation of the Cryptococcus incident was delegated to a dedicated expert advisory sub-group in February 2019. The sub-group's investigation continued for a number of years. The final version of its report is dated 5 April 2022.

4.19. A further decant took place from 6A to CDU in January 2019. The LICD had taken air samples and fungal counts were higher than she expected. Investigations uncovered water ingress via the shower wall coverings causing mould beneath the flooring. The IMT made the recommendation to decant whilst remedial work was done. Patients returned to 6A in February 2019.

4.20. The paediatric Haemato-oncology unit moved back into RHC Wards 2A/B following completion and validation of the ventilation works in March 2022. The new design now provided HEPA filtered air to both Ward 2A and 2B. It also ensured that both the patient bedrooms and the isolation bedrooms within ward 2A were positively pressured from room to ward corridor and the ward corridor now had a positive pressure gradient from ward corridor to Hospital Street.

4.21. The installation of separate supply and extraction systems to wards 2A and B removed the risk of cross contamination from other zones and other levels within RHC. The provision of duty/standby arrangements added resilience to the systems and allowed for planned maintenance of the AHUs to be undertaken without impacting the patient group. During the work undertaken to upgrade ventilation systems serving ward 2A, one of the

remaining PPVL isolation rooms within Ward 2A was converted to a negative pressure isolation room thus providing a suitable environment for caring for infectious disease and respiratory patients. While the ventilation system was being re-configured, a new, dedicated ventilation system was fitted to provide HEPA filtered ventilation to the MIBG suite within ward 2A.

5. WATER SYSTEM

5.1. As with ventilation, the Inquiry suggests in PPP11 that there are two issues that need to be understood. This first is what aspects of the water system require to be considered. The second is to determine the extent to which any such feature was in an unsafe condition *"in the sense that that feature presented an additional risk of avoidance infection to patients."*

5.2. NHSGGC accepts the that the features identified in PPP11 were features of the water system, subject to the points of clarification within this document and its annexes. NHSGGC also accepts the content of PPP11 insofar as it describes the operation of the system, subject again to any clarification in this response.

5.3. Determining whether any features are "deficient" will require detailed factual and expert evidence. However, rather than focussing on certain features, the evidence must look at the system as a whole and ask whether there was any additional risk to patient safety over what would be expected in a comparable environment. The Inquiry must also look at the maintenance, flushing and cleaning systems in place. Based on information presently available, NHSGGC does not accept that the water system was deficient in the sense that NHSGGC does not accept that the system presented any enhanced risk to patients beyond that which would be expected in a comparable hospital environment.

(i) Pre-handover

5.4. Prior to handover, testing and flushing of the domestic water system was the responsibility of Multiplex and its sub-contractors. NHSGGC has now identified certain shortcomings with this process. In particular, a certificate provided by Multiplex's sub-contractor, Mercury, indicates a Leachate flush of the whole water system was completed on 16 January 2014. Subsequent commissioning records indicate that the water tanks were not tested and the cold-water booster pumps were not commissioned until March 2014. Invitations to witness leachate flushing in plantrooms in November 2014 indicates that the leachate flushing may not have been undertaken as a whole system flush and contradicts

the certificate provided by Mercury certifying leachate flushing was completed in January 2014.

5.5. NHSGGC sought guidance from HPS about the Horne Optitherm taps which had been installed. In response HPS produced an SBAR, dated 9 April 2014. On 5 June 2014, a meeting was attended by HPS and HFS representatives together with senior NHSGGC estates representatives and representatives of Horne Engineering. This meeting discussed installation of the Optitherm taps and guidance issued by HPS. It was unanimously agreed that as the taps installed within the new build development complied with guidance current at the time of its specification and that the hospital was in the process of being commissioned, it should be regarded as being in the "retrospective" category, not "new build". NHSGGC were advised that there was no need to apply additional flow control facilities or remove flow straighteners and any residual perceived or potential risks would form part of the routine management process.

5.6. Whilst guidance released following the build and installation advised against the use of taps with flow straighteners in units which housed immunocompromised patients, such as wards 2A/B and 4B, it was determined by NHSGGC, with input from Infection Control experts, that potential risks could be managed as part of the routine management process of the water system.

5.7. A Risk Assessment and Method Statement (RAMS) by Multiplex sub-contractor, Mercury laid out the strategy of how the sterilisation, temperature recording, TMV testing, and water sampling would be undertaken on the domestic water system. The document identified the temperatures to be achieved at hot and cold outlets and the parameters to be met for microbiological sampling. The RAMS was provided to demonstrate how the system would be commissioned. However subsequent results failed to demonstrate the system was commissioned and managed in the way that the RAMS stated it would be. Reference is made to the response to Section 21 Notice no.8.

5.8. In December 2014 and January 2015, Multiplex undertook a full, sequential disinfection of the water system process as part of the commissioning process. Disinfections took place from the basement plant room to each of the plant rooms as part of the commissioning process. Following disinfection, microbiological sampling for Total Viable Counts (TVCs), *E. coli* and coliforms from representative points on each system were taken. Some sampling was also undertaken for legionella. When the results were returned some of the results showed high Total Viable Counts (TVCs) and *E. coli* in the water. These outlets were re-disinfected and retested.

(ii) Handover

5.9. In December 2014 DMA Canyon were engaged to undertake a pre-occupancy water legionella risk assessment. The initial review and subsequent site survey took place from January to April 2015. The final report, which was titled “Legionella L8 Risk Assessment 2015 (pre-occupancy)”, was issued in May 2015. Comment was made with regard to the water safety management structure noting it was not documented and clear lines of communication were not recorded and therefore the management structure for the new hospitals may not be adequate for the management of legionella control .The report further noted several technical issues with the water system including failures in the temperature control of the water system, debris being present in a water storage tank, non-compliant flexi-hoses had been installed that may present a risk of bacterial growth and that no written scheme or protocols in relation to the management of the new water system were in place.

5.10. Actions in relation to the findings of the report were delegated, by the Estates manager to two members of the Estates team. From handover in 2015, the management and implementation of planned and reactive tasks relating to the water systems was undertaken by Estates Officers and Estates Managers who had transferred to the new facility from other locations. Dead legs were identified to be removed, although some of these were actually outlets waiting on appliances being fitted such as cold water drink dispensers and dishwashers.

5.11. A flushing regime was instituted by NHSGGC Estates staff, with the support of agency staff, to ensure turnover of water prior to patient occupation. Water sampling was undertaken post-handover leading to re-sterilisation of hot and cold-water systems in specific areas of the hospital.

5.12. At no time was the existence of the 2015 DMA Canyon Report concealed by the estates manager or NHSGGC, and, on its existence and contents being made known for the first time to more senior management in June 2018, it was immediately shared with a number of organisations including HFS, and the lead ICD in her capacity as Chair of the IMT. Actions to resolve all identified risks were undertaken urgently and SHI have the full actions plans with evidence of completion.

(iii) Investigations in 2016 and 2017

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

5.14. In September 2017, work on a second report by DMA Canyon began – this is a biannual risk assessment. The final report was completed in April 2018. All actions to address the recommendations of the 2015 and 2017 DMA Canyon reports were completed by 16 December 2018.

(iv) March 2018

5.15. Water sampling found Cupriavidus in some outlets on RHC ward 2A in February 2018 and Pseudomonas in one outlet on RHC ward 2A. The LICD immediately recommended control measures were put in place. Advice was given that patients on Ward 2A/B should not use the water from the taps. Bottled water was provided together with portable handwashing facilities whilst investigations were carried out. Stenotrophomonas was isolated from some outlets in RHC ward 2A in March 2018. This situation was discussed at a number of IMTs. The IMTs looked in detail at the taps. It was hypothesised that the infections were potentially linked to contamination from the water system. The IMT recommended the installation of Point Of Use Filters POUF(s) on the taps. Cleaning and enhanced hand hygiene was also instigated. The IMTs at this time included representatives from HPS and HFS, at the request of the LICD. HPS had responsibility to report any incidents that scored red or amber to the Scottish Government. The IMT was closed at the end of March when POU filters were installed on taps and testing showed no bacteraemia. Control measures were put in place on other high risk areas and long term solution planning started when outlets elsewhere in the QEUH and RHC were found positive for gram negative organisms and fungus.

5.16. IMTs started again in June 2018 due to a spike in gram negative infections in the RHC. The hypothesis was that the problem was with drainage after drains swabs were found to contain gram negative organisms. Estates liaised with DMA Canyon to arrange silver hydrogen peroxide dosing of the drains. This took place on several occasions. A further

plan was developed to undertake a Hydrogen Peroxide Vapour (HPV) clean of the rooms in Ward 2A. This programme commenced in early June 2018. The final IMT meeting in that cycle took place on 21 June 2018. HPS and HFS remained members of this IMT.

(v) HPS Report

5.17. On 20 March 2018 HPS was requested by the Scottish Government to lead an investigation into the water system following NHSGGC's request for support from HPS on 16th March 2018 and the invocation of the national support algorithm by the Scottish Government. HPS worked with HFS on a review of water systems in addition to specific infection control work. The HPS report was completed in August 2018. The report concluded that contamination of the water system in the hospital had occurred, either: (i) during the construction phase and through lack of adequate maintenance, leading to build up of biofilm and consequently the proliferation of gram negative bacteraemia, or (ii) that biofilm had built up in the tap flow straighteners and regressed back into the water system. HFS recommended that NHSGGC implement the recommendations set out in the DMA reports. HPS reported that "exact link" between "patient cases and the water system" was said not to have been made. HPS's conclusions were supported by a report authorised by the Chair of the IMT.

(vi) Chlorine Dioxide (Cl02) dosing

5.18. On 23 May 2018 plans relating to the hospital water systems were reported to the BICC. This included tap replacements in ward 2A and POUFs to be installed in specified clinical areas. On 8 June 2018 the Water Review Group, which had been set up to advise on water related issues, considered plans for ClO2 continuous dosing of the QEUH/RHC water system. On 15 June 2018, the IMT noted that plans had been discussed for the introduction of ClO2 dosing of the water system. IMTs took place throughout June 2018 to consider this issue. Dosing was installed initially in ward 2A and brought on line in November 2018. 2A had by this time been decanted. The next phase was to implement the system site wide and dosing commenced into water systems between January and March 2019. The dosing was to be accompanied by an extensive replacement programme within ward 2A which included the replacement of sanitary ware such as basins, taps and drainage outlets with additional work being done to replace the flooring, decor, entry systems, and lighting and ventilation systems. This work was undertaken while the area was vacated.

5.19. Between July and September 2018, a Water Executive Group of senior managers oversaw water systems actions including a review of past actions and ensuring completion of all outstanding actions from the earlier DMA Canyon water risk assessments. The meetings related to governance, compliance and the reviewing of both DMA Canyon reports. Meetings were attended by senior estates and infection control managers, and on occasion the Chief Executive. A ClO2 dosing procurement process took place over July and August. Equipment delivery, installation and commissioning began initially in Ward 2A in November before being commissioned site wide from January to March 2019.

(vii) 2A/2B Ward Decant

5.20. Further incidents of gram negative patient infections associated with RHC ward 2A were discovered in September 2018. It was the view of the LICD that the source was drains as gram negative organisms had been identified from drain sampling. It was also noted that POUFs were in place on all water outlets making this source unlikely. Drains were dosed and cleaned. Remedial work was disruptive to patients and families and, as further work including a full drain survey would be difficult to do with patients still in their rooms, a decision was made to decant patients from Wards 2A/B to 6A and 4B in the adult hospital. This took place on 26 September 2018. This decision was made after considering a number of alternative locations but the decant to the adult hospital would allow the Bone Marrow Transplant Unit in ward 4B to be used for paediatric transplant patients. The Water Executive Group signed off the ward 2A/B decant plans. HPS and HFS remained as IMT members and there was by this point intensive Scottish Government scrutiny of all actions with regular teleconferences taking place from June 2018, this was in addition to the regular day to day reporting to Scottish Government. The water IMT continued until the end of November 2018.

5.21. Extensive work was undertaken in Ward 2A and 2B whilst patients were decanted. A programme of replacing taps, sinks, toilets and pipes was undertaken and a dosing system installed locally which provided ClO2 to ward 2A. This was commissioned in November 2018. The water related work was completed by 20 December 2018. During this time, an extended review and assessment of the ventilation system resulted in agreement to upgrade the ventilation systems. This meant the patients remained on decant until the ventilation work was completed in March 2022.

5.22. An IMT commenced in June 2019 following Problem Assessment Group meetings (PAGs) held into cases of gram negative bacteraemia in paediatric Haemato-oncology patients

now located in QEUH ward 6A. The IMT also reviewed a case of mycobacteria chelonae in a patient associated with ward 6A. POUFs were installed to all areas within the 6A patient pathway (i.e. out with 6A itself). Chlorine Dioxide dosing of the water system was increased. Sampling was increased, including sampling of the chilled beams. A decision was taken to close 6A to new admissions in August 2019.

5.23. On 11 October 2019, the IMT noted a high level of sampling with almost entirely negative results and that hospital water was considered to be safe with additional assurance in Ward 6A due to POUFs still being in place. Dr Kennedy presented epidemiology data indicating that environmental gram negative organisms among paediatric Haemato-oncology patients were the same as when the same patient cohort was at the old Yorkhill building. Senior microbiologists stated that the ward was safe with no patient gram negative samples linked to any water or environmental samples and all unique on typing. A detailed further action plan was undertaken with HPS to provide further reassurance as to the safety of the ward. There was again intense Scottish Government scrutiny as to actions and from October a Scottish Government representative attended IMT meetings and was appointed as the single point of contact for the families of paediatric haemato-oncology patients.

5.24. In late September 2019 the Chief Nursing Officer (CNO) commissioned HPS to undertake a review into gram negative infections in the NHSGGC paediatric Haemato-oncology population. The review identified no reason to support the continuation of restrictions on the ward. Water testing identified no issues. At the 14 November 2019 IMT, the report by HPS was reviewed which confirmed that the restrictions could be lifted. The ward reopened on 21 November 2019 following the agreement of the Scottish Government and CNO.

5.25. Wards 2A/B reopened to patients in March 2022 with all remedial work in relation to water and ventilation complete.

6. CONCLUSION

6.1. NHSGGC welcomes the opportunity to comment on PPP11 and 12. In particular, NHSGGC welcomes the Inquiry's position stated in PPP11 [25.1] that whether the whole or part of the system was or remains in an unsafe condition will be determined after evidence is heard. Further evidence, particularly expert evidence of microbiologists and epidemiologists must be heard in order to reach any meaningful conclusions on the water and ventilation systems within the QEUH/RHC. The existence or non-existence of any link between the built environment and any incident of infection is a matter for expert evidence in due course.

6.2. At this stage, it is submitted that the Inquiry cannot determine whether any feature of the ventilation or water systems had any impact at all on patient care. As previously stated, NHSGGC does not accept, and its investigations have not demonstrated, that there is any link between incidents of infections and the built environment beyond what would be ordinarily present in any comparable hospital environment. NHSGGC submits that the features of the system should not be looked at in isolation. Expert evidence and evidence in respect of the design and build of the relevant systems is required in order to validate whether any feature of the systems had any impact on patient care.

6.3. Whilst this response provides NHSGGC's overview of the relevant systems, NHSGGC has also endeavoured to set out its position in respect of each incident of infection. That is detailed in Annex 3. NHSGGC's responses show that any link with the built environment was investigated, and appropriate remedial action was taken.

Peter Gray KC
Emma Toner, Advocate
Andrew McWhirter, Advocate

16 April 2024

ANNEX 1
DETAILED RESPONSE TO PPP11

General Comments:

It appears that some of documents referred to in PPP11 have not been included in the bundle provided. There also appears to be errors in references to page numbers in the Bundle.

Paragraph	**Response**
2.6	Inaccurate Description: There were two at handover in 2015 but there are now 3. NHSGGC added one, ref response to RFI. 8, 9 and 17
2.7	Inaccurate Description: Tanks are described as 1a and b, 2a and b so should be counted as 4 tanks.
2.8	Inaccurate Description: POUF were not installed in quantity until 2018. Note that this is in a section that is describing the system so the use of "were" is incorrect.
2.16	Inaccurate Description: Hot water did and still does come from the energy centre.
2.17	Inaccurate Description: It is designed to absorb pressure not volume.
2.20	Inaccurate Description: the use of "shelving" is misleading. NHSGGC assumes that what the Inquiry are describing here is the depth of the basin surround adjacent to the wall and not a defined "shelf".
2.26	Comment: There is PVC and cast iron piping. Inaccurate Description: U-bends are to prevent foul air from the waste system entering the occupied space. Inaccurate Description: Venting is primarily to remove "air" so that the gravity nature of the system works, not to remove odours from a closed pipe.
5.4	Inaccurate Description: There are two different "bypass" scenarios. The first one is the "designed" bypass from the public water main to the bulk water storage tank, which did miss out the filtration unit but was before the booster sets. It was part of the design for use only in an emergency as

described in the handover documentation. When the third filtration unit was installed this bypass design was removed. Refer to RFI response s21 Notice 8. 1(iii) and (iv)
The second bypass scenario is the one described in this paragraph as witnessed by DMA, when a bypass was used that was connected after the booster pumps.

5.10 Further Investigation by the Inquiry is required: It is not defined in the Intertek report where the valve was removed from and it cannot be assumed that it was an inlet valve on the mains supply. NHSGGC do not believe that the main inlet valves have ever been removed or inspected. It is likely that this is a valve from a plantroom location removed when the CLO2 works were ongoing.

5.11 Inaccurate Description of date There is an inconsistency in the report dates: front page has summer dates and date adjacent to photos of valve analysis note opening up in Dec 2018.

Inaccurate Description (of valve) see note above on para 5.10.

5.13 Further Investigation by the Inquiry required: NHSGGC does not consider that there is any scenario when pressure difference circumstances create this potentially deficient feature. The description does not define what “location” is being referred to.

5.14 Further Investigation Required: NHSGGC have located this report and will provide to SHI. Note that the report does not identify a non-compliance but notes that checks are to be made. As noted, those checks were completed.

Inaccurate Description: As noted in the rectification report the double check valve was replaced.

Footnote 17 & 18 Comment: These page references to the bundle are not correct. It appears that reference documents are not in the bundle.

6.4 Comment: for clarity, this should be consistent with the number of tanks when in subsequent paragraphs the subdivisions are separately identified. (ref comment to para 2.7 above). There are 4 raw tanks (known as 1A,

1B, 2A and 2B), there are 4 bulk storage tanks (known as 1A, 1B, 2A and 2B), and then there is the trade tank. This is a total of 9.

Inaccurate Description: the Energy Centre has a separate mains feed.

6.7 Comment: suggest missing the word “not” before flow.

6.14 Comment: It is unclear what “two examples” are being referred to.

6.23 Comment: In the latest AE audit provided to SHI (ref RFI S21 Notice 8) this is not listed as an ongoing concern.

6.34 Comment: The latest AE audit provided to SHI (ref RFI S21. Notice 8). This is not listed as an ongoing concern.

Water Testing of Tanks Further Investigation Required: NHSGGC considers that this is lacking in clarity. It is unclear if the PPP is commenting on the testing of the water in the tanks or of the environment of the water tank room or both.

7.1 Further Investigation by the Inquiry is required: NHSGGC do not recognise the description of a concern that the filtration system is set up to “exclude useful functions”.

7.7 Inaccurate Description: This is not considered to be what the drawing shows. According to the Handover drawing ZBP-XX-XX- SC-500-001 rev B, (Status Construction T3 last update Nov 2012) there is a valve that allows flow between the two tanks and consequently if one filtration was out of use...then both tanks are filled from only one. Refer also to section 7.12 below.

7.8 Inaccurate Description: Please see comment at para 7.6. The install of the 3rd filtration unit is the ultimate remedy. If in fault, the balancing valve at low level could be opened to fill both tanks from one filtration unit. The remedial action was the third filtration plant.

7.9 Incorrect statement: As noted above the as-fitted drawings show that the bulk water tanks could both be filled from only one filtration unit. Refer to the description quoted in Para. 7.12. The “bypass” between the two bulk storage tanks can be opened.

7.13 Comment: The by-pass as described in this paragraph should be described as a balancing valve. It is a valve that links tanks 1A/B and 2A/B bulk storage tanks. Refer also to the comment on Para 5.4.

7.19	Comment: Filtration plant was maintained and all records provided in response to RFI 8 and RFI 23.
8.3	Inaccurate description: Supervisors report covers both the Lab block and the Adults and Childrens Hospitals. However, at the time of this report the note referenced is about the Lab Block as there was no pipework commenced on the Adult and Childrens.
8.4	Comment: Refer to 8.3, QEUH M&E installation had not started at this time.
8.25	Inaccurate Description: The document in the bundle is a description of a survey that was going to happen, not the results of one that did happen.
10.2	Incorrect statement. Disinfection of tanks can and indeed has been done separately as have local disinfections of specific areas in a planned and controlled manner.
10.8	Incorrect Statement: NHSGGC does not recognise the reference to “persistently”. It was identified in a risk assessment which is a snapshot in time. We have provided water tank temperatures from 2018 which are largely compliant. Additional controls are now installed on the system.
11.5	Further investigation by the Inquiry is required: while there were instances of lower temperatures, these were very rare and not for extended periods of time. NHSGGC have provided hot water temperatures from all calorifiers and return temperatures from March 2018 which contradicts this statement.
11.7	Further investigation by the Inquiry is required: Real data analysis would be required to assess when and how often the hot temperatures were out of range and if that contributes to potential risk.
12.6	Further investigation by the Inquiry is required: Real data analysis would be required to assess when and how often the hot temperatures were out of range and if that contributes to potential risk. (Refer also to comment on para 11.7)

14.1	Comment: The chilled system is separate to any potable water system. Consequently, is outwith the description of the potable water system.
14.7	Comment: NHSGGC requests that the Inquiry clarify whether it considers that the deficiency is not the use of the CBU's but the quality of the fittings that permitted the leak.
16.1	Inaccurate description: there is no connection-point between the taps and the drains.
16.3	Inaccurate description: The sink was not in 2A, it was in the aseptic unit. With reference to the HPS extract (221) this statement is inaccurate as the February 2016 patient was not a RHC Ward 2A patient.
16.6 & 16.7	Inaccurate description / Further investigation by the Inquiry required: NHSGGC cannot agree to the accuracy of the comments within these paragraphs until further investigation is undertaken. This case was investigated in 2017 and assessment was that this was not linked to the aseptic pharmacy.
16.8	Further Investigation by the Inquiry is required: NHSGGC interpret this comment as noting that flushing of LUO may not be required if this is already being achieved by the cleaning regime. Comment: This was noted as a recommendation not a concern
16.11	Comment for clarity: The extensive programme of works on changing sinks was within wards 2a and 2b.
18.16	Inaccurate Description: The ICE Building is part of the retained estate and separate from the QEUH or RHC.
18.17	Inaccurate Description: The report notes this action only against the showers in the ICE.
18.19	Comment: It appears that there are a series of "Potentially Deficient Features" ("PDFs") listed in PPP11 that all relate to infrequency of use and whether or not they are sufficiently flushed to maintain water safety. Validation of any risk therefore requires consideration of use and flushing.
18.38	This was in relation to shower heads requiring to be restrained.

19.8	Inaccurate Statement: The “use of Arjo baths” is not considered to be of itself a potentially deficient feature. However, if procedures for use and maintenance of the flexible hoses are not followed there is the potential for a risk.
20.1	Comment: Stand alone dispensers should not be considered to be part of the water system. These are free standing units with water supplied in bottles by an external source.
22.11	Comment: While issues may have caused lower than desired temperatures, NHSGGC logs suggest this was not a frequent event. Supporting date has been provided in RFI 24. Refer to comment on para.11.5.
22.12	Incorrect statement: The reference to “LTHW” should read “DHW”.
23.1	Incorrect statement: The energy centre water system is separate from the hospital potable water system. They are fed from the same incoming mains which are connected underground. However, the previous paragraph identifies that the systems are separate. See para: 6.4.
23.8	Incorrect Statement: It is submitted that the inclusion of an irrigation system is not a potentially deficient feature in the potable water system as the irrigation system is fed from the trades tank.
24.6	Incorrect description: It is not clear what is being referred to as “increasing filtering”.
24.16	Incorrect description: This is a different building and the neurosurgical block drainage system is unconnected to the RHC/QEUH.

ANNEX 2

DETAILED RESPONSE TO PPP12

Paragraph	Response
1.8	Comment: Ward 2A - Haematology and Oncology is known as "Schiehallion" and for clarity should be shown as RHC.
3.5	Comment: SHTM's are Scottish version of HTM's. They should not have differing descriptions.
3.12	Further investigation by the Inquiry required: In the QEUH / RHC project the ADB system was used in the briefing process as evidenced by their inclusion in the contract documents. However, the vent requirements are not present in some of the ADB Room Data sheets.
3.14	Inaccurate Description: This was not a "live" log that changed during the build phase. These were agreed before the Instruction to Proceed was issued on 16 Dec 2010. There was no subsequent document recording derogations provided at Handover.
3.27	Inaccurate description: NHSGGC reading is that the ventilation system provided could be any of a variety of solutions. Inaccurate description: document is "NSGH WARD VENTILATION DESIGN STRATEGY" and note it is not referencing any place in a bundle.
5.11	Inaccurate Description: "lowest" is an incorrect definition. Andrew Poplett used the terms coarse and fine. HEPA H12 is not the "top". He acknowledges H14. Andrew Poplett's verbal evidence does not articulate differences between H12 and H14 but does note HEPA is at the "top end of the spectrum" of filtration. There is a filter grade that is higher than H12 (H14).
5.13	Further Investigation Required by the Inquiry: This paragraph appears to be an interpretation of expert evidence by CTI. NHSGGC request the supporting documentation for this.

5.16	Comment: for clarity flow rate can be “into” or “out of” the space. Note that expert refers to “supply” but the same principle applies for extract.
5.17	Comment: NHSGGC does not accept the use of “required”. NHSGGC would accept “used” subject to clinician decision.
5.22	Inaccurate Description: The HTM does not say they are “not recommended” although it does describe some risks and that their use should be with the agreement in writing of the Ventilation Safety Group. Inaccurate Description: The quoting of the expert that moisture “will” condense should be reconsidered as this is not an inherent design feature that always occurs but only applicable if dew point controls are not correct.
5.23	Inaccurate description: “suspended” and “sealed” ceilings are not opposites. A sealed ceiling does not need to be smooth or without joints although should be impervious. A suspended ceiling is the method of fixing to the substructure not a description of the surface and how “sealed” it is. A plasterboard “sealed” ceiling can also be suspended.
6.7 & 6.10	Inaccurate Description: the guidance has “recommendations” not requirements in Table A1.
6.13	Inaccurate Description: The current 2022 SHTM as published by NSS is still marked as “INTERIM”. In any event the wording is the same as the HTM noted above at para 5.22, and the same comment applies in that “not recommended” is not an accurate comment.
6.15	Inaccurate Description: This is in the “general ward” section and annual verification is not undertaken in general wards. It is only undertaken in areas where there is specialist ventilation. General wards do not have “annual verification” so the statement about commencement in 2018/19 is inaccurate.
6.16	Comment: “was” and still “is”.

6.20 Comment: 8 x BMT isolation rooms were provided, but ref paragraph 1.10 above that these rooms will be the subject of a separate PPP.

6.32 Further Investigation by the Inquiry required: This comment is about what NHSGGC agreed to for "general wards" but RHC Ward 2A should not have been provided as a "general ward". Consideration of this potentially deficient feature requires an understanding of the role of Multiplex in design and construction and compliance with employer's requirements.

6.33 Further Investigation Required: NHSGGC do not have any records of what the air pressure to the corridor was at handover.

Comment: It is not clear how this feature is different from that identified at paragraph 6.32.

6.36 Inaccurate Description: a non-sealed ceiling is not in itself a "defect"

6.43 Comment: NHSGGC note that there was verification of the BMT isolation rooms within the ward and it is understood that this will be the subject of a separate PPP.

6.45 Inaccurate description: Refer to comment on paragraph 5.23. Sealing the ceilings of the bedrooms is to contribute to the performance of the air pressure cascade, non-sealed ceilings are not necessarily a deficient feature in themselves.

6.51 Inaccurate description: It is "recommended" to be 6 ACH in Table A1.

6.52 Inaccurate description: It is "recommended" to be 6 ACH in Table A1.

6.54 Inaccurate description: The "recommendation" of the Guidance is 6.

6.60 Comment: As noted above this is an incorrect use of the description of "suspended" and "sealed". These are not opposites - a ceiling can be both.

6.66	Inaccurate description: Ward 2B was not designated as having critical ventilation therefore would not have required annual verification.
6.67	Comment: for clarity Work commenced in 2019 but was not complete until 2022.
6.70	Inaccurate Description: the guidance has “recommendations” not requirements.
6.72	Inaccurate description: The change order followed the decision to transfer Beatson BMT patients to QEUH.
6.73	Inaccurate description: Ward 4B would accommodate both BMT and Haemato-oncology patients.
6.74	Inaccurate description: Ward 4B was already in construction at the time of the decision to move BMT patients to QEUH. An internal Change Form was agreed and subsequently a PMI was issued to the contractor to change specific aspects to make the ward suitable to BMT patients.
6.75	Inaccurate description: Refer to 6.74. Ward 4B was changed to accommodate BMT patients.
6.78	Inaccurate description: These issues are not set out in the change order.
6.80-82	Comment: These paragraphs are out of order chronologically.
6.88	Inaccurate Description: the guidance has “recommendations” not requirements.
6.90	Inaccurate Description: the guidance has “recommendations” not requirements.
6.91	Inaccurate Description: the guidance recommends "+10 PA"
6.93	Inaccurate Description: the guidance recommends "+10 PA"

6.96 Inaccurate Description: Suspended ceilings is not incompatible with being "space sealed". Lack of "sealing" in itself is not a potentially deficient feature other than it contributes to the success or otherwise of the pressure cascade.

6.99 Comment: Use of "require" is incorrect. The COS did note the ventilation requirements for pressure differentials. Is it NHSGGC position that the installation gauges for monitoring is inherent in that request. It is not accurate to say that they were not "required" because they were not specifically listed.

6.100 Comment: This is a repeat of status for general wards (Para 6.14)

6.105 Inaccurate Description: Implementation of the specification that was described in the PMI was undertaken. However, not by Multiplex. It would be accurate to say "partial implementation of the works described in the PMI"

QEUH Ward 4C Haemato-oncology & Renal

It is inaccurate to describe all Haemato-oncology patients as immunocompromised or neutropenic to the degree that they require specialist ventilation.

6.113 Inaccurate Description: the guidance has "recommendations" not requirements.

6.114 Inaccurate Description: the guidance has "recommendations" not requirements.

6.135 Inaccurate Description: the guidance has "recommendations" not requirements.

6.136 Inaccurate Description: the guidance has "recommendations" not requirements.

6.138 Inaccurate Description: the guidance has "recommendations" not requirements.

6.139 Inaccurate Description: the guidance has “recommendations” not requirements.

6.141 Comment: The potentially deficient feature identified is not clear.

6.142 Inaccurate Description: the guidance has “recommendations” not requirements.

6.143 Inaccurate Description: the guidance has “recommendations” not requirements.

Inaccurate Description: Refer to our comment in para 6.13.

6.145 Inaccurate Description: Annual verification is not undertaken in general wards, only in areas where there is specialist ventilation. General wards still do not have “annual verification” refer also to comment in para. 6.15

6.146 Inaccurate Description: the guidance has “recommendations” not requirements.

Footnote 101 Further Investigation Required: A zone chart can be provided illustrating location of zones 512, 513 and 514.

ANNEX 3

RESPONSE TO INCIDENTS OF INFECTION

1. NHSGGC provided a response to the Inquiry's Provisional Position Paper 5 ("**PPP5**") on 21 April 2023. In that response, NHSGGC explained that the timeline set out in PPP5 did not give the full picture of NHSGGC's actions in respect of the identified incidents of infection (referred to in PPP5 as "episodes of concern"). Counsel to the Inquiry provided an updated timeline in their closing submissions following the June 2023 hearings. It is said that the timeline set out in the closing submissions is "the Inquiry's updated understanding of the principal known concerns about the built environment."

2. In their written submissions, Counsel to the Inquiry ask why the chronology cannot simply be accepted (para 149). NHSGGC considers that the chronology set out in the submissions, is largely accurate, insofar as it identifies incidences of infection. However, NHSGGC is concerned that the Inquiry's timeline presents a partial picture of its response to the infections identified. It also fails to acknowledge the critical involvement of external bodies. On that basis, NHSGGC was, and remains, unable to accept that the timeline presents an accurate history of what occurred. NHSGGC committed in its response to PPP5 to providing further detail on NHSGGC's actions in relation to the identified incidents of infection. This summary is not intended to be exhaustive but is intended to show where further detail requires to be included.

3. NHSGGC does not accept, and its investigations have not demonstrated, that there is any link between the incidents of infections and the built environment beyond what would be ordinarily present in any comparable hospital environment. With the exception of two discrete cases of paediatric infection in 2016 and 2019, the details of which have already been shared with the Inquiry, NHSGGC does not accept that there was any causal link between the built environment and any infection suffered by a patient within the QEUH. A non-exhaustive summary of NHSGGC's specific actions in respect of each identified instance of infection is detailed below. NHSGGC notes that the Inquiry is yet to hear any evidence from any microbiologists and IC experts. This evidence will be critical to determining the objective validity of any concerns and, in particular, whether any "potentially deficient feature" identified in PPP11 and 12 was causally connected with any incident of infection.

4. In respect of all incidents of infection identified within PPP5 which also met the national criteria of an incident/outbreak, an investigation and actions which could include sampling, typing and sanitation/remedial work were undertaken. NHSGGC acted at all times in line with national guidance, National Infection Prevention and Control Manual (NIPCM) in

investigating incidents. It should be noted therefore that single cases of infection are not necessarily incidents requiring investigation. HPS were informed of all incidents/outbreaks as required by this guidance.

5. At all stages, NHSGGC acted with input of appropriate specialists in identifying, validating and implementing strategies to manage identified and potential infections. In some cases, adopted strategies were devised with input from external bodies such as HPS and HFS. Management of risks included, where appropriate, a programme of enhanced cleaning and administration of prophylaxis to vulnerable patients.

6. NHSGGC invites the Inquiry to have regard to NHSGGC's responses to the Inquiry's RFIs (particularly RFI 17 and 18) for further detail of meetings, investigations that resulted from those meetings and remedial action that was implemented. The Inquiry has also been provided with minutes from Incident Management Team (IMT), Acute Infection Control Committee (AICC), Board Infection Control Committee (BICC) and other relevant meetings. The Inquiry is invited to have regard to the terms of those minutes in showing the detail of the investigations and recommendations implemented following the meetings.

	Incident of Infection	**NHSGGC Response**
1	13 cases of Serratia marcescens (July to November 2015)	Reference should be made to submissions under RFI 7 in reference to this incident, which occurred in the NICU in the retained hospital estate and not within the new build hospitals. An action plan was agreed with HPS who had extensive input into the incident following the formal invocation of the National Support Framework in November 2015. The action plan was shared with the Scottish Government. The full incident ran until February 2016 with a total of 18 patients (2 infected, 16 colonised). Some patients were found to have the same strain of Serratia and cross-contamination was considered to be a factor therefore in some cases.

		Remedial work included that taps and sinks be cleaned twice daily and hand hygiene sinks all flushed including those not in use. Water sampling was undertaken on outlets and environmental swabbing undertaken, which did not find Serratia. Taps were changed to the same type as in the RHC. Extensive work was done to improve equipment decontamination, cleaning and safe practice.
2	Stenotrophomonas maltophilia Cupriavidus pauculus, Pseudomonas October 2015	Positive cultures did not require investigations at that time. Investigations of individual organisms was not recommended as per NIPCM
3	1 case of Klebsiella oxytoca isolated 4 December 2015 and 1 of Pseudomonas putida isolated 21 October 2015 from patients associated with RHC 2A.	PPP5 states these were identified retrospectively by the Case Note Review. Single cases would not necessarily be treated and investigated as an incident. Single cases of antibiotic-sensitive Klebsiella are not required under national guidance to be investigated.
4	January 2016 Cupriavidus in aseptic unit	A wash hand basin where a tap sample was linked to a patient infection was removed and the other sink dosed with silver Sanosil – further samples were negative. This followed an investigation into the cause of persistent high TVCs in the tap water from these 2 sinks which revealed Cupriavidus in both tap samples. A look back exercise into any patient cases of Cupriavidus found one case where a parenteral feed given had been made up in this unit. A PAG meeting was held 17 June 2016 – the Inquiry have the minutes (RFI 11 1.2.2). Typing indicated that the patient

		infection was linked to the tap sample. The patient had not been on RHC ward 2A.
5	Acinetobacter baumanii (June 2016)	These were 2 cases associated with the RHC 1D (PICU) and considered to be due to patient cross-transmission as the patients were nursed next to each other.
6	Klebsiella (June to November 2016)	There were 9 episodes of Klebsiella infection (K. oxytoca and K. pneumoniae), affecting 8 patients in Ward 2A. Please see above note in respect of single cases of Klebsiella.
7	Increased cases of Aspergillus in adult ITU (January – June 2016)	A PAG (see RFI 11 1.2.2) was held 16 June 2016 which identified 4 cases, suggested a possible link to water ingress and subsequent damage to a window and bed space at the end of 2015 and made plans for remediation of this damage. An IMT was held 21 June 2016 which considered that 2 patients met the case definition (positive for Aspergillus after more than 24 hours in critical care), confirmed that remediation work would be undertaken on the damaged space and noted that HPS had been informed.
8	Aspergillus (isolated 29 July 2016)	Following the infection of a patient within Ward 2A with Aspergillus, portable HEPA filters were temporarily placed in the unit.. Following IMT advice in August 2016, Prophylaxis (AmBisome or Posaconazole) was administered to

		high risk patients in response to this case.
9	Serratia marcescens and Pseudomonas (September/October 2016)	6 patients were reported to have Serratia in the RHC Paediatric Intensive Care Unit (PICU). The environment was screened by surface swabbing as negative for Serratia and Pseudomonas. No Serratia or Pseudomonas was found in tap samples. Several PAG and IMT meetings were held with minutes submitted to the SHI under RFI 7 2.3.
10	3 cases of Serratia in PICU/1D (1 case included from 2016 incident positive 28 September 2016, 1 1 December 2016, 1 30 January 2017)	PAG held 6 February 2017 (SHI has minutes Section 21 notice no.2 1.2.3) Isolates sent for typing, environmental and equipment cleaning reviewed.
11	Three cases of Elizabethkingia miricola (September 2016 to February 2017)	Isolated from patient line cultures over this time period associated with RHC 2A/B. All were unique strains and not linked to the environment, or each other, following extensive sampling of water outlets, chilled beams and vents with all samples being negative. Minutes were submitted to Inquiry under RFI 7 2.
12	Fungal infections (possible Aspergillus) ward 2A (March 2017)	An IMT took place on 7 March 2017 (see RFI 7 2.5) with reporting to HPS. This followed a PAG held 3 March 2017 in response to clinician perceptions of a rise in fungal infections (candidaemia and possible Aspergillus). 2 candidaemia cases, 1 Aspergillus cases from July 2016 and 2 cases of probable Aspergillus were discussed

		The extent of construction and demolition works on and around the site and the general ward environment was discussed and patients were to wear facemasks if near these areas. Prophylaxis was undertaken for acute lymphoblastic leukaemia patients. The Infection Control team sought to identify any leaks or estates works which may have exposed patients. 1 water damaged ceiling tile was removed. Inspection of full ceiling void then followed with no dampness or mould found. All vents and chilled beams were cleaned and chilled beams inspected for leaks. Air and water sampling together with a hand hygiene audit were carried out. No link was identified with the built environment. An additional possible Aspergillus case was identified on 25 April 2017. This and the other 2 cases from 2017 were not found positive for Aspergillus on laboratory testing.
13	Perceived increase in positive blood cultures in paediatric Haemato-oncology wards	A PAG was held 3 March 2017 in response to concerns, with vent cleaning and line care to be looked at. HPS were informed.
14	Stenotrophomonas maltophilia (July 2017)	Two cases were identified. A PAG meeting was held and HPS were informed. Both isolates were different types, and no further cases were reported. Water was tested with a negative result. The incident was closed on 15 August 2017. HPS were

		contacted after the incident was closed. They advised that no further action was required by NHSGGC or HPS. Extensive reviews were held into these and other gram negative cases over 2017 when concerns were raised in 2019. Extensive quality improvement work took place over 2017 in ward 2A including cleaning and line care. Whole genome sequencing has since been undertaken and found no link between the cases or the environment. Including these 2 cases there were a total of 6 Stenotrophomonas cases in RHC ward 2A in 2017.
15	Mycobacterium abscessus (20 July 2017)	An IMT took place 20.7.2017 to discuss cases within the adult Cystic Fibrosis patient population – at this point there had been no new cases for over a year and no additional local action was considered necessary. A separate narrative on this issue has been submitted to the Inquiry under Section 21 notice number 6[4]. HPS were in attendance at the IMT. Whole genome sequencing did not reveal a link between cases.
16	Exophilia (22 September 2017)	An IMT took place to consider cases in the adult cystic fibrosis population. Remedial action was being undertaken on dishwashers following positive samples there and bottled water was provided to patients until the water jugs etc were considered safe. Vent cleaning was to be reviewed. HPS were

[4] M abscessus SBAR January 2017 V2

		advised and considered that no further action was necessary.
17	Klebsiella in Ward 2A (July-December 2017)	See notes above regarding the significance of single cases of Klebsiella.
18	Pseudomonas: in PICU (August 2017); and in Ward 10D QEUH (November 2017)	A PAG was held 2 August 2017 regarding 2 PICU cases (1 colonisation, 1 infection) where the patients had occupied the same bed space immediately after each other. As usual in Pseudomonas outbreaks a Pseudomonas checklist was completed. Samples were sent for typing (and found unique) and additional cleaning was undertaken. Water testing was carried out and found negative for Pseudomonas. The 10D IMT was held following a PAG 27 October 2017 following positive patient samples in September 2017. Typing was to be undertaken (no match was found) and concerns expressed about the amount of time for cleaning. The IMT considered these 2 patients and 2 others. Environmental swabbing was recommended – the IMT was concerned about the possibility of cross-contamination. The Pseudomonas checklist had been completed without issues. The ward was reopened after a terminal clean. No further cases were found after patient screening.

19	Serratia marcescens in PICU (October 2017)	4 patients were colonised with Serratia. A PAG was held 6 October 2017 where concerns around hand hygiene and cleaning were raised and remediations planned.
20	Aspergillus in Ward 2A (October 2017)	1 probable case of Aspergillus was investigated. Cleaning was enhanced and additional monitoring of the ward took place.
21	Acinetobacter baumanii in various locations of RHC (October-November 2017)	Investigation into Acinetobacter cases across took place across several areas. See RFI 7 2.9 and 2.11. A PAG was held 13 October 2017 into RHC 3A cases (1 isolated 21 June 2016, 1 20 March 2017, 1 26 July 2017 and 1 3 October 2017) and matched 3 patient cases including the 2016 case by typing. The 2 matched 2017 cases were often in physical contact. There was no bed space link. A PAG was held 13 November 2017 into 2 Acinetobacter cases on 1D for that month – one associated with ward 1E and both linked by the same bed bay. A third case from October 2017 was also linked with the bed bay as was the 2016 3A case. Cleanliness including vent cleaning was reviewed and unused trough sinks to be again requested for removal, typing and environmental sampling to be carried out. A PAG was held 30 November 2017 with a new colonisation reported typing links between some patients and that

		previous environmental testing of the associated bed bay had been negative. An IMT was held 4 December 2017 into the same cases (7 at this point) and noted that theatre environmental testing had been negative. Fans were to be removed, trough sinks removed and hand hygiene reinforced. A final IMT was held 8 December 2017 reviewing 11 defined cases going back to June 2017. Further testing was to be undertaken on the 5 isolates linked by typing and water testing was to be undertaken (and was found to be negative). Typing results suggested to the Infection Control Nurse leading on this that cross-transmission between patients was still occurring.
22	Pseudomonas aeruginosa in PICU (January 2018)	An investigation (PAG held 22 January 2018) was held into 4 cases of Pseudomonas (3 were long term colonisations) associated with PICU. Water testing and environmental sampling was undertaken with negative results, and water sources were to be inspected. Typing indicated no link between cases.
23	Klebsiella in Ward 2A (January-May 2018)	See above for the situation with single cases of Klebsiella.
24	Various Gram-Negative Bacteria in Ward 2A (26 January - March 2018)	A PAG was convened on 5 February 2018 due to a case of Cupriavidus. Ward 2A water outlets were sampled and found positive for Cupriavidus and Pseudomonas (and Stenotrophomonas

		was later found in water outlets in March 2018). Supply tanks, PICU and aseptic pharmacy water testing were negative. Silver hydrogen peroxide (Sanosil) dosing was undertaken the same day. The IMT started in March looking at the hypothesis of contaminated water causing cases of gram negative bacteraemias in RHC ward 2A. Support was requested from HPS and HFS as outlets outwith RHC 2A were reported to be positive for Cupriavidus and the hypothesis was that there was a widespread problem with outlets. Water tanks were to be resampled, domestic service rooms were sampled on multiple wards (those treating high risk patients) in RHC and QEUH and water sampling of water before it reached the hospital and within the retained estate was to be undertaken. Water outwith the outlets was negative. Cupriavidus was still found in outlet samples despite Sanosil dosing – further dosing with chlorine was planned. Point of use filters were to be fitted to all outlets in RHC 2A/B, RHC 3C (a surgical ward where some 2A patients are treated) and PICU, and water was to be tested before and after fitting. A Water Technical Group was convened to oversee technical remediations and consider long term solutions and further sources of independent advice were sought.

		No link was found between patients and the environment on typing or via whole genome testing later undertaken. No further cases associated with bacteraemia identified in water samples occurred after 19 March 2018. Of the patients investigated by this IMT in addition to the Cupriavidus case 5 cases of Stenotrophomonas were considered to be linked to the water issues. A case of Pseudomonas in March 2018 was excluded as it did not match any of the water isolates. The patients reported at a March IMT to have raised temperatures had negative blood cultures. The March 2018 case of Stenotrophomonas in PICU was not linked to ward 2A and was not formally part of the IMT therefore. The 1 Stenotrophomonas case in 3C was not considered to be hospital-acquired.
25	Acinetobacter baumanii in PICU (April/May 2018)	Investigation was undertaken into colonised Acinetobacter cases in PICU beginning with a PAG meeting on 3 May 2018 after surveillance noted 3 patients positive in April and 1 in February. Minutes note that no source was found for cases investigated in earlier IMTs. A further PAG was held 11 May 2018 due to a 4th case considered to be an HAI. Typing was undertaken and ward and equipment hygiene reviewed. A final IMT was held on 6 July 2018. Environmental swabs had come back negative with the exception of one baby bath. 2 patient

		clusters were identified by whole genome sequencing. Ciprofloxacin prescribed to ward 2A patients and was reviewed and stopped after the implementation of control measures at the end of March 2018.
26	Various gram-negative bacteria in Ward 2A (May-June 2018)	The IMT restarted on 4 June 2018 following a PAG meeting 18 May 2018 in which 3 cases of Stenotrophomonas in patients who had attended RHC wards 2A or 2B were investigated. While a link with the water system was considered unlikely (as point of use filters were by this point in place on water outlets) water on these wards was re-sampled. Typing was undertaken and again no link to the environment was found via this or via later whole genome sequencing. PAG and IMT meetings were held 18 and 29 May into 4 cases of Enterobacter Cloacae associated with RHC 2A/B, and the June IMT also reviewed these cases. Drains were to be sampled and sanitised as the IMT Chair was concerned (on basis of the appearance of the drains and reports in the literature) that they could be a source. Water testing was reported as negative. The IMT Chair considered that the drains were ‘very likely’ as a source of

		Enterobacter infections. Drain cleaning was not advised by the experts consulted. However, drains were to be cleaned at the request of the Chair. A filter was to be added to an outlet in the aseptic pharmacy. Waste pipes were replaced. HPS were instructed by the Scottish Government to compose a formal review of RHC ward 2A/B including epidemiology. Drains were cleaned and sampled and the Chair requested this weekly. The Scottish Government were closely monitoring the situation via HPS at this date. The Water Technical Group decided on remediation via shock and continuous chlorine dioxide dosing to the QEUH/RHC water system followed by tap replacement in high risk areas.
27	15 June 2018: cases of Mycobacterium chelonae	One case was identified in May 2018 in a patient associated with RHC 2A/B but no water testing had taken place on that ward since the installation of point of use filters. HPS were informed informally of the case early in June. The other case was in the Beatson with no known link to the new hospital. The 2A case was not included within the IMT investigations at that time. Drain cleaning was being undertaken in multiple locations in RHC and QEUH. Chlorine dioxide dosing was to take

		place in November and tap replacement January 2019. Use of Ciprofloxacin was restarted in June 2018, in direct response to a concern that drains posed a risk of infection. Use of Ciprofloxacin was stopped following implementation of control measures. The IMT closed on 21 June 2018 as there were no new cases.
28	CPE Klebsiella in Acute Spinal Injuries Unit (July 2018)	This took place outwith the new build hospitals. It should be noted that like the NICU this retained estate area is a separate building with a separate water supply to the new hospitals. An IMT was held 20 June 2018 following the identification in a patient of a strain of Klebsiella was resistant to some antibiotics. Patient screening was ongoing and had so far identified another 7 patients (all bar the first identified case were colonised). Environmental screening had been negative but was ongoing and typing was undertaken. A further IMT was held 5 July 2018 and it was noted that drains were being swabbed (Klebsiella was found in some drains). Some patients were linked by typing and the hypothesis was the initial infection of one patient abroad and subsequent transmission between patients.
29	Enterobacter cloacae in Ward 2A (July-August 2018)	Two further isolates of Enterobacter cloacae were found in July and August

		- these cases were not HAIs and therefore were not a trigger and would not have resulted in a PAG/IMT. The July case was from another hospital and was previously positive in a stool specimen (endogenous infection), the second case was admitted on the day of a blood culture - their last visit to the unit was to the day case area 7 days before.
30	Further Gram-Negative Bacteria cases in Ward 2A (September 2018)	The IMT was restarted following 3 gram negative bacteraemias associated with RHC 2A which in 2 cases involved the same microorganisms as found in drain sampling (though no link was found via typing or genome sequencing). Drain observation and sampling was planned for 2A and other wards. It was noted that existing HPS guidance does not support drain cleaning. However, the IMT Chair and the HPS IMT attendee supported it. 2A drains were to be cleaned weekly. A water testing programme was under discussion. An external contractor began a drain survey in September 2018. Estates mapped the RHC drains to see if there were common factors in problems. The Scottish Government was involved throughout and teleconferences with them continued. The ward was decanted on 26 September 2018 to allow for a full drain investigation. The drain survey found no issues in design or deviation from the hospital build plans.

31	Pseudomonas aeruginosa in Theatre 6 RHC (October/November 2018)	A PAG was held 25 October 2018 following 3 isolates of Pseudomonas found in 3 surgical patients in RHC. Water samples were taken but the Chair did not consider water or ventilation to be a source as isolates were not found in other patients treated in that theatre, only for patients receiving the same procedure in a short time period. Water samples were negative, and while there was growth from drain samples this was stated by the IMT Chair that this was not unusual for drains. Equipment was also swabbed.
32	Cryptococcus neoformans in Ward 6A and 4C (December 2018)	A PAG was held in December 2018 following the discovery (in one case post-mortem) of Cryptococcus neoformans in 2 patients (one paediatric associated with 6A and one adult with 4C). No typing link was found between the patients. Over December 2018/January 2019, IMTs took place and anti-fungal prophylaxis was recommended for patients in Wards 6A (paediatric Haemato-oncology decant ward) and 4C (adult Haemato-oncology patients).
33	2018 retrospective investigations	As above single cases of Klebsiella do not require investigation. See above re the 2018 chelonae case – the SHI has extensive information on chelonae cases.
34	Cryptococcus albidus identified in air samples in Ward 6A (January 2019)	As detailed in the Cryptococcus Expert Group report a very extensive sampling

		regime was undertaken in and around the hospitals and no Cryptococcus neoformans was ever identified in samples. There was no typing link between patients. Extensive investigations continued via the IMT following the Cryptococcus PAG and by the Expert Group looking at multiple hypotheses for the cause of the infections. At an early stage it was concluded that the ventilation system (via the plant rooms) could not have been a source. Portable HEPA filters were installed in 6A as a precaution though following work on the shower rooms there were no concerns as to air quality.
35	21 January 2019 Mucor in adult hospital	An IMT was held 21 January 2019 into 2 cases of mucormycosis associated with adult critical care (1 patient colonised, 1 infected and subsequently died) with detailed investigations around this (and another IMT on 28 January 2019) and a detailed narrative on this was sent to the SHI. Air sampling (negative for mucoraceous mould), cleaning and possible mould sources were reviewed (no source of mucoraceous mould was found). At the end of 2019 the Procurator Fiscal concluded that mucormycosis had not contributed to the patient's death.
36	2 cases of Klebsiella in 2019-associated with 6A (4.01.2019 and 5.03.2019)	Single cases of antibiotic sensitive Klebsiella do not trigger an alert on ICNet – see above.
37	Gram negative bacteraemia in Ward 6A (April/May 2019)	27 May 2019 Stenotrophomonas had been isolated from the basement water storage tanks. Sampling was being

		undertaken on ward 6A. Drain cleaning was ongoing. A PAG was then held 3 June2019 to investigate 4 gram negative bacteraemia patient cases associated with QEUH ward 6A including the 2 cases of Stenotrophomonas. Water sampling had been undertaken in ward 6A and found no gram negative organisms. Sampling was to be undertaken in interventional radiology and a theatre in RHC (which patients had also visited). It was confirmed that point of use filters were in place in QEUH ward 6A and that drains were dosed weekly with Hysan and there was no build-up of grime. Drains in the theatre and interventional radiology were to be examined. A water fountain in the ward meeting room was to be removed. Typing had been requested (no typing links were found).
38	Acinetobacter baumanii in PICU (April 2019)	A PAG was held 16 April 2019 when a typing match was found between 2 patient cases. No bed space link was found between patients.
39	Acinetobacter baumanni in Ward 4D and 4A (March-May 2019)	4 patients tested positive. An IMT into the 2 initial patients (matched by typing) was held 15 March 2019 and an additional 2 cases were identified on screening. Cross-transmission between patients via staff or relative hands was considered the probable source and action was taken on cleaning and hand hygiene.

40	Environmental bacteria in Ward 6A (June 2019)	An investigation via IMTs into 5 gram negative bacteraemias and 1 case of atypical Mycobacteria associated with ward 6A continued, following on from the earlier PAG connected with 6A. A Mycobacteria chelonae case from May 2018 was discussed during this IMT after another case was identified in May 2019 (investigation found that the cases were not linked to each other). Theatre drains were inspected and anaesthetic and prep room sinks were considered to have 'grime' build up with samples of gram negative organisms found in drains. No positive results were found in theatre water samples. Mycobacteria chelonae was found in 6A outlets when point of use filters were removed. Further water sampling and inquiries as to the effectiveness of filters against Mycobacteria were to be carried out. The IMT Chair requested that point of use filters be added to theatres. Drains were to be monitored for grime build up following manual cleaning. Additional point of use filters were to be added to any areas potentially accessed by paediatric Haemato-oncology patients including outpatients, Accident & Emergency, interventional radiology and theatres. The IMT Chair suggested that the drains may have biofilm build up not

		affected by chlorine dioxide dosing, and stated that the QEUH 6A drains were not affected as they receive regular chemical clean. Theatre drain cleaning was ongoing. Estates were to report on all chilled beam leaks and fluid within these was to be sampled.
41	2 further GNBs in Ward 6A (July 2019)	The 6A gram negative bacteraemia IMT was continuing. Further water testing was to be undertaken to ensure that all outlets were tested on 6A. Whole genome sequencing was carried out on the Mycobacteria patient samples and Mycobacteria water samples. Filters were added to and drains cleaned in all areas where 6A patients thought to possibly visit. Following sampling, the IMT hypothesis was that the that 2019 Mycobacteria patient had accessed unfiltered water outwith 6A (directly or indirectly via another person) – a link to unfiltered water outwith 6A was confirmed by whole genome sequencing for this patient. It was confirmed that there were no positive results from samples taken from point of use filters on ward 6A and that filter integrity was satisfactory.

		In ward 6A chilled beams were to be cleaned more frequently and surfaces sampled before cleaning. Chemical drain cleans were occurring weekly. Chilled beam water samples were negative in the hot water system. Pseudomonas oleovorans was isolated in the chilled beam cold water system which the IMT chair stated as being unexpected. Chilled beam surface sampling was positive for low levels of gram negative organisms which did not match organisms found in patients. Disinfection of chilled beam fluid and a patient decant were being discussed as options by the IMT.
42	4 further gram negative bacteraemia positive patients in Ward 6A (August 2019)	Sampling of water within chilled beams on QEUH ward 6A is ongoing. Hypotheses at this point for the source of gram negative bacteraemia patient cases on QEUH ward 6A were still: contact with water from within chilled beams (from leaks or condensation); contact with water outwith QEUH ward 6A from outlets lacking point of use filters. Other than the 2019 mycobacteria patient no links via typing or sequencing had been made to the environment. Biocides were to be introduced to the chilled beam water the following week. Actions were also being undertaken to reduce condensation on beams, clean them better, and to replace the sink

		used for a supply of water for cleaning of QEUH ward 6A with one which could have a point of use filter attached. Testing of the water of the sink used for cleaning of the PICU was to be undertaken. Extensive estates work was undertaken including vent cleaning and HEPA filtration to ensuite bathrooms. Ciprofloxacin was for restarted for patients in response to concerns about gram-negative infections potentially connected to the environment.
43	3 further cases of GNB in Ward 6A (September 2019)	IMT investigations continued with these added to the patients under investigation. Environmental sampling was negative and no links were found by typing. Internal epidemiological investigation had been undertaken and there was support within the IMT for the lifting of ward restrictions.
44	Delftia acidovorans in patient on Ward 6A (October 2019)	This case was added to those under investigation by the IMT. No further cases were identified after this. Extensive epidemiological investigation was undertaken by HPS before the Scottish Government/CNO agreed to the lifting of ward restrictions in November. Root Cause Analyses were performed on all cases and water continued to be tested extensively across the hospital site.
45	November 2019 - 2 Pseudomonas cases in RHC PICU	A PAG was held 12 November 2019 and an IMT held 19 November 2019.

		Water used in the ECMO machine used on both patients was tested and found negative. There were no issues on the Pseudomonas checklist. No match was found on typing between patients. PICU, NICU and theatre water was tested and found negative and ward hygiene was reviewed.
46	Pseudomonas PICU November 2019	A 21 November 2019 PAG took place into a single case. Ward hygiene was reviewed, there were no issues on the water safety pseudomonas checklist or in water samples, typing was being undertaken.
47	November 2019 - Serratia patient in RHC PICU (1D)	An IMT was held 27 November 2019. Water samples for PICU and theatre 8 were negative. Environmental sampling was undertaken and ward hygiene reviewed. Typing was performed with another Serratia patient reviewed in the 6A IMT. Earlier Pseudomonas and Acinetobacter cases (stated as 3) were also reviewed at the IMT.
48	December 2019 - 4 cases of gram negative bacteraemia on RHC PICU	An IMT was held 30 December 2019 following on from 2 earlier IMTs. The IMT was reviewing 4 cases of gram negative bacteraemia associated with PICU since 5 October 2019. The latest case was Acinetobacter isolated 23 December 2019. The meeting noted that 1 case was a retrospective case examined at the request of the Scottish Government. Environmental sampling and water sampling was negative including drains, rooms occupied by patients and theatre attended by patients. Further water

		sampling and a full survey for dampness was to be carried out.
49	Collective investigation of gram negative bacteraemias in PICU December 2019	An IMT was held 10 December 2019 at the request of the Scottish Government reviewing all gram negative PICU incidents since August 2019 using the same case definition as used at the 2018 IMT. It was noted that water and environmental sampling had been negative. HPS attended these IMTs. A further IMT was held 17 December 2019 on the same basis. Water sampling and environmental swabbing were to be carried out for the following month, drain sanitisation continued and a look back over the previous 6 months would be completed at the request of the Scottish Government with Root Cause Analyses completed for all gram negative cases. A further IMT was held 30 December 2019 in response to a new Acinetobacter case. No link was found to the environment. The unit was to be checked for possible sources of damp.

SCOTTISH HOSPITALS INQUIRY

RESPONSE ON BEHALF OF DR CHRISTINE PETERS

TO PROVISIONAL POSITION PAPER 11

POTENTIALLY DEFICIENT FEATURES OF THE WATER SYSTEM OF THE QEUH/RHC

I. INTRODUCTION

1. This response to Provisional Position Paper 11, Potentially Deficient Features of the Water System of the QEUH/RHC ("Water PPP") is submitted on behalf of Dr Christine Peters in accordance with the procedure set out at paragraphs 1.9 to 1.12 of the PPP. References herein to chapter and paragraph numbers and to defined terms are to such numbers and terms used in the Water PPP unless otherwise stated.

II. CHAPTER 4: LIST OF SOURCES

Guidance

2. **Para. 4.1:** An additional source which the Inquiry should consider are the British Standards for healthcare premises (BS 8580-2:2022) which were published in January 2022.

III. WATER TESTING RESULTS

3. **Paras. 6.56, 10.30-10.33, 16.35, 18.17-18.18:** It is noted with concern that, in relation to the water test results referred to in these paragraphs, the Inquiry states that it is not known if the concerns raised by the results have been resolved. For the potentially deficient features identified in these parts of the Water PPP to be properly and accurately described, further up to date information should be obtained from NHSGGC which explains whether the concerns have been addressed, and, if so, when and how that was done with the accompanying water testing regimes and results.

IV. CHAPTER 8: PIPEWORK

Use of carbon steel pipework

4. **Para. 8.26:** The use of carbon steel pipework in the water system is identified as a potentially deficient feature. Provided the feature is not considered to be restricted to one section of pipe (as *per* para. 8.23), no issue is taken with the accuracy of the description of this feature.

5. It is acknowledged that it appears that a survey was conducted in November 2016 to try to determine whether the incident with the carbon steel pipe was an isolated one (*per* para. 8.25). However, it is to be queried how comprehensive a random survey can be, particularly when considered in the context of a water system which experiences frequent leaks verbally reported to be due to corroded pipes.

6. Of relevance in this regard is the fact that, towards the end of 2021, there was a leak in Ward 6A when a pipe burst in the ceiling of a patient's room. The pipe burst because it was extremely corroded. From the photographs taken of the pipe that burst, the pipe looked corroded which is not what would be expected of a pipe made of stainless steel (*see* Appendix 1).

7. Consideration of Estates records (which will provide details of all leakage incidents and examinations of pipes and should be obtained from NHSGGC) will assist in determining how widespread or otherwise the use of carbon steel pipework is at the QEUH/RHC. Reference is made to emails regarding the Ward 6A leak and to the "NHS GGC IPC Incident summary Hot water pipe valve leaks" dated 2 November 2021 (*see* Appendices 2 and 3).

V. CHAPTER 14: CHILLED BEAM UNITS ("CBUs")

8. **Paras. 14.1-14.7:** While the use of CBUs in the hospital is identified as a potentially deficient feature, the description should be expanded to include the following five points.

9. First, at least some of the CBUs were installed at the QEUH/RHC without appropriate set points for dehumidification in the AHU supplying the CBU. The absence of dehumidification means that the CBUs are more likely to have condensation events which create an infection risk. The CBUs were present at handover in 2015 in all Wards save Ward 4B and the ITU. They were subsequently removed from Ward 2A. Therefore, even if it was

accepted (which it is not) that CBUs can be used in low risk areas of hospitals, the CBUs installed at the QEUH/RHC should still be considered a potentially deficient feature because they were installed without appropriate dehumidification settings. Indoor rain is indicative of a failure to install appropriately for the climactic conditions. Reference is made to the email chain titled "Chill beam" dated 30 June 2019 to 19 July 2019 and to the email chain titled "QEUH new building handover" dated 10 to 12 October 2016. (*see* Appendix 4). Further Estates logs of numerous incidents of indoor rain should also be examined to understand the extent of the issue.

10. Second, and linked to the absence of appropriate dehumidification settings to remove condensation, it should be noted by the Inquiry that there was an incident in Ward 2A on 19 July 2016 when 4 single rooms had water dripping down from the chilled beams which was described as "indoor rain". This problem was occurring at that time across several clinical areas in the QEUH. Reference is made to the email chain titled "Ward 2a cubicles 8-11" dated 19 to 21 July 2016 (*see* Appendix 5). Chilled beams should not be used in hospital environments because of the infection risk caused by water running through dirty fins and grills.

11. Third, in June 2019, reports of leaking chilled beams in Ward 6A were investigated. During the investigation water dripping from the connecting pipe into the framework around the chilled beam was observed, which tracked along the metal casing and then dripped on to the floor. Swabs were taken from the water dripping which were processed in the lab. The swabs grew Kokuria, Micrococcus and *Staph hominis* (which is consistent with skin commensal flora collecting on the fin). Pseudomonas was also isolated which is consistent with contaminated water. This pseudomonas was identified as *Pseudomonas olevorans.* The same species of Pseudomonas was grown from water samples taken from the chilled beams supply system and processed at the GRI lab. This water also grew *Pseudomonas aeruginosa.* This would indicate that the water system was contaminated. It is believed that there was no system in place up until this point to monitor the water and pick up this sort of contamination. Reference is made to the SBAR produced (*see* Appendix 6). Reference is also made to the journal article Inkster, T., C. Peters, and H. Soulsby. "Potential infection control risks associated with chilled beam technology: experience from a UK hospital." Journal of Hospital Infection 106.3 (2020): 613-616.

12. Fourth, the CBUs required cleaning at an interval of 6 weeks in Ward 6A. Indeed, across the QEUH/RHC site the frequency of cleaning required to keep the fins free from dust and lint

was in excess of the years that is normally quoted for these units. It is unclear why this is and should be considered a potentially deficient feature. Reference is made to photographs showing dust and material on the CBUs (*see* Appendix 7).

13. Fifth, the guidance states that CBUs should be placed in a position that can be easily accessed for cleaning. As the CBUs are positioned immediately above beds throughout the hospital, this should be considered a potentially deficient feature.

VI. CHAPTER 16: HAND WASH BASIS, TAPS, POINT-OF-USE FILTERS

Hand wash basins

14. **Paras. 16.1-16.12:** The potentially deficient feature identified at paragraph 16.12 of the Water PPP should be expanded to include the presence of hand hygiene sinks in kitchens on Wards at the QEUH/RHC.

15. By way of explanation, each Ward at the QEUH/RHC has a kitchen. Each kitchen has a hand hygiene sink. These sinks were present at handover in 2015 and remain at the hospital to date. These sinks should be included within the description of the potentially deficient feature because they do not conform to the applicable guidance, that is SHTM 64, Sanitary Assemblies (December 2009) at p. 50. Specifically, the sinks are not compliant with the required size or design. Reference is made to the attached photograph which shows an example of a sink at issue *in situ* (*see* Appendix 8).

Organisms in taps

16. **Para. 16.27:** The description of the results obtained in March 2018 from sampling should be expanded to refer not only to *Cupriavidus sp* but to other environmental gram negatives. Reference is made to the "Report on Environmental Sampling on 2A and 4B" prepared by Dr Christine Peters (*see* Appendix 9).

VII. CHAPTER 21: DISHWASHERS

17. **Para. 21.2:** In line with paragraph 1.9 of the Water PPP, it is submitted that the extract referred to in this paragraph which states that Exophilia "does not cause clinical infection" is incorrect.[1]

18. In CF patients *Exophilia sp* can and does cause infection. It can also colonise. It complicates biofilm and some of those CF patients became long term colonised. This becomes particularly important if the patient requires a lung transplant. This incident, therefore, did have clinical significance.

19. It is also incorrect to state that "[n]o patients were affected".[2] The epidemiology suggests otherwise and was written up in a the attached poster titled "Epidemiology of Exophiala dermatitidis in a Glasgow hospital, potential hospital sources and control measures" (*see* Appendix 10).

VIII. CHAPTER 23: IRRIGATION SYSTEM

20. It is not clear if the potentially deficient feature identified at paragraph 23.8 includes the irrigation for the NICU roof garden. This feature should be included because of the longstanding leak in the NICU roof and the rates of unusual environmental organisms. Reference is made to the email chain titled "NICU leak" dated 7 and 8 November 2021 (*see* Appendix 11).

IX. OMISSIONS

Sprinkler system

21. There are three water systems at the QEUH/RHC entering most clinical areas - chilled beams, potable water and the sprinkler system. Of these three systems, the sprinkler system is not included in the Water PPP and should be. It should also be considered a potentially deficient feature because of the reported leaks and the results obtained following samples taken from the leaks.

[1] Bundle 15 – Water PPP, p. 718 (incorrectly cited as p. 842 at Water PPP, fn 314).
[2] Water PPP, para. 21.2, fn. 315 citing Bundle for Oral Hearing commencing 12 June 2023, Bundle 5, p. 313.

22. Specifically, in December 2019 there was a leak from the sprinkler system in the PICU. A sample was taken from the water leak and gram negatives were isolated. These test results could be relevant to patient cases in the PICU of Pseudomonas aeruginosa as discussed by Dr Inkster at the time with the OB. Reference is made to the email chain titled "Pseudomonas bacteraemias" dated 30 December 2019 (*see* Appendix 12) and to microbiology culture results dated 7 January 2020 (*see* Appendix 13).

Leak at Dialysis Point

23. The Water PPP should include as a potentially deficient feature the omission of drainage from the dialysis points in the adult ITU which allowed back flow from the sluice up into the dialysis point and leakage into a PPVL room wall in the ITU, creating a risk. The omission was identified in the course of an IMT on 2 Mucor cases in the adult ITU chaired by Dr Peters in January 2019.

X. CONCLUSION

24. Dr Peters will 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

12 April 2024

Appendices:

1. Photographs x 4 re burst pipe, Ward 6A
2. Email chain titled "leaks on level 6 - major incident meeting needed" dated 31 October to 4 November 2021
3. "NHS GGC IPC Incident summary Hot water pipe valve leaks" dated 2 November 2021

4. Email chain titled “Chill beam” dated 30 June 2019 to 19 July 2019 and email chain titled “QEUH new building handover” dated 10 to 12 October 2016
5. Email chain titled “Ward 2a cubicles 8-11” dated 19 to 21 July 2016
6. SBAR re investigation of leaking chilled beams in Ward 6A
7. Photographs x 3 showing dust and material on the CBUs
8. Photograph of hand hygiene sink in kitchen at the QEUH/RHC
9. “Report on Environmental Sampling on 2A and 4B” prepared by Dr Christine Peters
10. Poster titled “Epidemiology of *Exophiala dermatitidis* in a Glasgow hospital, potential hospital sources and control measures”
11. Email chain titled “NICU leak” dated 7 and 8 November 2021
12. Email chain titled “Pseudomonas bacteraemias” dated 30 December 2019
13. Microbiology culture results dated 7 January 2020

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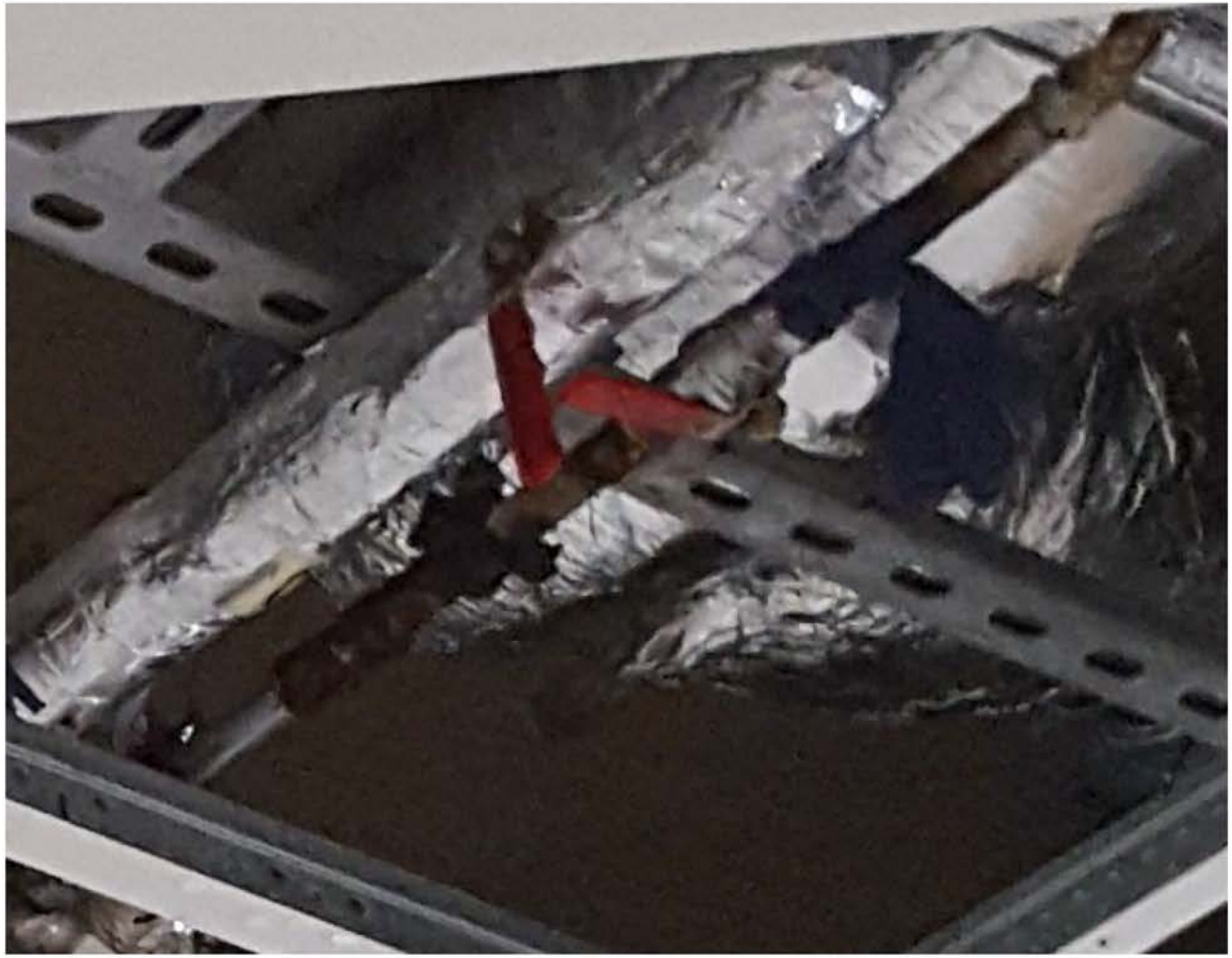

Louise Mackinnon

From: Peters, Christine
Sent: 04 November 2021 12:02
To: Deshpande, Ashutosh; Gibson, Brenda; Devine, Sandra; Berry, John; Mcdaid, April; McColgan, Melanie; Marek, Aleksandra; Ramsay, Thomas; Groom, Susan; Kalsoon, Mohammed; Paterson, Nicolle; Halsey, Christina; Coyne, Patricia; Riddell, Catriona; Friel, Patricia; Riddell, Mark; Bowskill, Gillian; Pritchard, Lynn; Redfern, Jamie; Bal, Abhijit; Bustillo, Sandra; Gardner, Morag; Loudon, Lorna; Clark, Andrew; Halsey, Christina
Cc: Bagrade, Linda
Subject: RE: leaks on level 6 - major incident meeting needed

Hi Sandra,

I think it is important to note in any ongoing risk assessment that the photos look like corrosion of pipe work and a burst pipe at the point of corrosion.

The multiple leaks at the same time could be linked by an increase in pressure through the system, eg increase in temperature of the hot water. This would cause leaks at points of corrosion or weakness in the system. I mention this as a key component of preventive action for future assurances of non re-occurance in the immune compromised settings.

Kr
Christine

From: Deshpande, Ashutosh
Sent: 04 November 2021 11:11
To: Gibson, Brenda [redacted]; Devine, Sandra [redacted]; Berry, John [redacted]; Mcdaid, April [redacted]; McColgan, Melanie [redacted]; Marek, Aleksandra [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Coyne, Patricia [redacted]; Riddell, Catriona [redacted]; Friel, Patricia [redacted]; Riddell, Mark [redacted]; Bowskill, Gillian [redacted]; Pritchard, Lynn [redacted]; Redfern, Jamie [redacted]; Bal, Abhijit [redacted]; Bustillo, Sandra [redacted]; Gardner, Morag [redacted]; Loudon, Lorna [redacted]; Clark, Andrew [redacted]; Halsey, Christina [redacted]
Cc: Peters, Christine [redacted]; Bagrade, Linda [redacted]
Subject: Re: leaks on level 6 - major incident meeting needed

Hi Sandra,

Thanks for the summary.

I have added more detail to the summary to reflect the state of information and evolving situation at the time of the meeting and what happened after. I think this is very important because not all who were present at the meeting were then involved in the assessments of the other wards or the more detailed assessment of 6a that happened thereafter. If written comms have also been sent to 6a families (based purely on the 31st meeting rather than the subsequent assessments by Linda and/or Abs) please do let me have a look at them for accuracy.

Appreciate the IC steer at the meeting, that scoring might not have been needed at that particular point in time, but purely based on the information available at that moment in time, if scoring had been done at the meeting then I agree public anxiety is at least moderate. However, I agree with Brenda in that we would also have entered into further discussion among the group about the other columns in the scoring tool.

It is possible that were this scored higher at the 31st late afternoon meeting, assessment the next morning by ICDs might have indicated that this be downgraded, however we were not part of the further assessment. Indeed, Linda came and spoke to me and Christine on Monday morning after she had done further assessment and didn't feel things were as bad as I had felt they might be (as my perception of events led me to ask for the urgent meeting in the late afternoon, mobilising all who could attend as soon as possible).

I handed this over quite comprehensively over to ICD colleagues as a priority and I know that Linda and Abs were taking this forward, so if the scoring reflects their more detailed assessment of 6a as well as the other wards then I can't really comment on it. I'm also presuming that this score was prepared in conjunction with clinicians, as I gather subsequently that there may still have been cases on 6a not on antifungals although not sure if they would have been considered to be part of the exposure risk. In any case, the summary needs to reflect that whatever scoring is finally decided is an outcome of global IC assessment over that 24-48 hour period, as the initial draft seemed to read as though the scoring is as a sole outcome of the 31st meeting at which point in time information was still being gathered. This is also why I suggested first thing the next day that ICD colleagues have further meetings and reconsider scoring in light of more comprehensive information-gathering and assessment, including some further points to consider.

Regards,

Ash

From: Gibson, Brenda [redacted]
Sent: 04 November 2021 10:34
To: Devine, Sandra [redacted]; Berry, John [redacted]; Mcdaid, April [redacted]; McColgan, Melanie [redacted]; Marek, Aleksandra [redacted]; Deshpande, Ashutosh [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Coyne, Patricia [redacted]; Riddell, Catriona [redacted]; Friel, Patricia [redacted]; Riddell, Mark [redacted]; Bowskill, Gillian [redacted]; Pritchard, Lynn [redacted]; Redfern, Jamie [redacted]; Bal, Abhijit [redacted]; Bustillo, Sandra [redacted]; Gardner, Morag [redacted]; Loudon, Lorna [redacted]; Clark, Andrew [redacted]
Subject: Re: leaks on level 6 - major incident meeting needed

I am sorry but I don't agree with the scoring . For families any deficiency in the building is unacceptable and major . We do have families giving evidence to the Public Inquiry this week who have threatened the lives of anyone found responsible for environmental infection . I have colleagues asking for protection . The families don't know most people on this trail but they all know the 6A doctors. Brenda

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From: Devine, Sandra [redacted]
Sent: Thursday, November 4, 2021 10:23:59 AM
To: Berry, John [redacted]; Mcdaid, April [redacted]; McColgan, Melanie [redacted]; Marek, Aleksandra [redacted]; Deshpande,

Ashutosh [redacted]; Gibson, Brenda [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Coyne, Patricia [redacted]; Riddell, Catriona [redacted]; Friel, Patricia [redacted]; Riddell, Mark [redacted]; Bowskill, Gillian [redacted]; Pritchard, Lynn [redacted]; Redfern, Jamie [redacted]; Bal, Abhijit [redacted]; Bustillo, Sandra [redacted]; Gardner, Morag [redacted]; Loudon, Lorna [redacted]; Clark, Andrew [redacted]

Subject: RE: leaks on level 6 - major incident meeting needed

thank you

Sandra Devine
Acting Infection Control Manager
NHS Greater Glasgow & Clyde
[redacted] (PA Ann Lang)

If you require an urgent response can I please ask you to telephone me as I am often in meetings and away from the office and unable to check voicemail until the end of the day. Thank you

---

From: Berry, John
Sent: 04 November 2021 10:23
To: Mcdaid, April [redacted]; McColgan, Melanie [redacted]; Marek, Aleksandra [redacted]; Devine, Sandra [redacted]; Deshpande, Ashutosh [redacted]; Gibson, Brenda [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Coyne, Patricia [redacted]; Riddell, Catriona [redacted]; Friel, Patricia [redacted]; Riddell, Mark [redacted]; Bowskill, Gillian [redacted]; Pritchard, Lynn [redacted]; Redfern, Jamie [redacted]; Bal, Abhijit [redacted]; Bustillo, Sandra [redacted]; Gardner, Morag [redacted]; Loudon, Lorna [redacted]; Clark, Andrew [redacted]
Subject: RE: leaks on level 6 - major incident meeting needed

Hi all,

From a comms perspective we agree with the scoring.

We have a media statement prepared, which can be shared if required.

Thanks,

John

John Berry
Senior Communications Officer
NHS Greater Glasgow and Clyde
J B Russell House
Gartnavel Royal Hospital
1055 Great Western Road
Glasgow
G12 0XH

Telephone: [redacted]

24-hour media enquiry line: 0141 201 4429
Visit our Media Centre at: www.nhsggc.org.uk/mediacentre

Like our Facebook page at www.facebook.com/nhsggc and follow us on Twitter @nhsggc

From: Mcdaid, April
Sent: 04 November 2021 09:27
To: McColgan, Melanie; Marek, Aleksandra; Devine, Sandra; Deshpande, Ashutosh; Gibson, Brenda; Ramsay, Thomas; Groom, Susan; Kalsoon, Mohammed; Paterson, Nicolle; Halsey, Christina; Coyne, Patricia; Berry, John; Riddell, Catriona; Friel, Patricia; Riddell, Mark; Bowskill, Gillian; Pritchard, Lynn; Redfern, Jamie; Bal, Abhijit; Bustillo, Sandra; Gardner, Morag; Loudon, Lorna
Subject: Re: leaks on level 6 - major incident meeting needed

Hi all

Agree with the scoring as detailed by Sandra.

Kind regards,
April

From: McColgan, Melanie [redacted]
Sent: 03 November 2021 16:56
To: Marek, Aleksandra [redacted]; Devine, Sandra [redacted]; Deshpande, Ashutosh [redacted]; Gibson, Brenda [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Coyne, Patricia [redacted]; Berry, John [redacted]; Mcdaid, April [redacted]; Riddell, Catriona [redacted]; Friel, Patricia [redacted]; Riddell, Mark [redacted]; Bowskill, Gillian [redacted]; Pritchard, Lynn [redacted]; Redfern, Jamie [redacted]; Bal, Abhijit [redacted]; Bustillo, Sandra [redacted]; Gardner, Morag

[redacted]; Loudon, Lorna [redacted]
Subject: RE: leaks on level 6 - major incident meeting needed

Thankyou
Yes, from my involvement on Sunday, I do too.
Kr
Melanie

From: Marek, Aleksandra [redacted]
Sent: 03 November 2021 16:55
To: Devine, Sandra [redacted]; Deshpande, Ashutosh [redacted]; Gibson, Brenda [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Coyne, Patricia [redacted]; Berry, John [redacted]; Mcdaid, April [redacted]; Riddell, Catriona [redacted]; Friel, Patricia [redacted]; Riddell, Mark [redacted]; Bowskill, Gillian [redacted]; Pritchard, Lynn [redacted]; Redfern, Jamie [redacted]; McColgan, Melanie [redacted]; Bal, Abhijit [redacted]; Bustillo, Sandra [redacted]; Gardner, Morag [redacted]; Loudon, Lorna [redacted]
Subject: RE: leaks on level 6 - major incident meeting needed

Thank you Sandra, I agree with this assessment.

Kind regards,
Aleks.

From: Devine, Sandra
Sent: 03 November 2021 15:30
To: Deshpande, Ashutosh [redacted]; Gibson, Brenda [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Marek, Aleksandra [redacted]; Coyne, Patricia [redacted]; Berry, John [redacted]; Mcdaid, April [redacted]; Riddell, Catriona [redacted]; Friel, Patricia [redacted]; Riddell, Mark [redacted]; Bowskill, Gillian [redacted]; Pritchard, Lynn [redacted]; Redfern, Jamie [redacted]; McColgan, Melanie [redacted]; Bal, Abhijit [redacted]; Bustillo, Sandra [redacted]; Gardner, Morag [redacted]; Loudon, Lorna [redacted]
Subject: RE: leaks on level 6 - major incident meeting needed

Hi
We have been asked by ARHAI Scotland to HIIAT assess this incident. Rather than having another meeting at such a critical time for services and staff can we suggest that you review the attached summary and let me know by 2pm tomorrow if you agree or disagree with the HIIAT assessment proposed by the IPCT.

I have cc in those from the meeting on Sunday (that I can remember) and senior managers and IPCT members who have prepared the attached. Sandra apologies I don't recall who the comms

rep was on Sunday so would be very grateful if you could forward on. If I have forgotten anyone from Sunday, if someone could send, on I would be grateful.

I have attached the HIIAT tool for information.

Patients – Minor

Minor is defined as Patients require only minor clinical interventional support as a consequence of the incident. There is no associated mortality as a direct result of this incident.) There were no patient harmed as a consequence of this incident, however we will continue to monitor.

Services – Minor

No or minor impact on services Moderate would be multiple wards closed or an ITU closed as a consequence of the control measures.

Risk of Transmission – Minor

Minor implications for public health. Minor risk or no evidence of cross transmission or ongoing exposure.

Public Anxiety – Moderate

Moderate public anxiety is anticipated. Media interest expected: prepare a press statement.

Thank you

Sandra

Sandra Devine
Acting Infection Control Manager
NHS Greater Glasgow & Clyde

[redacted] (PA Ann Lang)

If you require an urgent response can I please ask you to telephone me as I am often in meetings and away from the office and unable to check voicemail until the end of the day. Thank you

---

From: Deshpande, Ashutosh
Sent: 01 November 2021 10:48
To: Gibson, Brenda [redacted]; Peters, Christine [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Marek, Aleksandra [redacted]; Devine, Sandra [redacted]; Coyne, Patricia [redacted]; Berry, John [redacted]; Somerville, Emma [redacted]; Mcdaid, April [redacted]; Howat, Angela [redacted]; Riddell, Catriona [redacted]; Friel, Patricia [redacted]; Higgins, Sandra [redacted]; Rennie, Sylvia [redacted]
Cc: Bagrade, Linda [redacted]; Bowskill, Gillian [redacted]; Johnson, Angela [redacted]; Redfern, Jamie [redacted]; Joannidis, Pamela [redacted]; Kennea, Lynne [redacted]; Anderson, Kathryn [redacted]; McColgan, Melanie [redacted]; Pritchard, Lynn [redacted]; Bal, Abhijit [redacted]; Macleod, Mairi [redacted]
Subject: Re: leaks on level 6 - major incident meeting needed

Hi all,

I'll hand this over formally to ICD colleagues now to progress, but further to our microbiology consultant meeting this morning, just some further/final points to consider for today:

1. At last night's meeting I discussed scoring this incident but it was felt that for that moment in time as things were emerging everyone knew who needed to know. However, given the public inquiry related to paediatric haemonc and the fact that there are leaks in multiple areas, we thought we should mention that it would be worth scoring formally today based on any further info and assessment as there is likely to be public anxiety as well as individual patient exposure risks, particularly as it seems that leaks were not only in 6A. The families will probably have noticed the cleaning and remedial action happening.
2. In terms of the ceiling falling in and dispersion of particles, possible ongoing risks to others in the ward from the ceiling vaults need to be considered and worth double checking again that clinically all patients have been assessed and fungal prophylaxis checked.
3. Environmental sampling - I've already emailed about this. Samples in QE lab awaiting ICD action.
4. At the meeting it was thought this is likely to be coincidental, but several leaks occurring close together raises the thought of increased pressure in the system, so just to clarify about other interventions to the system that could have caused this

5. Other areas in the adult stack with leaks - I've handed this over separately to adult IPCT, but again patient exposures in these areas also need considered alongside the other issues particularly as I gather the patient placement policy that has been on Staffnet might not be correct.
6. Corrosion level of pipes, particularly in immunocompromised pipes needs highlighted and assessed
7. Review of any recent air sampling results on 6A
8. Duty of candour not only to the patient/family who had been housed in room 1 on 6A, but to other patients/families on 6A and indeed on other wards in the hospital with leaks particularly with regards exposure risks
9. Role of microbiologist when major incidents affecting multiple areas like this occur out of hours as I imagine it could happen again

Best wishes and thanks again to all who helped last night.

Ash

From: Deshpande, Ashutosh [redacted]
Sent: 01 November 2021 09:36
To: Gibson, Brenda [redacted]; Peters, Christine [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Marek, Aleksandra [redacted]; Devine, Sandra [redacted]; Coyne, Patricia [redacted]; Berry, John [redacted]; Somerville, Emma [redacted]; Mcdaid, April [redacted]; Howat, Angela [redacted]; Riddell, Catriona [redacted]; Friel, Patricia [redacted]; Higgins, Sandra [redacted]; Rennie, Sylvia [redacted]
Cc: Bagrade, Linda [redacted]; Bowskill, Gillian [redacted]; Johnson, Angela [redacted]; Redfern, Jamie [redacted]; Joannidis, Pamela [redacted]; Kennea, Lynne [redacted]; Anderson, Kathryn [redacted]; McColgan, Melanie [redacted]; Pritchard, Lynn [redacted]; Bal, Abhijit [redacted]
Subject: Re: leaks on level 6 - major incident meeting needed

Dear all,
Just copying in some more colleagues into the trail to keep them in the loop (thanks Kalsoom for letting me know), and also some lab colleagues for their info - once the sampling forms / instructions from ICDs are complete as per the LI for environmental sampling then lab will progress the processing of the environmental samples, currently these samples are at QE microbiology lab.
Regards,
Ash

From: Deshpande, Ashutosh [redacted]
Sent: 01 November 2021 09:03
To: Gibson, Brenda [redacted]; Peters, Christine [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Marek, Aleksandra [redacted]; Devine, Sandra [redacted]; Coyne, Patricia [redacted]; Berry, John [redacted]
Cc: Bagrade, Linda [redacted]; Bowskill, Gillian [redacted]; Johnson, Angela [redacted]; Redfern, Jamie [redacted]; Joannidis, Pamela [redacted]; Kennea, Lynne [redacted]; Anderson, Kathryn [redacted]; McColgan, Melanie [redacted]; Pritchard, Lynn

[redacted]; Bal, Abhijit [redacted]
Subject: Re: leaks on level 6 - major incident meeting needed

Thanks all,

For ICDs - just to let you know that swabs of the mouldy room 1 (where the immunosuppressed patient was housed) as well as particles of debris and ? mould from the collapsed ceiling have been received in the lab at QE site for testing and work-up if one of the ICDs could please liaise with the lab further to take forward.

Best wishes,

Ash

From: Gibson, Brenda [redacted]
Sent: 31 October 2021 18:50
To: Peters, Christine [redacted]; Deshpande, Ashutosh [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Marek, Aleksandra [redacted]; Devine, Sandra [redacted]; Coyne, Patricia [redacted]; Berry, John [redacted]
Cc: Bagrade, Linda [redacted]; Bowskill, Gillian [redacted]; Johnson, Angela [redacted]; Redfern, Jamie [redacted]; Joannidis, Pamela [redacted]; Kennea, Lynne [redacted]; Anderson, Kathryn [redacted]; McColgan, Melanie [redacted]; Pritchard, Lynn [redacted]; Bal, Abhijit [redacted]
Subject: Re: leaks on level 6 - major incident meeting needed

Thanks .

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From: Peters, Christine [redacted]
Sent: Sunday, October 31, 2021 6:49:41 PM
To: Deshpande, Ashutosh [redacted]; Gibson, Brenda [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Marek, Aleksandra [redacted]; Devine, Sandra [redacted]; Coyne, Patricia [redacted]; Berry, John [redacted]
Cc: Bagrade, Linda [redacted]; Bowskill, Gillian [redacted]; Johnson, Angela [redacted]; Redfern, Jamie [redacted]; Joannidis, Pamela [redacted]; Kennea, Lynne [redacted]; Anderson, Kathryn [redacted]; McColgan, Melanie [redacted]; Pritchard, Lynn [redacted]; Bal, Abhijit [redacted]
Subject: RE: leaks on level 6 - major incident meeting needed

Thanks for the update Ash as I am on call overnight.

I wonder what the source of the multiple leaks throughout the hospital is. I have not been aware of regular leaks in any immune compromised settings till today and its worth clarifying tomorrow the nature and frequency and investigation of these occurrence to understand the location of the risk of mould and water ingress through fabric.

4B and 6A will be subject to air sampling which usually gives an antecedent hint of increased mould in the environment if this is a chronic issue.

Kr
Christine

Dr Christine Peters
Clinical Lead
Consultant Microbiologist
QEUH
[redacted]

From: Deshpande, Ashutosh
Sent: 31 October 2021 17:31
To: Gibson, Brenda [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Marek, Aleksandra [redacted]; Devine, Sandra [redacted]; Coyne, Patricia [redacted]; Berry, John [redacted]
Cc: Peters, Christine [redacted]; Bagrade, Linda [redacted]; Bowskill, Gillian [redacted]; Johnson, Angela [redacted]; Redfern, Jamie [redacted]; Joannidis, Pamela [redacted]; Kennea, Lynne [redacted]; Anderson, Kathryn [redacted]; McColgan, Melanie [redacted]; Pritchard, Lynn [redacted]; Bal, Abhijit [redacted]
Subject: Re: leaks on level 6 - major incident meeting needed

Dear all,

Thanks for attending at short notice.

To sum up briefly by means of notes -

There have been leaks on ward 6A, starting in room 1 (which housed a heavily immunosuppressed patient - this patient was moved before the leak happened, although there may have been some mould exposure as mould was seen on the sink before the leak). Since then, 3 further non-patient rooms have also leaked.

There have also been leaks reported in levels 4, 10, 8 and 5, and the A stack this happens frequently in the A stack, but is also known to happen in the B stack.

Estates are in the process of rectifying these situations, with measures in place at the highest risk level. It is not envisaged that there will be further leaks (estates colleagues you could perhaps elaborate on the technicalities if needed) but this is not 100% guaranteed.

Patients on 6A are on antifungal prophylaxis, with HEPA filters in the rooms.

There may be rooms on level 4 available for some patients should we wish to move them, but level 4 has also had leaks.

There are bed pressures throughout the hospital and moving patients as a precautionary measure would prove challenging and consensus from all in attendance is that on risk-benefit analysis, it is safer to keep

patients where they are overnight with close monitoring, and assess tomorrow with the additional safeguard of a deep clean of corridors and communal spaces and an inspection and clean of patient rooms after this. This is also because leaks elsewhere have been occurring and so it is not yet clear where the best place to move patients would be even without the bed pressures.

If any mould is detected in rooms on the unit, on or if a leak occurs again, then this would trigger another discussion and reassessment of the situation. The contingency is that there are empty beds elsewhere some patients could go but this would need to be assessed on a case-by-case basis.

In terms of duty of candour, clinical team will discuss with the family of patient who was in room 1 and follow up/monitor clinically.

If I may add that given the number of leaks that appear to have been happening outwith 6A it would be worth a discussion with IPCT to clarify exact extent and also patients that might have been affected by these leaks, copied in my IC colleagues covering adult stack too for their info.

Please forward onto anyone present who I've missed out. Please also feel free to correct if anything inaccurate or add anything that I might have missed out.

Regards,

Ash Deshpande
Microbiologist

From: Deshpande, Ashutosh [redacted]
Sent: 31 October 2021 16:10
To: Gibson, Brenda [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Marek, Aleksandra [redacted]; Devine, Sandra [redacted]
Cc: Peters, Christine [redacted]; Bagrade, Linda [redacted]; Bowskill, Gillian [redacted]; Johnson, Angela [redacted]; Redfern, Jamie [redacted]; Joannidis, Pamela [redacted]; Kennea, Lynne [redacted]; Anderson, Kathryn [redacted]; McColgan, Melanie [redacted]; Pritchard, Lynn [redacted]; Bal, Abhijit [redacted]
Subject: Re: leaks on level 6 - major incident meeting needed

Hi Brenda,
link below (thanks Melanie).
Best wishes
Ash

Sharing link on behalf of Ash
Please share with you anyone not included that you think should be in attendance or let me know and I will share.
Melanie

Microsoft Teams meeting

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Video Conference ID: [redacted]
Alternate VTC instructions

Or call in (audio only)

[redacted] United Kingdom, London
Phone Conference ID: [redacted]
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Learn More | Meeting options

From: Gibson, Brenda [redacted]
Sent: 31 October 2021 16:08
To: Deshpande, Ashutosh [redacted]; Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]
Cc: Peters, Christine [redacted]; Bagrade, Linda [redacted]; Bowskill, Gillian [redacted]; Johnson, Angela [redacted]; Redfern, Jamie [redacted]; Joannidis, Pamela [redacted]; Kennea, Lynne [redacted]; Anderson, Kathryn [redacted]; McColgan, Melanie [redacted]; Pritchard, Lynn [redacted]; Bal, Abhijit [redacted]
Subject: Re: leaks on level 6 - major incident meeting needed

Can we please know as a mater of urgency when the Major incident Will be held and on what platform?
Brenda

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From: Deshpande, Ashutosh [redacted]
Sent: Sunday, October 31, 2021 3:53:29 PM
To: Ramsay, Thomas [redacted]; Groom, Susan [redacted]; Kalsoon, Mohammed [redacted]; Paterson, Nicolle [redacted]; Halsey, Christina [redacted]; Gibson, Brenda [redacted]
Cc: Peters, Christine [redacted]; Bagrade, Linda [redacted]; Bowskill, Gillian [redacted]; Johnson, Angela [redacted]; Redfern, Jamie [redacted]; Joannidis, Pamela [redacted]; Kennea, Lynne [redacted]; Anderson, Kathryn [redacted]; McColgan, Melanie [redacted]; Pritchard, Lynn [redacted]; Bal, Abhijit [redacted]
Subject: leaks on level 6 - major incident meeting needed

Dear all,

I've been up to 6A to look at the leak in the past 1 hour, please find photos attached. I gather that there was an immunocompromised, post-transplant patient in the room with the initial leak and this patient has been moved. I gather also that there has been mould visualised at the sink, and falling from the ceilings.

I also gather there is now another leak in a non-patient handover room on the other side of the ward, and that there may be other areas outwith 6A affected too and that estates are reviewing.

I've spoken to estates and advised that the reparative work on 6A needs the highest risk level of SCRIBE including full sealing of the area and negative pressure within.

I had initially thought that the area outside the room can be sealed off, with the patients in the two rooms adjacent to this being moved elsewhere so that that wing can be as empty as possible. However, the leak in the handover room which I gather is concerning because this means that there might be a more widespread problem. I have also just been told that a couple of further rooms may also be leaking, and also that other floors above this have a leak problem.

Because this appears to be an evolving situation, if the safety of the other areas of the ward can't be guaranteed, then there is a real concern for the other patients remaining on the ward particularly with regards mould and environmental organism infections (as many of these patients are immunocompromised), and it is important to find alternative accommodation for these patients as soon as possible in the first instance.

Nicolle has kindly agreed to take environmental swabs/samples to send for microbiological culture so that we know what the patients have been exposed to. This should be done in any room with a leak or with damage, with careful noting of which patient was in which room and the patients closely monitored.

As estates are still reviewing and contingencies are being made, this is just a snapshot of circumstances at this moment in time, I'm copying in my colleague on this evening too for her info. This is an urgent situation and needs escalated through management. I think the issue is with pipes given the extent of the issue but estates will be able to advise if pipes, chill beams or what the technical issue is.

Is it possible to have a major incident meeting? Perhaps at about 4.15pm? Melanie is kindly helping set the link up. I've copied in my colleague who is covering after 5pm too, copied in other IC colleagues too in case this is an issue throughout the adult hospital.

Regards,

Ash

Dr Ash Deshpande

Microbiologist

NHS GGC IPC Incident summary

Date reporting / Update no.	02.11.21
Sector / Hospital	QEUH South Adults & Paeds
Ward / departments	QEUH - Multiple Wards
Incident statement	Individual leaks from hot water valves/pipes in 3 stacks of QEUH.

Patient cases

Situation:

Small amount of discoloured sealant noted at CWHB in room 1 Ward 6a prior to event described below on 31.10.21 and patient moved to another room to allow for sealant to be replaced.31.10.21 - individual leaks from hot water valves/pipes in 3 stacks of QEUH. Advised by estates that these leaks were not linked.

2 leaks in 4B (BMT)
Corridor outside Store Room - Water noted to be leaking from ceiling tile. No patients directly exposed to water as patients remain in rooms with doors closed. Valve repaired and ceiling tiles repaired.

Room 56 (patient in room at time of water ingress). Patient alerted staff to water dripping from wall/ceiling edge. Patient immediately transferred to another room. On investigation, at inside of window frame at ceiling the plaster was cracked and water noted to be leaking from crack. Currently the room is closed off and door has DustGuard® screen and awaiting repair but on inspection the plaster looked dry and no further leakage noted. The ceiling within this room is a solid ceiling and not suspended. Both leaks caused by hot water valves. 3 leaks in 6A (Paeds Haem Onc) – Room 1 (room empty), Staff room (outside of ward) and Day care waiting area (room unoccupied). Advised by estates leak in Room 1 caused by eroded hot water pipe, leak in day care waiting area and staff room caused by hot water valve failure.

1 leak in Immediate Assessment Unit – Room 14, caused by hot water valve.
1 leak in 5D – Day room, caused by hot water valve.
1 leak in 7D – Room 56 caused by hot water valve. 1 leak in 8A - Day Room caused by hot water valve.
1 leak in Ward 9A – Day Room at window ledge unclear of cause
1 leak in 10A Day Room caused by hot water valve.
1 leak in Ward 11C – Day Room at window ledge unclear of cause

Control measures

An initial incident meeting held 31.10.21 at 4.15pm, led by Dr A Deshpande. The trigger for this meeting was that Dr Deshpande was informed of the leak in ward 6a room 1 in the afternoon (the patient in the room had already been moved by then), and he visited and photographed this and called the meeting as soon as he returned from visiting the ward. On inspection, the ceiling had come down and there was water and considerable debris (some of which appeared black in colour)

on the floor. The meeting was held to gather information (particularly because different wording appeared to have been used with regards the description of mould in room 1) and make sure the situation was understood and an action plan in place for overnight, as new information was coming to light and the situation appeared to be evolving.

No new admissions were anticipated in Ward 6a overnight. There was one empty room unaffected by water ingress. It was agreed that this would not be used overnight until further information could be obtained from estates on Monday.

Present at the initial meeting were the director on call, on-call managers, nursing and medical representation from the clinical team, microbiology and infection control, site estates and the press office.

Incident meeting discussed patient placement in Ward 6a only as this was the only area was notified about in the initial instance.

At the meeting, it was established that two further areas in 6a also had leaks, and that leaks had also been reported in other wards including 4B (where patients also receive antifungals), 5D, 10A and 8A.

Because this information only came to light at the meeting, it was not possible for the group to discuss these wards without further information. However, estates were aware of these and were rectifying the situation.

At the end of the meeting, Dr Deshpande asked about consideration of scoring although at that stage, IC representatives felt this might not be needed given the time and that the situation was still under assessment.

The outcome and actions of the initial meeting on late afternoon of 31st October were as follows:

- No further patient moves were required as a result of this incident and the team felt that the risk of moving patients outweighed the benefits in keeping them in the ward. In addition, most patients in 6a receive antifungals. Ward 6a have portable HEPA filters in all rooms and corridors.
- Work to repair damage caused by leaks carried out under SCRIBE measures (Room sealed, supply ventilation isolated and extract ventilation left running) and in accordance with the Water Damage guidance document.
- Terminal clean and wall washing carried out in corridors and communal spaces and all ward 6a patient rooms following completion of work.
- Clinical team were going to review cases further and consider duty of candour too
- Estates were gathering information, assessing and remedying the leaks in the other wards
- Dr Deshpande made sure this was handed over to IPCT colleagues and further assessment of the situation both on 6a and the other wards was then undertaken by ICDs Drs Bagrade and Bal alongside IPCT and estates colleagues as a priority within the next 24 hours and their further assessment is described under “situation” as well as “investigations”.
- Subsequently ICDs, IPCT and estates felt that no further meetings were required

Investigations

Initial photographs of room 1 ward 6a had already been taken. Subsequently, Dr Bagrade and colleagues inspected not only ward 6a but the other affected areas that came to light at the initial meeting in conjunction with estates. Inspection of ceiling space carried out for signs of mould – no sign of mould present. Environmental sampling carried out – Ward 6a Room 1 only. Swab from a sink (surface swab) and 2 universal containers containing debris from collapsed ceiling tile. All samples to be processed looking for fungal growth only. However, all samples were obtained after the event of the ceiling collapsing. Air sampling and particle counts will be carried out when all remedial work has been completed. Routine sampling on 6a was paused during COVID 19 however it has recommenced in 4B which is a specially ventilated area. Request for routine air sampling of Ward 6a to be recommenced has been made.
Hypothesis
N/A
HIIAT Score
N/A
Communications / next steps
Parents in Ward 6a have been informed of incident by clinicians. Communications sent to all families in Ward 6a from NHSGGC Nurse Director and Director of W&C Services NHS GGC.
Press statement
N/A

Date	Incident update

Action Plan

Date Agreed	Action	Responsible Person	Outcome/Update

Julie Rothney

From: Peters, Christine
Sent: 19 July 2019 19:43
To: Conner, Darryl James; Purdon, Colin; Dodd, Susie; Guthrie, James
Cc: Balfour, Alison; Inkster, Teresa (NHSmail)
Subject: RE: Chill beam

Yes indeed it would and it would maybe be a future approach for the AHUs that don't have it.

I wonder why some do and others don't?

C

From: Conner, Darryl James
Sent: 19 July 2019 17:15
To: Peters, Christine; Purdon, Colin; Dodd, Susie; Guthrie, James
Cc: Balfour, Alison; Inkster, Teresa (NHSmail)
Subject: RE: Chill beam

Hi Christine,

That's no problem at all, if I can achieve full visibility of the recorded chilled beam incidents then I can cross reference that information with the associated plant serving it, if that piece of work shows that the AHUs stated are not included as per the list of AHUs below then I believe that information will support the success of this part of the strategy.

Regards
Darryl

Darryl James Conner MIHEEM
Interim Site Manager Operational Estates (SMOE)
Queen Elizabeth University Hospital Campus,
Labs Bldg.
1345 Govan Rd
Glasgow
G51 4TF

Tel: [redacted]
Mob: [redacted]
Email: [redacted]

From: Peters, Christine
Sent: 19 July 2019 15:37
To: Conner, Darryl James [redacted]; Purdon, Colin [redacted]; Dodd, Susie [redacted]; Guthrie, James [redacted]

Cc: Balfour, Alison [redacted]; Inkster, Teresa (NHSmail) [redacted]
Subject: RE: Chill beam

Thanks for that Darryl,
Thanks for all the hard work in trying to resolve the issue.

Is it the case that the AHUs where the de humidification is in the AHU that condensation has not occurred in the chilled beams served by that AHU?

Kr
Christine

From: Conner, Darryl James
Sent: 19 July 2019 14:43
To: Purdon, Colin; Peters, Christine; Dodd, Susie; Guthrie, James
Cc: Balfour, Alison; Inkster, Teresa (NHSmail)
Subject: RE: Chill beam

Hi Colin,

No problem,

Regarding chiller operation, I have carried out an investigation of chiller controls and delivery to main hospital, my findings are :

From the main energy centre chiller plant the chiller flow and return temperature sensors are fixed to 8'C and 12'C , this has no bearing on the temperature delivery to the hospital as the flow temperatures are set in the chillers themselves and the BMS only enables the chillers to be on or off. Having checked the operation of all the field Plate Heat Exchangers for Chilled Water in all the associated plant rooms, they appear to be working correctly by design with a constant set point of 15'C to the chilled beams, this is in fact is the problem with the sweating of the chilled beams under extreme weather conditions. The system is set up that the Plant Room PHX set points are all compensated according to outside air temperature in a fashion that if the outside temperature is 7'C then the PHX set point is 8'C going to the chiller battery on the AHUs and if the outside temperature is 22,C then the PHX set point is 12'C or 14'C depending on the plant room and the AHU plant served from it with respect to the associated AHU discharge air set temp point. In addition to this there are 12 off AHUs that have humidity monitoring set up on them which are :

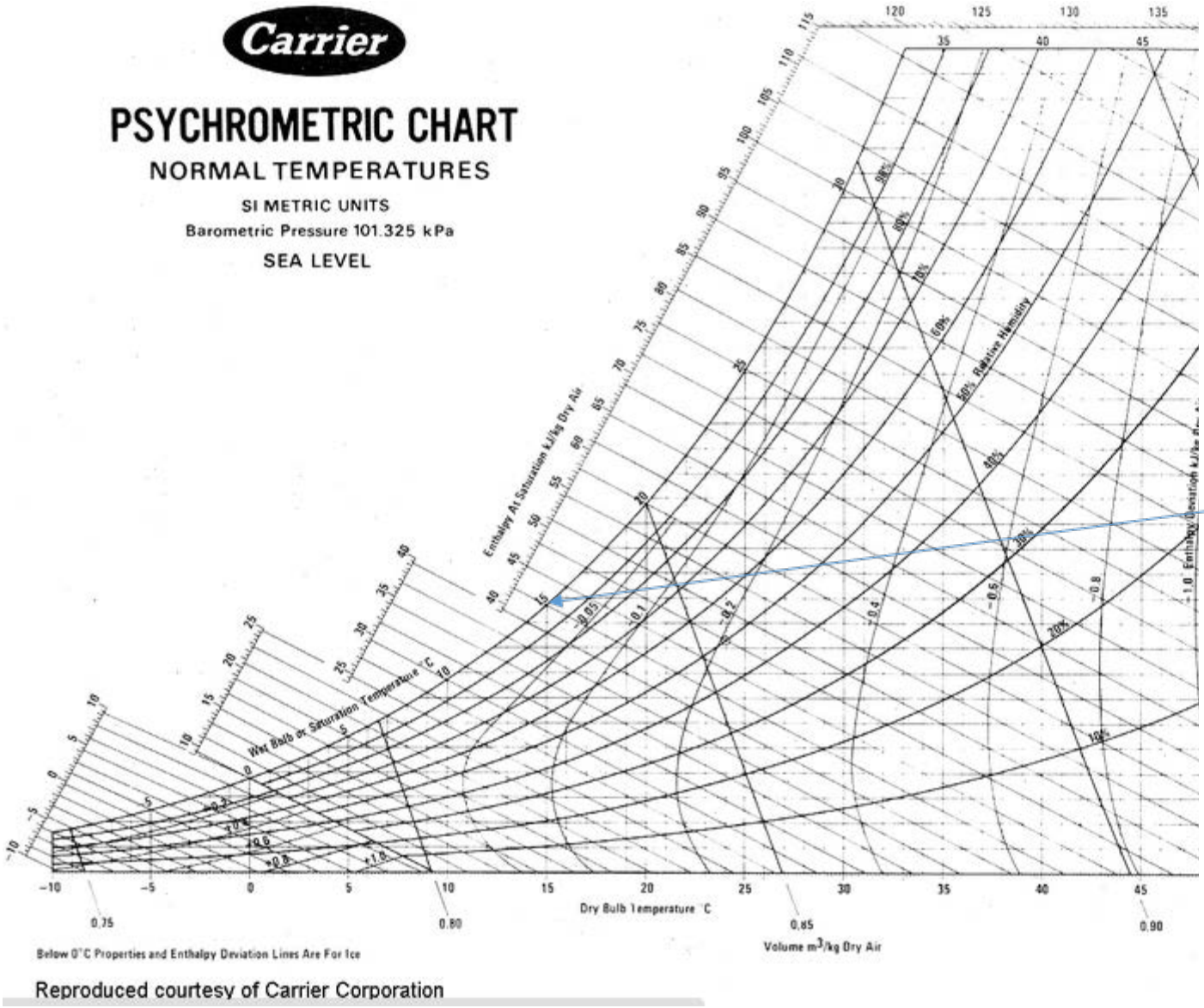
ADULTS – 121AHU02, 121AHU05, 122AHU02, 122AHU05, 123AHU02, 123AHU05, 124AHU02, 124AHU05.
&
CHILDS – 41AHU03B, 41AHU20A, 41AHU17, 41AHU24.

These units were chosen for this strategy to give us the best space dehumidification within the limits of our chilled water generation capacity, This control strategy governs the operation of the cooling valves on the AHU according to the moisture content of the incoming air and subsequently dehumidifies it depending on the external conditions, this is when the hot humid air is cooled significantly to remove the moisture content and then sensibly heated back to the tempered air set point of that particular system,(16-18 C) the problem we face is that the Plant Room Chilled beam set points serving the room chilled beams are all fixed at 15'C with no implemented dew monitoring strategy applied. As a result of this under extreme atmospheric conditions for Glasgow occurring where the dew point exceeds this set point of 15C then sweating of the chilled beams will occur.

I am currently implementing a reset control scheme to modify the set point of the chilled beams in the event of extreme atmospheric conditions, to maintain the chilled beam flow temperature above the dew point when in excess of 15,C,this will effectively resolve or condensation issues and mitigate the clinical risk associated with chilled beam condensation with the only slight disadvantage that the space cooling capacity will be reduced for the time period that these conditions are met.

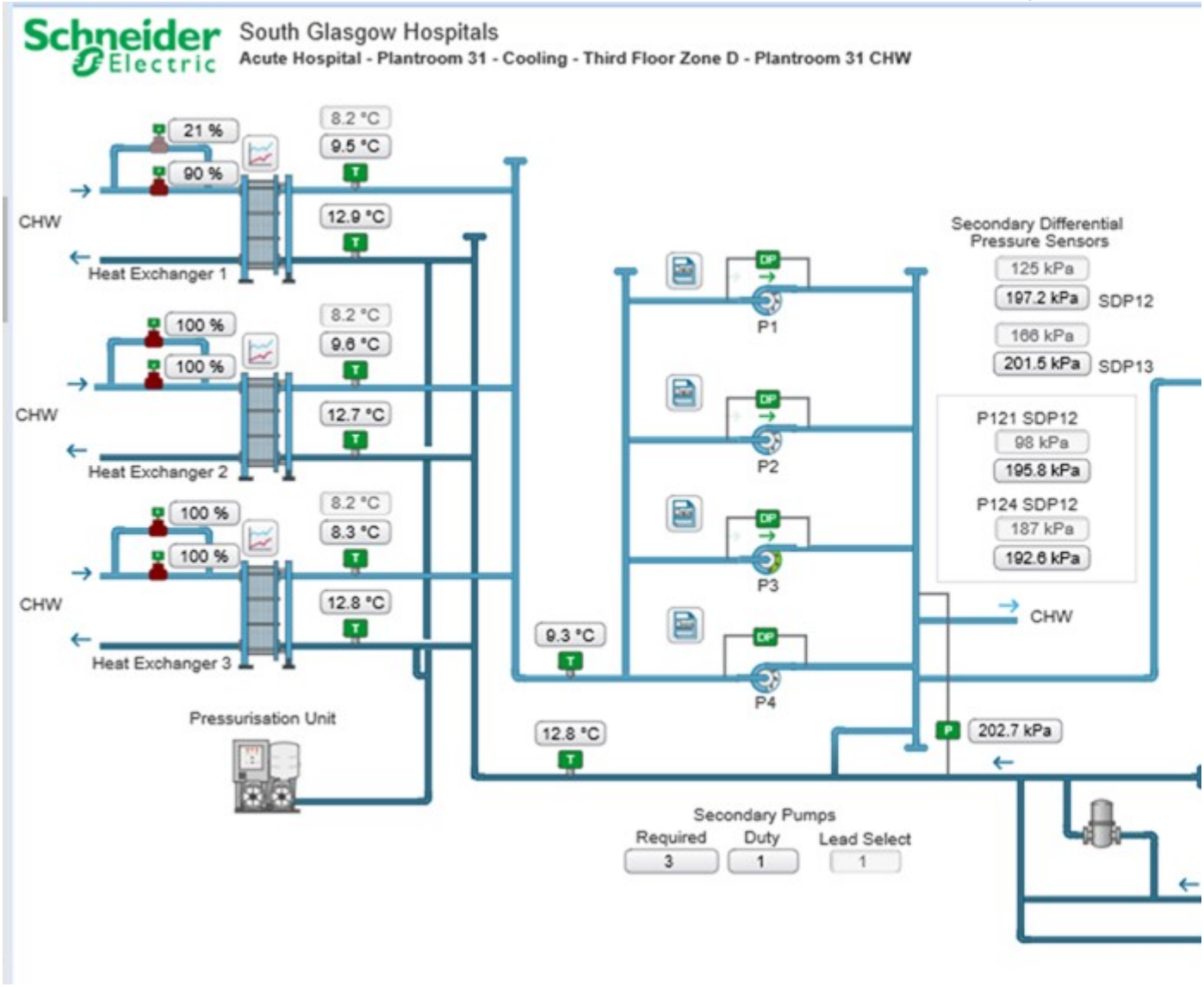
While I am establishing this new software our interim contingency SOP is as follows :

To protect against chilled beam condensation under certain extreme conditions on suspected warm days >22d,C
Estates will check the weather dew point periodically (Glasgow Airport website)
If this parameter is found to be above **14 degrees C**
Estates will manually override each chilled water chilled beam circuit set point to **16 Degrees C**, or N+2 depending on what the condition at the time is.
As a result this will keep us away from the condensation dew point and stop any condensation dripping from the chilled beams!



The idea is to create a 2 degree buffer due to the lag on the system adjustment
Space temperatures will be monitored for significant temperature increase and adjusted accordingly.

System example :



Best

Regards

Darryl

Darryl James Conner MIHEEM
Interim Site Manager Operational Estates (SMOE)
Queen Elizabeth University Hospital Campus,
Labs Bldg.
1345 Govan Rd
Glasgow
G51 4TF

Tel: [redacted]
Mob: [redacted]
Email: [redacted]

From: Purdon, Colin
Sent: 19 July 2019 11:54
To: Peters, Christine [redacted]; Dodd, Susie [redacted]; Conner, Darryl James [redacted]; Guthrie, James [redacted]
Cc: Balfour, Alison [redacted]; Inkster, Teresa (NHSmail) [redacted]
Subject: RE: Chill beam

Christine,

I would expect that it does happen in other places as conditions dictate. There may be slight variations in the conditions within the building which leads to varying degrees of condensation formation. Some of these occurrences are possibly going unreported.

Darryl, Can you provide an explanation of the dew point controls strategy programmed into the BMS and also describe your SOP for monitoring the dew point during periods of high humidity please.

I am unaware if the manufacturers were previously approached to comment on the issue. I will make enquiries.

Regards
Colin

Colin Purdon | BSc (Hons)
Interim Sector Estates Manager (*South*)

Estates Dept
Queen Elizabeth University Hospital Campus,
Room L0/B/002
Laboratory Medicine and Facilities Management Bldg.
1345 Govan Rd
Glasgow
G51 4TF

Office: [redacted]
Mob: [redacted]

Email: [redacted]

<>

From: Peters, Christine
Sent: 19 July 2019 10:32
To: Purdon, Colin; Dodd, Susie; Conner, Darryl James; Guthrie, James
Cc: Balfour, Alison; Inkster, Teresa (NHSmail)
Subject: RE: Chill beam

Hi Colin,
The problem I have with the condensation explanation is why does this not happen in other places at the same time? Also what has been done to
manage the set dew point? Condensation is as unacceptable in terms of risk for fungus as leaks.

Have the manufacturers of the beam technology been approached regarding this repeated condensation issue?

Kr
Christine

From: Purdon, Colin
Sent: 19 July 2019 10:14
To: Peters, Christine; Dodd, Susie; Conner, Darryl James; Guthrie, James
Cc: Balfour, Alison; Inkster, Teresa (NHSmail)
Subject: RE: Chill beam

Christine,

There are two issues at play here.

The incidence of water coming from the chilled beams around 30th June was related to high relative humidity in the ambient air and resultant condensation forming on the cooling coils of the beam which in turn drip into the room. I would stress that this is not leakage from any of the piped systems in the ceiling. It is moisture forming on the chilled surface from humid air within the environment.

The fittings replacement you refer to only presents itself if we have a loss of temperature within the heating system. This results in contraction of the push fit connections and subsequent water leakage. The six rooms in Ward 6A where this was identified were all addressed through replacement of the push-fit connections for compression fittings.

Regards
Colin

Colin Purdon | BSc (Hons)
Interim Sector Estates Manager (*South*)

Estates Dept
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Room L0/B/002
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1345 Govan Rd
Glasgow
G51 4TF

Office: [redacted]
Mob: [redacted]

Email: [redacted]

<>

From: Peters, Christine
Sent: 17 July 2019 15:28
To: Dodd, Susie; Purdon, Colin
Cc: Balfour, Alison; Inkster, Teresa (NHSmail)
Subject: RE: Chill beam

Thanks Susie,
Yes this fits with the air sampling results.
Colin can you please update on what has happened re fixing the fittings to these chilled beams?

Kr
Christine

From: Dodd, Susie
Sent: 17 July 2019 15:24
To: Purdon, Colin
Cc: Peters, Christine
Subject: FW: Chill beam

Hi Colin,
I was sent this email whilst on A/L. This might be the leaks the staff on 6A were referring to. It would also fit with air samples carried out 2 days prior.
Susie

Susie Dodd
Lead Infection Prevention and Control Nurse
Royal Hopsital for Children
[redacted]

From: Inkster, Teresa
Sent: 30 June 2019 11:07
To: Meikle, Kirsteen; Dodd, Susie
Subject: Re: Chill beam

Thanks Kirsteen
I have asked Dr Alison Balfour to contact you as she is the on call micro Consultant today and has been in touch with me re this issue. I had suggested estates check the ceiling voids above the rooms to make sure no water is collecting up there

Kind regards
Teresa

Sent from my BlackBerry 10 smartphone on the EE network.

From: Meikle, Kirsteen
Sent: Sunday, 30 June 2019 10:58 AM
To: Dodd, Susie
Cc: Inkster, Teresa
Subject: Chill beam

Hi Susie

We had an issue lastnight with the chill beams in rooms 3, 4 and 5. They were all dripping and the patients had to be moved. This was an issue all over the hospital. Estates attended lastnight and have said the issue has been sorted.

We are awaiting the wall washers today then were told the rooms could be used.

I have contacted on call microbiologist for advice via switchboard but it is just ringing out. I will continue to call them, but wanted to send you an email so you were aware of our situation.

Kind Regards

Kirsteen

Louise Mackinnon

From: DESHPANDE, Ashutosh (NHS GREATER GLASGOW & CLYDE) [redacted]
Sent: 02 October 2017 21:23
To: Peters, Christine
Subject: [ExternaltoGGC]FW: QEUH new building handover

Follow Up Flag: Follow up
Flag Status: Flagged

_____
From: Inkster Teresa (NHS GREATER GLASGOW & CLYDE)
Sent: 12 October 2016 18:12
To: Powrie Ian (NHS GREATER GLASGOW & CLYDE); Deshpande Ashutosh (NHS GREATER GLASGOW & CLYDE)
Cc: Walsh Thomas (NHS GREATER GLASGOW & CLYDE); Loudon David (NHS GREATER GLASGOW & CLYDE)
Subject: Re: QEUH new building handover

Thanks for the update Ian

KR

Teresa

Dr Teresa Inkster
Lead Infection Control Doctor NHSGGC
Training Programme Director Medical Microbiology Dept of Microbiology Queen Elizabeth University Hospital Glasgow Direct dial : [redacted] _____
From: Powrie, Ian [redacted]
Sent: 12 October 2016 17:34
To: Inkster Teresa (NHS GREATER GLASGOW & CLYDE); Deshpande Ashutosh (NHS GREATER GLASGOW & CLYDE)
Cc: Walsh Thomas (NHS GREATER GLASGOW & CLYDE); Loudon David (NHS GREATER GLASGOW & CLYDE)
Subject: RE: QEUH new building handover

I. Powrie
Sector Estates Manager (South & Clyde)
Queen Elizabeth University Hospital Campus,
1345 Govan Rd,
Glasgow,
G51 4TF,
PA Elaine McNeil: [redacted]
Direct : [redacted]
Mob: [redacted]

From: Inkster Teresa (NHS GREATER GLASGOW & CLYDE) [[redacted]]
Sent: 11 October 2016 14:20
To: Deshpande, Ashutosh (NHSmail)
Cc: Walsh, Tom; Powrie, Ian; Loudon, David
Subject: Re: QEUH new building handover

Ash - comments from me in red below. I am aware of these issues and don't need you to do anything further at the moment . I will update you with progress.

Kind regards

Teresa
Dr Teresa Inkster
Lead Infection Control Doctor NHSGGC
Training Programme Director Medical Microbiology Dept of Microbiology Queen Elizabeth University Hospital Glasgow Direct dial : [redacted] _____
From: Deshpande Ashutosh (NHS GREATER GLASGOW & CLYDE)
Sent: 11 October 2016 08:48
To: Inkster Teresa (NHS GREATER GLASGOW & CLYDE)
Subject: Fw: QEUH new building handover

Hi Teresa,

Would it be possible to have a meeting over the next few weeks at some point to try and make an action plan for these points? Just to give me a clear idea of how best to tackle the issues.

Thanks,

Ash

_____
From: Peters, Christine
[redacted]
Sent: 10 October 2016 18:19
To: Deshpande Ashutosh (NHS GREATER GLASGOW & CLYDE)
Cc: Inkster Teresa (NHS GREATER GLASGOW & CLYDE); Powrie Ian (NHS GREATER GLASGOW & CLYDE); Loudon David (NHS GREATER GLASGOW & CLYDE); Walsh Thomas (NHS GREATER GLASGOW & CLYDE)
Subject: QEUH new building handover

Dear Ash,

As discussed this is a quick resume of the infection Control related issues with the new build :

1. Isolation rooms : Since June 2015 I have been raising concerns regarding the design and commissioning of the isolation suites within the Critical Care Unit as is summarised in the first email attached . This eventually led to HPS and HFS inspecting the rooms this year . As far as I am aware a report is awaited from them regarding the suitability of the design and build of these rooms for highly pathogenic and infectious patients. An urgent update is required regarding this as our ability to isolate MERS, open TB and MDR TB cases , as well as varicella zoster and measles would be compromised if these PPVL rooms are confirmed as being unsuitable for these cases. For example last week we had two proven cases of infective TB , a query MERS and a possible VHF patient , all of which need respiratory isolation which we can reassure our clinical colleagues are compliant with Health and Safety guidance. An initial report has been received from HFS/HPS and there will be a meeting to discuss the implications shortly. I am leading on this and will let you know the outcome. Medical director aware .

2. Ventilation throughout the building: all single room patient accommodation and outpatient departments are designed to have 3 air exchanges per hour (6 is the recommendation in SHTM) and the design is such that clean supplied air is cooled/heated at point of supply through coils, the air sinks and "induced air" goes back into the supply duct through a grill. Problems that arise with this design are that the dust in the room is taken back into the supply grill , with collection of thick dust occurring on the grills and coils. Furthermore condensation occurs when humidity levels are high and have caused dripping of dirty water into the bedrooms. A programme of cleaning is being put in place to mitigate this risk. The frequency and methodology is not finalised. Again an update will be required. There is nothing we can do re the 3 ach/hour at this stage. A risk assessment has been undertaken to identify high risk areas i.e. resp ward, resp clinics- in these areas 2 hours will be left following aerosol generating procedures. Again Medical Director aware. Ian Powrie aware of issues with cleaning chilled beams - await confirmation of frequency of cleaning.

IP Comment: With regards to chilled beams, i am currently under taking several courses of action.

1. RHC, Ward 2A, Chilled beams have been cleaned and decontaminated along with each room affected condensation, weekly monitoring is in place to establish the duration for regenerated fibre build-up on cooling coils, once established this will dictate cleaning frequency.

2. Condensation generation due to no dew point control on chilled water system, proposals are currently being developed to address this, it is not expected that this issue will arise again until summer 2017, by which time we will have implemented an automatic control solution.

3. I am also in consultation with the manufacturer of the chilled beams with regards to the recirculation aspect of the chilled beam operation to establish if there are any actions we can implement to minimise the impact of regenerated fibre collection.

4. HAI SCRIBE has been complete and ratified by ICT for accessing and cleaning chilled beams across the site, this will be a large under taking requiring a dedicated Estates resource and will take some 6 months to complete, therefore we will commence with the identified high risk areas, Respiratory, ARU (as requested by Christine) etc. Please note this requires the single room to be empty during cleaning and therefore will be dependent on access.

Furthermore the ventilation design is that the patient bedroom accommodation is about neutral pressure to the corridors. This means that there is no clear flow of air from room to toilet, away from corridor. Doors remaining closed at all times is therefore very important to avoid spread of airborne pathogens.

3. I have not yet seen the design and commissioning parameters for the Endoscopy suite, treatment rooms, interventional radiology and Pacing wire cardiology room which needs to be followed up to ensure IC considerations have been taken into account. Will be discussed at specialist ventilation meeting , 19th Oct . Myself and Tom attending. I will be the ICD rep on this new group until it is established. We will be looking at all GGC specialist ventilated areas.

4. Theatres – these are designed to have shared prep rooms, however do not have interlocking doors or door closing mechanisms in the prep room. This has been requested to be in line with HTM guidance , but has not been put in place to date and our surgical colleagues have repeatedly raised this as an issue that needs to be rectified. I agreed at ICD meeting last month to take this forward.

IP Comment: Pilot works to add prep room door interlock arrangements have been agreed with theatre management team to be carried out in theatre 7 & 8 prep room, PO is in place for this work, an installation date will be agreed with theatre once the HAI SCRIBE RS is ratified by ICT. The work

will be executed out of normal working hours & will include the addition of a door closer to the prep room\corridor access door.

5. Dialysis water supply – I understand that some dialysis points come off the domestic supply route, however these are all within the renal service area as far as I am aware which comes under Teresa's area . This is Regional sector which I cover - being addressed

6. Decontamination in the respiratory clinic: there is no decontamination room for the respiratory clinic – I am going to assess this as part of the CF work and make recommendations for remedial work. I would suggest you link in with Christine re this OP clinic .

7. BMT: I raised the issues regarding the fact that 4B was not built to a suitable spec for BMT patients in the severely immunocompromised state in June 2015, and currently the unit is being used as a general medical ward – with the ventilation altered to drop pressures to just about neutral. The gauges on the door are irrelevant to these rooms at present. Teresa is dealing with the future planning for BMT specific accommodation. Again ,regional sector and being addressed

I have further details of all these issues if anyone requires,

Regards,

Christine
Dr Christine Peters
Consultant Microbiologist
Southern General Hospital
GGC
Ex [redacted]
Mobile: [redacted]

****

30

30. email

Julie Rothney

From:	Peters, Christine
Sent:	22 July 2016 09:09
To:	Powrie, Ian; Redfern, Jamie; Joannidis, Pamela
Cc:	Kirkwood, Jean; Hutton, Melanie; Brattey, David; Rodgers, Jennifer; Inkster, Teresa (NHSmail); Hunter, William; Kane, Mary Anne; Loudon, David; Brattey, David; Inkster, Teresa (NHSmail)
Subject:	RE: Ward 2a cubicles 8-11

Thanks Ian for the details and reassurance regarding the cooling methods in the isolation rooms.

Kind regards,

Christine

Dr Christine Peters
Consultant Microbiologist
Southern General Hospital
GGC
Ex [redacted]
Mobile: [redacted]

From: Powrie, Ian
Sent: 21 July 2016 18:24
To: Peters, Christine; Redfern, Jamie; Joannidis, Pamela
Cc: Kirkwood, Jean; Hutton, Melanie; Brattey, David; Rodgers, Jennifer; Inkster, Teresa (NHSmail); Hunter, William; Kane, Mary Anne; Loudon, David; Brattey, David; Inkster, Teresa (NHSmail)
Subject: RE: Ward 2a cubicles 8-11

Hi Christine,

The re-generated fibres\dust is collecting on the coil fins inside the ceiling mounted chilled beams (supply air is provided via these beams), there is no indication that the positive air supply pressure is not being maintained. With respect to the isolation rooms, these do not have chilled beams as the air is supplied directly from the Air Handling unit (where the cooling function takes place remotely from the room) and then passes through the HEPA filter housing in the lobby. There will be no condensation generated at the lobby air supply point and therefore no resulting damp within these facilities.

Hope this helps.

Regards

Ian

I. Powrie

Sector Estates Manager (South & Clyde)
Queen Elizabeth University Hospital Campus,

1345 Govan Rd,
Glasgow,
G51 4TF,
PA Elaine McNeil: [redacted]
Direct : [redacted]
Mob: [redacted]

From: Peters, Christine
Sent: 21 July 2016 14:58
To: Redfern, Jamie; Powrie, Ian; Joannidis, Pamela
Cc: Kirkwood, Jean; Hutton, Melanie; Brattey, David; Rodgers, Jennifer; Inkster, Teresa (NHSmail); Hunter, William; Kane, Mary Anne; Loudon, David; Brattey, David; Inkster, Teresa (NHSmail)
Subject: RE: Ward 2a cubicles 8-11

Thanks Ian,

For clarity – is the dust particulate matter collecting on the supply grilles? Have there been any indications that the positive pressure is not being achieved ?

With specific reference to the isolation rooms – is the same cooling system in place?

My concern is the collection of damp within accommodation for immune compromised patients.

Regards,

Christine

Dr Christine Peters
Consultant Microbiologist
Southern General Hospital
GGC
Ex [redacted]
Mobile: [redacted]

From: Redfern, Jamie
Sent: 21 July 2016 14:49
To: Powrie, Ian; Joannidis, Pamela
Cc: Kirkwood, Jean; Hutton, Melanie; Brattey, David; Rodgers, Jennifer; Inkster, Teresa (NHSmail); Hunter, William; Kane, Mary Anne; Loudon, David; Brattey, David; Peters, Christine
Subject: Re: Ward 2a cubicles 8-11

Thanks Ian

Sent from my BlackBerry 10 smartphone on the EE network.

From: Powrie, Ian
Sent: Thursday, 21 July 2016 12:45
To: Redfern, Jamie; Joannidis, Pamela
Cc: Kirkwood, Jean; Hutton, Melanie; Brattey, David; Rodgers, Jennifer; Inkster, Teresa (NHSmail); Hunter, William; Kane, Mary Anne; Loudon, David; Brattey, David; Peters, Christine
Subject: RE: Ward 2a cubicles 8-11

Jamie\Pamela,

By way of an update and for clarification, I would advise that the issue currently being experienced with regards to condensation from chilled beams across many clinical areas which has been compounded in some cases by regenerated fibres\dust (generated by normal room activities) collecting on the chilled beam vent fins causing the condensation to turn black, we recognise the infection control issues with this and as such David and the estates team have worked tirelessly to address this across all areas. However as I am sure that you are aware while the is high humidity persists condensation will continue to be produced.

There are two issues to be considered with respect to this incident:

1. Condensation: Condensation should be controlled under the chilled water control philosophy, however I have investigated this and this level of control strategy is missing.
2. Regenerated fibres\dust: This was not anticipated to require a routine PPM for the chilled beams to be cleaned as these are under positive pressure and therefore fibres\dust should not be entrained in to the chilled beam finned surfaces, normally regenerated fibres\dust would collect on the extract grilles. Manufactures recommendations are that "The interval between cleaning varies depending on the type of product, where the product is located and the nature of the operations conducted in the premises. Smoking, particle emitting materials, wall-to-wall carpeting and printers are typical factors that affect the interval between cleaning. Under normal operating conditions, schedule the cleaning to be carried out every fifth year.." Given that we are operating in a clinically clean environment, this would be classed as an improvement on normal and therefore the 5 year cleaning frequency was included in the PPM schedule.

I have raised these concerns over the infection risk arising from both these issues with Brookfield and requested that they review the design criteria, control strategy applied and investigate the unexpected entrainment of regenerated fibres\dust on the chilled beams. Once this has been reviewed I will update you on the outcome.

In the mean time, I will arrange for a systematic cleaning programme for all chilled beam to assess and record the condition in all locations and allow us to monitor the status at key locations at monthly intervals to establish a suitable cleaning PPM frequency.

Best regards

Ian

I. Powrie

Sector Estates Manager (South & Clyde)
Queen Elizabeth University Hospital Campus,
1345 Govan Rd,
Glasgow,
G51 4TF,
PA Elaine McNeil: [redacted]
Direct : [redacted]
Mob: [redacted]

From: Redfern, Jamie
Sent: 19 July 2016 19:18
To: Joannidis, Pamela
Cc: Kirkwood, Jean; Hutton, Melanie; Powrie, Ian; Brattey, David; Rodgers, Jennifer; Inkster, Teresa (NHSmail)
Subject: RE: Ward 2a cubicles 8-11

Thanks Pamela

Can I just confirm there are no actions to be taken for now in respect of this linked to picu or any other wards in hospital?

Jamie Redfern
General Manager, Hospital Paediatrics & Neonates

Patient safety starts and ends with the person we serve.

From: Joannidis, Pamela
Sent: 19 July 2016 19:11
To: Redfern, Jamie; Rodgers, Jennifer; Inkster, Teresa (NHSmail)
Cc: Kirkwood, Jean; Hutton, Melanie; Powrie, Ian; Brattey, David
Subject: Ward 2a cubicles 8-11

Hi
Just updating you on decisions made following incident:
Jean Kirkwood had reported to estates last night that discoloured water had dripped down from the ventilation onto the floor next to a patient's bed. Estates met with us (Jean, Melanie and I) in Ward 2a to review the issue. In Ward 2a, 4 single rooms (not BMT) are affected but not all to same degree.
Each non-BMT room in Ward 2a has a chill beam in the ceiling and in front of it a ventilation grille. Due to excessive heat, air condensed on the beam and dripped onto the grille, then on to the floor. Unfortunately the grilles have not been subject to PPM and some are thick with stour. This turned the water black as it dripped down.
Estates plan is :
Seal up room from inside. Remove grille, vacuum (HEPA filtered) and wash (Actichlor Plus). Clean chill beam (Actichlor Plus). Clean materials and remove seals. Deep clean.
Ward 2a are keen to get these rooms in to action asap. They need all 4 rooms cleaned over next two days. After that they need a PPM for all the grilles. Not all grilles seem to have the same level of stour / dust in RHC, but it will be worth doing a review of which rooms have them in which wards so that they can be part of the PPM.
I have agreed this with the acting Lead ICD, SCN and estates (David Brattey) and will write it up.
We need to work with Estates to undertake a further SCRIBE for routine PPM for grille cleaning in all affected rooms.
While in Ward 2a, Jean enquired about BMT room 24. Estates have described what needs to be undertaken with respect to fixing a torn piece of duct in the ceiling space in the lobby of this room. I will help estates to write up and agree the HAI SCRIBE for this work and share with Jean in the first instance.

kind regards

Pamela Joannidis
Nurse Consultant
Infection Prevention and Control

[redacted]

SBAR – Ward 6A environment
26/8/19, Microbiology dept QEUH

Situation	Ward 2A in Paediatric haemato-oncology was moved to Ward 6A QEUH in September 2018. This was initially planned to be a short term decant assessed via an options appraisal to enable water control measures to be implemented on 2A. During that time HPS commissioned a review of the ventilation strategy for ward 2A. An external report concluded that the ventilation strategy for 2A was abnormal, placing patients at risk of infection, therefore the decant had to be extended to enable extensive ventilation remedial actions. Given that there were no further cases that met the water incident case definition between September and April, a repeat options appraisal was not undertaken when it became apparent that the decant was to last much longer than at first anticipated. A PAG was held on 3rd June 2019 to discuss 4 cases of Gram negative bacteraemias. An IMT followed on 19th June due to a further environmental bacteraemia, this time a Mycobacterium species which was subsequently found to be related to the water supply utilising whole genome sequencing. The hypothesis for M chelonae acquisition was exposure to unfiltered water outside 6A, possibly operating theatres. The IMT process is still ongoing and to date there have been 11 confirmed and one possible case of Gram negative bacteraemias since 13th April.
Background	Surveillance of all bacteraemias was put in place when the ward was decanted to 6A. From September to April bacteraemia rates were very low and any Gram negatives were coliforms, i.e. expected species of bacteria and usually endogenous gut flora. From April 2019, bacteraemias secondary to environmental organisms have occurred, some of these meet the case definition from the previous incidents from 2A e.g.*Stenotrophomonas maltophilia*, *Enterobacter cloacae*. Others are from rare organisms not part of that incident but of a soil/water type of bacterial species. Examples include *Chryseomonas sp*, *Elizabethkingia miricola, Pantoea septica.*
Assessment	Current environmental risks on ward 6A 1. Air changes – essential for dilution and removal of pathogens generated within the room environment e.g.

	from toilet plume, respiratory generated infectious aerosols, and water generated aerosols from taps and drains containing pathogens as well as flora shed from skin such as *Staphylococcus aureus*. Current Air Changes per Hour is less than 3. SHTM guidance is 10 for neutropenic rooms i.e. less than a third of fresh air turnover required to meet standards 2.Chilled beam technology is in place in each bedroom at the point of supply Chilled beam technology should NOT be used in the neutropenic setting. Infection risks associated with chilled beams : 1. Build up of dust which typically harbours skin organisms, fungi and *Acinetobacter sp*. This is due to recirculation of air, with no clean to dirty pathway and with essentially the beam functioning as a filter that is not changeable which collects up dust and fibres from the room air. These are requiring 6 weekly cleaning schedule, however they are not designed to be thoroughly cleaned in situ and will require removal under HAISCRIBE conditions to achieve. 2. Water source from a) Condensation b) Leaks from the hot and cold circulating water (known contaminated cold water) c) Dripping water from both can become contaminated with the dust organisms The SHTM guidance states that condensation should not be allowed to occur when these systems are in place. However condensation events have been recorded on numerous occasions throughout the hospital including on 2A and 6A. This allows multiplication and growth of bacteria and fungi, particularly when dripping through collected dirt on the unit. Leaking connections have also occurred which allows water borne organisms from a complex water system to ingress into the room. This poses a risk of Legionella as well as Pseudomonas and other water borne organisms. Water has been seen to pool in the frame of the unit thus causing a significant potential for fungal overgrowth. This chilled beam water system has not been subject to the water quality management system through the water governance structures of the organisation. *Pseudomonas aeruginosa* and *P.oleovorans* and unidentified environmental organisms have been grown

	from the water supply, and from the surface swabs *Stenotrophomonas sp, Pantoea sp, Acinetobacter sp*, *Exophiala, Pseudomonas olevorans*, and fungal species. 3. Pressure cascade: recommended pressure of 10 pascals positive pressure to corridor in SHTM, currently there is a nominal 2 pascal positive pressure which is insufficient to ensure robust air movement out of the room, allowing external contaminants to ingress into the rooms from the building void and corridor. Furthermore air sampling studies have shown ingress form risers of heavily unfiltered contaminated air. 4. HEPA filtration: SHTM recommends HEPA filtration of all air supplied to the neutropenic rooms. Currently on 6A there is no HEPA filtration on the supply air. Portable HEPAs are in place in an effort to reduce airborne contamination, but this is not ensuring that HEPA filtered air only is breathed by patients. Contaminated air continues to enter the room and we are reliant on portable HEPA to clean the air 5. Air sampling in the bathrooms has detected pathogenic fungi such as Aspergillus and Mucoraceous mould. Previous issues with mould in the bathrooms was identified and rectified due to weak joins between the shower floor and the wall, however the risk remains as the weak join remains as per original spec – it is only a matter of time before the join is coming apart again. A long term solution to remove the join altogether has not been supplied to date. There is potential for HEPA filters to be placed in the bathroom ceilings, however again, this is a cleaning method for air rather than a HEPA supply. 6. Toilets – toilet plume is a risk as no toilet seat in place. These are currently being rolled out 7. Exposure to unfiltered water ; while all bathroom and bedroom outlets have had point of use filters applied , it has not been possible to place these in the DSR where water is sourced for domestic cleaning . 8. Ceiling: solid ceilings are required to both assist with positive pressure achievement and protection from ingress of water from services in ceiling; however ceilings are tiled and therefore inappropriate for this setting. 9. Play areas; there is no play area and communal toys are

	situated in the corridor, thus presenting a risk of cross transmission 10. Door entry – no double door or pressure cascade therefore external hospital air ingresses to the unit readily 11. Kitchen hand wash sink is a non compliant size and no POU filters. 12. Prep room – stainless steel sink, not useable due to tap misalignment and therefore clinical hand hygiene sink is being used for prep room functions
Recommendations	1. The decant from 2A was for a short term only and given ongoing environmental risks and recent environmental bacteraemias, a reassessment of the options appraisal is urgently acquired. 2. 6A should be considered to have significant unacceptable levels of infection risk for the immune compromised patients due to the built environment. 3. External peer review from colleagues in Great Ormond Street

In alphabetical order;

Dr Alison Balfour
Dr Teresa Inkster
Dr Kam Khalsa
Dr Nitish Khanna
Dr Christine Peters
Dr Kalyopi Valyraki
Dr Pauline Wright

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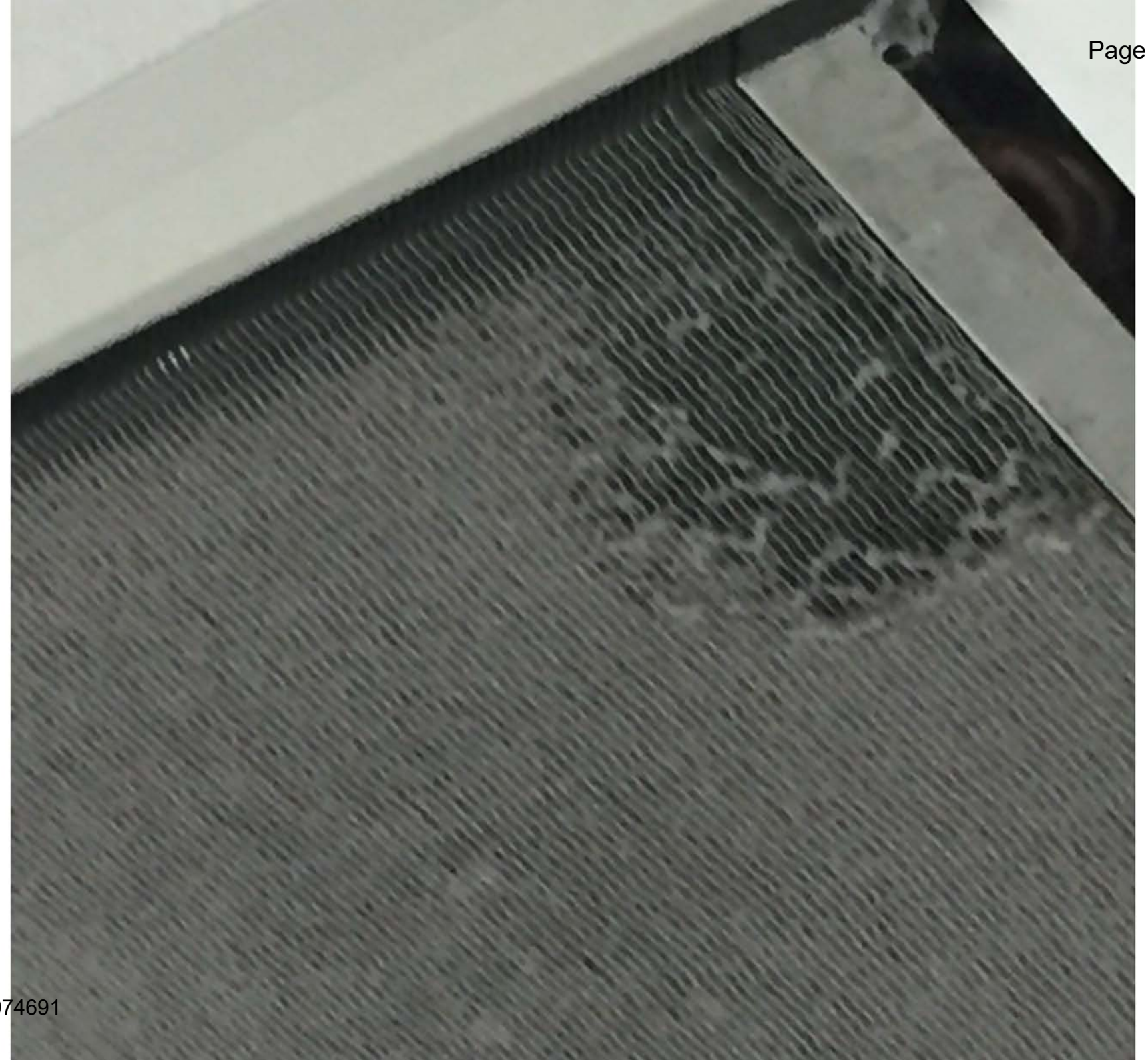

65a. REPORT on Environmental Sampling of taps and showerheads on 2A and 4B

Julie Rothney

From:	Peters, Christine
Sent:	22 March 2018 16:51
To:	Inkster, Teresa (NHSmail)
Cc:	Mallon, John; Reynolds, Fiona (NHSmail); Young, Janet; Higgins, Sandra
Subject:	REPORT on Environmental Sampling of taps and showerheads on 2A and 4B
Attachments:	REPORT on Environmental Sampling of taps and showerheads on 2A and 4B.docx

Hi All,
Please see my final report for IMT tomorrow,

KR,
Christine

REPORT on Environmental Sampling on 2A and 4B

Microbiology Department QEUH – Report author Dr C Peters

Sampling carried out by Dr Peters, Dr Valyraki and Dr Sowerby

Laboratory identification on VITEK and VITEK MS and API20 NE, carried out by BMS staff

Isolates sent to Colindale by BMS staff

Background

In response to two cases of *Cuproavadis pauculus* bacteraemias in children treated on 2A (Haem onc and BMT paediatric ward) a PAG agreed to the testing of water from two outlets on ward 2A - the treatment room and prep room. These were positive for *Cupriavadus pauculus* and the IPCT instigated a number of control measures. Taps and showers were removed and a sample sent to Microbiology for environmental sampling to look specifically for *Cupriavadus pauculus* on 02.03.18 and again on 14.03.18. Further samples from detergents, lotions and wipes were sent on 20.03.18. These were processed to detect Cupriavadis and Stenotrophomonas sp .

Taps and showers are subject to routine maintenance regimes and it is unclear when the last thermal disinfection or the age of the TMV cartilages [4] which may influence the microbiological testing of the fittings.

Laboratory Processing

Standard protocols do not exist for this situation and a pragmatic approach to sampling was taken in response to a rapidly evolving situation[1].

Method appended in Appendix A.

First samples

Taps and showers from 2A 02/03/18 were processed to look for and report on isolation of *Cupriavadus pauculus* .

Taps were dismantled and each component separately sampled. The TMV was only extracted from one tap – this required Estates personnel to get an Allan key and use a substantial amount of force to open. [4]

Visual inspection of the tap components showed discolouration and slime around the rubber seals of the flow directors and flow straightener, as well as green growth on the plastic components of the TMVs.(Photos Appendix 2)

Results

Gram negative oxidase positive colonies that had a good level ID on VITEK MS were reported, but not pursued further if not Cupriavadus . None ID'd as stenotrophomonas. A single isolate of fungus was reported as this is a BMT ward and may have been relevant – ID is awaited from Bristol ref laboratory. Cupriavadus isolates have been sent for typing to Colindale.

The samples from 02/03 identified widespread Cupriavadus in shower heads as well as taps, with a propensity of Cupriavadus to grow in pure form at the air - water interface, although not exclusively at every outlet. (Photos in appendix 3). Cupriavadus required 48 hours before adequate growth for further identification.

Location	Article	Site	Culture Result
2A room 26	Shower	head inner	Cupriavadis pauculus
2A room 6	shower	, tubing	no Cup
2A room 6	shower	head inner	NG
2A room 26	TAP	cold water filter/director	Cupriavadus pauculus
2A room 15	TAP	spout exit site	Cupriavadus pauculus
2A room 24	TAP	flow straightener	Cupriavadus pauculus
2A room 26	TAP	flow director (labeled filter)	Sphingimonas pauculus + GNBOX not cup
2A room 15	TAP	Hot filter/flow director	Cupriavadis pauculus + GNBOX
2A room 15	TAP	flow straightener	Cupriavadus pauculus pure growth
2A room 15	shower	head	Cupriavadus pauculus + Fungus
2A room 1 5	TAP	cold water filter/filter	GNBOX - not cupr
2A room 26	TAP	Hot filter/flow director	GNBOX - not cupr
2A room 26	TAP	Cold filter/director	GNBOX - not cupr
2A room 26	TAP	TMV	Shingimonas pauculus , no Cup

Second Samples

The second lot of 50 or so showers from 2A were received by the Microbiology lab on 14/03/18 – we sampled only two as discussed with IPCT . Showers and Tap parts (flow straightener and flow directors) came separately from 4B – the flow directors were separately bagged and not labelled as to whether hot or cold , and NO TMVs were sent. On visual inspection, some showers were soapy with detergent bubbles on them, flow straighteners were somewhat slimy around the rubber ring and the metal mesh in one of the taps had clear debri in it and a distinct sulphourous odour (photo appendix B) .

The samples from the second batch of outlets appears to have more biodiversity, with a number of environmental gram negative organisms represented. This may be skewed by the fact that ID was pursued in all isolates beyond VITEK MS, to VITEK GNI and and API20NE, but may also reflect disruption of bio film post treatment [2].

Results

Location	Article	Site	Culture Result
4B Room 94	Shower	Head inner	Cupriavadis pauculus
4B Room 94	Shower	Head outer	Cupriavadis pauculus
4B Room 94	Shower	tubing /hose inner	Cupriavadis pauculus
4B room 94	Tap	flow straightener	Sphingimonas Paucimobilis + Ochrobactrum anthropi
4B Room 94	Tap	flow director A	Sphingimonas Paucimobilis + Ochrobactrum anthropi

4B Room 94	TAP	flow director B	Sphingimonas Paucimobilis + Ochrobactrum anthropi Brevundimonas sp
4B Room 90	Shower	Head inner	Burkholderia sp + ? Comamonas
4B Room 90	Shower	head outer	Burkholderia sp + ? Comamonas
4B Room 90	Shower	tubing inner	Burkholderia sp + ? Comamonas
4B room 90	Shower	Rinse of head	Burkholderia sp + ? Comamonas
4B room 90	TAP	Flow straightener	Shingimonas paucimobilis
4B room 90	TAP	Flow Director A	Shingimonas paucimobilis + Cupriavadis paucimobilis
4B room 90	TAP	Flow Director B	Cupriavadis pauculus + Delfia acidovorans
4B room 88	shower	head inner	Delfia acidovorans + Shingimonas paucimobilis
4B room 88	shower	head outer	Delfia acidovorans + Shingimonas paucimobilis
4B room 88	shower	tubing	Delfia acidovorans + Shingimonas paucimobilis
4B room 88	TAP	flow straightener	shingimonas paucimobilis + Serratia fonticola
4B room 88	TAP	flow director A	shingimonas paucimobilis + Serratia fonticola
4B room 88	TAP	flow director B	shingimonas paucimobilis + Serratia fonticola
4B room 84	Shower	Head inner	Shingimonas paucimobilis + Bevundimonas sp
4B room 84	Shower	head outer	Shingimonas paucimobilis + Bevundimonas sp
4B room 84	Shower	tubing inner	Shingimonas paucimobilis + Bevundimonas sp
4B room 84	Shower	Rinse of head	Shingimonas paucimobilis + Bevundimonas sp
4B room 84	TAP	Flow straightener	Shingimonas paucimobilis + Bevundimonas sp
4B room 84	TAP	flow director A	Shingimonas paucimobilis + Delfia acidovorvans
4B room 84	TAP	flow director B	Shingimonas paucimobilis + Delfia acidovorvans
2A room 13	shower	head inner	cupriavadis pauculus + rhodotorula mucilaginosa candida Guillermondii
2A room 14	shower	head outer	cupriavadis pauculus + rhodotorula mucilaginosa candida Guillermondii
2A room 15	shower	tubing inner	cupriavadis pauculus + rhodotorula mucilaginosa candida Guillermondii
2A room 9	shower	head inner	Cupriavadis pauculus + bordetella bronchisepticum
2A room 9	shower	head outer	Cupriavadis pauculus + bordetella bronchisepticum
2A room 9	shower	tubing inner	Cupriavadis pauculus + bordetella bronchisepticum

Third Group of Samples

Environmental swabs and samples of wipes, lotions and cleaning agents taken on 20/03/18 were only plated to CLED with a mero disc. SABS were not requested.

Only one sample from Disposable wipe was positive : this grew a Pseudomonas species – as yet to be speciated.

Summary

A number of different gram negative species have been isolated from the tap and shower components in 4B and 2A including *Cupriavadus pauculus* which is a rarely reported organism in water and clinical cases . It appears to be very robust and growing almost purely in some flow

directors . Of note nothing grew from the copper component of the TMV. The plastic components showed more diversity and levels of growth – although this was not quantitatively sampled and based purely on observation of single swab . Stenotrophomonas was NOT isolated from any outlet. The maintenance schedule of the complex taps (Appendix D) and showers is essential for prevention of biofilm and long term colonisation of water outlets .

Clinical Significance

All the gram negatives isolated have been described in the literature as potential pathogens in severely immunocompromised patients, particularly neutropenia in the context of BMT and most have been linked to water borne out breaks [3].

Of particular note in RHC there have been clinical cases of

- three cases of bacteraemia with Cupriavadis since the opening of the RHC
- Rhodotorulla bacteraemia
- *Candida guillermondii* has caused colonisation on 2A and infections in NICU
- *Two Breundimonas Bacteraeias in 2A in 2017*
- *Delfia acidovorans bacteraemia in 2017 in 2A*

Burkholderia gladioli is of particular importance for CF patients as it can colonise CF lungs and contribute to respiratory impairment.

Bordatella bronchospetica is more commonly a dog /cat pathogen and has very rarely caused human infections.

Further Microbiology

- It is possible that with the use of a biocide Mycobacterial colonisation of taps may increase[2] and It may be worth testing for this in the new situation.
- As suggested by Peter Hoffman if a further tap could be supplied to the lab we can attempt a quasi quantitative method of culture.
- If required by the IMT we can dig out previous Brevimonas and Delfia sp from bacteraemia isolates and send for typing. This has not been done yet.
- Waste water testing as part of an MSc project in the old ICU at QEUH site in 2015 grew Cupriavadus isolates which may be worth comparing with current isolates

References

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2. Shift in the Microbial Ecology of a Hospital Hot Water System following the Introduction of an On-site Monochloramine Disinfection System Baron et al PLOS: 2014: 9:7 : 1-8

3. Healthcare Outbreaks Associated With a Waster Reservoir and Infection Prevention Strategies

CID: 2016:62 1423 - 1435

4. TAP maintainance instructions: http://www.horne.co.uk/Products/Optitherm/Installation-and-Maintenance/

Appendix A : METHODOLOGY TAPS AND SHOWER S

Cupriavadis investigation

Culture from Taps and shower heads,

- Change Gloves between handling items.
- Clean bench with Trigene between each component being handled.

1 Sterile rayon swab to be placed in fresh sterile H2O , then the area to be sampled by brushing over with swab, covering as extensive an area as possible to maximise sensitivity.

2. Swab to be plated directly on to CLED agar and SAB agar, plated out to single colonies.

SABs omitted from final environmental sampling 20/03/18 and mero disc applied to CLED to aid identification of stenotrophomonas

3. Plates incubated at 37degrees O2

4. Read at 24, 48 hours, and 5 days for fungus

5. Colonies for fungus sent to Mycology ref lab for ID

6 All colony types NLFs to be set up for ID on MALDI

7. Reports to be issued without UKAS accredited comment

Enrichment

1. Component parts small enough to be incubated in Robertson's media for 48 hours
2. If cloudy subbed onto CLED and SAB ONLY if no growth from direct culture

NOTE ALL samples grew organisms – therefore no RBM subbed

Sampled areas

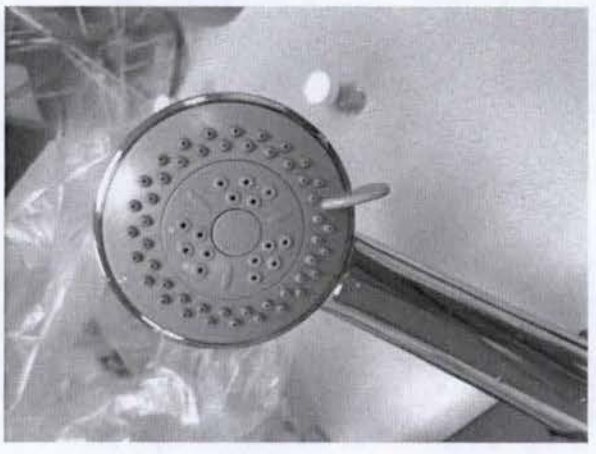
1. Shower
    - Inside shower head
    - Outside shower head
    - Inside tubing
    - Saline flush of head
2. Tap
    - Spout exit
    - Flow straightener/aerator
    - Flow directors
    - Rubber rings

- Filter/metal mesh
- TMV- plastic rings, copper rod, sieve

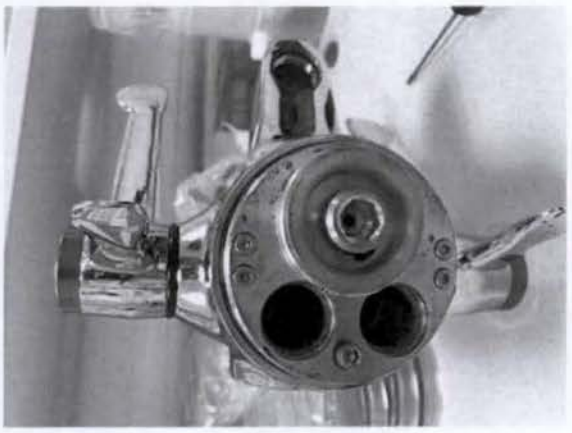
3. Environmental Swabs:
    - Air freshener
    - domestic trolley
    - Clinell wipes
    - disposable wipes
    - AHG
4. Samples of :
    - Achtichlor
    - magic dazzle
    - moisturiser
    - multi purpose cleaner
    - multi purpose cleaner for grease
    - Titan
    - soap

Appendix B Photos of Water Outlets samples

Shower head –



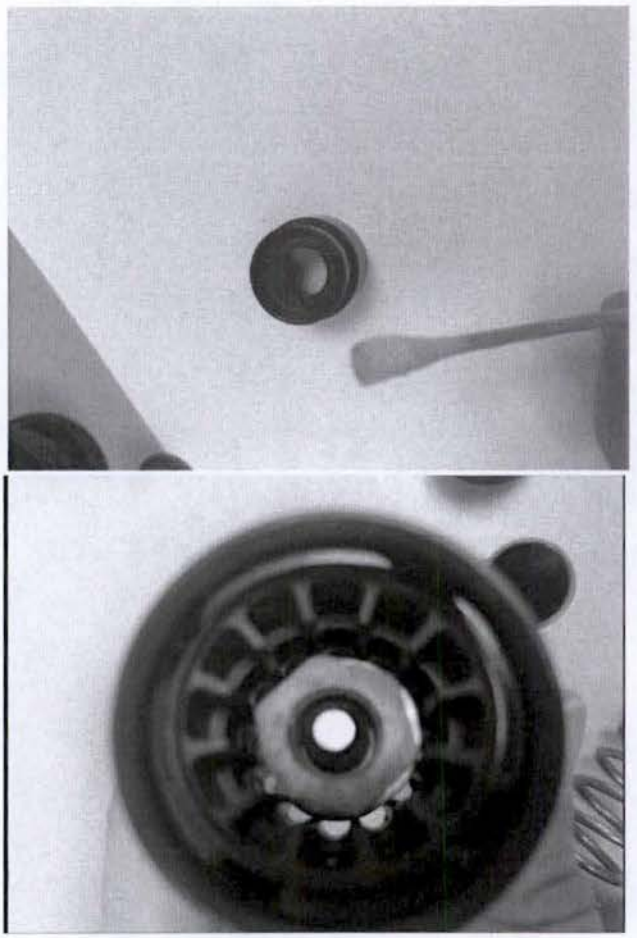
TAP : Optitherm Horne Tap Nice video on performance and maintanence at :
http://www.horne.co.uk/Products/Optitherm/



TAP Flow Directors

1.
2. **TAP TMV**

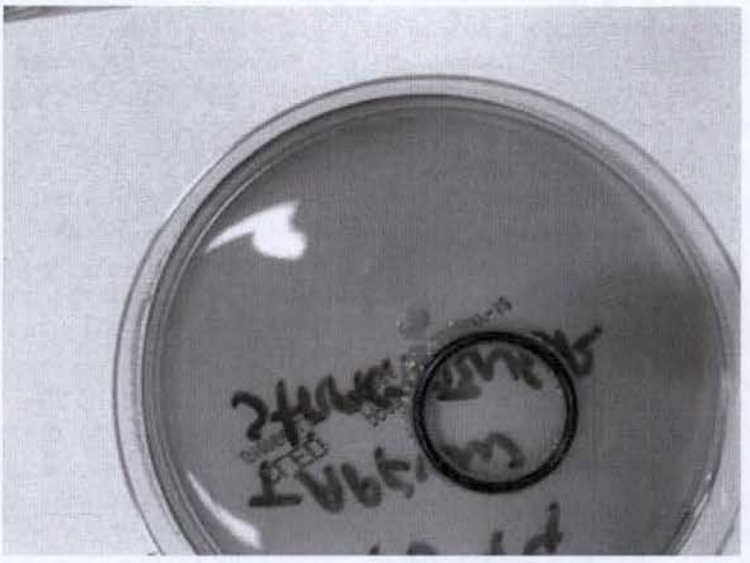
3.



4. **TAP metal mesh – note grit**

Appendix C Photos of cultures

Ring around flow straightener



Appendix D HORNE Optitherm MAINTENANCE advice

Maintenance of all TMVs and thermostatic taps is essential. If a TMV does not operate properly, there is a risk of someone being scalded. The frequency of maintenance depends upon the condition of the water passing through the TMV. The remarks in 4.1.3 regarding in-service testing apply equally to maintenance. Generally, the thermostatic cartridge should be replaced after three years. The strainer/check-valve cartridges and ceramic disc cartridges should be replaced as necessary.

4.1 IN-SERVICE TESTING

4.1.1 Periodic testing should be carried out to check whether or not any deterioration has occurred in the performance of the Horne OPTITHERM Thermostatic Bib Tap.

4.1.2 A COLD WATER FAILURE TEST should be carried out as described in paragraph 2.7 above. If the water coming from the tap is at a temperature of more than 3°C above the mixed water temperature setting then the Horne OPTITHERM Thermostatic Bib Tap is due for maintenance.

NOTE: A TMV in need of maintenance can be undetectable in normal use and only become apparent when a disruption occurs in the hot or cold water supply pressures or temperatures.

4.1.3 The frequency of in-service testing depends upon the condition of the water passing through the tap. In-service testing must be carried out more frequently in hard water areas than in soft water areas. As a general guide, in-service testing should be carried out at least every twelve months and, where the water is hard, the interval may be less than six months. Experience of local conditions and the in-service testing record will dictate the frequency of in-service testing.

4.2 FLUSHING AND THERMAL DISINFECTION

4.2.1 Horne recommends periodic thermal disinfection in conjunction with high velocity flushing, using the Water Quality Compliance Kit (part no.6006). See paragraphs 1.3 and 1.4. The periodicity of this maintenance should be determined in conjunction with the current best practice.

4.3 CLEANING AND REPLACEMENT OF STRAINERS

4.3.1 Close the isolating valves (13,14) at the back underneath the tap spigot; open the levers and allow the residual water to drain.

4.3.2 Unscrew the main bottom cover (16) using a strap wrench.

4.3.3 Remove the strainer/check-valve cartridges (20,21) using a 12mm hex key or Horne special tool (part no. 23-5459).

4.3.4 The strainer can be removed from the top of the cartridge and cleaned or replaced as necessary.

No; 1465

Epidemiology of Exophiala dermatitidis in a Glasgow hospital, potential hospital sources and control measures

Inkster T, [1] Peters C,[1] MacGregor G [2]

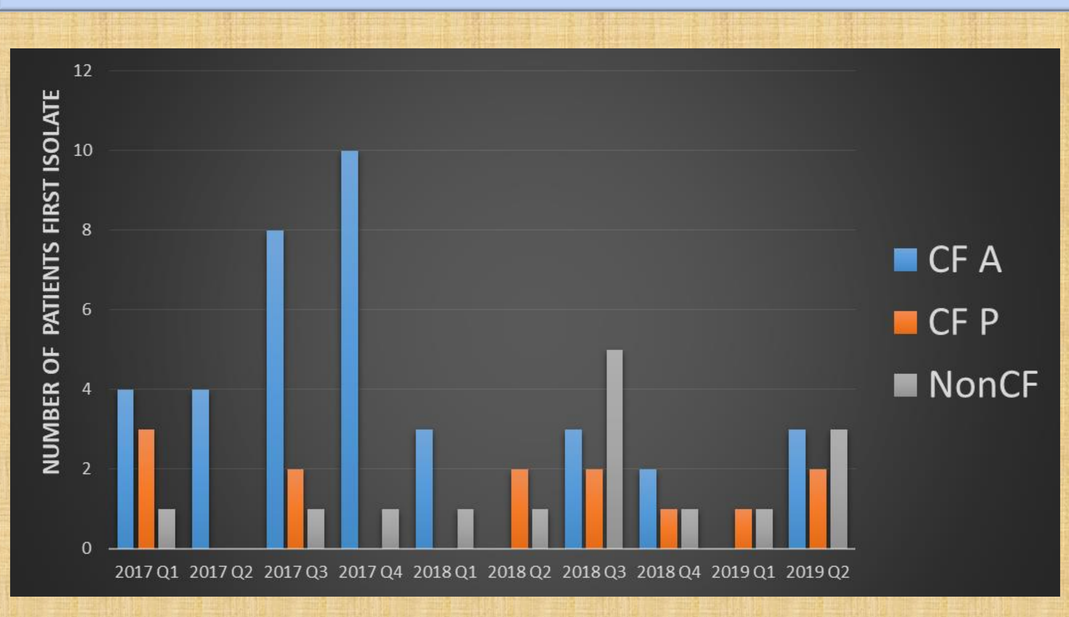
1.Department of Microbiology

2.Department of Respiratory Medicine

Queen Elizabeth University Hospital, Glasgow ,Scotland, UK

Introduction

Exophiala dermatitidis is a saprophytic black yeast commonly found in soil and plant debris and in moist indoor environments. [1,2] It has been associated with respiratory , soft tissue and bloodstream infection. Its prevalence in Cystic Fibrosis patients (CF) ranges from 1-19% worldwide. Whilst felt to colonise the respiratory tract in most CF patients, some have developed respiratory infection requiring treatment. [3,4] Whilst previous studies have found evidence of *E. dermatitidis* in domestic sources there is a paucity of literature on hospital acquisition , sources and relevant control measures. [1] We discuss the epidemiology of *E. dermatitidis* in our hospital, the investigations undertaken to investigate potential hospital sources and relevant control measures.



Cases in adult and paediatric CF patients and non-CF patients per quarter 2017-2019

CHILLED BEAM IN BEDROOM CEILING

Methods

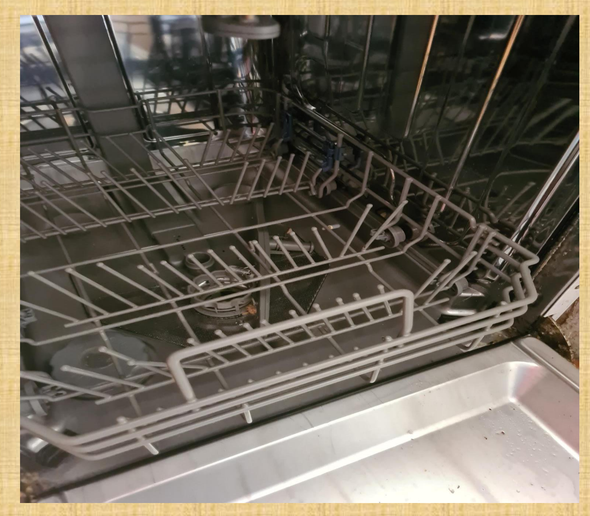
Data between January 2016 and June 2019 was extracted for all patient isolates of *E. dermatitidis* from all sample types. Deduplication of positive isolates was undertaken with the first isolate in each patient included in the analysis. Demographics collected included age, sex, underlying condition and hospital ward.

Environmental swabs of chilled beams, dishwashers, washing machines, linen and drains were undertaken using cotton swabs . These were plated on to a Sabouraud agar (SAB) plate and incubated at 37C for 5 days. *E dermatitidis* was identified using MALDI. Air sampling was undertaken using an Aquaria microflow air sample , sampling 500L of air over 2 minutes, mounted with a SAB plate.

Results

E. dermatitidis was isolated predominantly from patients with CF and more frequently from adults with the condition compared to children. Other patient groups with positive isolates included those with chronic lung conditions and haematological disorders. The majority of samples were respiratory although five patients had positive blood cultures during the study period. The number of affected patients reached a peak in quarters two and three of 2017 and fell following the identification of environmental sources and implementation of control measures. Positive results from environmental sampling were obtained from dishwashers, chilled beams and air sampling of ward environments.

DISHWASHERS ARE A KNOWN SOUCRE OF EXOPHIALA SPP.



DAMAGED SHOWER FLOOR

Conclusion

We found evidence of **hospital sources** of *E. dermatitidis*. The yeast was found in **dishwashers, chilled beams** and from air sampling. Another potential source was **damage to shower flooring** and the presence of visible black mould. We implemented the following control measures;

- **Dishwashers were removed from wards housing immunosuppressed patients**
- **An increase in cleaning frequency was introduced for chilled beams**
- **Damaged showers were repaired**

Previous studies have demonstrated the growth *of E dermatitidis* in dishwashers and other domestic sources. [5] In dishwashers the environment is such that detergent use leads to high PH and salt concentrations with temperatures as high as 60-80C in which E *dermatitidis* can thrive. It has been postulated that the transmission route from the dishwasher to an individual is via aerosol inhalation. Visible black mould was present in shower rooms and may account for the presence of *E dermatitidis* in air sampling in wards. One study described the isolation of *Exophiala mesophilia* from silicone seals in shower rooms of a hospital [6]

Infection control teams should be aware of the environmental conditions which might promote growth of *E dermatitidis* and how to mitigate the risks

REFERENCES

1. Kalsinc R, Riesenhuber M,Bacher A, Willinger B. Invasive fungal infection caused by Exophiala dermatitidis in a patient after lung transplantation : Case report and literature review. *Mycopathologia.* 2019;**184**:107-113

2. Delfino E,Del-Puente F, Briano F, Spepulcri C, Giacobbe DR. Respiratory fungal diseases in adult patients with Cystic Fibrosis. Clinical Medical Insights, *Respiratory and Pulmonday Medicine* 2019;**13**:1-6

3. Pihet M, Carrere J, Cimon B, Chabasse D, Delhaes L, Symoens F, Bouchara JP. Occurrence and relevance of filamentous fungi in respiratory secretions of patients with cystic fibrosis – a review. Medical mycology. 2009**;47**:387-397

4. Griffard EA, Guajardo JR, Copperstock MS, Scoville CL. Isolation of E dermatiiditis from pigmented sputum in a cystic fibrosis patient. Paediatric pulmonology. 2010;**45**:508-10

5. Zalar P, Novak M, de HOOG GS, Gunde-Cimerman N. Dishwashers – a man made ecological niche accommodating human opportunistic pathogens. Fungal Biol 2011;**115**:997-1007

6. Listemann H, Freiesleben H. Exophiala mesophila spce.nov Mycoses 2996;**39**:1-3

A48974691

Julie Rothney

From: Deshpande, Ashutosh
Sent: 08 November 2021 15:55
To: Peters, Christine; Coutts, Jonathan; Redfern, Jamie; MacDonald, David
Cc: Bagrade, Linda; Marek, Aleksandra
Subject: Re: NICU leak

Dear all,

Thanks Christine for the SBAR.

Clinical update from ward round.

Main clinical concerns are around the patient on whose cot I gather leaks had been dripping but may be wrong ([redacted] - the same patient with previous Burkholderia, Candidaemia and ? aspergillosis) - clinically less well over the weekend and latest fungal biomarkers have also come back raised although don't think all are scanned to Portal yet. We've got an interim plan for ongoing clinical monitoring and management. In terms of the other patients who were in the room I've suggested low threshold for consideration of fungi and environmental Gram negative bacteria as causative agents if any infective concerns and suggested repeating their screening swabs.

Best wishes,

Ash

From: Peters, Christine [redacted]
Sent: 07 November 2021 22:42
To: Coutts, Jonathan [redacted]; Redfern, Jamie [redacted]; MacDonald, David [redacted]
Cc: Bagrade, Linda [redacted]; Marek, Aleksandra [redacted]; Deshpande, Ashutosh [redacted]
Subject: NICU leak

Hi All
Further to conversations this evening and thanks to Johnathon, David and Gary

Situation

Report of water Leak through ceiling tiles above NICU cot, identified am 07/11/2021, call from David MacDonald lead for facilities to oncall ICD – Dr Christine Peter

Background

NICU room 4 is a 6 bedded bay , with 5 babies in incubators, tertiary referral centre for neonatal medicine.
Leak identified as drips coming through ceiling and reported to estates on Sunday
Unable to gain access to the roof to assess the roof and pipes.
Leak is immediately above incubator of a baby who has had a fungal infection and multiple co-morbidities

Assessment – d/w David MacDonald and Dr Johnathon Coutts

Unable to assess the cause/source of leak due to lack of access to roof and occupied NICU bay
Drips come slowly, but increasing frequency through the day.
Risks:
Physical – risk of increasing water leakage and damage to ceiling tile with potential for ceiling collapse (currently seems unlikely with rate of drip, but as source unknown and if heavy rain overnight this could be a consideration)
Infection

- Unfiltered domestic supply water OR roof rain water ingress to high risk of infection unit – splash risk to procedures and fomite contamination
- Damp materials encouraging fungal growth
- Collapse of ceiling (unlikely) would pose an immediate fungal exposure risk .
- Vulnerable babies required clinical assessment regarding risks and practicalities of moving out of bed bay, weighing up clinical needs and risks including unknown of above – Dr Coutts came in on site to carry this out
-

Recommendation

- Babies can be moved into 4 bedded bay after moving isolating baby into side room plus deep clean. This will leave room 4 empty
-
- HAISCRIBE discussed with Gary and visiscreen to be taped and sealed floor and ceiling to encompass leaking area and extract to result in negative pressure sealed off area. Doors to room kept closed.
- Urgent assessment to be carried out 7am to determine cause of leak and remedial works undertaken – to include inspection for any damp/water damaged materials and removal of same
- Any changes in situation to be re discussed on call
- PAG to be undertaken by IPCT on Monday

Please do not hesitate to contact me overnight if further complications arise.

Kr

Christine

Dr Christine Peters
Clinical Lead
Consultant Microbiologist
QEUH
[redacted]

Julie Rothney

From: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE) [redacted]
Sent: 30 December 2019 15:51
To: PETERS, Christine (NHS AYRSHIRE AND ARRAN); Shepherd L (Lesley); BAIN, Marion (NHS NATIONAL SERVICES SCOTLAND)
Subject: Re: Pseudomonas bacteraemias

Follow Up Flag: Follow up
Flag Status: Flagged

Hi,

Agree with all of that.

I remain confused as to why one is classed as community onset;

Patient 1 was admitted 18th Sept and positive on BAL on 21st and blood culture 23rd Sept. No prior colonisation. Clear HAI by definition. Typing clustering with an appendicectomy case, further evidence of a hospital strain

Patient 2 - inpatient since birth, blood culture and peritoneal fluid positive 7/11. HAI by definition

Also, I note on authorising lab results two possible environmental sources, the drains and water from a recent leak ? from sprinkler system. I'm not sure why these would not be sent for typing but that has been the instruction from IPCT.

Kr
Teresa

Dr Teresa Inkster
Consultant Microbiologist, QEUH
National Training Programme Director Medical Microbiology Dept of Microbiology Queen Elizabeth University Hospital Glasgow Direct dial : [redacted]

From: PETERS, Christine (NHS AYRSHIRE AND ARRAN)
Sent: 30 December 2019 12:41
To: Lesley.Shepherd[redacted]; BAIN, Marion (NHS NATIONAL SERVICES SCOTLAND)
Cc: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE)
Subject: Pseudomonas bacteraemias

Hi Lesley

I had a quick look at pseudomonas bacteraemia cases last week. The data I have from Telepath has been gathered by new IT staff so I am not 100% confident in it but Kathleen Harvey wood said it didn't sound far out, and she keeps her finger very much on the pulse.

I did a gather on pseudomonas from all sites and sample types since July 2015 - September 2019 from laboratory LIMs system. This excludes the recent 3 cases which were all deaths.

Interestingly since the childrens hospital opened there have been only 9 patients with Pseudomonas aeurginosa bacteraemias ie rare.

1 was the NICU death in 2015
3 were part of 2A/ 6A water incidents
5 were PICU cases

All have been HAIs to date as far as I can briefly deduct. With only one death with sepsis as noted in NICU.

My conclusions - if this data is verified, :

1, PA bacteraemia is NOT common in any patient group 2. Death from PA bacteraemia has been rare till september 2019 in-fact one death in 4.5 years in a neonate which triggered a red HIATT and SG intervention in the serratia outbreak.
3. All have been HAI till September 2019

Of note 2 of the 5 in PICU were also isolated from BAL , and 3 were post cardiac patients.
Therefore the three deaths with PA bacteraemia recorded since then would represent the first 2 PA bacteraemias classified as non HAI, and include the first deaths with Pseudomonas aeruginosa since 2015. This clustering also represents an increase in frequency and occurs at a time of other environmental gram negative cases very similar to the patterns previously experienced in NICU, PICU and haem onc.

I would interested if HPS have looked atthe PA epidemiology in RHC and come up with similar numbers.

Again just to reiterate this is a very quick and inbetween calls kind of look at the data.
kr

Christine

GLASGOW MICROBIOLOGY SERVICES NHS GREATER GLASGOW & CLYDE SOUTH SECTOR MICROBIOLOGY
Enquiries 0141 354 9132

Patient / Specimen details
SCREEN ENV RHC 1D

D.O.B. [redacted]
Sex [redacted]

Cons/GP Dr Christine Peters
Loc. Microbiology QEUH
Coll'd 10.12.2019 16:30
Rec'd 10.12.2019 16:50
Senders ref. No.

CHI/Hosp. No. [redacted]

Routine Culture Order No.
Environmental sample (not swab) Water from leaking ceiling at reception

Copy to:
Microbiology QEUH

---

* FINAL REPORT *

CULTURE RESULT:

	GROWTH:
a) Delftia acidovorans	Isolated
b) Stenotrophomonas maltophilia	Isolated
c) Pseudomonas fluorescens	Isolated
d) Sphingomonas paucimobilis	Isolated
e) Pseudomonas aeruginosa	Isolated
f) Pseudomonas stutzeri	Isolated

also isolated
Chryseobacterium indologeness
P itida
Ps. putida failed to grow on subculture
Stenotrophomonas maltophilia
4 colony variants isolated

Authorised by Kalliopi Valyraki MIC
Date/Time authorised 07.01.2020 14:49

Lab No. M,19.5371763.F

A48974691

SCOTTISH HOSPITALS INQUIRY

RESPONSE ON BEHALF OF DR TERESA INKSTER

TO PROVISIONAL POSITION PAPER 11

POTENTIALLY DEFICIENT FEATURES OF THE WATER SYSTEM OF THE QEUH/RHC

I. INTRODUCTION

1. This response to Provisional Position Paper 11, Potentially Deficient Features of the Water System of the QEUH/RHC ("Water PPP") is submitted on behalf of Dr Teresa Inkster in accordance with the procedure set out at paragraphs 1.9 to 1.12 of the PPP. References herein to chapter and paragraph numbers and to defined terms are to such numbers and terms used in the Water PPP unless otherwise stated.

II. CHAPTER 16: HAND WASH BASINS, TAPS, POINT OF USE FILTERS

Hand wash basins

2. **Para. 16.3:** There is an inaccuracy in the account of events provided by NHS Greater Glasgow and Clyde ("NHSGGC") in the extract taken from the "Summary of Incident and Findings of the NHS Greater Glasgow and Clyde: Queen Elizabeth University Hospital/Royal Hospital for Children water contamination incident and recommendations for NHS Scotland".[1] NHSGGC did not respond to a patient case in February 2016 but rather responded to abnormal water results. More specifically, monthly water testing identified out of specification Total Viable Count ("TVC") results from two sinks in the aseptic pharmacy. The patient case was detected later, after the contamination was identified during a look back exercise undertaken by Infection Control. This inaccuracy is carried forward to each of the various enquiries despite the chain of events being previously highlighted as incorrect. In support of this correction, reference is made to the attached poster titled "*Cupriavidus pauculus* bacteraemia related to contamination of an Aseptic pharmacy water supply", which was submitted to the FIS conference (*see* Appendix 1).

[1] Referred to at Water PPP, fn. 221.

3. **Para. 16.4:** Again, there is an inaccuracy in the description of events. It is accepted that it is good practice to identify and remove little used outlets. However, the wash hand basin referred to in this paragraph was also removed because it was felt to be a factor in the abnormal TVC results. It is anticipated that NHSGGC will be able to provide the relevant water test results for this period to support this correction.

Flow straighteners

4. **Paras. 16.14-16.18:** There is no mention in this section of the analysis of flow straighteners conducted by Intertek in July 2018 and September 2019 regarding the build-up of biofilm on these components. The resulting report dated 11 July 2018 was part of the evidence bundles for the June 2023 hearings[2] and the report dated 4 October 2019 is provided with this response (*see* Appendix 2). It is submitted that this work and reports provide important information for the Inquiry to consider as part of the evidence relating to the QEUH/RHC water system.

III. CHAPTER 18: SHOWERS, FLEXIBLE HOSES, PARTICULARITIES OF SINGLE-OCCUPANCY ROOMS

Mould in shower areas

5. **Paras. 18.31-18.36:** The description of the potentially deficient feature is not accurate because the issue with mould in bathrooms extended beyond Ward 6A.

6. In January/February 2019, the presence of visible black mould in showers was a significant issue on the Level 7, Respiratory Ward at the QEUH and may have contributed to cases of Exophiala in Cystic Fibrosis ("CF") patients. In relation to control measures to address the problem, Dr Inkster attended a meeting with Anne Harkness, CF clinicians and estates colleagues to agree a planned programme of replacement of the damaged showers. In support of this correction, reference is made to the attached poster titled "Epidemiology of Exophiala dermatitidis in a Glasgow hospital, potential hospital sources and control measures" which was

[2] Bundle of documents for the oral hearing commencing on 12 June 2023, Bundle 6 – Miscellaneous Documents, p. 632.

presented at the International Consortium for Prevention and Infection Control in 2021 (*see* Appendix 3).

7. In June 2019, significant mould was also found behind bathroom panels in the vacated Ward 2A at the QEUH. The exact reason for the presence of the mould is unknown. However, it was postulated at the time that the mould arose because of the auto flushing that was in place due to the ward being empty which was more than normal ward occupation flushing. However, this hypothesis was put forward before it was known that non-water repellent gyprock had been used during the build instead of the required water repellent jet gyprock. In support of this correction, reference is made to the attached photographs of the findings in Ward 2A (*see* Appendix 4).

IV. CHAPTER 24: WASTE SYSTEM

8. **Para. 24.19:** The description of the waste system as a potentially deficient feature should be extended to include the design and installation of the drains. As evidenced in the attached poster titled "An investigation down the drain" (which was presented at the International Consortium for Prevention and Infection Control in 2021 (*see* Appendix 5)), there were significant issues with the design and build of the drainage system at the QEUH/RHC that presented a risk to patients and facilitated reflux of drain contents back up into sinks. These issues included: a lip at the connection with the sink which facilitated pooling and stagnation of water; the presence of excess sealant causing partial obstruction and the presence of material prone to corrosion. The issues with the drains were identified as a result of two Problem Assessment Groups (or "PAGs") which were held in May 2018 to discuss an increase in cases of Stenotrophomonas and Enterobacter infections on Ward 2A.

V. OMISSIONS

Air conditioning units on Wards 4B and 6A

9. Air conditioning units represent an HAI risk and, depending on design and whether there is a water source, may need to be risk assessed as per the Legionella approved code of practice (L8).

10. Air conditioning units were present on Ward 6A at the nurses' stations. It is believed they were also present on Ward 4B. It is understood that these units were neither maintained nor risk assessed in accordance with L8. Dr Inkster no longer has access to her QEUH/RHC emails and so is unable to provide the relevant supporting documentation. However, it is submitted that these features should be considered as potentially deficient features for the purposes of Glasgow III and NHSGGC asked to provide the necessary documents, including any maintenance records.

VI. CONCLUSION

11. Dr Inkster will be happy to provide further input, information and/or clarification as required.

Helen Watts KC and Leigh Lawrie, Advocate

On behalf of Dr Teresa Inkster

11 April 2024

Appendices:

1. Poster titled "*Cupriavidus pauculus* bacteraemia related to contamination of an Aseptic pharmacy water supply"
2. Intertek Report dated 4 October 2019 prepared by D. Holloway BSc (Hons) MRSPH
3. Poster titled "Epidemiology of Exophiala dermatitidis in a Glasgow hospital, potential hospital sources and control measures"
4. Photographs of the findings in Ward 2A
5. Poster titled "An investigation down the drain"

Cupriavidius pauculus bacteraemia related to contamination of an Aseptic pharmacy water supply.

Teresa Inkster [1], Pamela Joannidis [1]

[1] Department of Infection control , NHS Greater Glasgow and Clyde

Background

Cupriavidis pauculus is a **Gram negative** non fermentative organism which is ubiquitous in the environment. Rarely it has been reported to cause infection in humans namely **bacteremias and meningitis**. Previous case reports have described infections associated with Extracorporeal Membrane Oxygenation (ECMO) with the **source being water** in the thermoregulator reservoir. [1] **Pseudo-outbreaks** due to **contaminated water** have also been described . [2]

Aims/Objectives

We describe persistent colonisation of the water supply of an aseptic pharmacy unit with *C. Pauculus* over a period of several months . A patient look back exercise during the period of contamination identified one patient with bacteraemia who was **receiving total parenteral nutrition** supplied by the unit.

Methods

Monthly water testing of two sinks in the aseptic unit revealed persistent colonisation with *C. pauculus*. Infection control investigations revealed evidence of **little used outlets** and some **practice issues** with the sinks in question. Decanting of TPN and contaminated water down the sinks due to lack of a decontamination sink occurred.

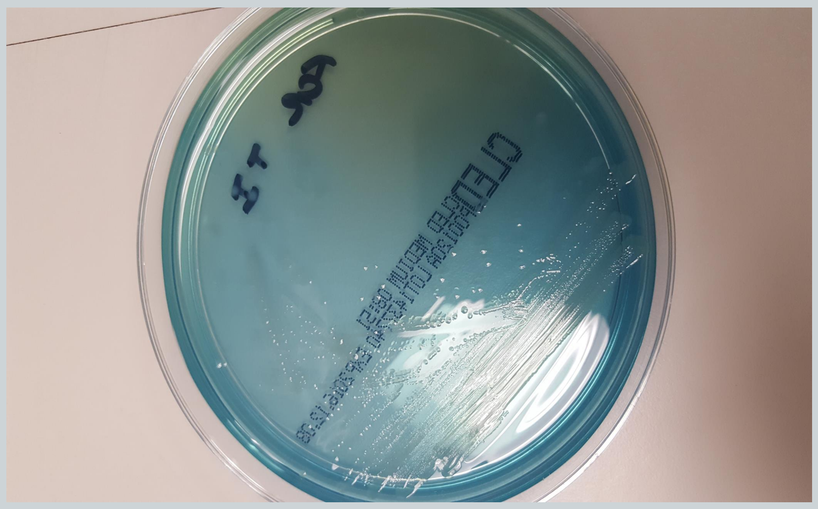
Results and control measures

Typing of the blood culture and water isolates revealed the same strain of *C. pauculus* . One of the **hand hygiene sinks** was identified as a **little used outlet** and removed. Elsewhere taps were cleaned and descaled. Dosing of the water supply was undertaken with **silver hydrogen peroxide** (Sanosil). **Education on practice** within the unit was delivered. The patient responded to treatment with intravenous meropenem. .

Following these measures *C. Pauculus* was eradicated .

Microbiology

C. pauculus is a Gram negative , aerobic, non spore forming organism. It is non-fermentative and is catalase and oxidase positive. Appearances can be similar to Pseudomonas sp.



Conclusion

C pauculus is a **Gram negative** environmental organism which can **contaminate hospital water outlets** and lead to infections in patients or pseudo-outbreaks**.** Investigations should include identification of little used outlets and a review of practice, hand hygiene sinks should be used solely for this purpose. Control measures included cleaning and descaling of taps and dosing the water supply with silver hydrogen peroxide . With these measures we have successfully eradicated the organism from the aseptic pharmacy unit.

References

1.Uzodi et al. *C. pauculus* bacteremia in a child on ECMO. ASAIO J 2014;60:740-1

2.Balada-Llasat JM et al. Pseudo-outbreak of *C.pauculus* infection at an outpatient clinic related to rinsing culturette swabs in tap water. J Clin Micro 2010;48:2645-7

Client Details

Glasgow Royal Infirmary

Report By

D. Holloway BSc (Hons) MRSPH
Water Microbiology Manager
Intertek
The Old Mill
Oxford Road
Stoke On Trent
England
ST6 6QP
[redacted]

Date Work Commenced

27/09/2019

Date Of Report

04/10/2019

Signed By:

D. Holloway

D. Holloway BSc (Hons) MRSPH

Background

Queen Elisabeth Hospital Glasgow sent 31 flow straighteners to the laboratory. The laboratory was asked to perform the same testing as done for the flow straighteners tested in report ITSS-0718-001W (contamination investigation of flow straighteners) and assess the bacterial load against those original samples.

Analysis method

An initial visual inspection of each flow straightener was performed looking for presence of soiling and potential contamination of the flow straightener. A rating was given to each flow straightener to reflect the level of soiling

Soiling assessment:
No= nNo visible soiling all holes appear clear with no ingress.
Light= Some visible soiling, no detachment during washing, >70% of holes appear clear with no ingress.
Moderate= Visible soiling, some detachment during washing, no more than 50% of holes showing indication of ingress.
Heavy= Heavy visible soiling, large fragments detached during washing, all holes show significant ingress or blockage.

Microbiological Analysis

A modified Bio-Burden test was used to analyse the flow straighteners.

a. 200ml of sterilised deionised water (SDW) was added to the bag containing the flow straightener and the bag was agitated for 30 seconds. The 200ml of liquid was then classed as the sample.

b. 1ml of the sample is used to create a serial dilution. Neat and 1:10 dilution was tested for total viable count (TVC)

c. 100ml of sample was filtered and the filter transferred to a TVC plate

d. The remainder of sample was filtered and transferred to a Pseudomonas aeruginosa specific plate

e. All plates were incubated at 35oC for 48 hours to stimulate bacterial growth.

f. After the incubation period all visible colonies were counted and recorded (any unusual growth types on the *P. aeruginosa* plates was recorded as non-typical (NT#)

Biofilm assessment

For the assessment of bioburden, a specialist product (Biofinder™) was used

Biofinder™ is a transparent yellow liquid which is sprayed onto a surface. When coming into contact with the biofilm protein structure produces a catalase reaction.

Assessment of the levels of biofilm was made based on the strength and speed of the reaction

Biofilm assessed on a score 0-5. 0= No reaction. No biofilm presence 5= Strong instant reaction large biofilm presence/ mature biofilm

Fully dismantled flow straightener.

intertek
Total Quality. Assured.

sample number	location	asset number	inset date	removal date	200ml SDW added	tvc 1ml	tvc1ml -1	tvc100ml	Pseud 100ml	Estimate total count per Item (cfu/straightener	soiling visual		biofilm
1	ARU4 Bed 61	AAW-270	19/07/2019	19/07/2019	yes	0		48	0	96	No		1
2	3A Bed 23	GW3-028	19/08/2019	26/09/2019	yes	450		<1000	0	90000	No		0
3	6B Bed 96	GENW-035	05/08/2019	26/09/2019	yes	10		210	0	420	No		0
4	10B Clean Utility	GENW20-081	29/07/2019	26/09/2019	yes	47		750	0	1500	No		0
5	Kids A&E Resus SS sink	EMC-018	29/08/2019	26/09/2019	yes	8		600	0	1200	No		0
6	3B Bed Bay 11-14 sink RHS	GW2-037	13/08/2019	26/09/2019	yes	6		400	0	800	No		0
7	11B Bedd 50	GENW-014	21/08/2019	26/09/2019	yes	38		500	0	1000	No		0
8	1E Bed Bay 1-4 Sink LHS	CAR-050	13/06/2019	26/09/2019	yes	310		<1000	0	62000	No		0

9	Kids X-ray Dirty Utility	RGG-087	24/07/2019	26/09/2019	yes	0		55	0	110	No		0
10	IAU Bed Bay 4	AAW-183	22/07/2010	26/09/2019	yes	0		106	0	212	No		0
11	ARU3 Bed 118	AAW-142	22/07/2019	26/09/2019	yes	12		200	0	400	No		0
12	1C MDU Kids Interview Room	MDU-026	13/06/2019	26/09/2019	yes	5		75	0	150	No		1
13	8D Bed 49	GENW10-017	30/08/2019	26/09/2019	yes	0		23	0	46	No		0
14	8A Bed 7	GENW9-014	01/08/2019	26/09/2019	yes	0		11	0	22	No		0
15	Clinic 5 Con Room 29	OPD-114	28/08/2019	26/09/2019	yes	2		105	0	210	No		0
16	5B Dirty Utility WHB	GENWD-079	14/08/2019	26/09/2019	yes	0		12	0	24	No		0
17	5D Bed 41	GENW1-035	15/08/2019	26/09/2019	yes	0		31	0	62	No		0
18	8B Bed 99	GENW12-031	05/08/2019	26/09/2019	yes	210		35	0	70	No		0

19	9B Bed 85	GENW16-065	31/07/2019	26/09/2019	yes	0		50	0	100	No		0
20	Clinic 1 Treatment Room A	OPD-031	27/08/2019	26/09/2019	yes	17		244	0	488	No		0
21	9A Bed 26	GEN13-060	31/07/2019	26/09/2019	yes	44		500	0	1000	No		0
22	9C Clean Utilty	GENW15-081	01/08/2019	26/09/2019	yes	0		61	0	122	No		0
23	11A Bed 14	GENW21-031	25/07/2019	26/09/2019	yes	0		11	0	22	No		0
24	6C Bed 68	GENW3-028	06/08/2019	26/09/2019	yes	0		5	0	10	No		0
25	ARU1 Clean Utility	AAW-319	18/07/2019	26/09/2019	yes	0		67	0	134	No		0
26	11B Bed 99	GENW23-031	26/07/2019	26/09/2019	yes	0		36	0	72	No		0
27	5A Bed 18	GENWA-040	14/07/2019	26/09/2019	yes	0		102	0	204	No		0
28	10C Bed 76	GENW19-044	30/07/2019	26/09/2019	yes	23		300	0	600	No		0

29	5C Beed 73	GENWC-038	15/08/2019	26/09/2019	yes	0		11	0	22	No		0
30	6D Bed 39	GENW2-038	12/08/2019	26/09/2019	yes	450		<1000	0	90000	No		0
31	10D Bed 55	GENW18-004	30/07/2019	26/09/2019	yes	0		7	0	14	No		0

Average count CFU/flow straightener 325cfu/straightener (3 of the results have been omitted when calculating the average. These three results were considered statistically significantly different and classed as outliers).

With the 3 omitted results included the average CFU/ flow straightener is 8100.

The results of the testing were compared to the results obtained from previous testing of flow straighteners.

To get a meaningful comparison that would allow a comparison assessment to be made the results were compared to the previous results for

- Unused flow straighteners
- Flow straighteners on the system for 1 week
- Flow straighteners on the system for 1 month.

Original testing results

UNUSED				1 WEEK				1 MONTH			
Estimate total count per Item (cfu/straighteners	soiling visual		biofilm	Estimate total count per Item (cfu/straighteners	soiling visual		biofilm	Estimate total count per Item (cfu/straighteners	soiling visual		biofilm
500	0		0	5000	NO		0	7000000	Non		1
400	0		0	>30000	NO		0	4400000	Non		3
720	0		0	5000	NO		0	>20000000	Non		1
1400	0		0	5000	NO		0	>20000000	Non		0
80	0		0	0	NO		0	>20000000	Non		0
14	0		0	4000	NO		0	9400000	Non		4
24	0		0	450	NO		0	4200000	Non		5
108	0		0	110	NO		0	>20000000	Non		0
20	0		0	4000	NO		0	>20000000	Non		0
average count per straightener											
363				2651				6800000			

Conclusion

No Biofilm was detected during this analysis

No visual soiling was detected during this analysis

Comparing the results from this testing against previous samples tested has shown a significant improvement against all three of the perimeters tested.

the results for this testing had an average cfu/flow straightener result of 325. This is in line with the results obtained from the original testing of unused flow straighteners.
This shows a significant improvement in the bacterial load and attachment in the period of use.

With this information it can be assumed that the additional work performed on the water system have made significant improvements on the condition of the flow straighteners attached to the water system. Pervious testing suggested that the flow straighteners were becoming heavily contaminated within 1 month of use. The result of this analysis suggest that this is no longer the case and the impact is greatly reduced with the flow straighteners being in a condition closer to that of unused with only a minimal bacterial load over 2 to 3 months of use.

No; 1465

Epidemiology of Exophiala dermatitidis in a Glasgow hospital, potential hospital sources and control measures

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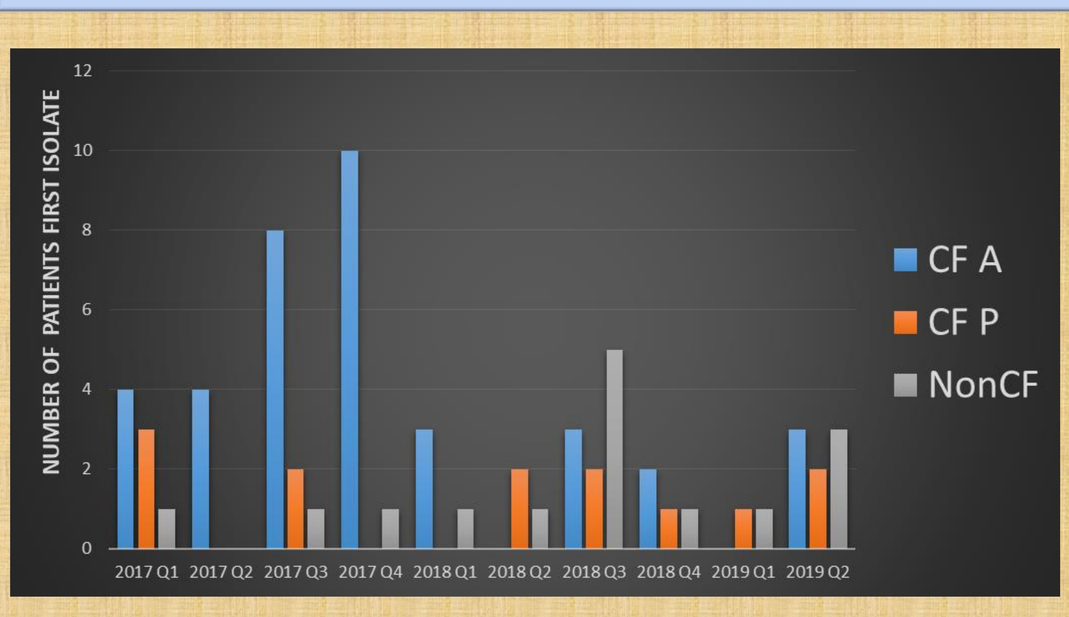
Introduction

Exophiala dermatitidis is a saprophytic black yeast commonly found in soil and plant debris and in moist indoor environments. [1,2] It has been associated with respiratory , soft tissue and bloodstream infection. Its prevalence in Cystic Fibrosis patients (CF) ranges from 1-19% worldwide. Whilst felt to colonise the respiratory tract in most CF patients, some have developed respiratory infection requiring treatment. [3,4] Whilst previous studies have found evidence of *E. dermatitidis* in domestic sources there is a paucity of literature on hospital acquisition , sources and relevant control measures. [1] We discuss the epidemiology of *E. dermatitidis* in our hospital, the investigations undertaken to investigate potential hospital sources and relevant control measures.



Cases in adult and paediatric CF patients and non-CF patients per quarter 2017-2019

CHILLED BEAM IN BEDROOM CEILING

Methods

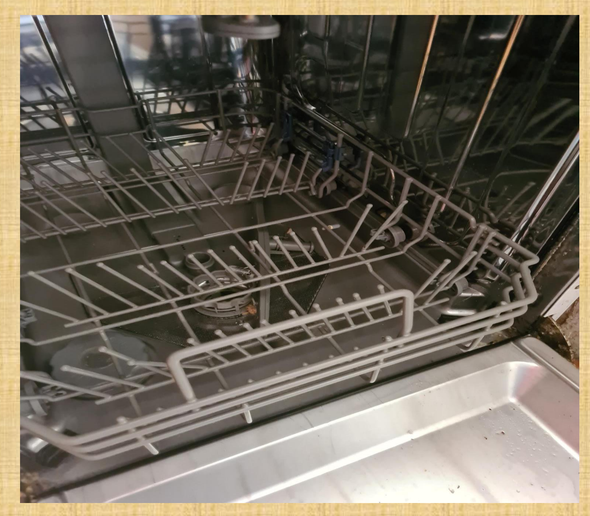
Data between January 2016 and June 2019 was extracted for all patient isolates of *E. dermatitidis* from all sample types. Deduplication of positive isolates was undertaken with the first isolate in each patient included in the analysis. Demographics collected included age, sex, underlying condition and hospital ward.

Environmental swabs of chilled beams, dishwashers, washing machines, linen and drains were undertaken using cotton swabs . These were plated on to a Sabouraud agar (SAB) plate and incubated at 37C for 5 days. *E dermatitidis* was identified using MALDI. Air sampling was undertaken using an Aquaria microflow air sample , sampling 500L of air over 2 minutes, mounted with a SAB plate.

Results

E. dermatitidis was isolated predominantly from patients with CF and more frequently from adults with the condition compared to children. Other patient groups with positive isolates included those with chronic lung conditions and haematological disorders. The majority of samples were respiratory although five patients had positive blood cultures during the study period. The number of affected patients reached a peak in quarters two and three of 2017 and fell following the identification of environmental sources and implementation of control measures. Positive results from environmental sampling were obtained from dishwashers, chilled beams and air sampling of ward environments.

DISHWASHERS ARE A KNOWN SOUCRE OF EXOPHIALA SPP.



DAMAGED SHOWER FLOOR

Conclusion

We found evidence of **hospital sources** of *E. dermatitidis*. The yeast was found in **dishwashers, chilled beams** and from air sampling. Another potential source was **damage to shower flooring** and the presence of visible black mould. We implemented the following control measures;

- **Dishwashers were removed from wards housing immunosuppressed patients**
- **An increase in cleaning frequency was introduced for chilled beams**
- **Damaged showers were repaired**

Previous studies have demonstrated the growth *of E dermatitidis* in dishwashers and other domestic sources. [5] In dishwashers the environment is such that detergent use leads to high PH and salt concentrations with temperatures as high as 60-80C in which E *dermatitidis* can thrive. It has been postulated that the transmission route from the dishwasher to an individual is via aerosol inhalation. Visible black mould was present in shower rooms and may account for the presence of *E dermatitidis* in air sampling in wards. One study described the isolation of *Exophiala mesophilia* from silicone seals in shower rooms of a hospital [6]

Infection control teams should be aware of the environmental conditions which might promote growth of *E dermatitidis* and how to mitigate the risks

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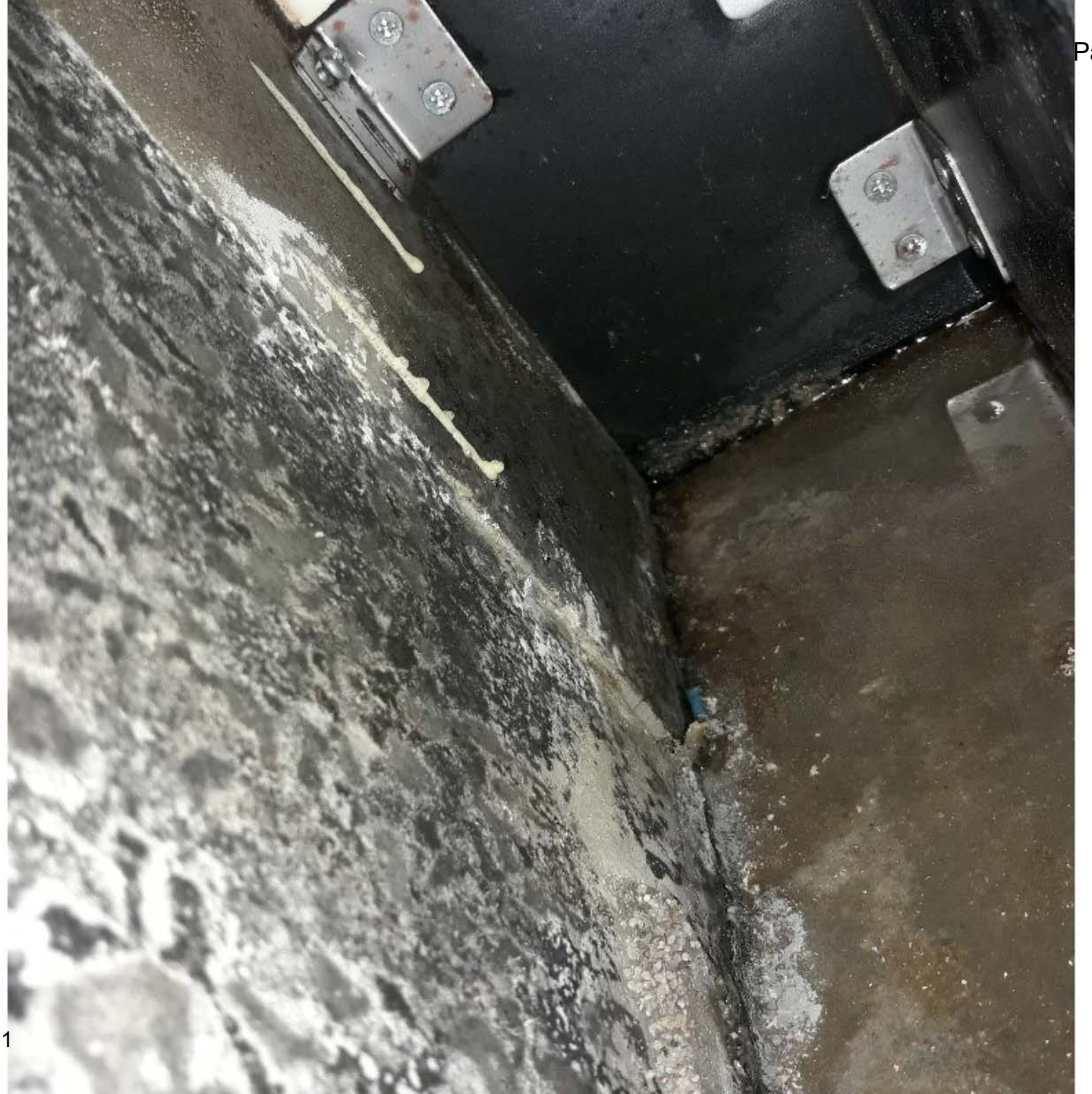


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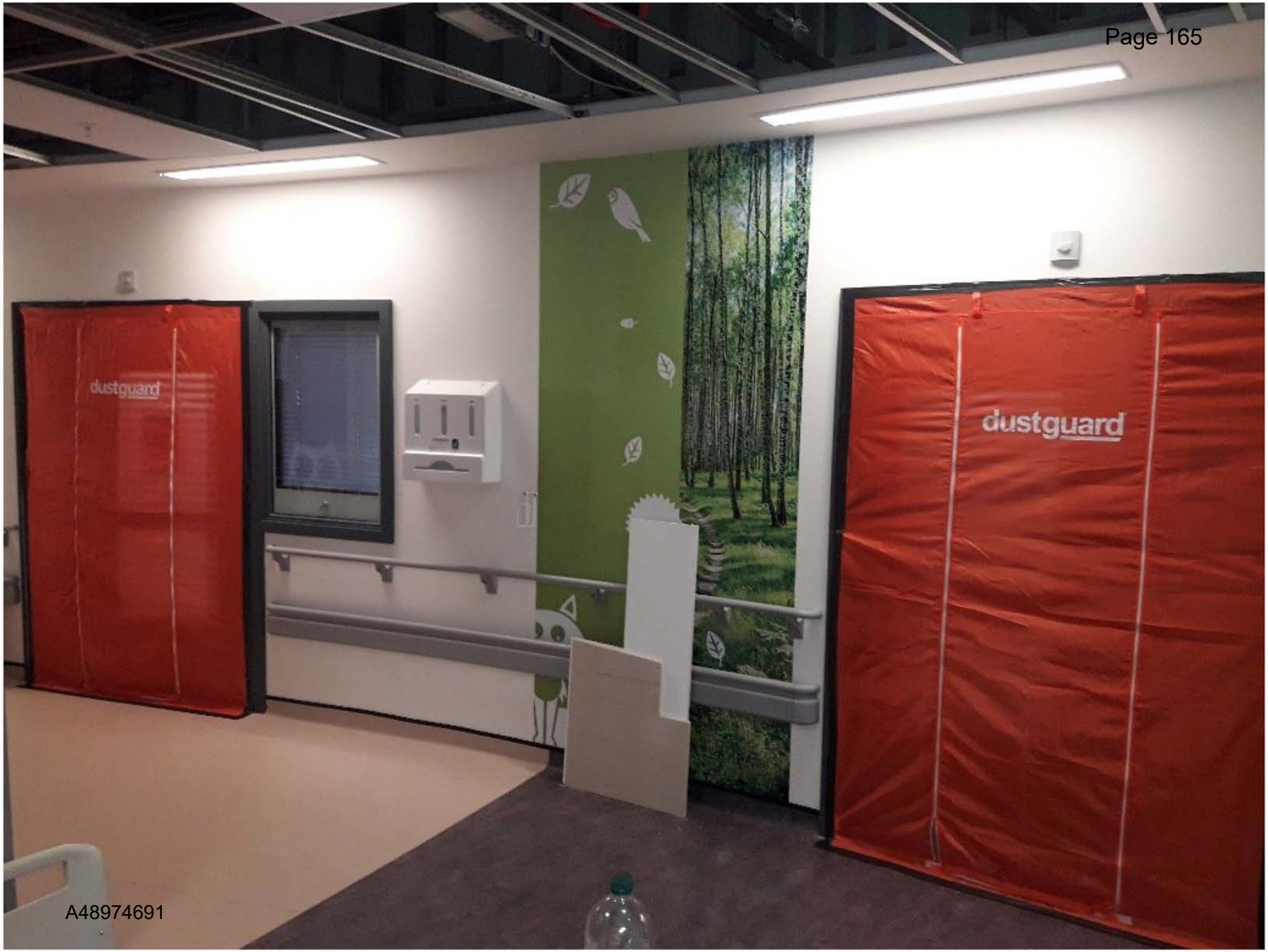

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An investigation down the drain No:1449

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INTRODUCTION

- Drainage systems are increasingly implicated as a source of outbreaks with organisms such as CPEs.[1,2]
- Antibiotic resistant organisms are not thought to possess special adaptations for transmission for drains, they merely attract attention.
- Transmission of sensitive organisms occurs but is largely unrecognised.
- It is therefore important to give thought to the design of drainage systems to mitigate the risk and to recognise drains as a potential source of patient infections.
- We describe an outbreak of Gram negative bacteraemias occurring in a new build hospital which was linked to issues with the sink drainage system

TRADITIONAL DRAIN LOCATION

RECESSED / REAR DRAIN

BACKGROUND

Location of sink drain may be broadly divided into two (see images);

1. **Traditional location**
2. **Recessed / rear**

Aranega Bou et al have shown the risk of dispersal of drain organisms to be high in traditional siting of the drain where outlet water directly hits the drain.[3]
The risk from a recessed/ rear drain is minimal **provided drainage is not impaired. Once drainage is impaired dispersal of drain organisms increases significantly**
In a new hospital sinks with rear drains were installed but as detailed below within a relatively short time these were implicated in transmission events to patients.

METHODS

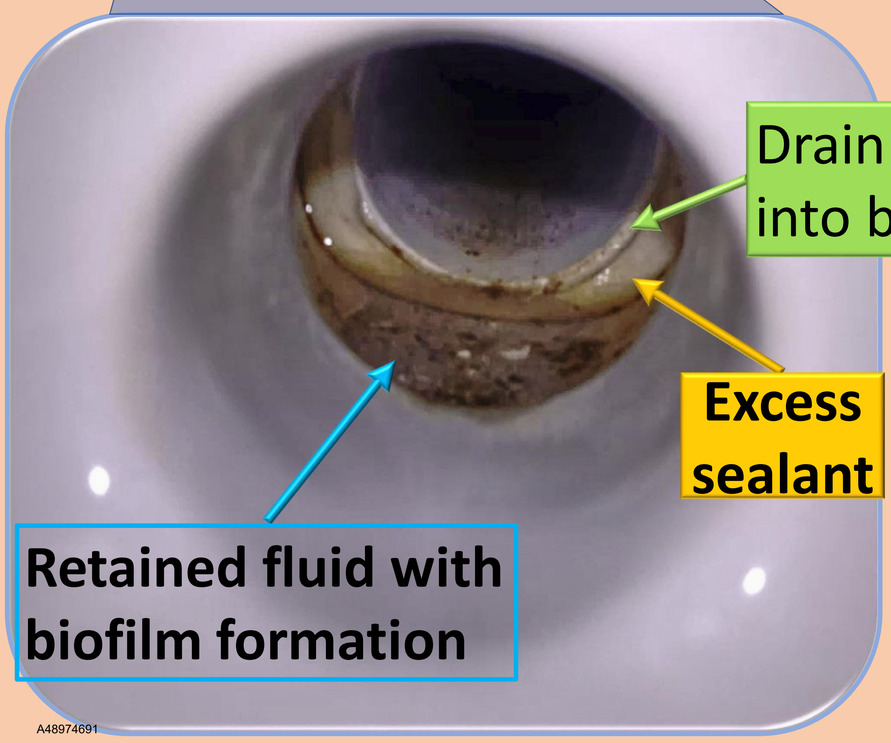
Drains were investigated following reports of reflux of material back up into sinks by staff and the development of Gram negative bacteraemias in patients. Drain components were removed for inspection and analysis by the laboratory. Assessment of biofilm reaction, and chemical analysis of drain debris was undertaken

RESULTS A

Drains were found not to be flush with the back of the sink with a lip present where water was stagnating (see image 1. below). Excess sealant was present in the drains and there was corrosion of an aluminium component (see image 2.). Mature biofilm and high bacterial counts were detected along with evidence of nutrients in drains. These included foodstuffs and urine in sink drains.

2. CORROSION OF COMPONENTS

1. INCORRECT INSTALLATION OF DRAIN PIPE WORK TO REAR DRAIN



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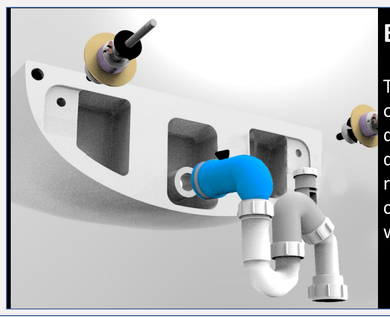
CONCLUSION

Several problems with drain design and installation were identified. Firstly the drain was not contiguous with the back of the sink which promoted stagnation and pooling of water. Excess sealant present in the drain led to occlusion and further exacerbated stagnation as the drain was not free flowing. Corrosion and splitting of an aluminium spigot enhanced the occlusion and provide an uneven surface for bacteria to adhere to. Together these conditions promoted biofilm formation exacerbated by the presence of foreign material and nutrients. There are several lessons from these findings that should be applied to future design of drains

1. **The drain should be completely flush with the back of the sink**
2. **Overzealous use of sealant should be avoided as this can lead to obstruction and poor flow/stagnation**
3. **Components used in drains should be with a material not liable to corrosion.**
4. **Workmanship should be of a high standard**

It is also important to **address behavioural aspects** and infection control teams should ensure staff/patients are aware of the importance of **drain hygiene**. Objects and fluids should not be decanted in drains and **alternative disposal methods should be provided.**



Engineering solutions

This manufacturer has engineered out the potential problem as described by having the rear drain (in blue) slide over the rear part of the sink drain. A clip provided ensures a seal without need for sealant

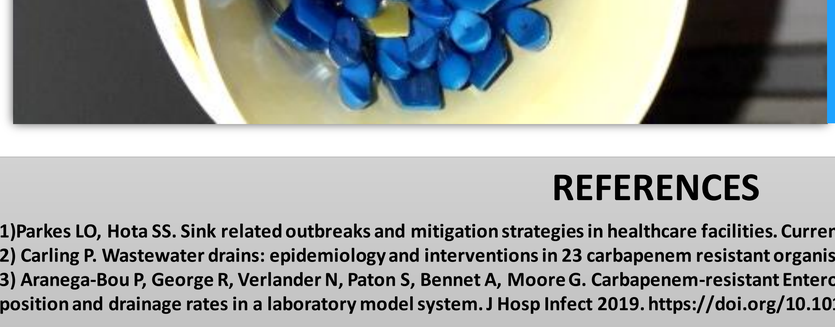
RESULTS B

Conventional drains commonly have a built in sieve (see image 3) which prevents objects falling down the drain and obstructing the waste trap. Rear drains may be fitted with a plastic sieve (see image 4), but these are not frequently used over concerns this will provide an area for biofilm formation.

Image 5 shows items removed from a waste trap which were impeding drainage of sink (rear drain no sieve) and would have substantially increased the risk of dispersal of drain organisms
Image 6 show large number of nail picks retrieved from the waste trap of poorly draining scrub sink. Again this will have aided dispersal of drain organisms.

3. CONVENTIONAL DRAIN WITH SIEVE

4. REAR DRAIN WITH OPTIONAL SIEVE



5. ITEMS REMOVED FROM WASTE TRAP OF SINK WITH REAR DRAIN AND NO SIEVE WHICH INCLUDES SYRINGES AND AMPOULES

6. SURGEON NAIL PICKS REMOVED FROM WASTE TRAP OF SURGICAL SCRUB SINK

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2) Carling P. Wastewater drains: epidemiology and interventions in 23 carbapenem resistant organism outbreaks. Infect Cont Hosp Epi. 2018;39:972-979
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SCOTTISH HOSPITALS INQUIRY

GLASGOW III

RESPONSE TO PROVISIONAL POSITION PAPER 11

BY CORE PARTICIPANTS – THE CUDDIHY AND MACKAY FAMILIES

12th April 2024

INTRODUCTION

The Inquiry has invited Core Participants to respond to PPP 11 and to address the following questions:

[1] Whether the description of the water system (including drainage) contained within the PPP is accepted as being correct and if there are points in respect of which the Core Participant challenges the description of the system, specifically what the points of disagreement are and what evidence exists to support the position taken by the CP;

[2] Whether the description of any Potentially Deficient Feature is accurate notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense;

[3] Where the PPP describes the date or dates upon which a Potentially Deficient Feature became known to a particular person or organisation whether the Core Participant accepts that date of knowledge or offers an alternative date notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense; And

[4] Whether there are any other features of the water system (including drainage) which should be considered by the Inquiry to be Potentially Deficient Features and what evidence exists to support that conclusion.

The response provided hereafter is based on the bundles of disclosure that are currently available for review and the position adopted by the respondent core participants may be further developed once disclosure of all Bundles have been received.

[1] Description of the Water System

We agree in principle with the outline of the system within the PPP although would wish to add some further aspects which we believe are critical within the system that is not explained within the PPP. See **[4]** below.

[2] Potentially Deficient Features

1. 10.22 Steam Humidifiers

The PPP 11 states at 10.24, "The non-commissioning of the steam humidifiers in the first few months of occupation of the hospital is a potentially deficient feature of the system for the purposes of Glasgow III. "

As this section of the PPP demonstrates, DMA Canyon commented on the non-commissioned steam humidifiers in 2015 and GGC state that they were removed in February 2018. There is no reference to them having been commissioned in the interim period. Therefore, to refer to non-commissioning "in the first few months of occupation" fails to fully reflect the duration of the potential deficient feature of the system.

2. 16.4 Flow Straighteners

The Inquiry are invited to consider the background to the decision to install Horne Optitherm taps across the QEUH/RHC estate and the subsequent agreement re responsibility for maintenance of taps and evidence of that being carried out as a potential defect in the water system that was installed. The following is evidence to support these matters being considered by the Inquiry.

It is referenced at 16.16 the importance of the minutes of the meeting held on 5 June 2014 which was attended by Currie Brown, NHS GGC Estates and Facilities, HPS and Dr Jimmy Walker, Expert to the Inquiry. Whilst the PPP refers to an aspect of the minutes, we would suggest that to fully understand the sequence of events that leads to the potential deficient feature one has to consider the preceding events. Therefore, the PI are invited to consider the following as having a material bearing on the decision by NHSGGC to install, retain and maintain such taps/flow straighteners as part of the water and waste water system.

On 12 December 2011 the Western Health and Social Care Trust (Western Trust) declared an outbreak of **Pseudomonas aeruginosa** at the neonatal unit at Altnagelvin Hospital, Londonderry, after three babies were confirmed to be infected. One baby had died, and a second baby had been transferred to the regional neonatal unit in the Royal Jubilee Maternity Service (RJMS). The third baby continued to be cared for in Altnagelvin at that time.

On 17 January 2012 the Belfast Health and Social Care Trust (Belfast Trust) declared an outbreak of **Pseudomonas aeruginosa** in the RJMS regional neonatal unit. At that time two babies who had been confirmed as having the infection had died and another baby was known to have been infected. A third baby died after the outbreak was declared.

Subsequently information became available through typing of strains of **pseudomonas** that one of the babies who had died in Belfast had a strain of **pseudomonas** which has been linked to Craigavon neonatal unit. It was also found that a baby, who had been diagnosed with **pseudomonas** at Craigavon Hospital in December 2011, had the strain of **pseudomonas** which caused the outbreak in Belfast. This baby died in January 2012. **Pseudomonas** was not the reported cause of death.

During the period from 17 to 31 January 2012, screening of babies in units across Northern Ireland confirmed that there were babies in other units who had been colonised with pseudomonas on their skin.

On 30 January 2012, Mr Edwin Poots, the Minister for Health, Social Services and Public Safety, asked The Regulation and Quality Improvement Authority (RQIA) to facilitate the establishment of an independent review into the circumstances leading to the incidents and the effectiveness of the response.

An interim report was submitted to the Minister on 30 March 2012 and published on 4 April 2012, with a final report being published on 31 May 2012. Suffice it to say that the incident and subsequent findings and recommendations influenced guidance throughout the United Kingdom and indeed Scotland.

On 07 February 2012, the then Chief Medical Officer, Sir Harry Burns and Derek Feeley, Director General, jointly sent a letter to numerous individuals across NHS Scotland, including all Board Chief Executives, Directors of Estates and Facilities, Health Protection Scotland and Heath Facilities Scotland, Infection Control Managers and HAI Executive leads, titled, Water Sources and potential infection risk to patients in high-risk units.

The purpose of the letter was to remind everyone of the potential infection risks posed by water systems in healthcare facilities and to clarify actions required. Indeed, this letter was a follow up to Health Facilities Scotland (HFS) email of 25 January 2011 "*water sources and potential for infection from TAPS and sinks*[1]" and communication to Infection Prevention and Control Teams (IPCT's) of January 2012 "*SBAR on Pseudomonas and Water*.

It is the case that this instruction was further updated on 03 May 2013 by way of a letter CEL 08 (2013) again from Sir Harry Burns and Derek Feeley, within which they reference matters alluded to in the background section above. Recipients were directed towards revised parts A and B of Scottish Health Technical Memorandum 04-01: Water safety for healthcare premises (SHTM-04-1) as well as National Services Scotland Guidance for (NNU's), adult and paediatric intensive care units in Scotland to minimise the risk of pseudomonas aeruginosa

infection from water. The authors thereafter provide instruction that NHS Boards must ensure that: -

- **all high-risk units where patients may be at increased risk of pseudomonas** and related infections are identified and control measures applied.
- best practice relating to the use of hand washing facilities is consistently and fully applied.
- **all taps in all clinical areas in high-risk units** (manually or automatically) are flushed daily (and a record kept) to minimise the risk of pseudomonal contamination. Flushing should be for a period of **one minute**, first thing in the morning, at the maximum flow rate that does not give rise to any splashing beyond the basin.
- domestic staff have been trained in the correct decontamination procedures for sinks, basins and taps in ICUs and neonatal units to minimise the risk of pseudomonas.
- **they have established a system of clear governance with accountability to the appropriate Executive Director.**
- they are compliant with revised SHTM-04-01.

It is the case that in March 2014 concerns were raised as to the matters alluded to in the expert report, specifically the installation of Horne Optitherm taps across the QEUH/RHC estate, resulting in discussions between a variety of stakeholders, including NHSGGC, Currie & Brown, one of the main contractors and National Services Scotland, which govern relevant entities such as Health Protection Scotland (HPS) and Health Facilities Scotland (HFS) (NSS). It is this meeting, held in June 2014, that the expert witness attended and therefore can 'speak' to such.

Expanding the timeline leading to the meeting on 5 June 2014, gives context for the meeting and the decision to transfer the risks associated with the Horn Taps from Currie Brown to NHS GGC. This transfer would require a risk mitigation strategy that stipulated that a pre-planned maintenance strategy should be created whereby those taps would be subject to maintenance every three months. This strategy is reflected in the QEUH draft written scheme '*taps should be serviced quarterly including cleaning and disinfection of strainers',* however, as evidence in

this report has shown, those taps were never subject to such maintenance and were found to be microbiologically contaminated. This re-enforces the need to consider as a potential deficient feature the manner in which the system is operated.

At 16.22 Point of Use Filters, GGC are alleged to have stated in January 2019,

"All High Risk areas have had TMT servicing and maintenance carried out until most recently when Point of Use (PoU) filters were installed. The only area where routine maintenance is not being carried out is on taps and showers across the QEUH/RHC. This will begin once the full water system chlorinisation project at the QEUH has been completed. High Risk Areas are currently protected by PALL filters installed at each outlet. All reactive maintenance is being auctioned through FMFirst (CaFM System)."

This statement suggests a number of critical points. Firstly, the assumption that once POU filters are in place, there is no longer a need for servicing and maintenance. Secondly, confirmation that no routine maintenance is being carried out in relation to taps, which contravenes the risk management plan agreed at the 2014 meeting.

3. 18.3 Particularities

The "draft meeting report" prepared by Suzanne Lee in April 2018 highlights some challenges with single occupancy rooms, suggesting that hospital stays are not as lengthy and when patients are very ill, there maybe limited use of aspects of the system. We would highlight the fact that Ward 2A is an extremely busy ward with occupancy invariably at maximum. When the patients are very ill, the facilities in the room continue to be used as the child has a parent/carer who is with them 24/7. Therefore, the rooms are always functioning an optimal level.

In addition, because they are operating at maximum, impact on the facilities are greater, with servicing of shower rooms required. It is the case that flooding was a recurring theme and therefore decant from room to room was often the reality.

It is important to note that when considering the system as a whole, such incidents are recorded by the ward who request maintenance. So, whilst there may be a lack of maintenance records, the note of the incident is recorded by the ward and therefore may offer a source of information not considered previously. Indeed, the CNR used this information when engaged in their review.

[4] Whether there are any other features of the water system (including drainage) which should be considered by the inquiry to be potentially Deficient Features and what evidence exists to support that conclusion.

The Manner in which the system is operated.

It is the case that even where legislation, regulation, guidance, expert opinion and evidenced good practice exists, it is the manner in which the system is operated that influences whether the system will be effective in achieving its objectives.

A series of reviews, legislative and statutory reports have concluded that the way this system was operated was at best dysfunctional. NHS GGC staff were not trained to fulfil legal and statutory requirements in roles such as Authorised Engineer Water (DMA Canyon 2018).
Further deficiencies include:

- No written scheme for water (DMA Canyon 2015, 2017, 2018);
- A lack of effective manual and electronic record keeping (DMA Canyon, Suzana Lee Legionella 2018, Innovated Design Solutions);
- A failure to adhere to agreed risk management processes and adhere to pre-planned maintenance regimes, especially with regards to taps (see minutes of meeting between Currie Brown and GGC June 2014);
- A failure to retain legal documentation in a safe and secure repository that rendered future access and risk management, redundant (Loss of DMA canyon reports 2015,2017; loss of Scottish Water By Laws Inspection Report);

- A failure to share information following statutory reviews with interdepartmental staff thus depriving them of ability to acquire crucial knowledge and implement risk mitigation/control measures (for example, CNR Review 2021, CNR Chair Letter to Cabinet Secretary and CEO NHS CEO March 2021; internal email communication and minutes of internal governance meetings including but not limited to South Water Safety Group Minutes- pre 2015; emails between Dr Inkster 2015 and others);
- A failure to discharge statutory obligations around water safety with omission of annual legionella testing, specifically 2016 (Expert Report Dr Jimmy Walker).

10.33 Continuous Chlorine Dioxide

Following widespread dosing of such chemicals, over long periods of time, what impact assessment has been carried out to determine whether such chemicals have a detrimental impact on the integrity of the system? It is considered that such information would be invaluable in determining whether 'action causes reaction' with the integrity of the system being compromised rendering the other control measures ineffective. That being the case, this would be considered as a potential deficient feature.

List of Sources- Section 4 of PPP11

The following documents are offered in support of the commentary above: -

Scottish Government Documents

- QEUH Case Note Review- Support to Report dated March 2021- personal letter to Molly Cuddihy
- CEL 7 (2012) Sir Harry Burns
- CEL 8 (2013 Sir Harry Burns
- Scottish Parliament Records/Media Release - 20 March 2018- Shona Robinson MSP, Cabinet Secretary
- Scottish Parliament Records/Media Release- June 2018- Shona Robison MSP

- Scottish Government Oversight Board Report QEUH/RHC March 2021- Timeline of Events- ****As amended*****
- Scottish Government Oversight Board Report QEUH/RHC - Access to Information enabling informed decisions as to how NHSGGC identified, responded to, communicated and managed water contamination/associated environmental contamination and outbreak of Mycobacterium Chelonae (MC) between 2015 and 2019.

External Documents

- DMA Water Gap Analysis of L8 HSG 274 and SHTM 04-01 dated 08 March 2016. Is this date correct? From the Expert Report completed by Dr Jimmy Walker he cites a statutory failure on the part of GGC for failure to conduct annual statutory legionella 8 audit. There is however a DMA Gap Analysis dated January 2018. Grateful for clarity on this matter.
- Pest Control Reports- QEUH Plant Room
- Photographs of plantroom prior to cleaning
- ARHAI Epidemiology Data showing bacterial infections reported in NHS GGC Ward 2A from 2015 to September 2018
- ARHAI Epidemiology Data showing bacterial infections reported in NHS GGC Ward 6A from September 2018 until March 2022
- ARHAI Epidemiology Data showing bacterial infections reported in NHS GGC QEUH/RHC regarding Mycobacterium Chelonae from 2015 to March 2022.

NHS GGC Documents

- Email communications between Dr Inkster and Facilities Management 2014 (seeking clarity on responsible owner for testing of potable water
- Email communications between Dr Peters/Dr Inkster and others, June 2015 onwards (seeking access to results from water testing)
- Training Records and Accreditation of all Authorised Engineers (Water) appointed by NHS GGC Estates and Facilities from point of opening in 2015 until now.
- NHS GGC Ward 2A Facilities/Estates call out records.

FURTHER INFORMATION THAT SHOULD BE CONSIDERED BY THE INQUIRY

1. **Minutes from the "South Water Safety Group"**

   These minutes pose questions relating to water safety/wholesomeness prior to occupying QEUH and also, concerns at point of occupancy.

2. **16.30 Organisms in Taps**

   There is a reference to filters being limited and as such prioritized to ward 2A. For an understanding of the extent of this potential deficiency it is requested that information be provided by GGC as to the mitigation strategy for all other areas, including Ward 2B, immediately adjacent to ward 2A and the associated 'patient pathway' for immunocompromised patients. Such information will enable understanding of this being an individual or connected issue.

   In addition, the PI are invited to consider the bacteria Mycobacterium Chelonae as an organism found in taps. It has not been reported under this section nor within the Timeline of incidents at QEUH/RHC 2015-2019 produced for the Oversight Board. It is the case that Mycobacterium Chelonae was found in various rooms of ward 2A in 2019 (when the ward was closed due to the water crisis). The Case Note Review, March 2021 and personal file of patient Molly Cuddihy (already provided to the Inquiry) details such organisms. This is important as it highlights the widespread contamination of Mycobacterium Chelonae, a rare pathogen, across the entire system. It is so rare it was not even on the National Register of bacteria until 2019.

4. **18.11 Organism Growth in Shower Head**

   Following requests for specific epidemiology information, ARHAI informed Professor Cuddihy that as this information had been provided to the Inquiry and cannot be shared further by them.

   It is requested that this data be examined for further evidence of organisms in showerheads and elsewhere.

THE SCOTTISH HOSPITALS INQUIRY

COMMENTS ON PROVISIONAL POSITION PAPER 11

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

1.1 We are invited to comment on Provisional Position Paper 11: Potentially Deficient Features of the water system of the QEUH/ RHC.

1.2 PPP11 was provided by the Inquiry around 8 March 2024. On 21 March 2024 the Inquiry provided a copy of a report from Dr Jimmy Walker (174 pages) on the water system at QEUH/ RHC along with a large bundle of doucments (1,257 pages) about the PPP on water.

1.3 We have requested permission to instruct a water expert to advise the Core Participants we represent on the evidence about the water system provided by the Inquiry. This request has been refused. The Inquiry are aware that NHSGGC have access to experts to comment on the water and ventilation reports and documentation produced by the Inquiry and, in addition, have instructed an expert on the issue of IPC. Despite being publicly funded they do not require to seek the Chair's approval for doing so. The issue of equality of arms arises.

1.4 We wish to instruct our own experts to allow us to be in a position to represent our Core Participant clients' interests by considering the Inquiry experts' reports including the report of Dr Walker. Our water expert will need to consider the documentation that has been provided by the Inquiry. This is essential to assist with the questions that we have been asked to address in PPP11. We are unable to properly do so without expert input. Neither counsel or the Core Participants we represent have particular experience or expertise in hospital built environments and the design, construction and technical issues associated with the planning, design (including

technical aspects, scientific matters, application of guidance and relevant standards), commissioning and management of water and ventilation systems in a healthcare environment.

1.5 The four questions posed in PPP 11 at paragraph 1.10 present a challenge for us to answer as we simply do not know if the description of the water system is accurate without an expert to advise us, or if the description of a "Potentially Deficient Feature" is accurate, or whether there are any other features of the water system which should be considered to be "Potentially Deficient Features".

1.6 The patients and families are at the heart of this Inquiry. They will not be properly informed without independent expert advice and guidance on both water and ventilation issues raised in PPP11 and the expert reports of the Inquiry.

1.7 In view of the refusal to allow the core participants to instruct experts an application will be made to the Chair.

1.8 Further, we cannot expect to be in a position to provide informed questions to the expert panel later in the year without access to our own experts so we may consider and where necessary query the methodology, the technical content of the evidence and also provide assistance with framing appropriate questions to ensure that the patients and families position and concerns about the hospital are fully addressed. As stated above, we have of course no expertise on ventilation and water supply matters which creates a barrier to us.

Steve Love KC
Gavin Thornley
12 April 2024

Scottish Hospitals Inquiry

By Email Only: legal@hospitalsinquiry.scot

Our Ref: RIL.T10513091
Your Ref:
Date: 11 April 2024
Please Ask For: Ruth Lawrence
Email: [redacted]
Direct Dial: [redacted]

Dear Sirs

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

We write with reference to the 'Provisional Position Paper 11 - Potentially Deficient Features of the water system of the QEUH/RHC' sent under cover of an email dated 28 February 2024. We note that the paper sets out the Inquiry team's understanding of the water system in place at the hospitals in the period following handover in the first part of 2015, and in particular the Inquiry team's understanding of the history of the raising of concerns with various aspects of that system.

We note that the Chair is likely to be invited by the Inquiry team to make findings in fact based on the content of the PPP and that any core participant or any other person holding relevant information is invited to seek to correct and/or contradict any material statement of fact which it considers to be incorrect and to point to what evidence exists to support the position taken by the core participant or other person.

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

"2.4. Initial storage: raw water. The water drawn from the public water mains is stored in two raw water storage tanks, each of 100,000 litres in capacity."

- Currie & Brown are in possession of a drawing, 'ZBP Equipment Data Sheet ZBP-XX-XX-SH-600-366 Rev A Jun 12 (Approved Status A)' (copy enclosed) which notes two break tanks each with a 125,000 litre capacity.

2.7. Filtered water storage tanks. There are two tanks in which the filtered water is stored. These are larger than the raw water storage tanks, at 275,000 litres in capacity. The hot and cold domestic water systems within QEUH are both drawn from these filtered water storage tanks. They are configured into compartments, in order to enable work to be carried out without disrupting the supply of water within the QEUH systems entirely.

Central Postal Address: Keoghs Scotland LLP, 2 The Parklands, Bolton, BL6 4SE
T: +44 (0)1204 677000 F: +44 (0)1204 677111 DX: 723540 Bolton (Lostock) keoghs.co.uk

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

- 'ZBP Equipment Data Sheet ZBP-XX-XX-SH-600-366 Rev A Jun 12 (Approved Status A)' notes 2 tanks each with a 243,750 litre capacity.

"14.2. An IMT Minute of 19 June 2019 raised a concern of leaks from CBUs due to a boiler failure. A later IMT of 1 August 2019 questioned why patients were situated underneath CBUs when there was a risk of condensation and/or leaking water dripping onto them. It was also noted that all patient rooms within the QEUH (with the exception of Ward 4B BMT) and RHC had CBUs."

- Chilled Beam Units were not used in isolation rooms. Currie & Brown refer to drawing 'ZBP-XX-XX-SC-524-707B' (copy enclosed) which notes that a Chilled Beam is not provided in these rooms.

"15.1. SHTM 04-01 provides:

> ***"Domestic hot & cold water systems should be temperature monitored by the Building Management Systems performing to SHTM 08-05 to ensure compliance with the temperature standards specified in the relevant regulations and guidance…"***

- Currie & Brown note that whilst the version of SHTM 04-01 published on 3 August 2015 makes reference to SHTM 08-05, SHTM 08-05 was published on 2 April 2012 and not added to the contract. SHTM 2005 was in place at the time of the contract.

"15.9 It is not clear what if any remedial action was taken in respect of this concern, and it remains a potentially deficient feature for the purposes of Glasgow III".

- Please find enclosed the following email correspondence from May 2018 to August 2018 between Multiplex and NHSGG&C on resolution to the temperature control issue in the MTHW system:

No.	Date/Time	To	From	Subject
1	01/06/2018 11:35	Alan Gallacher cc Andy Wilson; Ian Powrie; Douglas Ross; Karen Connelly, Matthew Lambert; Mary Ann Kane, Fergus Shaw	David Wilson	Re: QEUH Energy Centre Presentation to Brookfield
2	18/06/2018 17:30	Ian Powrie and Alan Gallacher cc Ian Storrar; Mary Ann Kane; Douglas Ross; Stewart McKechnie; Ciaran J Kellegher; Fergus Shaw; Stephen Houston	David Wilson	RE: BMS Data,
3	22/06/2018 12:49	Alan Gallacher cc Ian Powrie; Andy Wilson; Douglas Ross; Stewart	David Wilson	QEUH -Response to Inovated design Solutions Forensic Report

		McKechnie; Ciaran J Kellegher; Fergus Shaw; Stephen Houston; Mary Ann Kane; Ian Storrar		
4	29/06/2018 14:03	Alan Gallacher and Ian Powrie cc Mary Ann Kane; Douglas Ross	David Wilson	QEUH – MTHW
5	04/07/2018 10:23	Alan Gallacher and Ian Powrie cc Mary Anne Kane; Douglas Ross; Stewart McKechnie; Ciaran J Kellegher; Fergus Shaw	David Wilson	QEUH - MTHW Control Strategy
6	20/07/2018 14:50	Alan Gallacher cc Ian Powrie; Andy Wilson; Mary Anne Kane; Stewart McKechnie; Ciaran J Kellegher; Stephen Houston; Douglas Ross	David Wilson	QEUH - MTHW Control Strategy
7	07/08/2018 08:31	Alan Gallacher cc Ian Powrie; Andy Wilson; Mary Anne Kane; Ciaran J Kellegher; Paul McAllister; Stephen Houston; Matthew Lambert	David Wilson	RE: QEUH - MTHW Control Strategy (as Schneider Document attached)
8	16/08/2018 09:06	Alan Gallacher cc Ian Powrie; Andy Wilson; Mary Anne Kane; Douglas Ross; Matthew Lambert; Paul McAllister; Stewart McKechnie; Ciaran J Kellegher	David Wilson	QEUH - MTHW Control Strategy
9	16/08/2018 14:54	Alan Gallacher cc Mary Anne Kane; Allyson Hirst; Douglas Ross	David Wilson	RE: QEUH Energy Centre - NHSGG&C's response to Multiplex Comments

Currie & Brown also takes this opportunity to respond to each of the four questions posed in PPP 11 as follows:

1. *Whether the description of the water system (including drainage) contained within the PPP is accepted as being correct and if there are points in respect of which the Core Participant challenges the description of the system, specifically what the points of disagreement are and what evidence exists to support the position taken by the CP.*

   Subject to the points made above and whilst also noting that it professes no M&E expertise, Currie & Brown accept that the description of the water system (including drainage) contained within the PPP is correct.

2. *Whether the description of any Potentially Deficient Feature is accurate notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense.*

   Currie & Brown accept the accuracy of the descriptions of the Potentially Deficient Features notwithstanding that it may not accept that the features described are potentially deficient or deficient in any sense.

3. *Where the PPP describes the date or dates upon which a Potentially Deficient Feature became known to a particular person or organisation whether the Core Participant accepts that date of knowledge or offers an alternative date notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense.*

   The PPP does not describe the date(s) upon which any Potentially Deficient Features became known to Currie & Brown. The date(s) that any Potentially Deficient Features became known to any other persons or organisations is outside Currie & Brown's knowledge.

4. *Whether there are any other features of the water system (including drainage) which should be considered by the Inquiry to be Potentially Deficient Features and what evidence exists to support that conclusion.*

   Currie & Brown do not consider that there are any other features of the water system (including drainage) which should be considered by the Inquiry to be Potentially Deficient Features.

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

Yours faithfully

Keoghs LLP

From: David Wilson [redacted]
Sent: 01 June 2018 11:35
To: Gallacher, Alan
Cc: Wilson, Andy; Powrie, Ian; Douglas Ross; Connelly, Karen; Matthew Lambert; Kane, Mary Anne; Fergus Shaw; Stephen Houston
Subject: Re: QEUH Energy Centre Presentation to Brookfield
Attachments: image006.jpg; image008.jpg; image009.png; image010.png; image011.png; image012.png; image013.jpg

Sorry Alan,

Missed this email. Points noted below:

1. Primary F&R (A side)
2. Primary F&R (B side)
3. CHP F&R (at dump valve (3 no)
4. Secondary F&R Heating (at each plantroom)
5. Domestic hot water F&R (at each plantroom)
6. Boiler operation
7. CHP operation
8. 3PV position (dump valve prior to CHP)

Thanks

from my iPhone

On 1 Jun 2018, at 11:01, Gallacher, Alan [redacted] wrote:

> David,
> I need you to tell me exactly what information is being requested.
> Regards,
> Alan. G. Gallacher **CEng MIMechE, BEng(Hons), DipEM**
> **General Manager (Estates*)***
> Queen Elizabeth University Hospital Campus
> Property, Procurement & Facilities Management Directorate
> Facilities Corporate Services Dept
> CMB Building
> Glasgow
> G51 4TF
> **Tel No:** [redacted] : Internal [redacted]
> **Mobile:** [redacted]
> <image006.jpg>
> Think SAFE ENVIRONMENT.. ....please help cut carbon.....don't print this email unless you really have to.....and remember to recycle.....SAVE ENERGY - THE EASY WAY TO SAVE MONEY!
>
> **From:** David Wilson [[redacted]]
> **Sent:** 01 June 2018 09:06
> **To:** Gallacher, Alan
> **Cc:** Wilson, Andy; Powrie, Ian; 'Douglas Ross'; Connelly, Karen; Matthew Lambert; Kane, Mary Anne; Fergus Shaw; Stephen Houston
> **Subject:** [ExternaltoGGC]RE: QEUH Energy Centre Presentation to Brookfield
> Alan,

Can you let me know if we can download historical data logs this morning?
Regards
David
David Wilson
Commissioning Manager
<image008.jpg>
Multiplex Construction Europe Ltd
M [redacted]
E [redacted]
W www.multiplex.global

<image009.png>

<image010.png> <image011.png> <image012.png>

From: Gallacher, Alan [redacted]
Sent: 01 June 2018 08:26
To: David Wilson
Cc: Wilson, Andy; Powrie, Ian; 'Douglas Ross'; Connelly, Karen; Matthew Lambert; Kane, Mary Anne; Fergus Shaw; Stephen Houston
Subject: RE: QEUH Energy Centre Presentation to Brookfield

David,
Thank you for your e-mail.
Any instructions to Schneider around data interrogation or downloads from the controls package supporting the QEUH is not to be communicated direct to Schneider but must be done though this office. Accordingly we will review any requests and either approve or not approve.
Schneider have been instructed not to carry out any modifications or to take any instructions from any 3rd party organisations around the controls supporting the QEUH.
from the
Regards,
Alan. G. Gallacher **CEng MIMechE, BEng(Hons), DipEM**
General Manager (Estates*)*
Queen Elizabeth University Hospital Campus
Property, Procurement & Facilities Management Directorate
Facilities Corporate Services Dept
CMB Building
Glasgow
G51 4TF
Tel No: [redacted] : Internal [redacted]
Mobile: [redacted]
<image006.jpg>

From: David Wilson [redacted]
Sent: 31 May 2018 16:04
To: Gallacher, Alan
Cc: Wilson, Andy; Powrie, Ian; 'Douglas Ross'; Connelly, Karen; Matthew Lambert; Kane, Mary Anne; Fergus Shaw; Stephen Houston
Subject: [ExternaltoGGC]RE: QEUH Energy Centre Presentation to Brookfield

Alan,
We have met with our consultant engineer (TUV-Sud / Wallace Whittle) and mechanical contractor (Mercury) to review the course of action to address your concerns. The information provided in the presentation was a snap shot in time and does not give us the required information we need to interrogate the full system operation. In order to ascertain the MTHW system operating conditions / performance and to provide the data required to either back up your concerns or allay them, we have asked Schneider to down load some historical data logs from the BMS system which we intend to do tomorrow, thereafter we will review.
We would like to highlight that any changes we have made to the MTHW system control have been highlighted within the revised Functional Design Description and QEUH user guidance document (previously issued) and can't take responsibility for other system changes or issues that were

highlighted as part of the presentation such as automatic valves being open when they should be in the closed position, manual isolation valves at pump sets being closed, temperature sensor discrepancies etc.
We will let you know the outcome of our review and would note that we will not make any changes to the system until consultation with you and your team.
Regards
David

David Wilson
Commissioning Manager
<image008.jpg>
Multiplex Construction Europe Ltd
M [redacted]
E [redacted]
W www.multiplex.global

<image009.png>

<image010.png> <image011.png> <image012.png>

From: Gallacher, Alan [redacted]
Sent: 23 May 2018 20:13
To: David Wilson; Fergus Shaw
Cc: Wilson, Andy; Powrie, Ian; 'Douglas Ross'; Connelly, Karen; Matthew Lambert; Kane, Mary Anne
Subject: QEUH Energy Centre Presentation to Brookfield

Fergus/David,
Please find attached a copy of the presentation of the QEUH Energy Centre carried out yesterday at the CMB.
NHSGG&C's concerns are as follows:

- Failings in the system alterations appear to have an increased the risk of legionella bacteria growth within the domestic hot water service;
- Failings in the system alterations appear to have delivered a significant increase in heat rejection / boiler operation which in turn has increased substantially the carbon footprint and energy consumption of the facility. This in turn has meant a significant increase in operational costs for NHSGG&C;
- Probable issues with the original design have led to a reduction in CHP performance / running hours;
- Modifications appear to have been undertaken to increase CHP performance. This is possibly also due to ineffectiveness of the original differential pressure control strategy;
- The system alterations appear to be based around increasing the CHP performance, and have not taken cognisance of the consequential effects on the rest of the system (ie cause and effect);

The above are the initial important issues which need actioned and responded to by Multiplex.
Can I ask you to review the above within the next two weeks as I plan to reconvene a meeting on Thursday 14th June (commencing approx 10:00am) to go over these issues in detail.
Regards,

Alan. G. Gallacher **CEng MIMechE, BEng(Hons), DipEM**
General Manager (Estates*)*
Queen Elizabeth University Hospital Campus
Property, Procurement & Facilities Management Directorate
Facilities Corporate Services Dept
CMB Building
Glasgow
G51 4TF
Tel No: [redacted] : Internal [redacted]
Mobile: [redacted]

<image013.jpg>
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****
**
NHSGG&C Disclaimer

From: David Wilson [redacted]
Sent: 18 June 2018 17:30
To: Powrie, Ian; Gallacher, Alan
Cc: 'STORRAR, Ian (NHS NATIONAL SERVICES SCOTLAND)'; Kane, Mary Anne ([redacted]); Douglas Ross; McKechnie, Stewart; ''Ciaran J. Kellegher' ([redacted])'; Fergus Shaw; Stephen Houston
Subject: RE: BMS Data,

Hi Ian / Alan,

We have reviewed the DHW temperature trend data and from the analysis of the information are unable to see a consistent temperature problem as has been reported. Looking through the graphs the average flow temperatures are generally above 60^{O}C and returns above 50 ^{O}C. We would note that there are peaks and troughs but not a consistent problem that we could draw the conclusion (that we feel is being made and highlighted in correspondence) that the changes to the MTHW system control strategy made last year has caused an issue that could lead to the growth of legionella.

There are various events that can be seen within the graphs that have caused drops for sometimes short and other longer periods of time which could be caused by any number of issues. In particular we would draw your attention to Plantroom 32 Calorifier 3 graph. The flow temperature had been tracking the set point but then drops quite dramatically on the 27/04/18 as if the set point had been changed or other local issue (the other 2 calorifiers appear more stable) This in turn hassled to a drop in the common return temperatures which we would recommend you investigate as it would not appear to be rectified.

We are also continuing to review the forensic report issued and will issue our comments / recomendations for Thursdays meeting.

As we have previously stated we would like to work together in order to resolve any perceived or actual issues with the system.

Regards
David

David Wilson
Commissioning Manager

MULTIPLEX

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M [redacted]
E [redacted]
W www.multiplex.global

From: Powrie, Ian [[redacted]]
Sent: 14 June 2018 17:09
To: David Wilson
Cc: Gallacher, Alan; 'STORRAR, Ian (NHS NATIONAL SERVICES SCOTLAND)'
Subject: BMS Data,

Gents,

Quick update to advise that the DHW service return temperature trend data is included in the files submitted as a separate common return trend graph for each heat station.

Regards

ian

I. Powrie

Deputy General Manager (Estates)

Queen Elizabeth University Hospital Campus
1345 Govan Road
Laboratory Medicine & FM Centre
Glasgow
G51 4TF

PA Elaine McNeil: [redacted]
Direct : [redacted]
Internal [redacted]
Mob: [redacted]

From: David Wilson [redacted]
Sent: 22 June 2018 12:49
To: Gallacher, Alan
Cc: Powrie, Ian ([redacted]); Wilson, Andy ([redacted]); Douglas Ross; McKechnie, Stewart; ''Ciaran J. Kellegher' ([redacted])'; Fergus Shaw; Stephen Houston; Kane, Mary Anne ([redacted]); ian.storrar[redacted]
Subject: QEUH -Response to Inovated design Solutions Forensic Report
Attachments: Comments on Forensic Report.doc; MTHW & LTHW Presentation 16-12-2014.pptx

Alan,

Please find attached our response to the Energy Center Forensic report produced by Innovated Design Solutions.

As discussed at our meeting yesterday we are reviewing all the current data we have and developing a revised control strategy which I would hope to share with you by the end of next week and thereafter we can meet again to review with you and the rest of the team.

I have also attached the training presentation that was given at the MTHW training session, pre project handover, (located on Zutec) which provides the system design parameters and as installed information. Could you please pass this on to Matt as I don't have his email address.

Thanks
David

David Wilson
Commissioning Manager

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M [redacted]
E [redacted]
W www.multiplex.global

Project	QEUH & RHC	**Date**	22 June 2018
Subject	Comments on Energy Centre Forensic Report		

Introduction

Further to the receipt of the Energy Centre Forensic Analysis report produced by Innovated Design Solutions on behalf of NHS Greater Glasgow and Clyde we (Multiplex Construction, TUV-Sud and Mercury Engineering) have reviewed the report and have picked out the main themes of the report with the response / comments addressed within this document. The main themes being addressed are as noted below:

- Current MTHW System & Control
- System design capacity / Future Use
- Zutec / As built information

We would note that we were made aware of the MTHW reported issues at the presentation on 22 May 2018.

We note that the system operational comments within the report is based on BMS information from a point in time and not historical trend log data which we believe was not available to Innovated Design Solutions at the time of the system review.

Further historical trend data would be beneficial to all parties in order to establish the system operation and any deficiencies.

Current MTHW System & Control

The report extensively comments on the current MTHW control philosophy referencing the Schneider Functional Design Specification and the Operational user guide. The information reflects broadly the modifications that were made between August 2017 and October 2017 to address the operation of the CHPs.

From our reviews of information received it appears to us that there is an issue with volume flowrate ,which is alluded to in IS report and which is effectively causing a dilution of flow water and consequential reduction in flow temperature. We don't see from the info made available to us that this has caused any underheating issues as basically the increased flow volume has to a degree compensated for this. Nonetheless we have and are concentrating our efforts on exploring how we can ensure control strategy recognises and alters this.

It should be borne in mind that this system is in an Interim condition and will remain so until the original design conditions of bringing all of the retained estate come on line. It is imperative that we carry out the "soft Landings " philosophy which again as recorded at our meeting suffered a prolonged period of abeyance due a number of issues including PED works and Insurers inspections which in effect disabled key system components for a period of time.

The main modification to the control philosophy was to change the boiler enablement from delivered volumetric flow to the CHP return temperature. This change was made to ensure that the CHP units were always the lead heat generator with the boiler only firing when the demand was greater than the CHPs could satisfy. It was highlighted within the report that there were times that multiple boilers would be firing at the same time and we believe that this was due to a 30 minute delay between boilers firing being removed from the original control philosophy. This change was made previously on comment from the Estates team that in the event that they lost the MTHW system the 30 minute delay was prohibitive when trying to bring the boilers on quickly to return to a stable temperature.

The report highlights some other "changes" to the control philosophy such as 2 port motorised valves being open when should be closed and manual isolation valves within the basement headers being open when they should be closed. On this issue we would note that we have not altered any other valving arrangement either motorised or manual from the original design intent other than the details of changes provided within the FDS and user guide. These changes made by other parties would potentially cause further water dilution within the system (hot water being mixed with cooler water) subsequently reducing the MTHW temperatures.

System Design Capacity / Future Use

The system design and future capacity has not changed since the design review that was carried out jointly between Multiplex, The NHS GG&C project team and their technical advisors during the project design phase. The design was agreed and drawings and technical submission signed off during the RDD process.

As part of the client familerisation and subsequent training sessions held before the project was handed in January 2015 the system design and capacities for retained estates were explained and discussed. The presentation on the MTHW system can be found on Zutec.

Zutec / As built information

The report highlights some anomalies within the as built information provided within Zutec particularly around the system operating temperatures. The majority of the information provided within Zutec provides accurate information on the system operation and design temperatures. We would note that the during the various client training sessions given to the NHS Estates team the system capacities and temperatures were clearly defined, therefore it is unclear why this could not be confirmed to Innovated Design Solutions during the system review.

The report highlights that there is no designers information contained within Zutec and we would confirm that this is the case. The design specifications were issued and reviewed by the boards project team with the contractors information (drawings, technical submissions, Functional Design Specifications) also being issued and reviewed by the board. As is the case with all projects (and as discussed at our recent meeting) the operation and maintenance manuals contains the contractors as fitted information and not the original design information which the as fitted information supersedes.

It would be useful if there is specific information that is believed to be missing from Zutec then that is passed on to allow us to review and rectify as required.

Conclusion

In order to move forward and achieve a mutually acceptable outcome we have commenced a further review of the MTHW system operation and controls. We are taking into consideration some of the information contained within the forensic report and some of the historical trend logs issued although more trend and system operational information may be required. We will require some initial intervention from the Estates team to reset overridden valves (as noted in the Current MTHW System & Control section above).

We will produce a control strategy which we believe will provide the optimum system performance and issue to the Estates team for review and comment thereafter suggest a joint workshop is held to discuss and agree the strategy and implementation of the same.

We will carry out a review of the information held on Zutec pertaining to the MTHW system where queries have been raised and, if required, correct any anomalies. If there is any information that is felt would further assist the estates team then it can be added.

On completion of any agreed changes made to the system operating strategy we will update the relevant documents on Zutec.

With regard to the contractual energy requirements we would note that on the basis of the data for the 6 months to March 2018 (previously issued) we are on target to meet the requierements.

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A48974691

Welcome to NSGH

MTHW & LTHW Heating Systems

16th Dec 2014 ….9:00-15:00

Ciaran Kellegher

New South Glasgow Hospital - Systems Overview

- 1. **MTHW** System Description & Orientation
  - a) Design Loads
  - b) EC System Schematic
  - c) A&C System Schematic
  - d) Primary (MTHW) Pipework Distribution routes

- 2. **LTHW** System Description & Orientation
  - a) Heat Stations
  - b) LTHW Circuits
  - c) Injection Circuits
  - d) Areas Served

New South Glasgow Hospital - Systems Overview

3. Key Components

- MTHW Boilers / Burners
- CHPs - Combined Heat and Power plant
- Absorption Chillers & Heat Rejection unit
- Plate Heat Exchangers
- Circulating Pumps
- Pressurisation units & Expansion
- Wilo-mat pressurisation units
- Degassers
- Flowcon automatic balancing valves (Wafers)
- Flowcon Assemblies
- Terminal Units
  - Radiant Panels
  - Fan coil units
  - Chilled Beams
- Reverse acting by-pass valves
- Strainers
- Flamco Automatic air vents

New South Glasgow Hospital – Design Loads

- Max Available Heat Output (Boilers & CHP) = **38.6 MW**
- Max PHx Available Total Output = **28 MW**
- Max Operational Building Heat load = **22.5MW**
- Diversified Building Heat Load **18 MW**
- + labs, retained estates, future **+ 13.5 MW**
- **Max Site Heat Load** **= 31.5 MW**

Energy Centre A Side

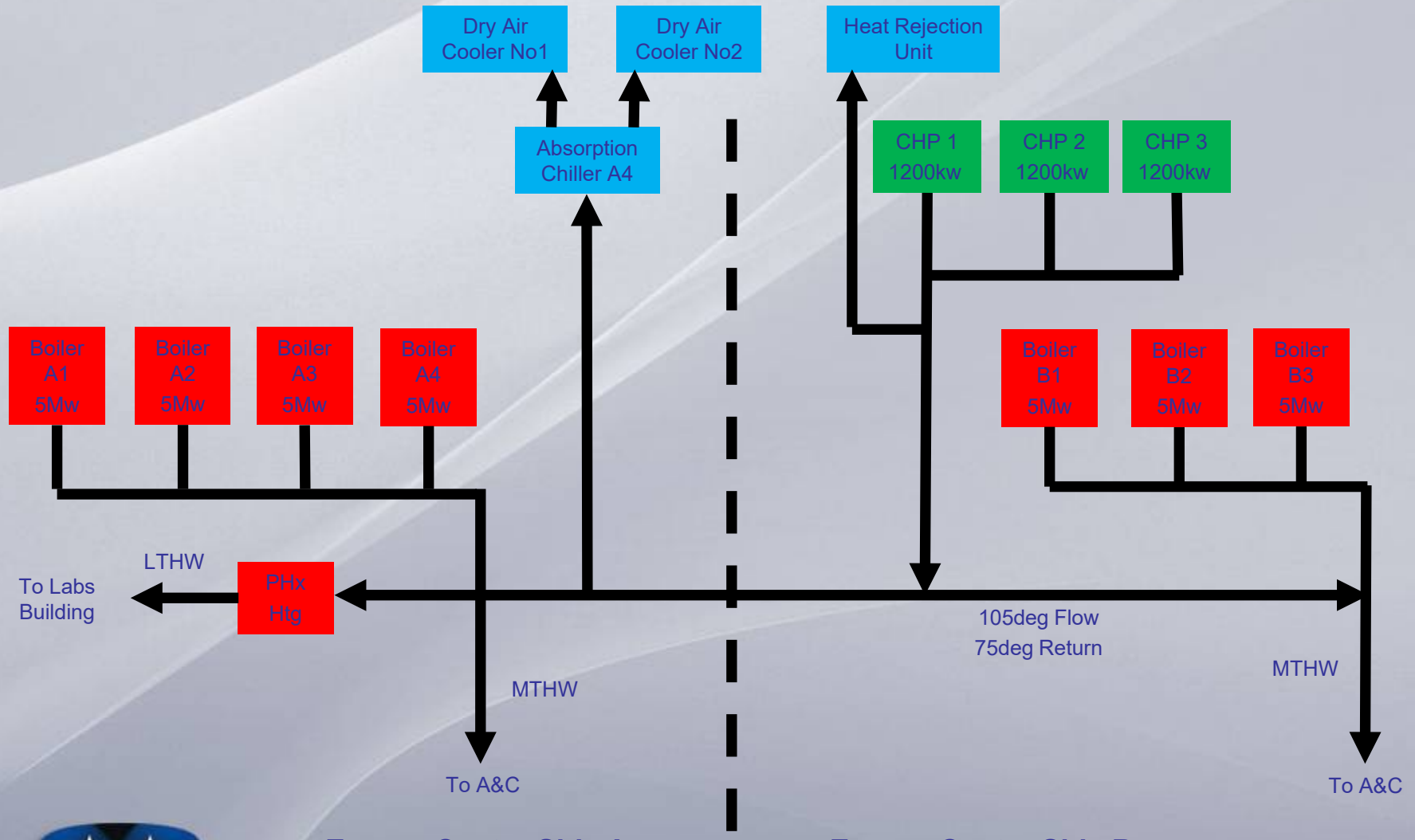
4 No Boilers @ 5MW ea Duty+Duty+Duty+Standby	= 20MW
Total	= **20MW**

Energy Centre B Side

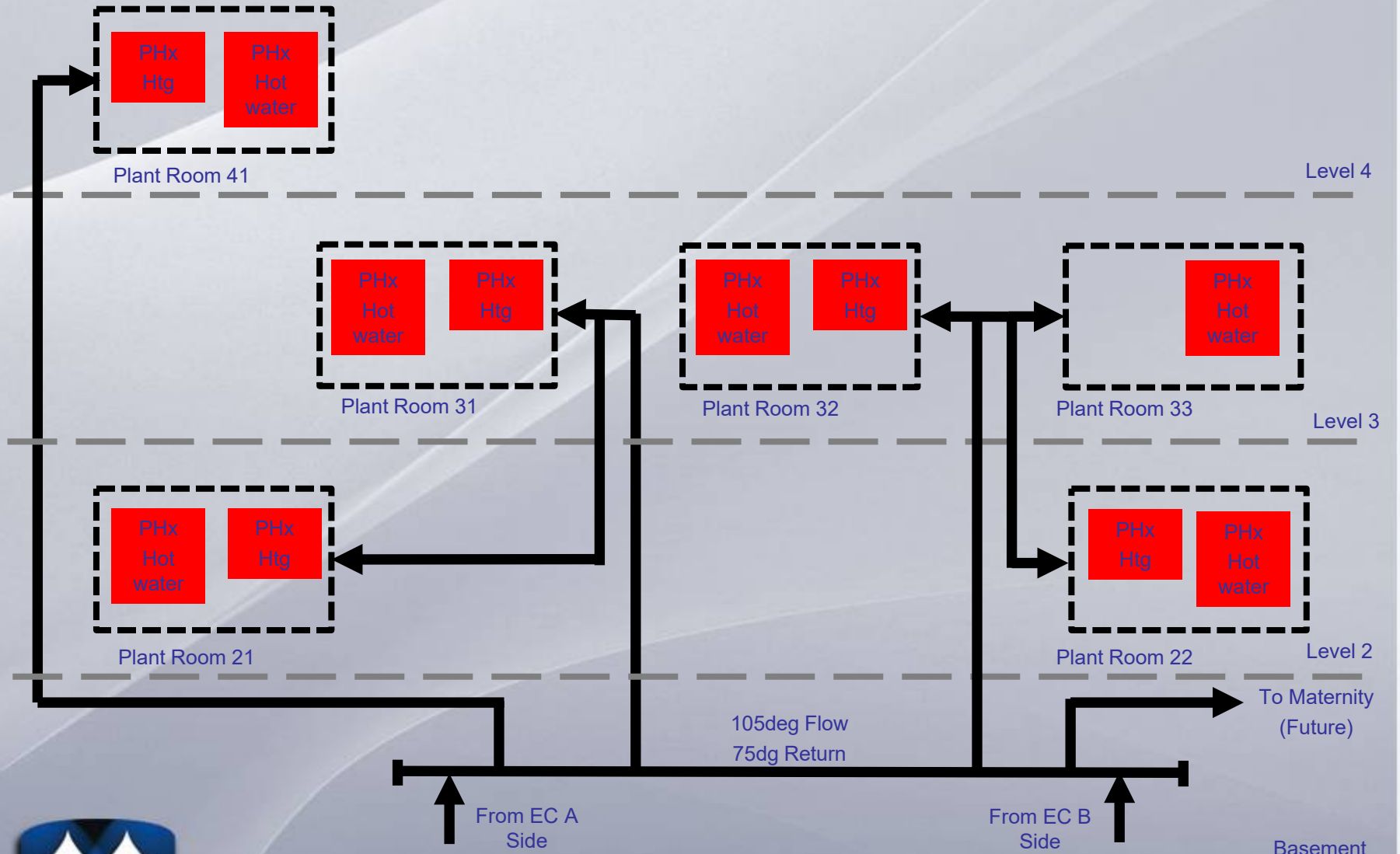
3 No Boilers @ 5MW each Duty+Duty+Standby	= 15MW
3 No CHP @ 1.2MW each	= 3.6MW
Total	= **18.6MW**

1 Boiler Failure	Max Available Capacity	= 33.6MW
1 CHP Failure	Max Available Capacity	= 37.4MW
1 Boiler + 1 CHP Failure	Max Available Capacity	= 32.4MW

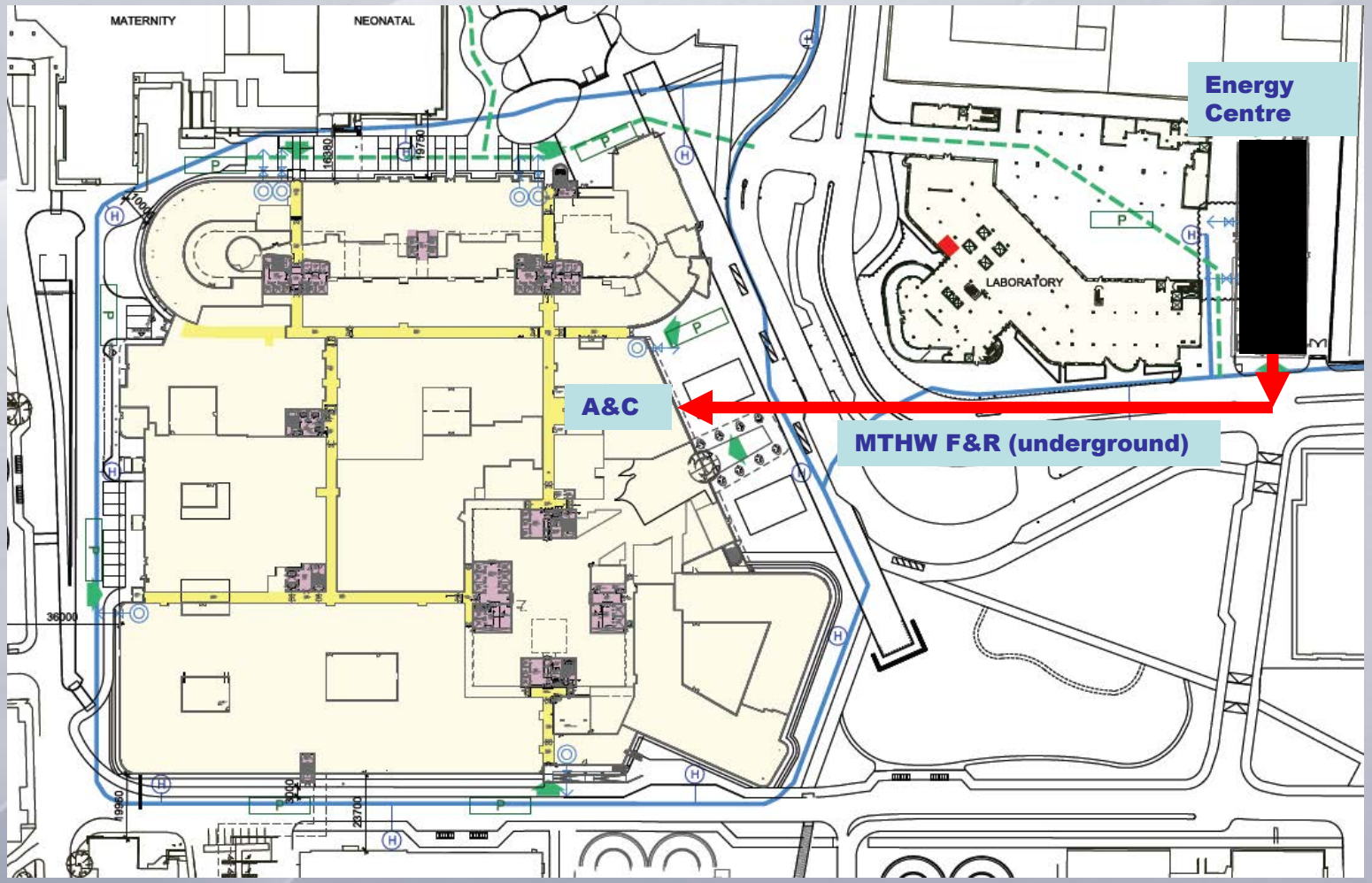
MTHW Heating System (EC)



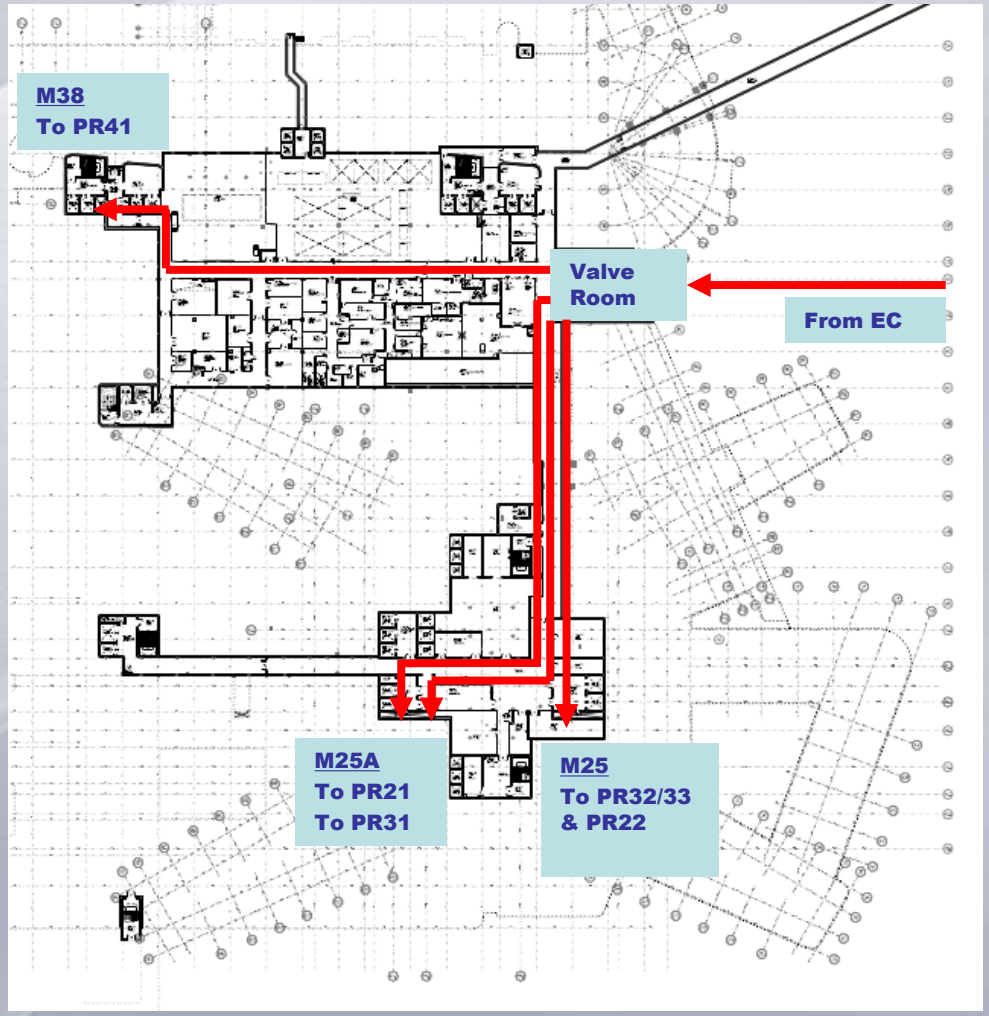
MTHW Heating System (A&C)



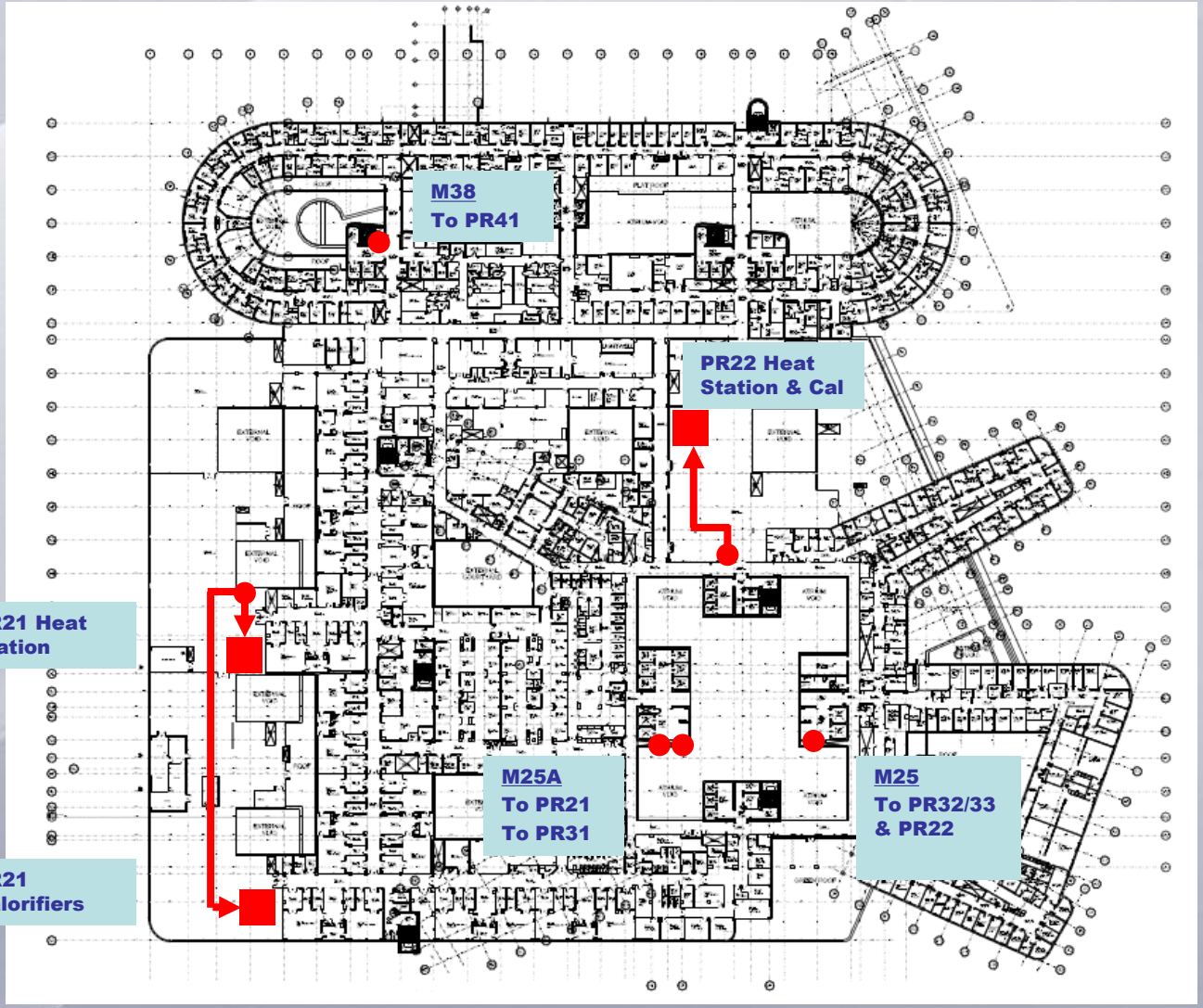
MTHW Pipework Distribution



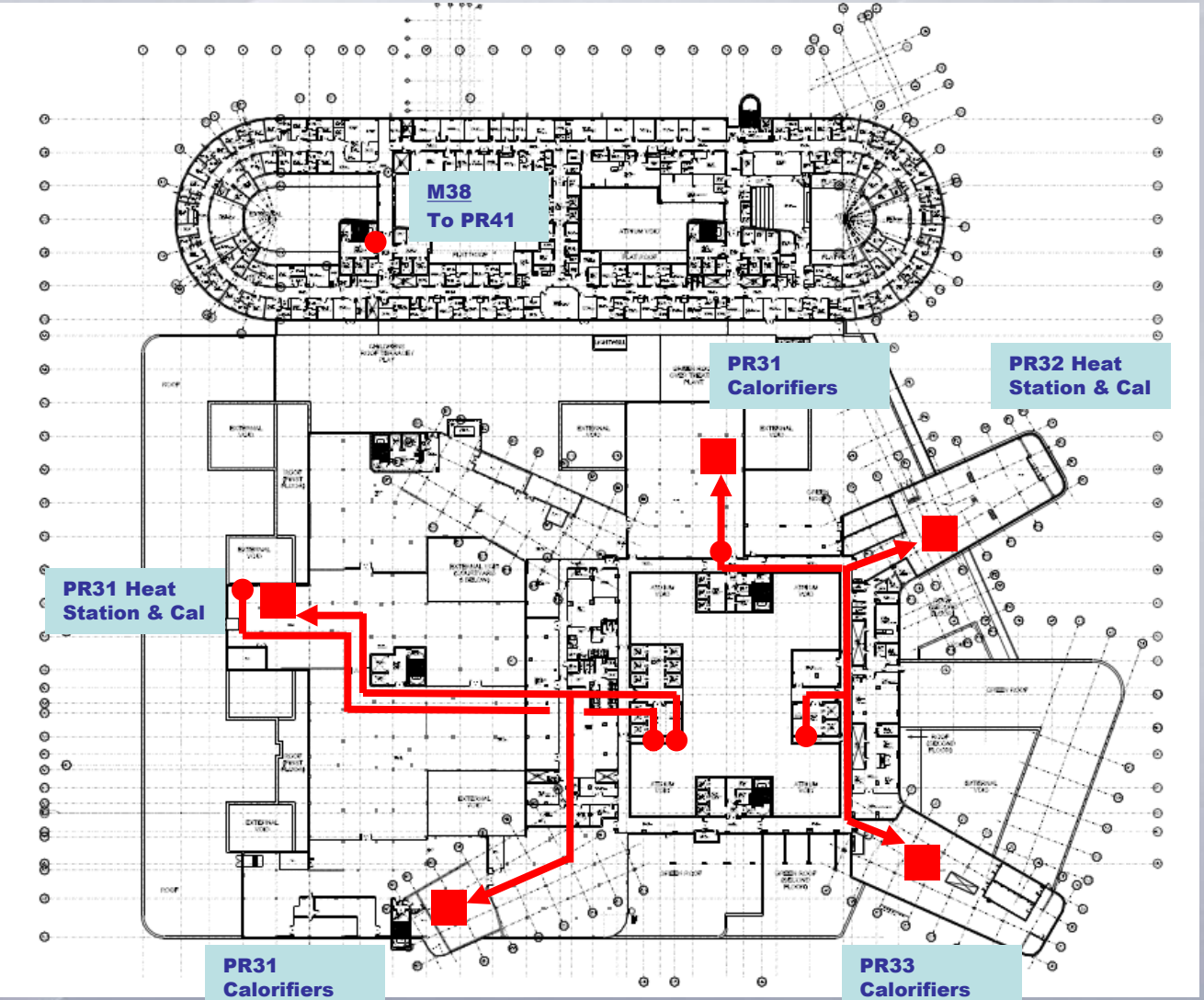
MTHW Pipework Distribution - Basement



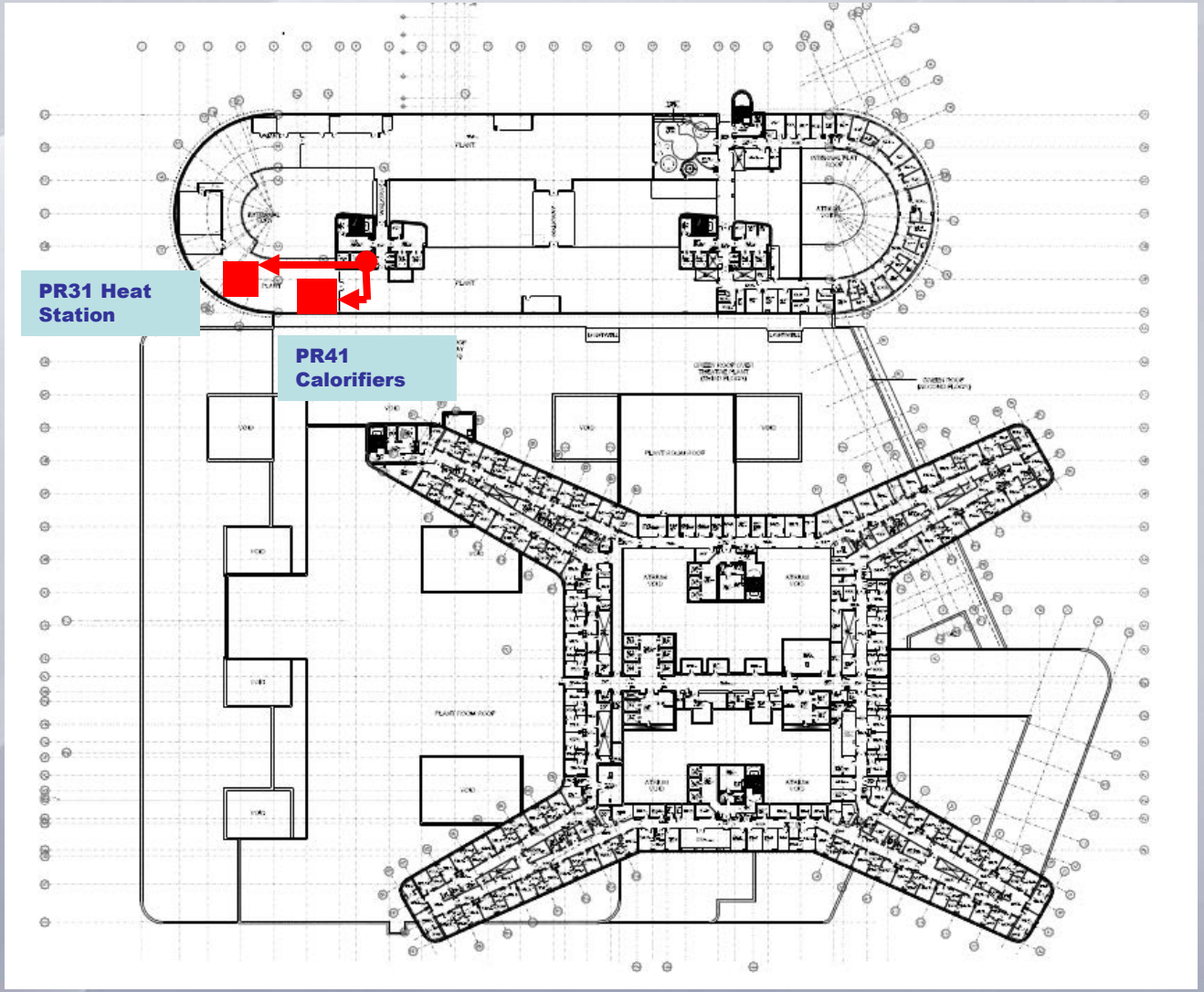
MTHW Pipework Distribution – Level 2



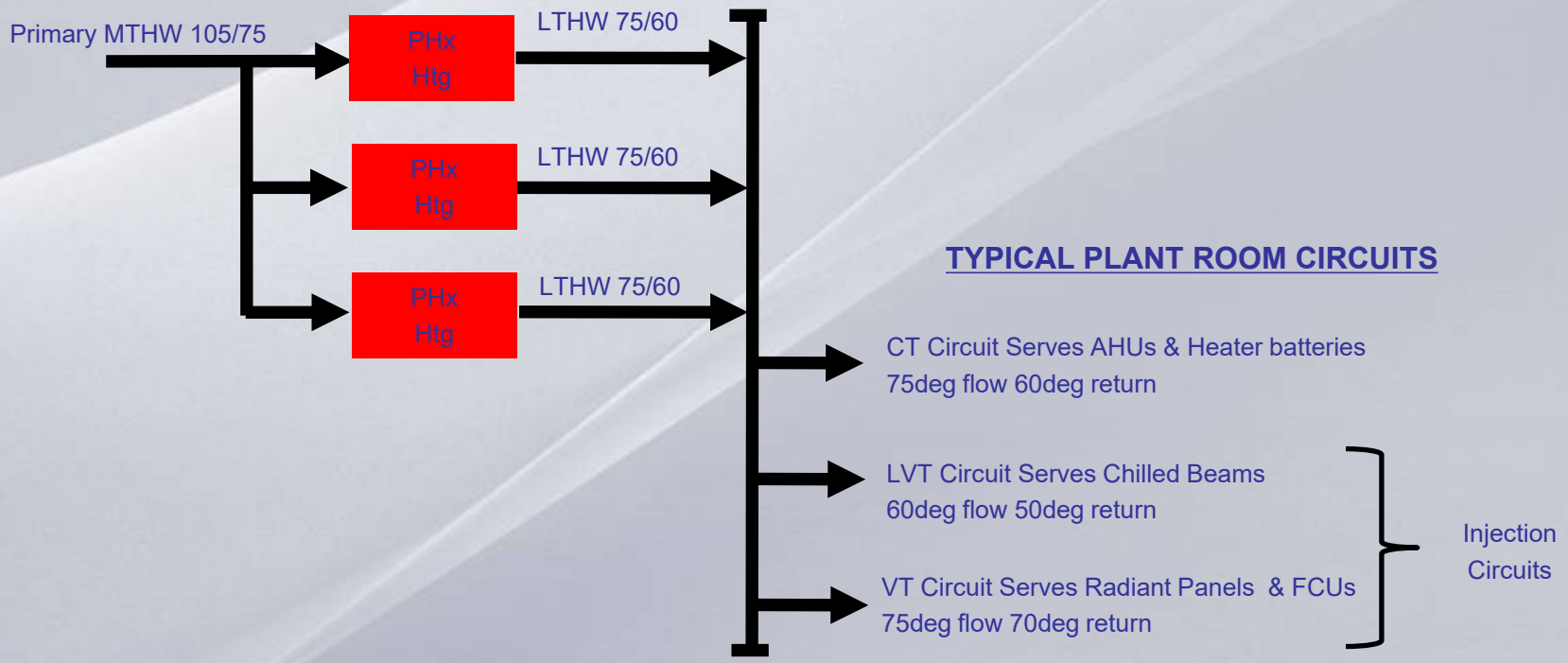
MTHW Pipework Distribution – Level 3



MTHW Pipework Distribution – Level 4

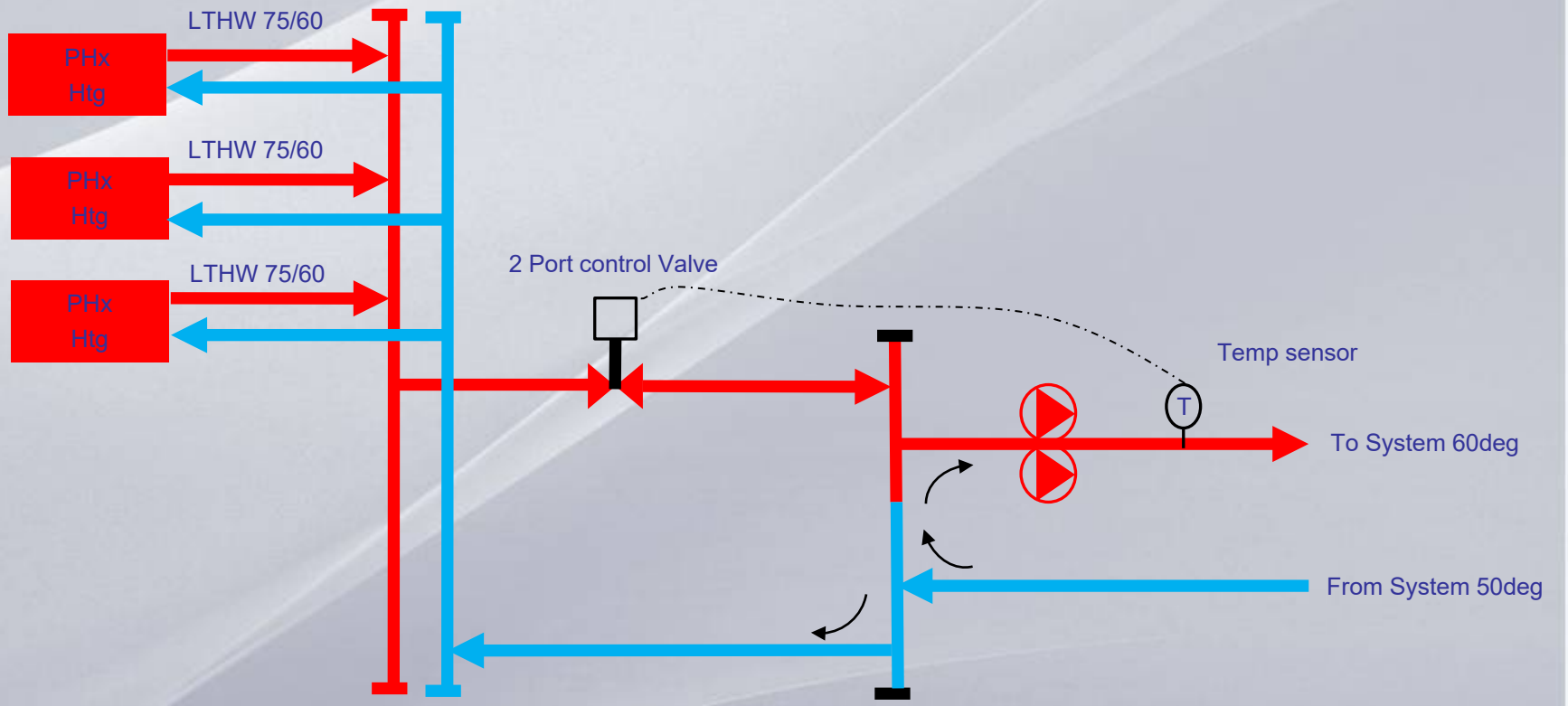


Typical Heating System



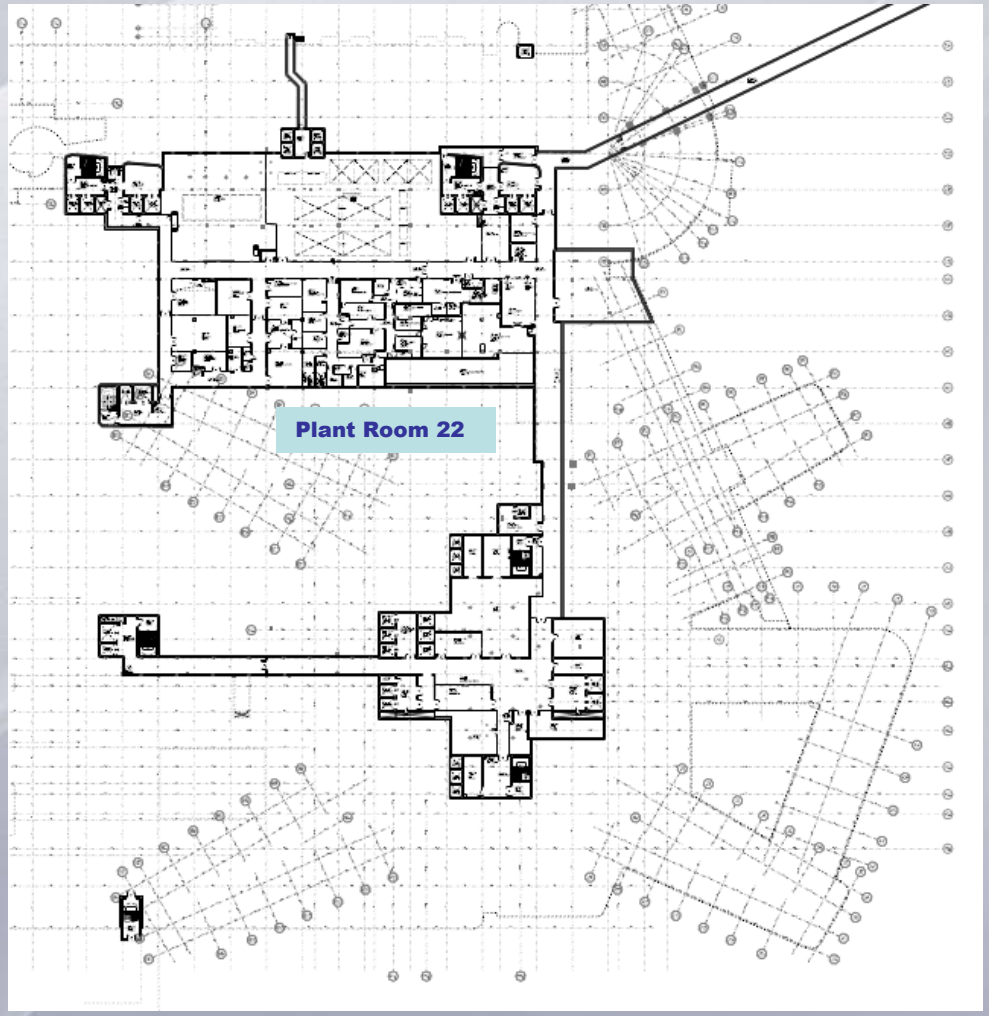
TYPICAL HEAT STATION

Typical LTHW Heat Station

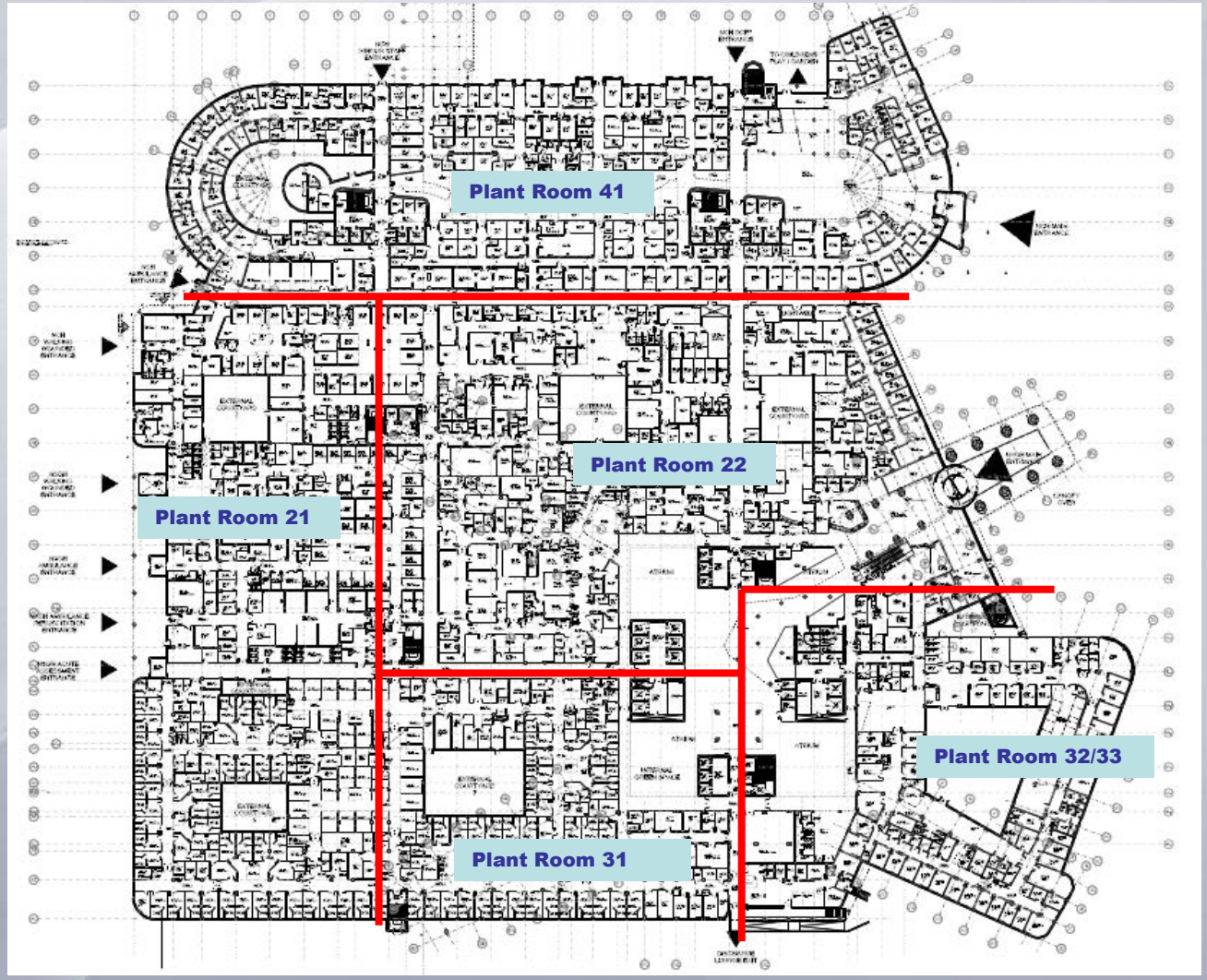


INJECTION CIRCUITS

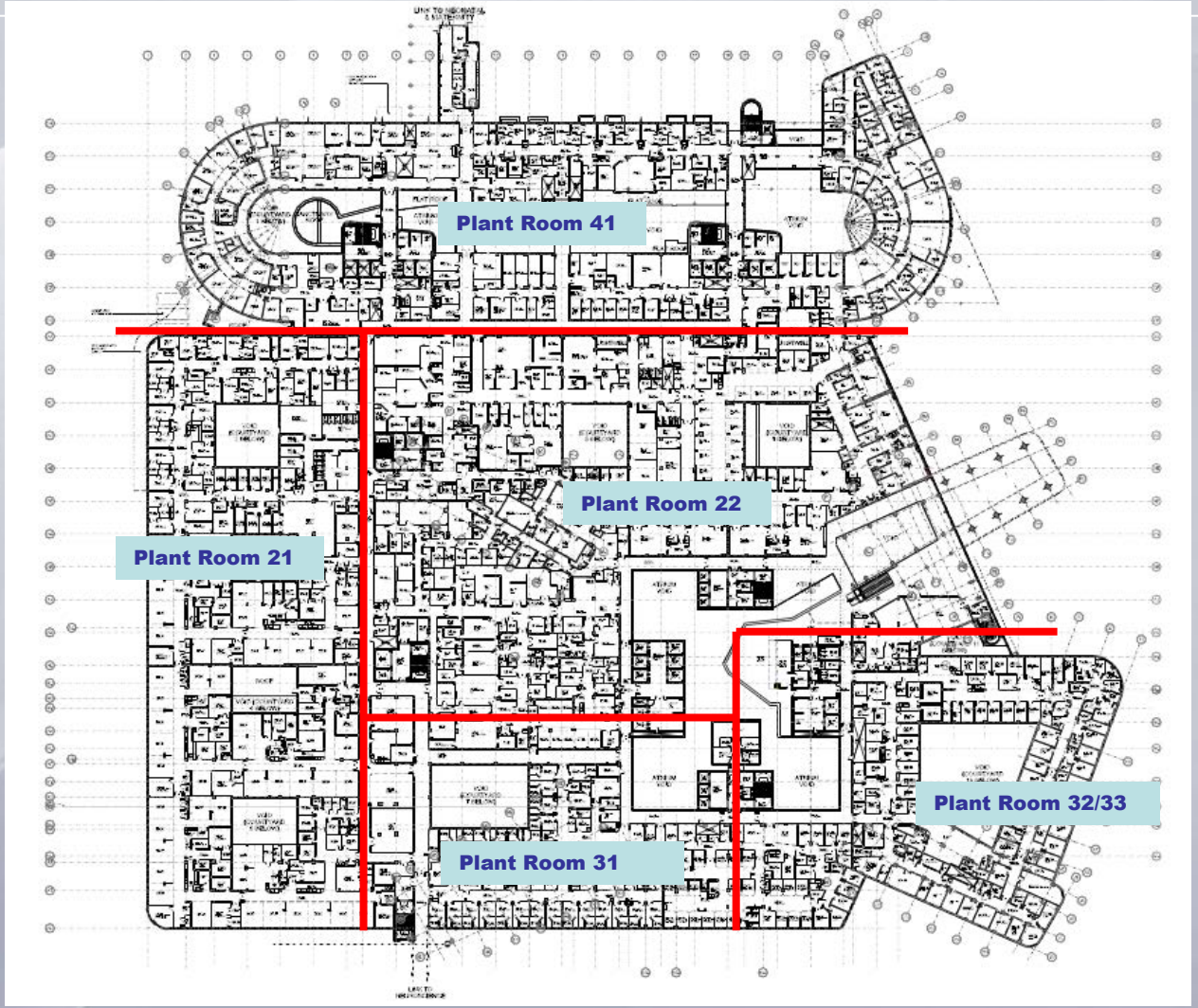
LTHW Areas Served - Basement



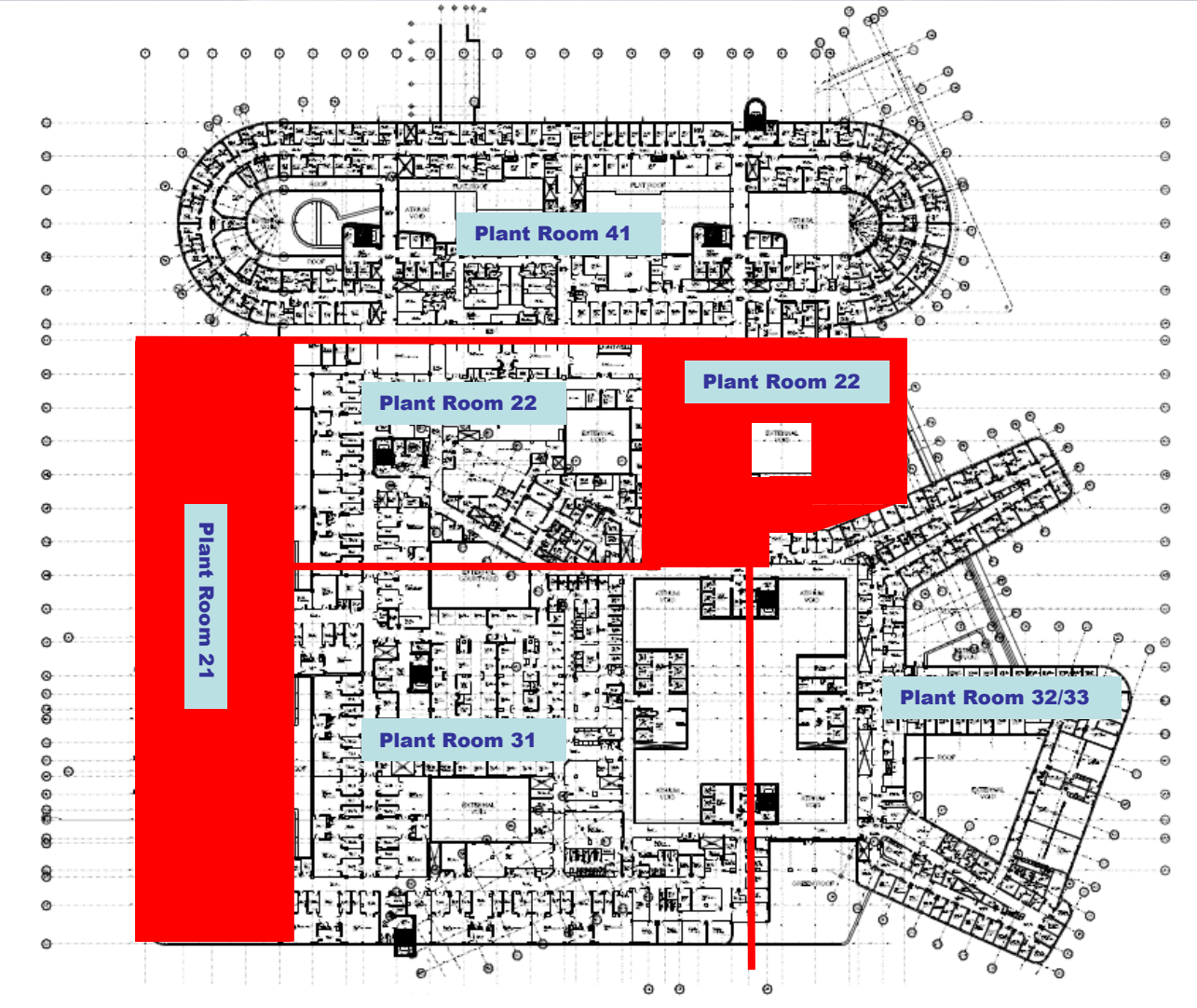
LTHW Areas Served– Level 0



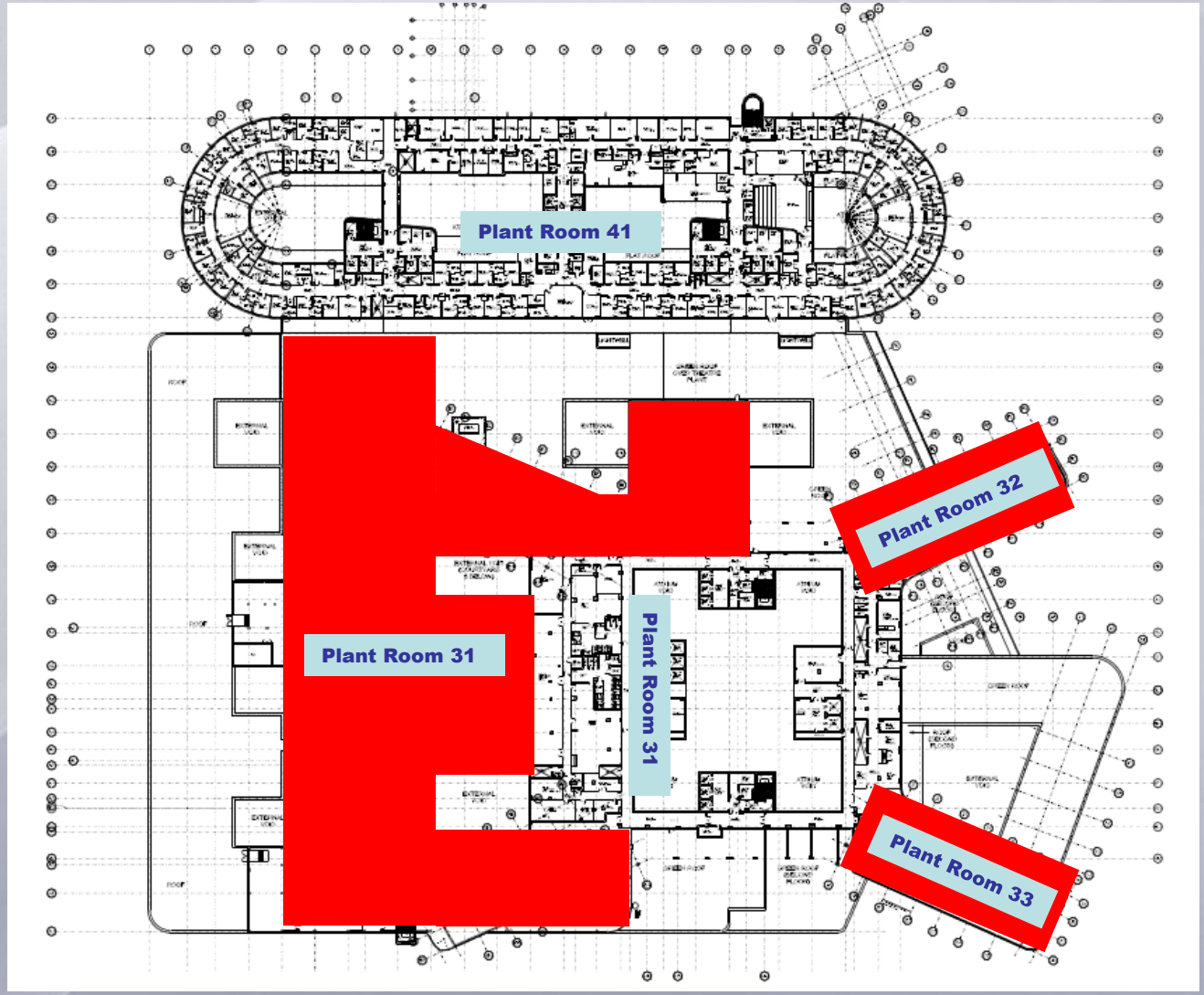
LTHW Areas Served– Level 1



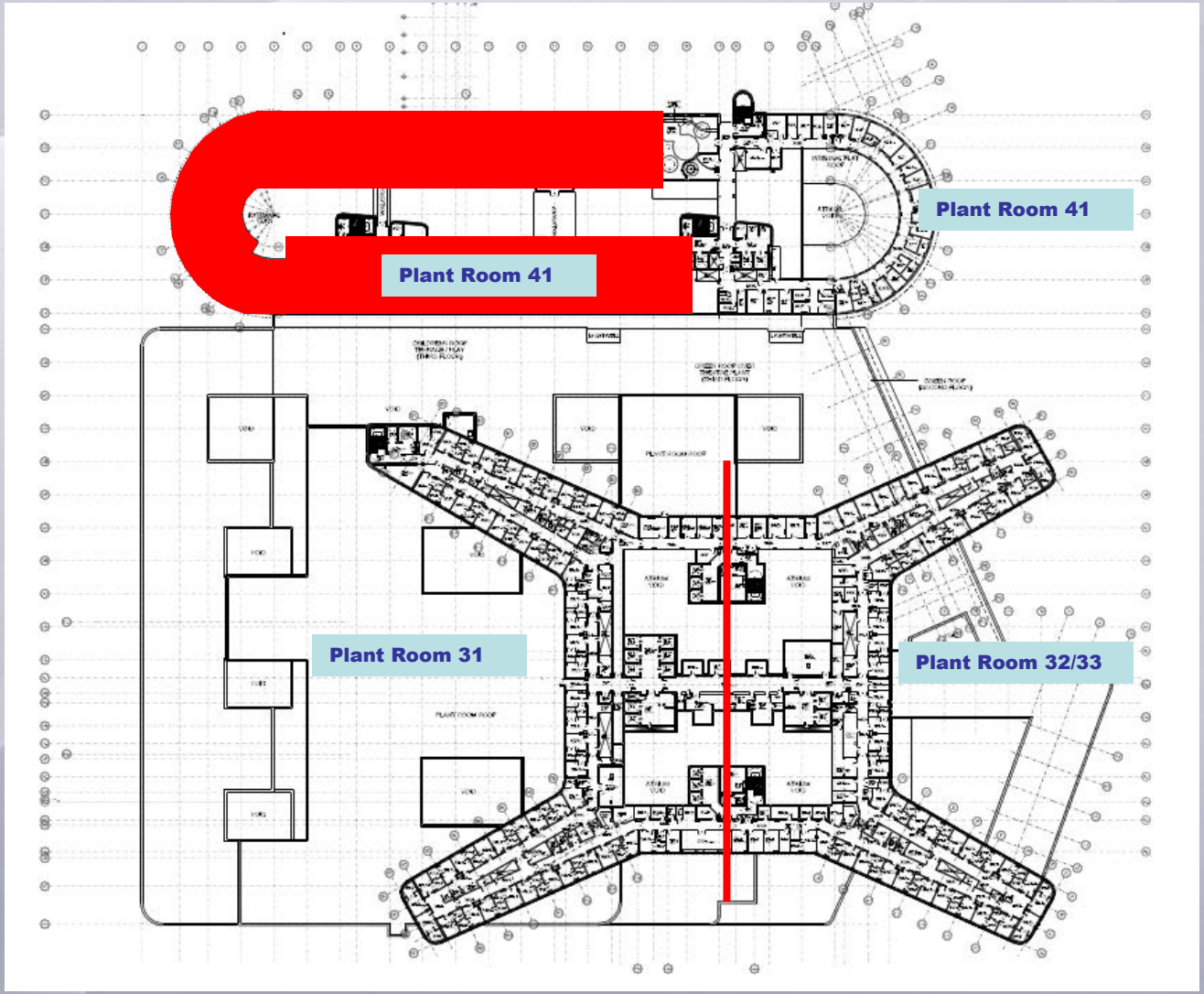
LTHW Areas Served– Level 2



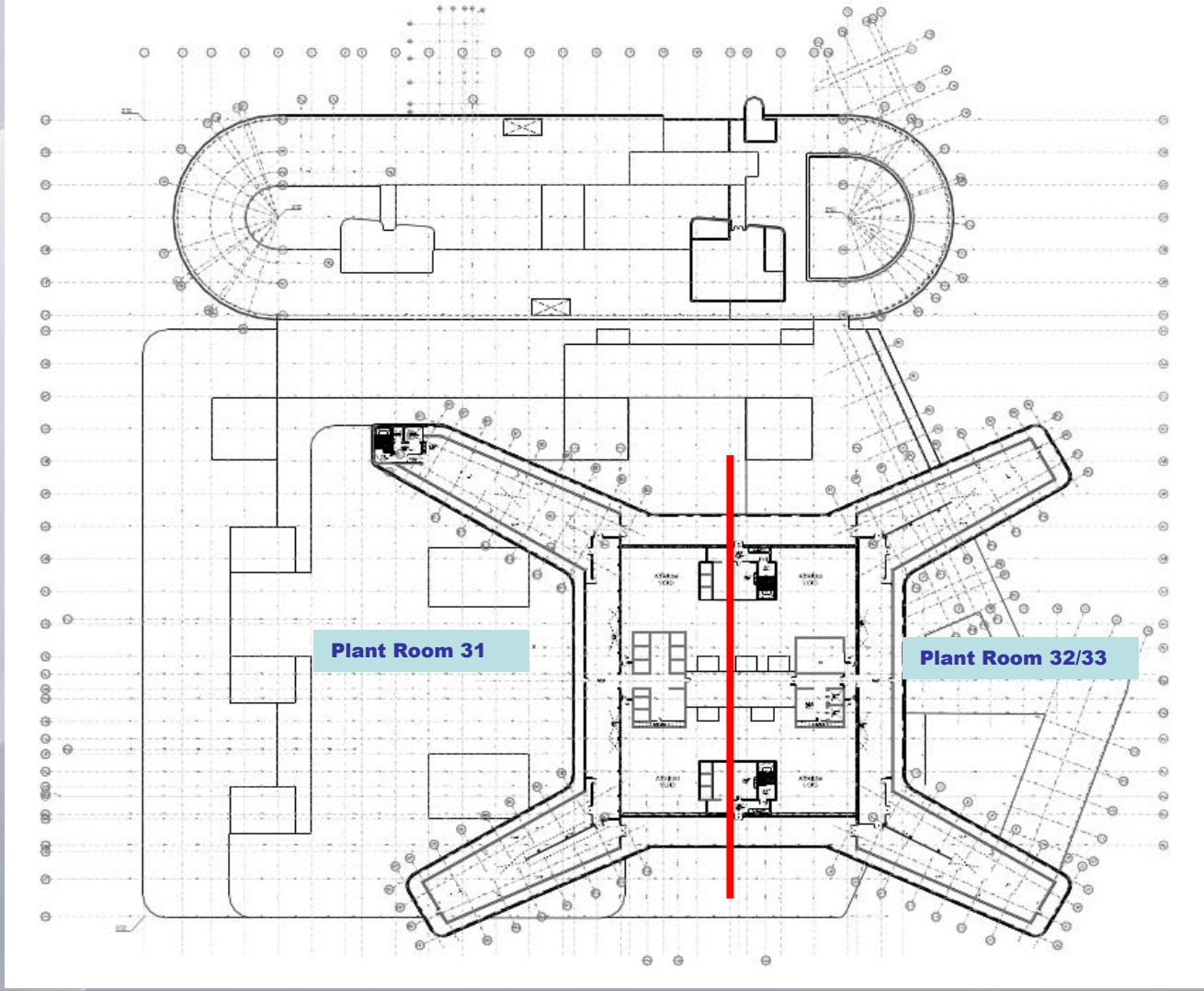
LTHW Areas Served– Level 3



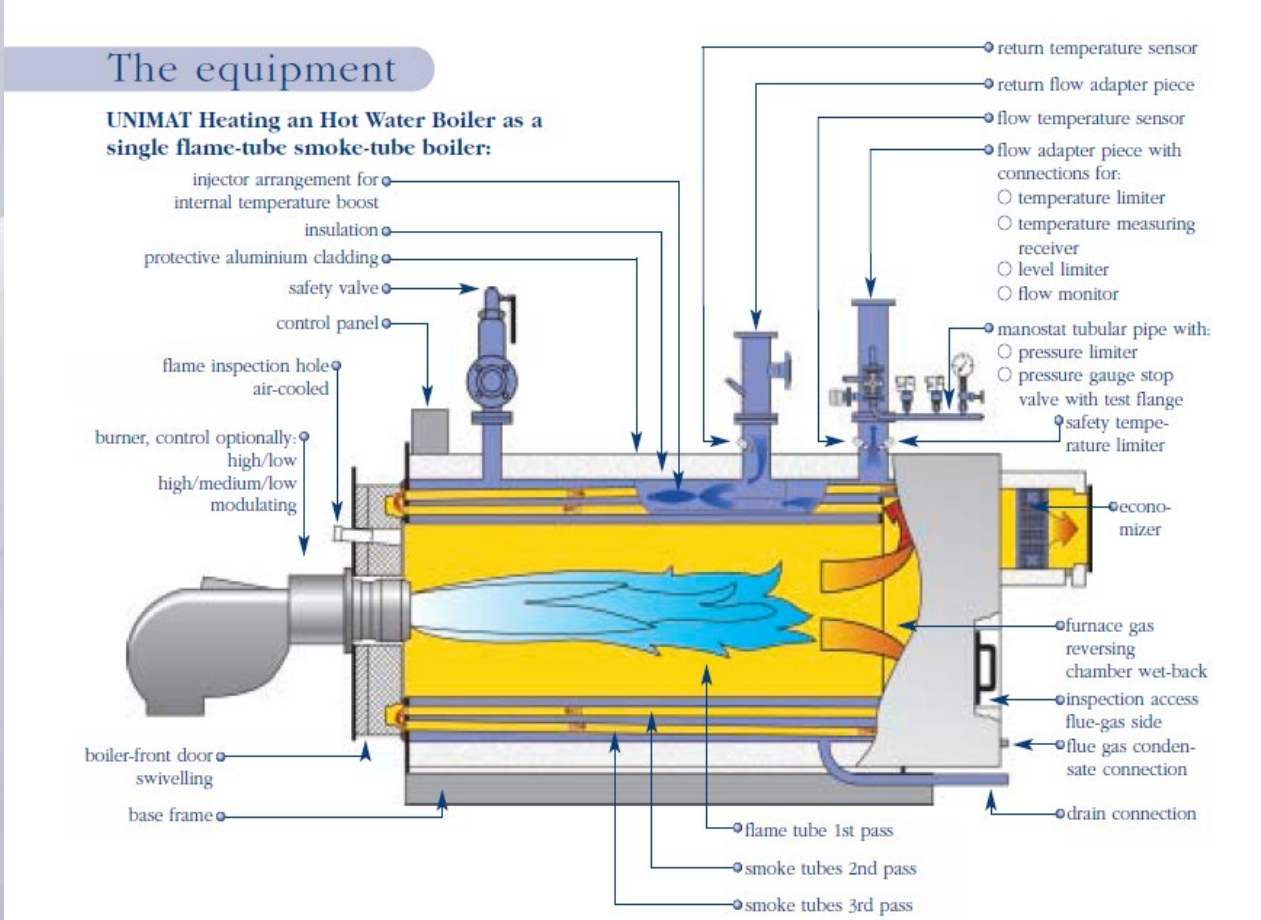
LTHW Areas Served– Level 4



LTHW Areas Served– Level 5 - 11



Key Components - Boilers



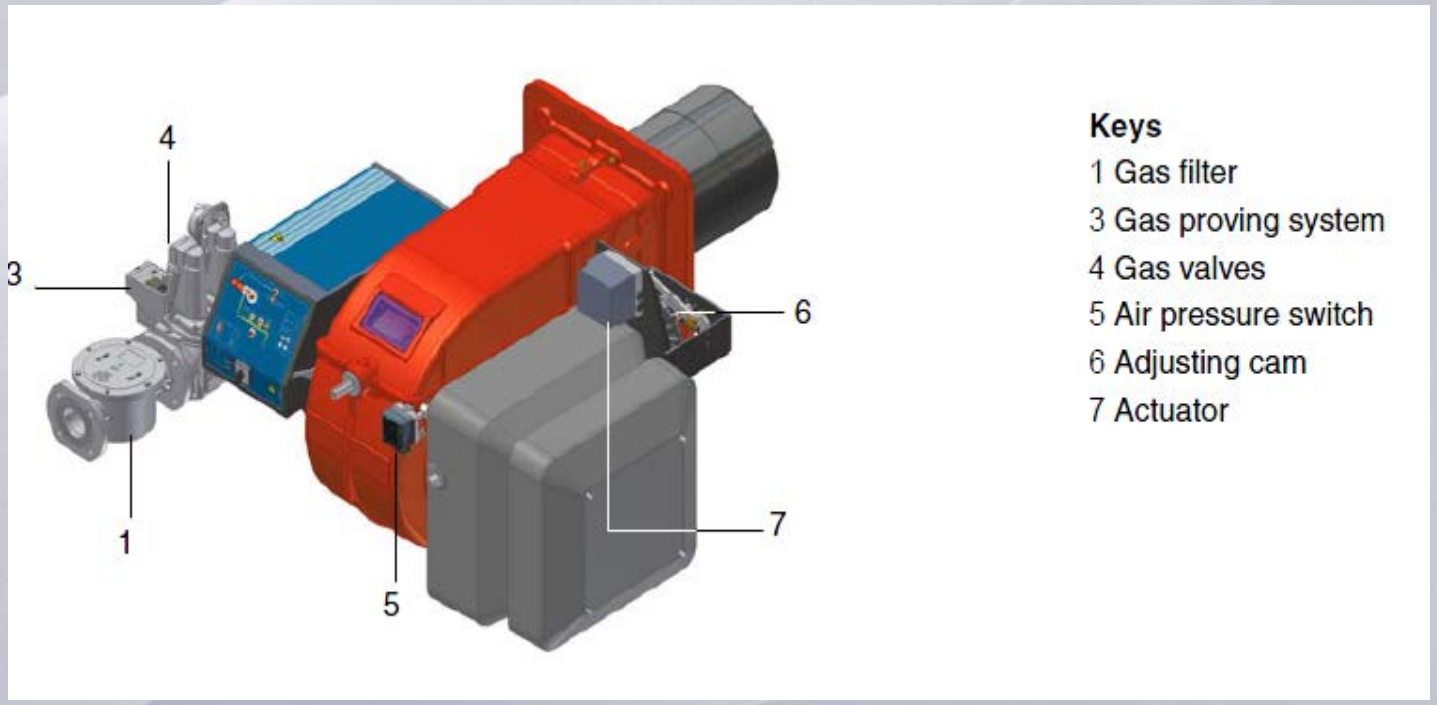
1. - 105 Degrees

2. - 3 pass boilers

3. - Dual Fuel Gas/Oil

4. - Economizer = increased efficiency

Key Components - Burners



Keys

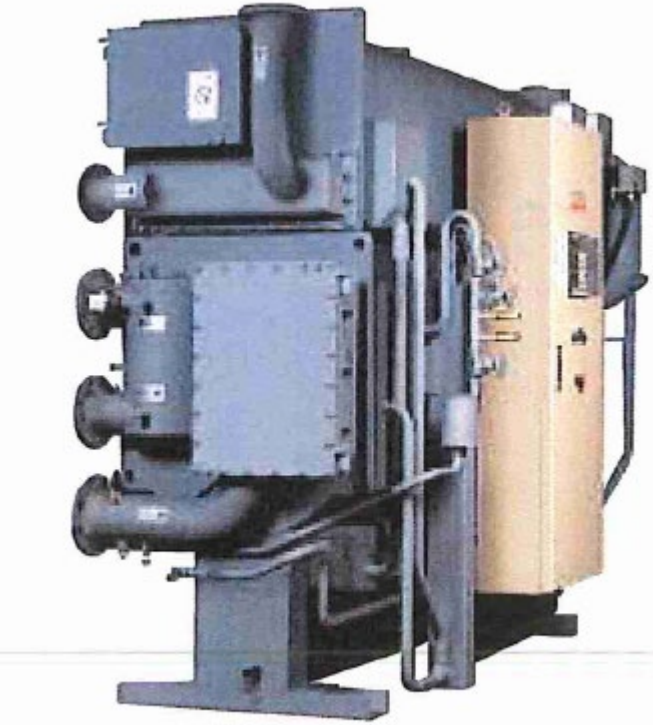
1 Gas filter
3 Gas proving system
4 Gas valves
5 Air pressure switch
6 Adjusting cam
7 Actuator

1. - 5000 KW capacity ea
2. - Dual Fuel Oil/Gas

Key Components - CHPs

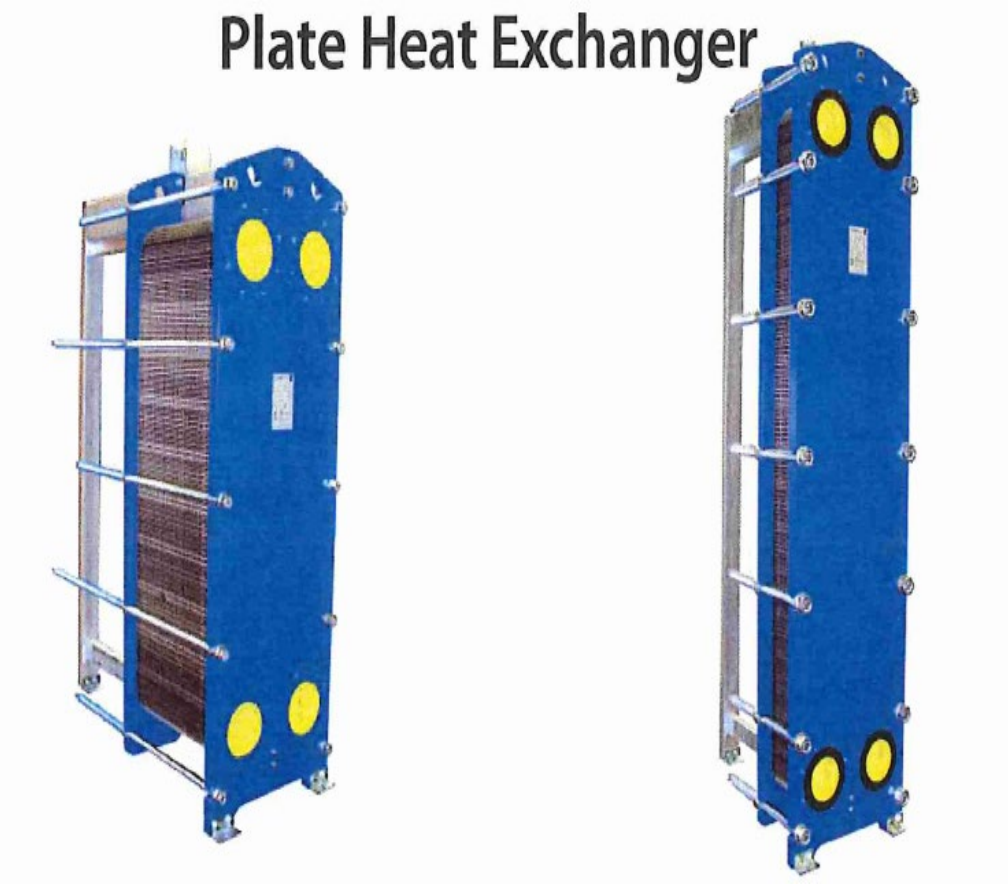
1. Purpose built container type
2. HV Gas fired Generator
3. Gas pipework c/w gas train and meter
4. Engine Coolant System
5. Room mounter Silencers
6. Exhaust mounted heat exchangers
7. CHP Control system
8. 1200 ltr Remote Clean Oil tank
9. 1200 ltr Remote Waste Oil tank

Key Components – Absorption Chiller



1. Chilled from Heat
2. Integrated controls

Key Components – Plate Heat Exchangers



36No in Total
- 16No Chilled
- 20No Heating

Arrangements

2 No	Duty/Standby 100%/100%
3No	Duty/Duty Standby 50%/50%/50%
4No	Duty/Duty/Duty/Standby 33%/33%/33%/33%

Key Components – Circulating Pumps

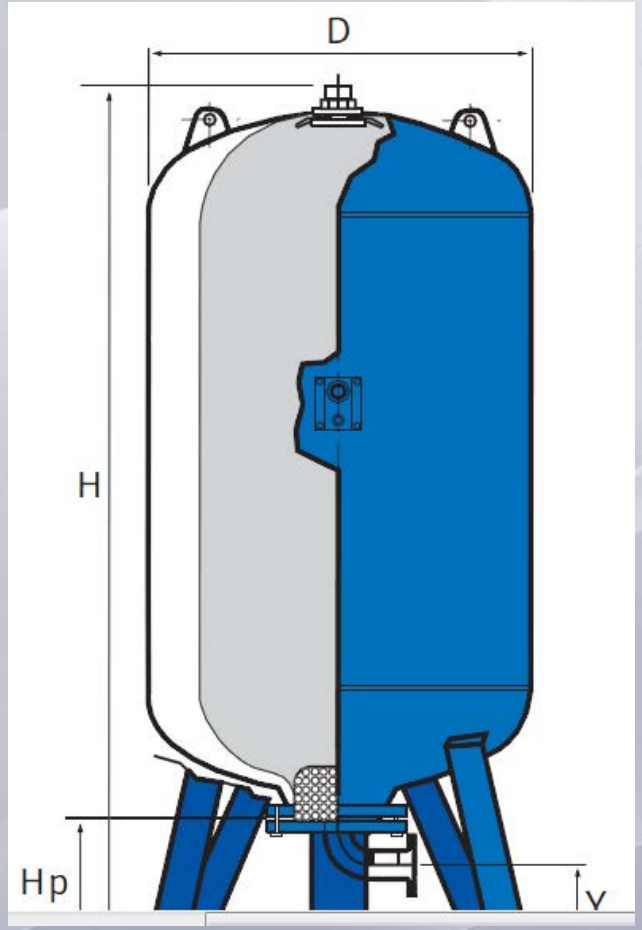
72No Heating pumps in Total
42No Heating Pumps in A&C
30No Heating Pumps in EC

All Duty/Standby
Single Pumps in Parallel Circuit

Cast Iron housing & impellers
Stainless steel shaft

Inverter driven

Key Components – Pressurisation Units



Wilo Comfort P260

C/W Expansion Vessels to suit system sizes

Internal Break tank

2 Pump units

Pressure transducers monitor pressure and feed 0-10v signal to controller

Key Components – Pressurisation Units

Wilomat Pressure-less Expansion

Suitable for larger systems instead of diaphragm units

Used in:
PR31 & 32 Heating & Labs Heating systems

Foot Sensors determine level in tank (12% min)

Pressurisation and De-aeration

“Spill & Fill” As system expands it is filled from vessel
As it cools it contracts and spills into vassel

Key Components – Degasser

Side stream vacuum dessasers

Vacuum removal of dissolved and free gas from water

Turbo feature for initial set up

Configurable running interval (set to every 60mins)

Key Components – Automatic Balancing Valves (Wafers)

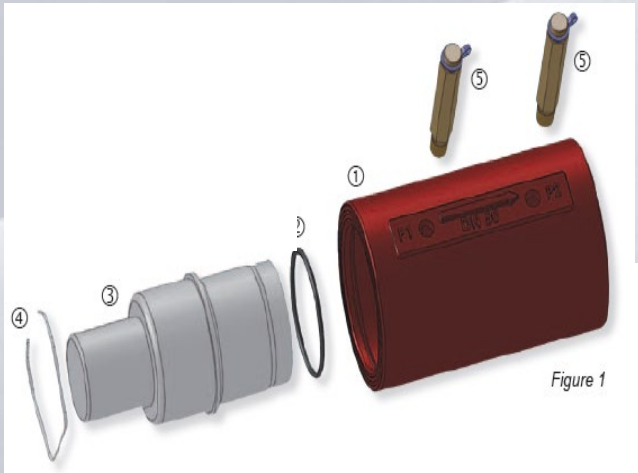


Figure 1

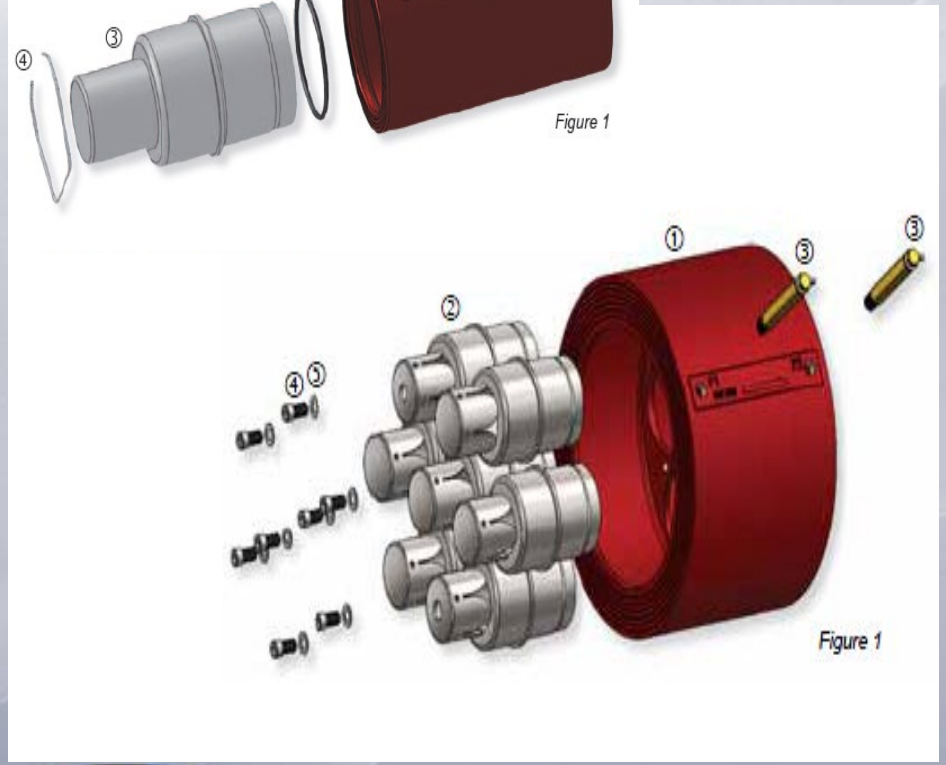


Figure 1

Pressure independent automatic balancing

Wafer Housing

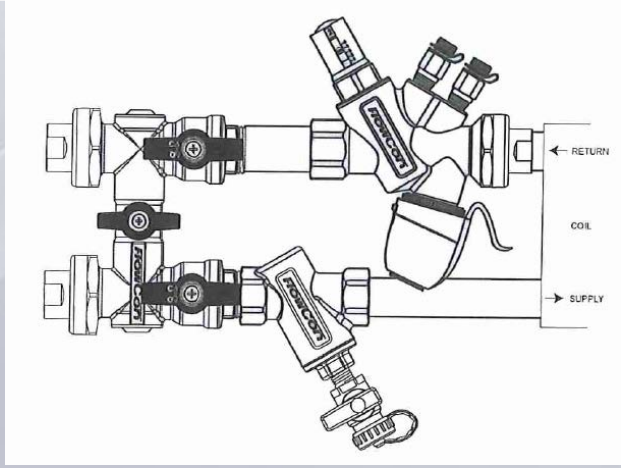
Stainless steel cartridges

Combination set to desired flow

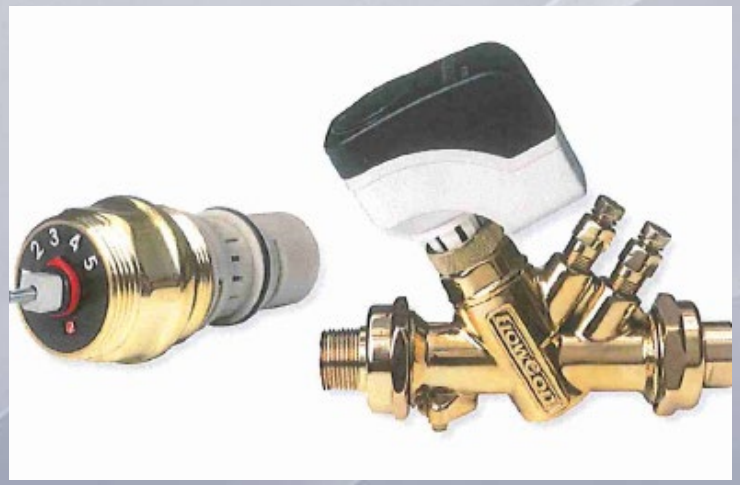
Key Components – Automatic Balancing Valve

Valved Bypass

Strainer



Bypass Assembly



PICV c/w cartridge & actuator

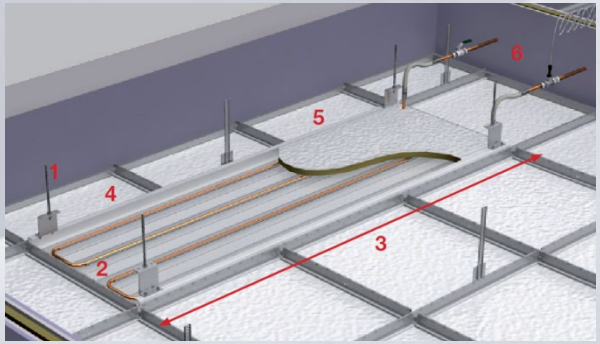
Pressure independent automatic balancing control valve

Pre-assembled off-site

Installed at chilled beams, FCU's & Heater batteries

Thermal actuators – Chilled beams
Modulating actuators – HB's and Fan coil units

Key Components – Terminal Units



Radiant Panels (SAS)

Ceilng mounted
Radiant heat – radiates down warming the surfaces not the air
Less water therefore more efficient, faster response time

Chilled Beams (Swegon)

Ceilng mounted
High capacity heating and cooling
Fresh air supply

Fan Coil Units (Ability)

Wall mounted
Fan assisted heating and cooling
Condensate tray c/w condensate pump

Key Components – RABV / Strainer /Air vents

PM 512 - Reverse Acting By-pass valves

Strainer

Flamco Automatic Air Vent

Any Questions ?

From: David Wilson [redacted]
Sent: 29 June 2018 14:03
To: Gallacher, Alan; Powrie, Ian ([redacted])
Cc: Kane, Mary Anne ([redacted]); Douglas Ross
Subject: QEUH - MTHW
Attachments: Queen Elizabeth University Hospital Energy Centre R02.doc

Alan / Ian,

We have been further working with Schneider and TUV Sud this week on the revised controls strategy for the MTHW system and have attached a draft strategy for your information. I am meeting with them again on Monday to further review and adjust as required so we will potentially have a further update later in the week, but thought it would be useful to issue so that you could see the direction we are moving in.

I have also asked TUV-Sud to review the lab heat exchanger size and advise on any remedial works required in relation to the 105/75^{O}C MTHW temperatures and will let you know the outcome.

David

David Wilson
Commissioning Manager

MULTIPLEX

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E [redacted]
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Building Management System
MTHW Boilers A and B Side, CHP System and LTHW Heat Exchangers

Contractor	Package
Schneider Electric Ltd	Building Management Systems

Title	Pages
Queen Elizabeth University Hospital Energy Centre	3

Document ID	Rev*	Original Written By	Date
QEUHospitalEnergyCentre	02	Mr. Chris Richardson	19/06/17

	Revised By	Checked By	Authorised By
By	C Richardson		
Date	29/06/17		

1 System Overview

The purpose of the proposal is too change the Energy Centre System Software to reduce the Energy Centre Primary Pump Volumes to transfer the MTHW hot water at a higher temperature.

1. The LTHW Heat Exchanger control to to be minimised on all Heat Exchangers and then control to be stepped on Duty/Lag1/Lag2/Lag3
2. The amount of Primary Pumps running will be matched to the CHP and Boilers
3. The Primary Pump Speed maintain a constant Primary Return Temperature
4. The Primary Pump speeds to be reduced based on the primary flow temperature
5. The Boiler Temperature Setpoint incremented to a 105°C based on the return temperature
6. Boiler Enable time delays enable and disablement

2 System Descriptions

2.1 The LTHW Heat Exchanger control to to be minimised on all Heat Exchangers and then control to be stepped on Duty/Lag1/Lag2/Lag3

The plantroom 31 LTHW has been used an example. The control will be introduced to Plantroom 21, 22, 31, 32, 41A and 41B LTHW Heat Exchangers

The LTHW Heat Exchangers (HX) will operate on a Duty/Lag1/Lag2/Lag3 step control and be rotated on a weekly/daily or manually operated basis

- Step1 The Duty HX control will be 0-50% and the Lag1/Lag2/Lag3 Hx's control will be 0-5%
- Step2 When the Duty HX control = 50% for an adjustable time period 120 Seconds the Lag1 HX will control 0-50%. The control will return to Step1 if the HX Duty or Lag1 control falls below 10% for a time period 120 Seconds.
- Step3 When the Duty or Lag1 HX control = 50% for an adjustable time period 120 Seconds the Lag2 HX will control = 0-50%. The control will return to Step2 if the HX Duty or Lag1 or Lag2 control falls below 10% for a time period 120 Seconds.
- Step4 When the Duty or Lag1 or Lag2 HX control = 50% for an adjustable time period 120 Seconds the Lag3 HX will control 0-50%. The control will return to Step3 if the HX Duty or Lag1 or Lag2 or Lag3 control falls below 10% for a time period 120 Seconds
- Step5 When the Duty or Lag1 or Lag2 or Lag3 HX control = 50% for an adjustable time period 120 Seconds the Duty HX will control 50-100%. The control will return to Step4 if the HX Duty control falls below 60% for a time period 120 Seconds or Lag1 or Lag2 or Lag3 control falls below 10% for a time period 120 seconds.
- Step6 When the Duty control = 100% for an adjustable time period 120 Seconds the Lag1 will control 50-100%. The control will return to Step5 if the HX Duty or Lag 1 control falls below 60% for a time period 120 Seconds or Lag2 or Lag3 control falls below 10%
- Step7 When the Duty or Lag1 control = 100% for an adjustable time period 120 Seconds the Lag2 will control 50-100%. The control will return to Step6 if the HX Duty or Lag1 or Lag2 control falls below 60% for a time period 120 Seconds or Lag3 control falls below 10%
- Step8 When the Duty or Lag1 or Lag2 control = 100% for an adjustable time period 120 Seconds the Lag3 will control 50-100%. The control will return to Step7 if the HX Duty or Lag1 or Lag2 or Lag 3 control falls below 60% for a time period 120 Seconds.

See tables below

	Step1	Step2	Step3	Step4
HX Duty	0-50%	0-50%	0-50%	0-50%
HX Lag1	0-5%	0-50%	0-50%	0-50%
HX Lag2	0-5%	0-5%	0-50%	0-50%
HX Lag3	0-5%	0-5%	0-5%	0-50%

	Step5	Step6	Step7	Step8
HX Duty	50%-100%	50%-100%	50%-100%	50%-100%
HX Lag1	0-50%	50%-100%	50%-100%	50%-100%
HX Lag2	0-50%	0-50%	50%-100%	50%-100%
HX Lag3	0-50%	0-50%	0-50%	50%-100%

2.2 The amount of Primary Pumps running will be matched to the CHP and Boilers

To allow the amount of water derived from the CHP and Boilers the Primary Pumps will be enabled as follow

	Duty	Lag1	Lag2	Standby
CHP	Y	N	N	N
1 Boiler + CHP	Y	Y	N	N
2 Boilers + CHP	Y	Y	Y	N
3 Boilers + CHP	Y	Y	Y	N

The control will be changed for the A and B systems
To Duty change the Boiler Plantroom Control this is manual only at present.
This can be set back to Automatic changeover of plantrooms can be proven when three Boilers are enabled at a control temperature of 105°C and three pumps are running at full speed
The running of two plantrooms that has been disabled can also be enabled.

2.3 The Primary Pump Speed maintain a constant Primary Return Temperature

The Primary water return temperature is monitored
The Primary Pump Speed will modulate to maintain a constant primary return temperature at an adjustable setpoint of 73°C

2.4 The Primary Pump speeds to be reduced based on the primary flow temperature

The primary water flow water temperature is monitored. If the flow temperature falls below a setpoint of 90°C the pump speed will be inhibited to its minimum speed via a PID routine to allow the Primary Water temperature to achieve a higher temperature

2.5 The Boiler Temperature Setpoint incremented to a 105°C based on the return CHP temperature.

When a Boiler is enabled it will be enabled at reduced setpoint 90°C. The Boiler Setpoint will be incremented via a PID routine to its setpoint of 105°C based on the CHP Return temperature.

2.6 Boiler Enable time delays enable and disablement

The Boiler enables time delays will be brought back into operation. The delay between enabling the next boiler will be 30 minutes. If the return temperature falls below 64°C then the time delays between enabling boilers will be disabled. (No time delay)

2.7 Boiler Enable Setpoints

The Boiler enable setpoints for winter control setpoint will be applied all year round.
71°C = 1 Boiler
68°C = 2 Boilers
65°C = 3 Boilers

3 Proposals

The items 21 – 2.7 are proposals to enhance the system controls to deliver maximum temperature. The changes will have to be monitored and trend logged.

Each stage of control is to be implemented in an agreed sequence.

The items that have been overridden on the system will have to be changed back to automatic control to allow the system to control via both Plantrooms and to allow the plantroom changeover to occur every three months as requested in the Innovated design report.

Once the changes have been accepted these can be written into the FDS and published to ZUTEC

From: David Wilson [redacted]
Sent: 04 July 2018 10:23
To: Gallacher, Alan; Powrie, Ian ([redacted])
Cc: Kane, Mary Anne ([redacted]); Douglas Ross; McKechnie, Stewart; ''Ciaran J. Kellegher' ([redacted])'; Fergus Shaw
Subject: QEUH - MTHW Control Strategy
Attachments: Queen Elizabeth University Hospital Energy Centre R03 (2).doc

Alan / Ian,

As noted in my email on Friday I met again earlier this week with Schneider, Mercury and TUV-Sud to further review the initial draft controls strategy. We have now made some adjustments and have attached for discussion. The strategy is focused particularly on the pump operation, boiler operation to ensure heat exchangers receive the required MTHW flow and maintaining the required return temperatures to complement the CHP operation. We are still reviewing how the system will react to varying loads, the CHP heat rejection cycle and absorption chiller operation (included within the current full controls FDS) and also a schedule of implementation/monitoring and cause and effect type scenarios.

It would be good if we could set up a workshop to jointly discuss and review the strategy and jointly develop the implementation plan. I have penciled our team in for Wednesday next week (11th) if that is suitable with your guys?

Thanks
David

David Wilson
Commissioning Manager

MULTIPLEX

Multiplex Construction Europe Ltd
M [redacted]
E [redacted]
W www.multiplex.global

Building Management System
MTHW Boilers A and B Side, CHP System and LTHW Heat Exchangers

Contractor	Package
Schneider Electric Ltd	Building Management Systems

Title	Pages
Queen Elizabeth University Hospital Energy Centre	3

Document ID	Rev*	Original Written By	Date
QEUHospitalEnergyCentre	03	Mr. Chris Richardson	19/06/18

	Revised By	Checked By	Authorised By
By	C Richardson		
Date	03/07/2018		

1 System Overview

The purpose of the proposal is too change the Energy Centre System Software to reduce the Energy Centre Primary Pump Volumes to transfer the MTHW hot water at a higher temperature.

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3. The Primary Pump Speed maintain a constant Primary Return Temperature
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6. Boiler Enable time delays enable and disablement

2 System Descriptions

2.1 The LTHW Heat Exchanger control to to be minimised on all Heat Exchangers and then control to be stepped on Duty/Lag1/Lag2/Lag3

The plantroom 31 LTHW has been used an example. The control will be introduced to Plantroom 21, 22, 31, 32, 41A and 41B LTHW Heat Exchangers. Each heat exchanger controls on its own flow temperature sensor. The current operation of the DHW Heat exchanger's control will not change (no lead lag, operate in parallel).

The LTHW Heat Exchangers (HX) will operate on a Duty/Lag1/Lag2/Lag3 step control and be rotated on a weekly/daily or manually operated basis

- Step1 The Duty HX control will be 0-100% and the Lag1/Lag2/Lag3 Hx's control will be 0-5%
- Step2 When the Duty HX control = 100% for an adjustable time period 120 Seconds the Lag1 HX will control 0-100%. The control will return to Step1 if the HX Duty or Lag1 control falls below 20% for a time period 120 Seconds.
- Step3 When the Duty or Lag1 HX control = 100% for an adjustable time period 120 Seconds the Lag2 HX will control = 0-100%. The control will return to Step2 if the HX Duty or Lag1 or Lag2 control falls below 20% for a time period 120 Seconds.
- Step4 When the Duty or Lag1 or Lag2 HX control = 100% for an adjustable time period 120 Seconds the Lag3 HX will control 0-100%. The control will return to Step3 if the HX Duty or Lag1 or Lag2 or Lag3 control falls below 20% for a time period 120 Seconds

See table below

	Step1	Step2	Step3	Step4
HX Duty	0-100%	0-100%	0-100%	0-100%
HX Lag1	0-5%	0-100%	0-100%	0-100%
HX Lag2	0-5%	0-5%	0-100%	0-100%
HX Lag3	0-5%	0-5%	0-5%	0-100%

2.2 The amount of Primary Pumps running will be matched to the CHP and Boilers

To allow the amount of water derived from the CHP and Boilers to be transferred the Primary Pumps will be enabled as shown in table.

	Duty	Lag1	Lag2	Standby
CHP	Y	N	N	N
1 Boiler + CHP	Y	Y	N	N
2 Boilers + CHP	Y	Y	Y	N
3 Boilers + CHP	Y	Y	Y	N

The control will be changed for the A and B systems
To Duty change the Boiler Plantroom Control this is manual only at present.
This can be set back to Automatic changeover of plantrooms can be proven when three Boilers are enabled at a control temperature of 105°C and three pumps are running at full speed
The running of two plantrooms that has been disabled can also be enabled.

2.3 The Primary Pump Speed maintain a constant Primary Return Temperature

The common Primary water return temperatures from the A and B Side are monitored.
The A side common return temperature controls the A side primary pumps. The B side common return temperature controls the B side primary pumps
The Primary Pump Speed will modulate to maintain a constant primary return temperature at an adjustable setpoint of 73°C.

2.4 The Primary Pump speeds to be reduced based on the primary flow temperature

The primary water flow water temperature is monitored. If the flow temperature falls below a setpoint of 90°C the pump speed will be inhibited to its minimum speed via a PID routine to allow the Primary Water temperature to achieve a higher temperature. Reducing the speed of the primary pumps when the common flow is less than 90°C will allow the Boilers and CHP temperature to achieve flow temperature and prevent over dilution from the primary return water temperature.

2.5 The Boiler Temperature Setpoint incremented to a 105°C based on the return CHP temperature.

When a Boiler is enabled it will be enabled at reduced setpoint 90°C. The Boiler Setpoint will be incremented via a PID routine to its setpoint of 105°C based on the CHP Return temperature.

2.6 Boiler Enable time delays enable and disablement

The Boiler enables time delays will be brought back into operation. The delay between enabling the next boiler will be 30 minutes. If the return temperature falls below 64°C then the time delays between enabling boilers will be disabled. (No time delay)

2.7 Boiler Enable Setpoints

The Boiler enable setpoints for winter control setpoint will be applied all year round. The Boilers are enabled based on the CHP return temperatures.
71°C = 1 Boiler
68°C = 2 Boilers
65°C = 3 Boilers

The above control is the current winter control for Boiler Enabling

When there is no flow to the CHP the Boilers will control via A side common return temperature for A Side Boilers and the B side common return temperature for B side Boilers

3 Proposals

The items 2.1 – 2.7 are proposals to enhance the system controls to deliver maximum temperature. The changes will have to be monitored and trend logged.

Implementation of control strategy
1. Set all overridden control points and manual valves back to commissioned / automatic settings
2. Switch off CHPs
3. Change pump control to return temperature / modulating (item 2.2/2.3)
4. Implement heat exchanger strategy working on one plant room at a time (item 2.1)
5. Implement boiler enable and delay controls (Item 2.6/2.7)
6. Implement boiler soft start temperature control (item 2.5)
7. Bring in CHP in stages (one at a time)

After each stage monitor system before moving to next stage. At end of implementation monitor and report

From: David Wilson [redacted]
Sent: 20 July 2018 14:50
To: Gallacher, Alan
Cc: Powrie, Ian ([redacted]); Wilson, Andy ([redacted]); Kane, Mary Anne ([redacted]); McKechnie, Stewart; ''Ciaran J. Kellegher' ([redacted])'; Stephen Houston; Douglas Ross
Subject: QEUH - MTHW Control Strategy
Attachments: Queen Elizabeth University Hospital Energy Centre R04.2.doc

Afternoon Alan,

I held another workshop with TUV-Sud / Mercury / and Schneider this week to further review the rev 3 of the controls strategy we issued over to you and we have made some minor enhancements. I have attached the enhanced version (rev 4) which is what we can chat/ work through on Thursday.

As previously advised I will be on holiday but will pick up from Stephen Houston when I return.

Have a good weekend
David

David Wilson
Commissioning Manager

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Building Management System
MTHW Boilers A and B Side, CHP System and LTHW Heat Exchangers

Contractor	Package
Schneider Electric Ltd	Building Management Systems

Title	Pages
Queen Elizabeth University Hospital Energy Centre	5

Document ID	Rev*	Original Written By	Date
QEUHospitalEnergyCentre	04	Mr. Chris Richardson	16/07/18

	Revised By	Checked By	Authorised By
By	C Richardson		
Date	03/07/2018		

1 System Overview

The purpose of the proposal is too change the Energy Centre System Software to reduce the Energy Centre Primary Pump Volumes to transfer the MTHW hot water at a higher temperature.

1. The LTHW Heat Exchanger control to to be minimised on all Heat Exchangers and then control to be stepped on Duty/Lag1/Lag2/Lag3
2. The amount of Primary Pumps running will be matched to the CHP and Boilers
3. The Primary Pump Speed maintain a constant Primary Return Temperature
4. The Primary Pump speeds to be reduced based on the primary flow temperature
5. The Boiler Temperature Setpoint incremented to a 105°C based on the return temperature
6. Boiler Enable time delays enable and disablement

2 System Descriptions

2.1 The LTHW Heat Exchanger control to be minimised on all Heat Exchangers and then control to be stepped on Duty/Lag1/Lag2/Lag3

The plantroom 31 LTHW has been used an example. The control will be introduced to Plantroom 21, 22, 31, 32, 41A and 41B LTHW Heat Exchangers. Each heat exchanger controls on its own flow temperature sensor. The current operation of the DHW Heat exchanger's control will not change (no lead lag, operate in parallel).

The LTHW Heat Exchangers (HX) will operate on a Duty/Lag1/Lag2/Lag3 step control and be rotated on a weekly/daily or manually operated basis

- Step1 The Duty HX control will be 0-100% and the Lag1/Lag2/Lag3 Hx's control will be 0-5%
- Step2 When the Duty HX control = 100% for an adjustable time period 120 Seconds the Lag1 HX will control 0-100%. The control will return to Step1 if the HX Duty or Lag1 control falls below 20% for a time period 120 Seconds.
- Step3 When the Duty or Lag1 HX control = 100% for an adjustable time period 120 Seconds the Lag2 HX will control = 0-100%. The control will return to Step2 if the HX Duty or Lag1 or Lag2 control falls below 20% for a time period 120 Seconds.
- Step4 When the Duty or Lag1 or Lag2 HX control = 100% for an adjustable time period 120 Seconds the Lag3 HX will control 0-100%. The control will return to Step3 if the HX Duty or Lag1 or Lag2 or Lag3 control falls below 20% for a time period 120 Seconds

See table below

	Step1	Step2	Step3	Step4
HX Duty	0-100%	0-100%	0-100%	0-100%
HX Lag1	0-5%	0-100%	0-100%	0-100%
HX Lag2	0-5%	0-5%	0-100%	0-100%
HX Lag3	0-5%	0-5%	0-5%	0-100%

2.2 The amount of Primary Pumps running will be matched to the CHP and Boilers

To allow the amount of water derived from the CHP and Boilers to be transferred the Primary Pumps will be enabled as shown in table.

	Duty	Lag1	Lag2	Standby
CHP	Y	N	N	N
1 Boiler + CHP	Y	Y	N	N
2 Boilers + CHP	Y	Y	Y	N
3 Boilers + CHP	Y	Y	Y	N

The control will be changed for the A and B systems
To Duty change the Boiler Plantroom Control this is manual only at present.
This can be set back to Automatic changeover of plantrooms can be proven when three Boilers are enabled at a control temperature of 105°C and three pumps are running at full speed
The running of two plantrooms that has been disabled can also be enabled.

2.3 The Primary Pump Speed maintain a constant Primary Return Temperature

The common Primary water return temperatures from the A and B Side are monitored.
The A side common return temperature controls the A side primary pumps. The B side common return temperature controls the B side primary pumps
The Primary Pump Speed will modulate to maintain a constant primary return temperature at an adjustable setpoint of 73°C.

2.4 The Primary Pump speeds to be reduced based on the primary flow temperature and DHWS High Demand

The primary water flow water temperature is monitored. If the flow temperature falls below a setpoint of 90°C the pump speed will be inhibited to its minimum speed via a PID routine to allow the Primary Water temperature to achieve a higher temperature. Reducing the speed of the primary pumps when the common flow is less than 90°C will allow the Boilers and CHP temperature to achieve flow temperature and prevent over dilution from the primary return water temperature.

The DHWS demand will be monitored within each plantroom. Should two DHWS Heat-exchangers valve rises above 75% the primary pump speed will increase between minimum (75%) and maximum (100%)

2.5 The Boiler Temperature Setpoint incremented to a 105°C based on the return CHP temperature and Boiler

When a Boiler is enabled it will be enabled at reduced setpoint 90°C. The Boiler Primary Pump Speed will be enabled at minimum volume 23.6l/s. The Boiler will be modulated to maximum volume 39.4l/s. The Boiler pumps speed and temperature Setpoint will be incremented in sequence via a PID routine increase the Boiler Pump Speed and then the Boiler temperature based on each Boilers return temperature.

2.6 Boiler Enable time delays enable and disablement

The Boiler enables time delays will be brought back into operation. The delay between enabling the next boiler will be 30 minutes. If the return temperature falls below 64°C then the time delays between enabling boilers will be disabled. (No time delay)

2.7 Boiler Enable Setpoints

The Boiler enable setpoints for winter control setpoint will be applied all year round. The Boilers are enabled based on the CHP return temperatures. (The control via CHP return temperature will be reviewed against the primary return temperature)
71°C = 1 Boiler
68°C = 2 Boilers
65°C = 3 Boilers

The above control is the current winter control for Boiler Enabling

When there is no flow to the CHP the Boilers will control via A side common return temperature for A Side Boilers and the B side common return temperature for B side Boilers.

2.8 Second Plantroom enable

The Second Plantroom will be enabled when there are three boilers enabled for Thirty Minutes and the primary pumps are running >95%. The standby plantroom will have the Duty Boiler and Lag1 Boiler enabled in warm up. When the Standby Boilers Duty and Lag1 are enabled there will be Two Secondary Pumps enabled (Five Boilers and a CHP. The third Boiler on the duty plantroom will be disabled when the Standby Plantroom have been enabled for thirty minutes.

Each Plantroom will run independently enabling the Boilers and Secondary Pumps
.
The Standby Plantroom will remain enabled until both Plantrooms are running on a single Boiler or the Duty Plantroom is enabled on CHP only

3 *Proposals*

The items 2.1 – 2.8 are proposals to enhance the system controls to deliver maximum temperature. The changes will have to be monitored and trend logged.

Implementation of control strategy
DAY 1

1. Set all overridden control points and manual valves back to commissioned / automatic settings
2. Switch off CHPs
3. Change pump control to return temperature / modulating (item 2.2/2.3)
4. Implement heat exchanger strategy working on one plant room at a time (item 2.1)
   Monitor
5. Implement boiler enable and delay controls (Item 2.6/2.7)
6. Implement boiler soft start temperature control (item 2.5)
   Monitor
7. Implement Primary Pump speeds to be reduced based on the primary flow temperature and increased via DHWS High Demand (Item 2.4)

DAY 2
8. Bring in CHP in stages (one at a time)
9. Implement the second plant room enablement strategy (2.8)

The system will be monitored for approximately 1 hour before moving to next stage. At end of implementation monitor and report.

From: David Wilson [redacted]
Sent: 07 August 2018 08:31
To: Gallacher, Alan
Cc: Powrie, Ian; Wilson, Andy; Kane, Mary Anne; McKechnie, Stewart; ''Ciaran J. Kellegher' ([redacted])'; Mcallister, Paul; Stephen Houston; Douglas Ross; Matthew Lambert
Subject: RE: QEUH - MTHW Control Strategy (as Schneider Document attached)

Alan,

I have returned from holiday and will meet with our team to review the outcome of the meeting and the comments you have made.

With regard to the baseline controls philosophy, it is the MTHW Boiler A and B side and CHP system Rev 2 FDS (which was sent to your team after controls changes last year) that we have been reviewing and discussing. The strategy document that we have issued and was discussed on the 26th July is an addendum to this. When we have completed any changes we will update the MTHW Boiler A&B side CHP system rev 2 FDS to incorporate any changes made and upload to Zutec. The CHP FDS which you refer to is a different FDS for the control of the CHP units. If we make any changes to this we will update and add to Zutec.

Hopefully the allays and concerns you have on this issue.

Regards
David

David Wilson
Commissioning Manager

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From: Gallacher, Alan [[redacted]]
Sent: 03 August 2018 17:59
To: David Wilson
Cc: Powrie, Ian; Wilson, Andy; Kane, Mary Anne; McKechnie, Stewart; ''Ciaran J. Kellegher' ([redacted])'; Mcallister, Paul; Stephen Houston; 'Douglas Ross'; Matthew Lambert
Subject: QEUH - MTHW Control Strategy (as Schneider Document attached)
Importance: High

David et al,

Following on from our recent meeting held on 26th July 2018 at QEUH CMB Building, NHSGG&C has reviewed the content of the above (attached) and forthwith submit their response.

Unfortunately after reviewing the controls philosophy being proposed NHSGG&C are of the opinion that this proposal does not address the outstanding controls & operational issues we have within this facility today and as such will not accept this proposal. The areas of concern are included with the attached.

At this meeting it was further identified that the FDS specification being used as a baseline document for these change proposals was different from the FDS held on Zutec by NHSGG&C and which has been referenced within the Energy Centre Forensic Report. NHSGG&C is extremely concerned about this and seek clarification as to how this should be. We have further checked the position under the following tree:

- Energy Centre
  - Building Services Information
    - Specialist Energy Centre
      - BMS
        - System Description
          - System Description

Revision	Date	Author	Checked by	Comments
R01	18/03/2015	CR		Record
R02	13/05/2016	CR	KW	Record
R03	03/11/2016	CR		Record

This confirms that the last revision of the CHP FDS recorded was 3/11/2016 and is based on the original control philosophy. The current arrangement (and which is operational at present) has not been added to Zutec and at the meeting of 26th July 2018 the FDS being worked on and which the changes were based on was revision RO2 dated 15/2/2018.

Finally please note that I will forward to you under separate e-mails NHSGG&C's response to the following for your perusal, attention and where required action;

- QEUH Energy Centre Forensic Report – a response to your comments on this document;
- QEUH DHWS End Of Line (EOL) Data Trends.

Regards,

Alan. G. Gallacher **CEng MIMechE, BEng(Hons), DipEM**
General Manager (Estates*)*

Queen Elizabeth University Hospital Campus
Property, Procurement & Facilities Management Directorate
Facilities Corporate Services Dept
CMB Building
Glasgow
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Tel No: [redacted] : Internal [redacted]
Mobile: [redacted]

From: David Wilson [redacted]
Sent: 16 August 2018 09:06
To: Gallacher, Alan
Cc: Powrie, Ian ([redacted]); Wilson, Andy ([redacted]); Kane, Mary Anne ([redacted]); Douglas Ross; Matthew Lambert ([redacted]); Mcallister, Paul ([redacted]); McKechnie, Stewart; ''Ciaran J. Kellegher' ([redacted])'
Subject: QEUH - MTHW Control Strategy
Attachments: Response to NHS GGC Comments 03 08 18.doc

Morning Alan,

I have attached our response to your comments on the previously issued MTHW Boiler A&B Side, CHP System and LTHW Heat Exchangers Control Proposal Rev 4.2. Hopefully this answers your queries and allows us to move forward.

It would good to meet again and agree the process for implementation.

Regards
David

David Wilson
Commissioning Manager

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Project	QEUH & RHC	Date	15 August 2018
Subject	Response to NHS GG&C Comments to MTHW Boiler A&B Side, CHP System and LTHW Heat Exchangers Control Proposal Rev 4		

Point 1
It has always been our intent in achieving high CHP performance / efficiency, but not, as stated, to the detriment of the system operating temperatures. The revised strategy focuses on achieving both and does not limit the flow temperature. The CHP flow temperature set point will remain as original design (105 ^{O}C) with the amendments being made to the boiler temperature allowing the boilers to start up at a lower set point (90^{O}C), to avoid dumping large amounts of heat into the system, and modulate up to 105^{O}C as required.

We do not agree that the domestic hot water temperatures will not be maintained with the control changes proposed as the premise of the strategy is to ensure the required flow temp is achieved at the heat exchangers.

Point 2
We are not aware of any modifications required to the MTHW primary circuit 2-port motorised valves? Section 4.05 of the Forensic report makes reference to short circuiting between the hot and cold plantrooms which under the original controls strategy should not occur (this part of the strategy was not changed) unless some override of the valves had been instigated, we can review this before we start to implement the revised strategy. The valve operation in relation to the A&B plantrooms is noted in section 2.8 of the strategy document.

Point 3
As we noted in our response to the Forensic report we have not made any alterations to the header isolation valves. However the strategy document within section 3, day 1 and point 1, we have noted that we will set all overridden valves and manual valves back to commissioned settings, which would cover this.

Point 4
Comment noted and this will be monitored after implementation of the strategy. Heat rejection temperatures can be adjusted if required to ensure that useful heat is not rejected.

Point 5
The CHP FDS details the set points for heat rejection and we do not foresee at present having to alter the set points, however if any changes are subsequently required and agreed we will update the FDS accordingly.

Point 6
We would expect that any calibration of inaccurate temperature sensors be carried out under the NHS / Schneider maintenance agreement, however if this is not completed before the implementation of the strategy we can investigate.

Point 7
The intent of the strategy is to remove any perceived system deficiencies. The reference to allowing the return temperature to drop to 64^{O}C before time delays are disabled (section 2.6) was in an abnormal condition and was added to act as a failsafe if BMS critical alarms had not been acted on and allowing multiple boilers to fire and bring the temperatures up quickly. This would not be a normal operation.

Point 8
Again the increase in primary pump speed was only in an abnormal condition and not in normal operation. This can be reviewed.

Point 9
The boiler burner will modulate (as is the case at the moment) to achieve the MTHW flow set point.

Point 10
The two day operation is to initially implement the strategy and as noted we would thereafter monitor the system. The monitoring duration can be discussed and agreed.

Point 11
Comment noted, this is an admin error and will be corrected.

Point 12
We would disagree that the strategy is difficult to interpret nor over complicated for a system of this size and strategic importance to the operation of a large hospital / campus. The reason we had requested a workshop was to walk all parties through our proposals to ensure all parties understood the intent and any miss interpretations could be resolved.

We feel that the revised strategy document and our previous response does address the salient points of the Forensic Report, but given the format and structure of the Forensic Report has made it difficult to respond in a concise manor.

We are more than happy to discuss and review any simplified strategy that you feel would provide a better system operation / efficiency but feel the strategy we have proposed is currently the best solution

We would hope that our response adequately answers the points raised and allows us to move forward.

From: David Wilson [redacted]
Sent: 16 August 2018 14:54
To: Gallacher, Alan
Cc: Kane, Mary Anne; Hirst, Allyson; Douglas Ross
Subject: RE: QEUH Energy Centre - NHSGG&C's response to Multiplex Comments

Alan,

As I have noted previously we feel our response to the report and subsequent controls strategy addresses the main issues but are happy to discuss any particular items where you disagree.

For information I have engaged with another M&E consultant to review the MTHW system and the strategy we have proposed to provide a fresh pair of eyes and any guidance should they feel there is a better solution.

Thanks for organizing the meeting as it would be good to meet with yourself and Mary Anne to agree a constructive way forward.

David

David Wilson
Commissioning Manager

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From: Gallacher, Alan [[redacted]]
Sent: 16 August 2018 13:53
To: David Wilson
Cc: Kane, Mary Anne; Hirst, Allyson; Douglas Ross
Subject: RE: QEUH Energy Centre - NHSGG&C's response to Multiplex Comments

David,

Whilst I recognise that we have has a couple of meetings to discuss some of the issues within the Energy Centre (particularly around the performance & control of the CHP's and boilers) I cannot detract from the fact that the independent forensic report commissioned by NHSGG&C into the set up and operation of the Energy Centre has brought to NHSGG&C's attention that there are significant issues which need addressed.
NHSGG&C is of the opinion the we now need to escalate these issues (and subsequently the forensic report) in an effort to move the whole performance, compliance and 'fit for purpose' issues forward.
The Interim Director is currently on leave, however I will ask her p.a. to organise a meeting between us three to discuss.
Ally, can you action please

Regards,

Alan. G. Gallacher **CEng MIMechE, BEng(Hons), DipEM**
General Manager (Estates*)*

Queen Elizabeth University Hospital Campus
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From: David Wilson [[redacted]]
Sent: 07 August 2018 09:19
To: Gallacher, Alan; Kane, Mary Anne
Cc: Powrie, Ian; Wilson, Andy; 'Douglas Ross'; McKechnie, Stewart; "Ciaran J. Kellegher' ([redacted])'; Fergus Shaw; Stephen Houston; Mcallister, Paul
Subject: [ExternaltoGGC]RE: QEUH Energy Centre - NHSGG&C's response to Multiplex Comments

Alan,

I was hoping that we would not get into this back and forward style of communication as it distracts us from what we are all trying to achieve.

Our response to your forensic report was deliberately kept high level and although not agreeing with all the points raised within the report accepted that the system needed some work to be done and confirmed in both written communication and at our meetings that we were committed to this. As I hope is being demonstrated through our current interaction with your team we fully appreciate the significance of the issues you are experiencing and will continue to work with you to resolve all matters and resolving any issues identified in the report.

It would be useful if I could meet with you and Mary Anne to discuss how we can work in a more collaborative way in order to achieve the results we are both looking for. Let me know a suitable day / time.

Thanks
David

David Wilson
Commissioning Manager

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From: Gallacher, Alan [redacted]
Sent: 03 August 2018 18:38
To: David Wilson
Cc: Powrie, Ian; Wilson, Andy; 'Douglas Ross'; McKechnie, Stewart; "Ciaran J. Kellegher' ([redacted])'; Fergus Shaw; Stephen Houston; Kane, Mary Anne; Mcallister, Paul
Subject: QEUH Energy Centre - NHSGG&C's response to Multiplex Comments

David et al,

Following on from reviewing your comments raised against the QEUH Energy Centre Forensic Report (see attached), I furthermore attach for your perusal, attention and action NHSGG&C's response.

Regards,

Alan. G. Gallacher **CEng MIMechE, BEng(Hons), DipEM**
General Manager (Estates*)*

Queen Elizabeth University Hospital Campus
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Tel No: [redacted] : Internal [redacted]
Mobile: [redacted]

From: David Wilson [redacted]
Sent: 22 June 2018 12:49
To: Gallacher, Alan
Cc: Powrie, Ian; Wilson, Andy; 'Douglas Ross'; McKechnie, Stewart; "Ciaran J. Kellegher' ([redacted])'; Fergus Shaw; Stephen Houston; Kane, Mary Anne; ian.storrar[redacted]
Subject: [ExternaltoGGC]QEUH -Response to Inovated design Solutions Forensic Report

Alan,

Please find attached our response to the Energy Center Forensic report produced by Innovated Design Solutions.

As discussed at our meeting yesterday we are reviewing all the current data we have and developing a revised control strategy which I would hope to share with you by the end of next week and thereafter we can meet again to review with you and the rest of the team.

I have also attached the training presentation that was given at the MTHW training session, pre project handover, (located on Zutec) which provides the system design parameters and as installed information. Could you please pass this on to Matt as I don't have his email address.

Thanks
David

David Wilson
Commissioning Manager

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NHSGG&C Disclaimer

NEW SOUTH GLASGOW HOSPITALS

SCHEDULES OF EQUIPMENT

WATER TANKS/CISTERNS

Ref: ZBP-XX-XX-SH-600-366

Status: Construction T3

Rev: A

Date: June 2012

ZBP
Zisman Bowyer & Partners LLP
Consulting Engineers

ZBP
Zisman Bowyer & Partners LLP
Consulting Engineers

SPECIFICATION CHECK / REVISION SHEET

PROJECT	New South Glasgow Hospitals	PROJECT NUMBER	2900
SERVICE (S)	Public Health	REF	ZBP-XX-XX-SH-600-366
EQUIPMENT SCHEDULE TITLE	Water Tanks/Cisterns	DATE	June 2012
PREPARED BY	SEB	CHECKED BY	PE

Revision Ref.	Date of Revision	Page No(s).	Revision Details	Checked By
A	June 2012	-	Issued for Construction T3	PE

WATER TANKS/CISTERNS EQUIPMENT DATA SHEET

Project:	New South Glasgow Hospitals	Prepared By:	MK
Ref:	ZBP-XX-XX-SH-600-366	Checked By:	PE
Revision:	A	Date:	Jun-12
Project No:	2900		

Mercury Submission Ref: **Date:**

Submitted By:

Mercury Engineering through this technical submission confirm that the proposals comply with the relevant specification in every respect. Any non compliances are identified in the section below identifying the reason for the non compliance, variation to technical performance, impact on energy consumption and carbon emissions and cost saving.
The equipment proposals fit within the spacial and structural constraints of the building and allow adequate space for maintenance activities.

Tank Reference		Raw Water Tank 1		Confirmed as Compliant	Raw Water Tank 2		Confirmed as Compliant
Location		Basement Tank Room			Basement Tank Room		
System		Raw water storage Break Tank			Raw water storage Break Tank		
Capacity (Nominal)	litres	125,000			125,000		
Dimensions				Confirmed as Compliant			Confirmed as Compliant
Length	mm	10000			10000		
Width	mm	5000			5000		
Height	mm	2500			2500		
Weight (at nominal capacity)	kg	17000			17000		
Construction				Confirmed as Compliant			Confirmed as Compliant
Material	Steel						
	GRP	*Y*			*Y*		
	Moulded Plastic						
Single piece tank							
Rectangular or Circular	R / C						
Sectional Tank		*Y*			*Y*		
Internal or external flanges	I / E	*external flanges*			*external flanges*		
Connections		No	mm	Confirmed as Compliant	No	mm	Confirmed as Compliant
Ball valve/inlet		2	150		2	150	
Outlet		2	150		2	150	
Overflow		2	200		2	200	
Warning pipe		2	25		2	25	
Drain		2	75		2	75	
*Access Manhole		2			2		
Ladders		2			2		
Screened cowls		2			2		
Special Requirements:				Confirmed as Compliant			Confirmed as Compliant
Venting		*Yes*			*Yes*		
Alarm Facilities		*Yes*			*Yes*		
Temperature probe		*Yes*			*Yes*		
Level indicators	Y / N	*Y*			*Y*		
Combined immersion htr & stat	Y / N	*N*			*N*		
Future extension	Y / N	*N*			*N*		
Access ladder	Y / N	*Y*			*Y*		
Insulation	Y / N	*Y*			*Y*		
Raised level control chamber	Y / N	*Y*			*Y*		
Division plates	Number of	*1*			*1*		
*Manholes / access hatches	600mm dia						
	600mm sq						
Site considerations				Confirmed as Compliant			Confirmed as Compliant
Exposed to weather	*Y / N*	*N*			*N*		
Wind loading (GRP Tanks only)							
Snow loading (GRP Tanks only)							

Notes: Type 'AB' air gaps to be provided to all water storage tanks
High level audible flood alarm linked to motorised shut-off valve on tank inflow (all in-flows)
Balvalves to of the delayed action floor mounted float valve type with a pilot line.
**Manhole/access hatchies to be as tank manufacturer's recommendation.*

This schedule should be read in conjunction with:	ZBP Drawing No's: ZBP-XX-XX-SC-500-001 and ZBP-FM-B1-PL-500-065
	Specification Section : Public Health - S10 Hot and Cold Water Supply Systems ZBP-XX-XX-SP-500-103

WATER TANKS/CISTERNS EQUIPMENT DATA SHEET

Project:	New South Glasgow Hospitals	Prepared By:	MK
Ref:	ZBP-XX-XX-SH-600-366	Checked By:	PE
Revision:	A	Date:	Jun-12
Project No:	2900		

Mercury Engineering through this technical submission confirm that the proposals comply with the relevant specification in every respect. Any non compliances are identified in the section below identifying the reason for the non compliance, variation to technical performance, impact on energy consumption and carbon emissions and cost saving.
The equipment proposals fit within the spacial and structural constraints of the building and allow adequate space for maintenance activities.

Mercury Submission Ref: **Date:**

Submitted By:

Tank Reference		Potable Bulk CWS Tank 1		Confirmed as Compliant	Potable Bulk CWS Tank 2		Confirmed as Compliant
Location		Basement Tank Room			Basement Tank Room		
System		Coldwater Storage			Coldwater Storage		
Capacity (Nominal)	litres	243,750			243,750		
Dimensions				**Confirmed as Compliant**			**Confirmed as Compliant**
Length	mm	20000			20000		
Width	mm	5000			5000		
Height	mm	2500			2500		
Weight (at nominal capacity)	kg	248000			248000		
Construction				**Confirmed as Compliant**			**Confirmed as Compliant**
Material	Steel						
	GRP	*Y*			*Y*		
	Moulded Plastic						
Single piece tank							
Rectangular or Circular	R / C						
Sectional Tank		*Y*			*Y*		
Internal or external flanges	I / E	*external flanges*			*external flanges*		
Connections		No	mm	**Confirmed as Compliant**	No	mm	**Confirmed as Compliant**
Ball valve/inlet		2	100		2	100	
Outlet		2	200		2	200	
Overflow		2	150		2	150	
Warning pipe		2	25		2	25	
Drain		2	75		2	75	
*Access Manhole		2			2		
Ladders		2			2		
Screened cowls		2			2		
Special Requirements:				**Confirmed as Compliant**			**Confirmed as Compliant**
Venting		*Yes*			*Yes*		
Alarm Facilities		*Yes*			*Yes*		
Temperature probe		*Yes*			*Yes*		
Level indicators	Y / N	*Y*			*Y*		
Combined immersion htr & stat	Y / N	*N*			*N*		
Future extension	Y / N	*N*			*N*		
Access ladder	Y / N	*Y*			*Y*		
Insulation	Y / N	*Y*			*Y*		
Raised level control chamber	Y / N	*Y*			*Y*		
Division plates	Number of	*1*			*1*		
*Manholes / access hatches	600mm dia						
	600mm sq						
Site considerations				**Confirmed as Compliant**			**Confirmed as Compliant**
Exposed to weather	*Y/N*	*N*			N		
Wind loading (GRP Tanks only)							
Snow loading (GRP Tanks only)							

Notes: Type 'AB' air gaps to be provided to all water storage tanks
High level audible flood alarm linked to motorised shut-off valve on tank inflow (all in-flows)
Ballvalves to of the delayed action floor mounted float valve type with a pilot line.
**Manhole/access hatches to be as tank manufacturer's recommendation.*

This schedule should be read in conjunction with:	ZBP Drawing No's: ZBP-XX-XX-SC-500-001 and ZBP-FM-B1-PL-500-065
	Specification Section : Public Health - S10 Hot and Cold Water Supply Systems ZBP-XX-XX-SP-500-103

WATER TANKS/CISTERNS EQUIPMENT DATA SHEET

Project:	New South Glasgow Hospitals	Prepared By:	MK
Ref:	ZBP-XX-XX-SH-600-366	Checked By:	PE
Revision:	A	Date:	Jun-12
Project No:	2900		

Mercury Submission Ref: **Date:**

Submitted By:

Mercury Engineering through this technical submission confirm that the proposals comply with the relevant specification in every respect. Any non compliances are identified in the section below identifying the reason for the non compliance, variation to technical performance, impact on energy consumption and carbon emissions and cost saving.
The equipment proposals fit within the spacial and structural constraints of the building and allow adequate space for maintenance activities.

Tank Reference		Trade Cold Water tank	Confirmed as Compliant		Confirmed as Compliant
Location		Basement Tank Room			
System		Coldwater Storage			
Capacity (Nominal)	litres	2,800			

Dimensions			Confirmed as Compliant		Confirmed as Compliant
Length	mm	2000			
Width	mm	2000			
Height	mm	1000			
Weight (at nominal capacity)	kg				

Construction			Confirmed as Compliant		Confirmed as Compliant
Material	Steel				
	GRP	*Y*			
	Moulded Plastic				
Single piece tank					
Rectangular or Circular	R / C				
Sectional Tank		*Y*			
Internal or external flanges	I / E	*external flanges*			

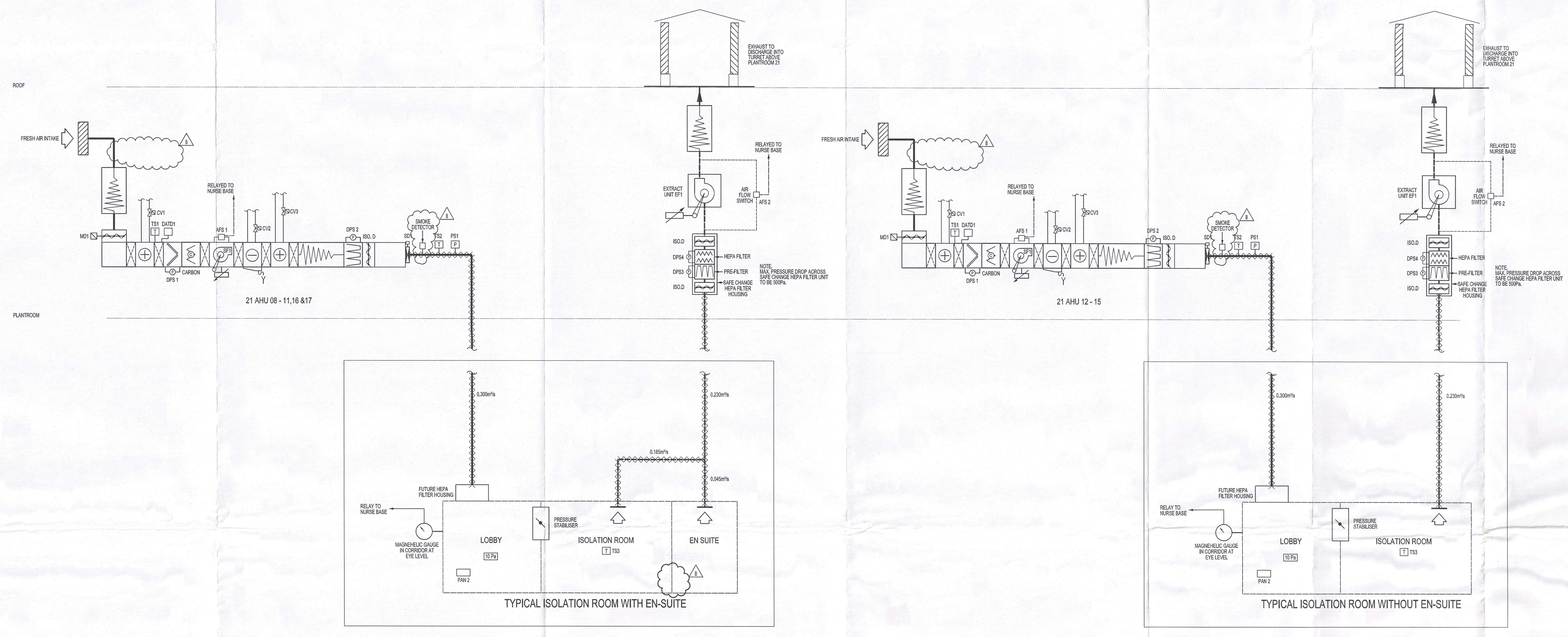
Connections	No	mm	Confirmed as Compliant		Confirmed as Compliant
Ball valve/inlet	2	25			
Outlet	2	54			
Overflow	2	40			
Warning pipe	2	25			
Drain	2	75			
*Access Manhole	2				
Ladders	2				
Screened cowls	2				

Special Requirements:			Confirmed as Compliant		Confirmed as Compliant
Venting		*Yes*			
Alarm Facilities		*Yes*			
Temperature probe		*Yes*			
Level indicators	Y / N	*Y*			
Combined immersion htr & stat	Y / N	*N*			
Future extension	Y / N	*N*			
Access ladder	Y / N	*Y*			
Insulation	Y / N	*Y*			
Raised level control chamber	Y / N	*Y*			
Division plates	Number of	*1*			
*Manholes / access hatches	600mm dia				
	600mm sq				

Site considerations			Confirmed as Compliant		Confirmed as Compliant
Exposed to weather	*Y / N*	N			
Wind loading (GRP Tanks only)					
Snow loading (GRP Tanks only)					

Notes: Type 'AB' air gaps to be provided to all water storage tanks
High level audible flood alarm linked to motorised shut-off valve on tank inflow (all in-flows)
Ballvalves to of the delayed action floor mounted float valve type with a pilot line.
**Manhole/access hatches to be as tank manufacturer's recommendation.*

This schedule should be read in conjunction with:	ZBP Drawing No's: ZBP-XX-XX-SC-500-001 and ZBP-FM-B1-PL-500-065
	Specification Section : Public Health - S10 Hot and Cold Water Supply Systems ZBP-XX-XX-SP-500-103



PANEL AT NURSE BASE

PAN 1

- NORMAL
- FAULT - ALARM / MUTE
- LOBBY PRESSURE DIFFERENTIAL
- ROOM TEMPERATURE

INDICATIVE PRESSURE RELIEF DAMPER INFORMATION		
AIRFLOW (L/S)	PRESSURE (Pa)	INDICATIVE OVERALL SIZE WIDTH X HEIGHT (mm)
160	10	600 x 400

LEGEND

SUPPLY DUCTWORK
EXTRACT DUCTWORK
DIRTY EXTRACT DUCTWORK
FIRE RATED DUCTWORK

Notes:
- This drawing is copyright.
- Do not scale dimensions from this drawing.
- All discrepancies on this drawing are to be reported to the architect.
- Do not modify any element of this drawing.
- Use drawing only for purpose(s) issued.

No	Design Risk Register

NOTES

1. FOR SYMBOLOGY REFER TO ZBP DRG No. ZBP-XX-XX-DT-590-001
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL CONTRACT DOCUMENTATION

Rev	Date	Revision Notes	Drn	Chk
B	21.02.12	REVISED AS INDICATED	VLT	AP
A	16.01.12	AMENDED AS INDICATED. ISSUED FOR CONSTRUCTION T3	DGH	AP
05	10.11.11	HEPA FILTERS REVISED	MW	AP
04	04.11.11	ISSUED FOR TENDER T1 REVIEW REVISED TO SUIT CURRENT PLANTROOM & FLOOR PLAN LAYOUTS	DGH	AP
03	14.07.11	ISSUED FOR TENDER T1 ISOLATION ROOM WITHOUT EN-SUITE ADDED GENERAL DUTIES UPDATED	VLT	AP
02	10.09.10	REVISED AS INDICATED	PS	AP
01	04/06/10	ISSUED FOR INFORMATION	RVS	AP

NEW SOUTH GLASGOW HOSPITALS & LABORATORY PROJECT
NEW ADULT & CHILDRENS HOSPITALS - DOCUMENT REVIEW

Date | Category | Signature
[redacted]

N S

Brookfield Multiplex
CONTRACTOR DOCUMENT REVIEW
[redacted]

NEW SOUTH GLASGOW HOSPITALS
25 JUN 2012

NHS Greater Glasgow and Clyde

Contractor

Brookfield Multiplex

ZBP Zisman Bowyer & Partners LLP Consulting Engineers www.zbp.co.uk

Project
NEW SOUTH GLASGOW HOSPITALS (NSGH) PROJECT

Drawing Title
MECHANICAL SERVICES
CRITICAL CARE ISOLATION ROOMS
VENTILATION SCHEMATIC
(PR21) AHU's 08-17

Job No	Drawn	Checked	Approved
2900	RVS	AJP	AP

Status	Date	Scale @ A0
CONSTRUCTION T3	APR '10	NTS

Drawing No.						Rev
Origin	Zone	Level	Type	Content	Sequential	
ZBP	XX	XX	SC	524	707	B

PLOTTED: 14/06/2012 @ 11:47:26 BY: adonnell
CAD FILE: J:\2900 Stage 3\ZBP Drawings\Schematics\Mechanical\ZBP-XX-XX-SC-524-707.dgn

A48974691

16 April 2024

For the attention of Inquiry Team
Scottish Hospitals Inquiry

By e-mail only – legal@hospitalsinquiry.scot

Our Ref: AVIV/1/17

Direct e-mail: [redacted]

Dear Sir or Madam,

TUV SUD Limited/Wallace Whittle Limited (TSWW)
QEUH and RHC Glasgow
Response to Provisional Position Paper 12 – Potentially Deficient Features of the Ventilation System in QEUH and RHC

TSWW welcomes the opportunity to comment on Provisional Position Paper 12 (PPP 12), setting out the Inquiry's review of the available material on the ventilation system provided to the new hospitals.

Core Participants are directed to confine their comments to those matters requiring material clarification or correction, particularly in relation to matters of fact.

With that direction in mind, we are pleased to provide the following comments, on behalf of our client TSWW, following the order and paragraph numbering of the PPP12.

In introduction we feel it is important to reiterate previous comments made about TSWW's involvement in this project. The building services design for QUEH/RHC was originally carried out by Zisman Bowyer & Partners LLP ("ZBP"). ZBP ceased trading in 2013 and Multiplex (MPX) appointed TSWW to assist in completing the project, at a point after the detailed design phase. The ability of TSWW to consider and comment upon certain issues raised in PPP12 is limited. TSWW does, however, have access to ZBP design records and will support the Inquiry as best it can using this information.

In line with that background our clients have provided comments on technical issues but are not best placed to contribute directly on design construction or operational issues.

QEUH General Wards
HEPA Filtration

6.6

Our clients agree that HEPA filtration is **not** a potentially deficient feature.

Room Air Change Rate ("ACH")

6.8

We agree with the statement made by Multiplex (MPX) regarding the agreed ventilation supply air volumes which were reached with the relevant derogation and thus consider this is **not** a potentially deficient feature in the original design.

Room Air Pressure

6.11

Our clients agree that room air pressure is **not** a potentially deficient feature.

Chilled Beams ("CBUs")

6.13

Our clients understand that the use of CBUs within single bedrooms was not an issue at the time of the original design. Thus, they consider such use of CBUs **not** to be a deficient feature at the point of the original design being accepted.

RHC Ward 2 A – Haematology and Oncology and Teenage Cancer Trust ("TCT")
Room Air Change Rate ("ACH")

6.26

We agree with the statement made by Multiplex (MPX) (quoted in paragraph 6.8 in PPP 12) regarding the agreed ventilation supply air volumes which were reached with the relevant derogation and thus consider this is **not** a potentially deficient feature in the original design.

Room Air Pressure

6.29 – 6.33

It is considered that the air pressure being in line with the derogation allowing the negative pressure means that this is not a deficiency in design, but rather with the requirements imposed by GGC. It may be considered a potentially deficient feature but regard must be had to how that arose.

Chilled Beams ("CBUs")

6.34 – 6.35

The use of CBUs was not mandated against at the time of the original design. The Employer Requirements were to consider the use of CBUs in all areas.

Air lock Entrance to Ward

6.37- 6.38

Again this architectural layout aligns with a non pressurised space and suggests that overall this was not the Design Teams understanding of the Clients requirements.

Back Up AHU

6.39

Our clients understand that a back up AHU was neither part of the original clients' brief nor do they understand there to be any reference to this within the guidance documents at the point of design stage. They consider the use of a back up AHU falls under user preference and as such would **not** constitute an original design deficiency.

Pressure Monitoring System

6.40

Given our comments under 6.29, 6.36 and 6.37 our clients consider the lack of a pressure monitoring system **not** to be a potentially deficient design feature.

Ward 2A Upgrade Works

6.44 – 6.46

Our clients have noted the outline description of the upgrade works carried out. It appears that the area required to be physically remodelled which suggests the alternative ventilation facilities could not have been provided originally without significant architectural changes.

RHC Ward 2B – Paediatric Haematology and Oncology – Day Care Unit
Room Air Change Rate ("ACH")

6.51 – 6.54

We agree with the statement made by Multiplex (MPX) (quoted in paragraph 6.8 of PPP 12) regarding the agreed ventilation supply air volumes which were reached with the relevant derogation and thus consider this is **not** a potentially deficient feature in the original design.

Room Air Pressure

6.57

Our clients agree that room air pressure is **not** a potentially deficient feature.

Chilled Beams ("CBUs")

6.58 – 6.59

The use of CBUs was not mandated against at the time of the original design. The Employer Requirements were to consider the use of CBUs in all areas.

QEUH Ward 4B – Bone Marrow Transplant ("BMT") Unit

6.71 – 6.79

We note the description of the original and change of use Including the note at Clause 6.74 that no COS was issued for the revised usage.

HEPA Filtration

6.80 – 6.85 Our clients note that it appears from the description of events that changes were instructed on the scope of HEPA filtration.

Backup AHU

6.98

Our clients understand that a back up AHU was neither part of the original clients' brief nor do they understand there to be any reference to this within the guidance documents at the point of design stage. They consider the use of a back up AHU falls under user preference and as such would **not** constitute an original design deficiency.

Ward 4B - 2024 Specification

We agree with the statement made by Multiplex (MPX) (quoted in paragraph 6.8 in PPP 12) regarding the agreed ventilation supply air volumes which were reached with the relevant derogation and thus consider this is **not** a potentially deficient feature in the original design.

QEUH Ward 4C Haemato-oncology & Renal
Room Air Change Rate

6.116 - 6.119

We agree with the statement made by Multiplex (MPX) (quoted at paragraph 6.8 of PPP 11) regarding the agreed ventilation supply air volumes which were reached with the relevant derogation and thus consider this is **not** a potentially deficient feature in the original design.

Chilled Beams ("CBUs")

6.124 – 6.125

The use of CBUs was not mandated against at the of the original design. The Employer Requirements were to consider the use of CBUs in all areas.

Airlock Entrance to Ward

6.129

It appears likely that no back up AHUs were included within the Employers' Requirements thus it is not a potential design defect.

QEUH Ward 6A – Decanted location of the Schiehallion Unit
Room Air Change Rate ("ACH")

6.138 – 6.140

We agree with the statement made by Multiplex (MPX) (quoted at paragraph 6.8 of PPP 12) regarding the agreed ventilation supply air volumes which were reached with the relevant derogation and thus consider this is **not** a potentially deficient feature in the original design.

Room Air Pressure

6.141

Our clients have noted that the single room air pressure appears to be in accordance with SHTM as set out in this paragraph and thus suggest that this is **not** a potentially deficient feature.

Chilled Beams ("CBUs")

6.142 – 6.143

The use of CBUs was not mandated against at the of the original design. The Employer Requirements were to consider the use of CBUs in all areas.

Appendix 2 – PPP 12 – Ventilation Table

Our clients have had regard to this spreadsheet and have commented that it greatly assists in highlighting the issues raised In PPP 12 against the timeline of the Hospital. It is apparent that the commentary contained within Appendix 2 is focused on current condition of the wards rather than the condition of the wards at handover 2015.

The Inquiry will be aware that at handover any influence which ZBP had over any design matters came to a conclusion.

We trust that the observations made by our clients are of assistance to the Inquiry in the ongoing work to review the situation in Glasgow.

Yours faithfully,

[redacted]

Laura J Donald
Consultant
For and on behalf of BTO Solicitors LLP

SCOTTISH HOSPITALS INQUIRY:
RESPONSE BY NHS NATIONAL SERVICES SCOTLAND TO PROVISIONAL POSITION PAPER 12

Please find below the response of NHS National Services Scotland ("NSS") to Provisional Position Paper 12. The key questions in para. 1.13 are addressed first, before addressing another miscellaneous point.

Key Questions in para. 1.13
NSS notes that it was only involved with the ventilation system insofar as requested by NHS GGC or by the Scottish Government. Accordingly, the scope of its involvement was limited. That is the context to the below answers.

[1] Whether the description of the ventilation system contained within the PPP is accepted as being correct and if there are any points in respect of which the Core Participant challenges the description of the system, specifically what the points of disagreement are and what evidence exists to support the position taken by the CP?
Given the limited nature of NSS's involvement, it does not have enough information to comment meaningfully.

[2] Whether the description of any potentially deficient feature is accurate notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense?
The descriptions are accepted as being accurate to the best of NSS's knowledge.

[3] Where the PPP describes the date or dates upon which a potentially deficient feature became known to a particular person or organisation whether the Core Participant accepts that date of knowledge or offers an alternative date notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense?
The dates are accepted as being correct to the best of NSS's knowledge.

[4] Whether there are any other features of the ventilation system which should be considered by the Inquiry to be potentially deficient features and what evidence exists to support that conclusion?
NSS is unaware of other features which should be considered.

Miscellaneous point

Appendix 1 **The list of Guidance omits the SHFN 30 guidance documents Parts A, B, and C, 2007 and 2014-15 ('HAI-SCRIBE'). SHFN 30 provides a framework for identifying, managing, and mitigating, issues in the built environment that affect infection prevention and control. It also seeks confirmation that there is compliance with other technical guidance.**

NHS National Services Scotland
15 April 2024

SCOTTISH HOSPITALS INQUIRY

RESPONSE ON BEHALF OF DR CHRISTINE PETERS

TO PROVISIONAL POSITION PAPER 12

POTENTIALLY DEFICIENT FEATURES OF THE VENTILATION SYSTEM OF THE QEUH/RHC

I. INTRODUCTION

1. This response to Provisional Position Paper 12, Potentially Deficient Features of the Ventilation System of the QEUH/RHC ("Ventilation PPP") is submitted on behalf of Dr Christine Peters in accordance with the procedure set out at paragraphs 1.12 to 1.15 of the PPP. References herein to chapter and paragraph numbers and to defined terms are to such numbers and terms used in the Ventilation PPP unless otherwise stated.

II. CHAPTER 4: PURPOSE OF VENTILATION

2. **Para. 4.8:** In relation to the risks referred to in this paragraph, it is important to include as an additional risk the human generated potential pathogens in the environment such as *Clostridioides difficile* spores, MRSA on skin squames, and VRE from loose stool.

III. CHAPTER 5: PARAMETERS IN A VENTILATION SYSTEM

Room Air Change Rate ("ACH")

3. **Para 5.14:** Additionally, it should be noted that the role of ACH in a single room is important for the dilution and removal of pathogens generating a risk to both staff from patients, and patients from staff (which was very important during COVID), as well as the removal of environmental pathogens generated from toilet plume, taps, drains, and clinical activities in the room space. It is a mistake to consider a single room to require less ACH in the context of a small space in which multiple people may be present. This is likely to be most significant for higher risk patients – such as the elderly, diabetics, renal patients, those on steroids, Cystic Fibrosis patients, cancer patients, all of which comprise a large number of hospital in-patients at any time. A lower ACH will allow a higher steady state of air

contamination for longer periods of time resulting in more deposition on surfaces – increasing risks of other routes of transmission.

4. In relation to the number of ACH, it is unhelpful to state that "[t]he position in relation to single rooms is unknown" (at Ventilation PPP, para. 5.14). All ventilation parameters are 'unknown" in an absolute sense but are achieved by consensus, based on experience of risk which varies by context. Single rooms are no more "unknown" than multiple occupancy rooms. 6 ACH has been agreed as a basic level to ensure removal of pathogens in a clinical context which is very different from offices due to the type of vulnerable person present, and the interventions carried out in the rooms such as catheter insertion, venous access, wound dressing, respiratory physiotherapy, and so on.

IV. CHAPTER 6: VENTILATION SYSTEMS IN WARDS

QEUH Ward 4B – Bone Marrow Transplant ("BMT") Unit

HEPA Filtration

5. **Paras. 6.84-6.85:** The description of the potentially deficient feature should be extended to include: (i) the fact that there were no HEPA filters in some supply grilles in patient bedrooms at handover in 2015; and (ii) the HEPA filters that had been installed had not been subject to DOP HEPA filter challenge tests or differential pressure tests. Reference is made to the email titled "Meeting re Ventilation" dated 25 June 2015 (*see* Appendix 1) and the email chain titled "ward 4b (HOW) commissioning data" dated 7 July 2015 (*see* Appendix 2).

Airlock Entrance to Ward

6. **Para. 6.97:** The failure to provide an air lock entrance for Ward 2A at handover is correctly identified as a potentially deficient feature for the purposes of Glasgow III at paragraph 6.38 of the Ventilation PPP. However, the failure to provide an airlock entrance to Ward 4B of the QEUH at handover in 2015 should also be considered a potentially deficient feature as it was to accommodate the same level of vulnerable patient cohort.

7. As outlined in paragraphs 6.73 and 6.74 of the Ventilation PPP, it was originally intended to provide accommodation for adult haemato-oncology patients in Ward 4B. However, it was then decided that these patients would move to Ward 4C and the adult BMT unit would be provided in Ward 4B. Accordingly, there was no COS for the BMT unit and the

Adult Haemato-Oncology COS was used for the design and construction of Ward 4B. Therefore, regardless of the change in patients to be accommodated in Ward 4B, both Wards 2A and 4B were originally designed and constructed to accommodate haemato-oncology patients, with the only difference being that Ward 2A would accommodate paediatric patients and 4B adults. On this basis, the COS used for both wards should have included the provision of an airlock.

8. As a matter of good practice an airlock entrance to Ward 4B should have been provided. First, despite accommodating less BMT patients than Ward 4B, Ward 2A had such a feature. Second, the Beatson West of Scotland Cancer Centre BMT Unit had an airlock entrance to the Ward. Given that Ward 4B was to replace the Beatson, it should have been built to the same if not better standard than the Unit it was replacing.

Annual Verification

9. The description of the ventilation system for Ward 4B is incomplete. While the Ventilation PPP addresses the issue of whether the annual verification of the ventilation system was carried out for each Ward at the QEUH/RHC, it fails to consider this matter for Ward 4B. This omission should be remedied and the necessary information included in the PPP so that an assessment of whether it should also be considered a potentially deficient feature can be conducted.

Annual Verification

10. **Paras. 6.15, 6.132 and 6.145:** The statements that no annual verification of the ventilation system of certain Wards was carried out post-handover until circa 2018 or 2019 is unsupported. Evidence to support the statement that annual verification has occurred from circa 2018 or 2019 onwards should be provided in order to assess whether the description of the ventilation system and, at paragraphs 6.132 and 6.145 the descriptions of the potentially deficient features, are accurate.

V. OMMISSIONS FROM THE VENTILATION PPP

11. It is submitted that the following features of the system, which are not included in the Ventilation PPP, should also be considered by the Inquiry to be potentially deficient features.

Air Handling Unit ("AHU")

12. The failure to provide back up AHUs at handover for certain Wards is identified as a potentially deficient feature at various points in the Ventilation PPP (*see, e.g.,* paragraph 6.39 and 6.62). However, the primary AHUs which are located in plant rooms on different floors and service the entire QEUH/RHC should be included and assessed in the Ventilation PPP as standalone features. For the reasons set out below, the primary AHUs should be considered a potentially deficient feature for the purposes of Glasgow III.

13. With regard to AHUs, SHTM 03-01 states:

> "3.15 All doors and panels should be close fitting without leaks."

14. However, there is no record of the validation of AHUs available at present (nor provided with the bundle accompanying the Ventilation PPP) that verifies that this requirement was complied with at handover in 2015. Instead, the available evidence indicates that there is a deficiency in relation to this requirement. On a walk round with HSE in January 2019, a significant leak was observed from the door of an AHU, as recorded in the contemporaneous notes provided with this response. Further, in the Cryptococcus IMT Expert Advisory Sub-Group Notes of Meeting dated 28 November 2019, it is noted that Darryl Conner commented that it was possible that the reason the plant rooms had lower fungal counts than the outside air was due to the level of leakage from the AHUs post-filter.[1] Reference is made to email titled "Notes of HSE visit meeting" dated 24 January 2019 and attached Word document containing the notes of the meeting (*see* Appendix 3).

15. Of additional relevance is that, in June 2019, following a request by NHSGGC that HFS investigate and comment on the proposed theatre ventilation system at the new Imaging Centre of Excellence (ICE) building on the QEUH Campus, HFS raised concerns that NHSGGC had accepted a derogation which meant AHU filters were located on the wrong side

[1] Bundle of documents for oral hearings commencing from 19 August 2024, Bundle 9 – QEUH Cryptococcus Sub-Group Minutes, at p.250

of the air-stream. In its report, HFS noted that "SHTM 03-01 advises that the filters should be installed correctly with respect to air flow and (SHTM 03-01 p53, 4.117) mounting frames should be designed such that the airflow pushes the filter into its housing to help minimise bypass." HFS further observed that "[t]his is not the case with the solution currently installed, and could be considered a risk given issues elsewhere on the campus and organisms found in the ventilation systems." Reference is made to Health Facilities Scotland Report, NHS Greater Glasgow & Clyde – Queen Elizabeth University Hospital Campus, Image Centre of Excellence: Theatre Ventilation, June 2019 (*see* Appendix 4). According to a verbal report provided to Dr Peters, this same derogation was accepted at the QEUH/RHC, i.e. it did not apply to the ICE in isolation. Documentation relating to the AHU specifications and validation should be provided by NHSGGC in order that information on leak testing, filter placement in relation to airflow, pressure monitoring across filters and spare capacity can be assessed for compliance with SHTM standards.

Ward 2A, Use of Thermal Wheel Devices

16. In October 2018, Innovated Design Solutions were instructed to assess the ventilation strategy in Ward 2A. Based on this report and the concerns raised therein, the use of thermal wheel devices in the ventilation system for this Ward should be considered a potentially deficient feature for the purposes of Glasgow III.[2] Given that all AHUs were fitted with thermal wheels, this deficiency would also apply to other critical ventilation areas such as ITU, infectious diseases accommodation and theatres.[3]

Heating Controls in Patient Bedrooms

17. The buttons in the control panel for patients to use to alter the temperature in the patient bedrooms are largely ineffective. Dr Peters has attempted to use these buttons herself on numerous occasions and the issue appears to be hospital wide. It has been reported to Dr Peters

[2] Bundle of documents for the oral hearing commencing on 12 June, Bundle 6 – Miscellaneous documents, Feasibility Study Regarding Increasing Ventilation Air Change Rates within ward 2A, prepared by Innovated Design Solutions, dated 24 October 2018, p. 676.
[3] Bundle of documents for the oral hearing commencing on 12 June, Bundle 16 – Ventilation PPP, Building User Guide Dated 23 January 2015 at p. 1727 (

that these controls were not connected/ hard wired to the system in order to alter temperature. This issue should be identified as potentially deficient feature for the purposes of Glasgow III.

Analysis of specialist ventilation incomplete

18. The Ventilation PPP should include an analysis of the specialist ventilation in the QEUH/RHC in the following areas:

- Theatre suites
- Treatment rooms
- Recovery areas
- Endoscopy
- Cardiac intervention
- Radiology intervention
- Imaging areas
- Infectious diseases unit

19. The inclusion of the Infectious Diseases Unit in the section on "QEUH General Wards" does not permit proper consideration of the specialist ventilation systems that are required by the applicable NHS guidance, i.e., SHTM 03-01 for this patient group.

Failure to validate the operating theatres at handover in 2015

20. At several points in the Ventilation PPP the failure to carry out validation of the ventilation system in certain wards at handover in 2015 is identified as a potentially deficient feature.

21. At handover in 2015, there was no IPC sign off or Microbiology commissioning of the operating theatres in the QEUH and RHC prior to be being put in use. This should also be considered a potentially deficient feature for the purposes of Glasgow III. Reference is made to the email chain "A&C Commissioning data (email 1 of 2)" dated 7 July 2015 (*see* Appendix 5). This email chain shows that the ICD in charge of sign off, Professor Williams, was being

sent the commissioning data after the building had been put into operation which supports the conclusion that there was no Microbiology sign off at handover in 2015.

22. In relation to this potentially deficient feature, it should be noted that December 2015 the following faults were identified, all of which demonstrate that the theatres had not been through the validation process:

- Incorrect Pressure cascades (doors remaining open)
- Lack of transfer grilles
- Lack of interlocking doors in shared prep area
- Incorrectly operating doors
- Blocked extracts

23. Reference is made to the attached SBAR which was prepared in relation to the above faults (*see* Appendix 6).

Plant room cleanliness

24. At paragraph 9.5 of the Provisional Position Paper 11, Potentially Deficient Features of the Water System of the QEUH/RHC, the cleanliness of the plant rooms is identified as a potentially deficient feature. It should also be included as a potentially deficient feature in the Ventilation PPP because the applicable ventilation guidance also requires plant rooms to be kept clean and free of vermin.

VI. CONCLUSION

25. Dr Peters will 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

15 April 2024

Appendices:

1. Email titled "Meeting re Ventilation" dated 25 June 2015
2. Email chain titled "ward 4b (HOW) commissioning data" dated 7 July 2015 (attachments not included as not necessary to response but can be provided if required)
3. Email titled “Notes of HSE visit meeting” dated 24 January 2019 and attached Word document containing the notes of the meeting
4. Health Facilities Scotland Report, NHS Greater Glasgow & Clyde – Queen Elizabeth University Hospital Campus, Image Centre of Excellence: Theatre Ventilation, June 2019
5. Email chain titled “A&C Commissioning data” dated 7 July 2015
6. SBAR re theatre faults, 2015

Julie Rothney

From: Peters, Christine
Sent: 25 June 2015 18:31
To: Powrie, Ian
Cc: Inkster, Teresa (NHSmail)
Subject: Meeting re Ventilation

Hi Ian,
Thanks for your time today and for arranging the meeting today with David Hall and the rep from Brookfield (David?).

Please let me know any inaccuracies in my summary below before we circulate more widely
By way of a brief summary;

1. The whole building is mechanically ventilated – ie no natural ventilation
2. We identified that none of the Positive pressure Lobbied rooms have HEPA filtered supply, although there is space for them, if they are put in this would involve changing the supply and extract balance
3. None of the lobbied rooms have been leak tested
4. There is an extract in the bedroom (in roof) as well as in the toilet in the lobbied suites
5. The lobbied suites are 2 on the RENAL 4C, 8 on Critical Care
6. There is a pressure Gauge for visual checks on the lobbied rooms
7. There is an alarm system for AHU failure but this is not linked to nurses station
8. Most of the rooms on 5B Haematology oncology ward (where BMT patients are currently housed)have HEPA supply – except for 2 which we need to have identified. There is no HEPA supply to the corridor, or the prep room on this ward
9. The 5B rooms are not designed to be positive pressure rooms to 10Kpascals differential to corridor, and the air exchange rate we think is 10 ph
10. The commissioning and validation data on ventilation for any part of the hospital including theatres has not had infection control signoff
11. There is no easy to read collection of relevant documents for the specialist ventilated areas including design spec, commissioning and validation data
12. There is no ongoing monitoring system in place for every lobbied room that includes alerts to infection control
13. The light fittings used in the isolation suites in Shahallion are not sealed, allowing open access to the ceiling space which would account for the high particle counts experienced in these rooms
14. The air sampling in the renal ward lobbied rooms were in non HEPA filtered rooms, and air sampling has not been carried out in the Haematology rooms
15. The decontamination room was not designed as an isolation suite for highly infectious patients, and does not have a HEPA extract or negative pressure to 10Kpascals. A redesign for change of use would need to be undergone, including the drainage tank which currently needs specialist emptying

We agreed the following course of action:

1. Brookfield to help put together a folder of documents relating to ventilation to include design spec and validation data easily identified for each room
2. ICDs to discuss and agree on ideal specifications for specialist isolation requirements
3. Gap analysis to be carried out
4. Urgent remediation to the light fittings in Shehallion- but needs to be done paying attention to HAISCRIBE methodology and air testing carried out before being re- occupied
5. David Hall to discuss above issues with Project manager Mr Lowden.

Kind regards,

Christine

Dr Christine Peters
Consultant Microbiologist
Southern General Hospital
GGC
Ex [redacted]
Mobile: [redacted]

Julie Rothney

From: Kane, Mary Anne
Sent: 07 July 2015 12:21
To: Jenkins, Gary; Peters, Christine
Subject: FW: ward 4b (HOW) commissioning data.
Attachments: Copy of Schedule of Isolation Rooms.xlsx; 31 - AHU 63 SUPPLY (4TH FLOOR HAEMATOLOGY) REPORT.pdf; 31 - AHU 63 EXTRACT (4TH FLOOR HAEMOTOLOGY) REPORT.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

FYI

From: Powrie, Ian
Sent: 07 July 2015 12:16
To: Williams, Craig
Cc: Kane, Mary Anne
Subject: ward 4b (HOW) commissioning data.

Hi Craig,

As discussed please find attached FYI the above commissioning data for ward 4b, as provided by Brookfield multiplex.
Having reviewed these I have confirm that Brookfield did not carry out DOP HEPA filter challenge tests or differential pressure tests from the isolation rooms to the corridor as “these rooms where not defined as isolation rooms”.

Let me know if you need any further input/ information?

Regards

Ian

I. Powrie

Ian Powrie,
Sector Estates Manager,
South Glasgow Hospitals Campus,
1345 Govan Rd,
Glasgow,
G51 4TF,
Direct 1: [redacted]
Direct 2: [redacted]
Mob: [redacted]

Julie Rothney

From:	Peters, Christine
Sent:	24 January 2019 17:51
To:	Inkster, Teresa (NHSmail)
Cc:	Peters, Christine
Subject:	Notes of HSE visit meeting
Attachments:	Notes of HSE visit meeting.docx

Hi this is the best I can do with notes;
Could you fill in the timeline you talked through and send back for both our records,
Thanks,
C

Notes of HSE visit meeting ,

Present

Tom Steele, Colin Purdon, Teresa Inkster, Karen Connelly, Kenneth Flemming, John Green, Christine Peters , Cameron Adam, Kathryn

Inspectors introduced, legal duty to not expose patients to risk. Query if this has occurred and if a safety notice has to be imposed.

Aim to clarify time line and details of the cryptococcal outbreak as many conflicting reports in the press.

Went through timeline with Teresa:

Two cases :

Case 1 , cancer adult 3 weeks in 4c prior to developing illness

Friday 21st _ Air sampling undertaken in plant rooms and rooms – 3 bird associated organisms

Saturday 22nd I chase up pest control report and clean up – it takes 11 men to do the jon

I went through the basic AHU and the investigations that I have been asked to undertake by Peter Hoffman.

I pointed out that crytpococcs from either the external air of plant room would get through F7 at 80% efficacy and that Cryptococcus could enter room from void in a non positively pressurised room. There are therefore a number of plausible routes , but at this stage it is very hard to confirm the exact route in these cases.

It was noted that there were no HEPAs in the room either patient was housed in therefore they were not protected from fungal spores. I pointed out SHTM 03-01 regulation re ventilation in neutropenic patients state positive pressure , increased ACH and HEPA filtered air. I also drew attention to the lack of negative pressure facilities and Tom Steele stated that the negative pressure rooms are being commissioned currently.

Tom Steele said he had commissioned a review from concept to build and commissioning to explore why the hospital had not been built to spec. I asked if infection control would be included in review, he said that not been agreed and I stated that it need to be as there are a suite of SHTMs which deal with IC being involved in the whole building planning and commissioning process. The company involved would be AECOM consulting .

The inspector indicated that a new hospital that failed to meet standards was a very big issue .

Questions were asked re the pigeon problems and history and control measures taken,

They asked for copies to be sent to them via John Green:

1. My SBAR for the IMT re crypto and ventilation
2. Air sampling results for plant rooms, 4C 6A and any other ward recently sampled
3. All IMT minutes for current Crypto outbreak
4. PAG minutes for crypto outbreak
5. Photos of this morning of the quadrangle
6. History of pest control re pigeons on the site
7. The report issued under FOI request re pigeons
8. Plan for clean up

We then go on a walk round firstly to the quadrangle where the guano had just been cleaned up. The inspectors were talked through the possible route of ingress into the ventilation system

Then we went into the plant room on the 12th floor,

Of interest there was a clear breach in the seal of the AHU 06 as air was pouring out of the dooe
There was still evidence of bird guano on a vent shaft .
The route of entry was actually through baffles which have netting
Baffles around the height of the building would have allowed pigeons to enter the void previously.

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Present

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NHS National Services Scotland

Health Facilities Scotland Report

NHS Greater Glasgow & Clyde – Queen Elizabeth University Hospital Campus

Imagine Centre of Excellence: Theatre Ventilation

June 2018

A48974691

1. Introduction

1.1. In May 2019, NHS Greater Glasgow and Clyde (NHS GGC) requested that Health Facilities Scotland (HFS) investigate and comment on the proposed theatre ventilation system at the new Imaging Centre of Excellence (ICE) building on the Queen Elizabeth University Hospital (QEUH) Campus.

1.2. NHS GGC's brief was for Glasgow University to provide four theatres (all designated as Ultra Clean Ventilation (UCV) suites), to meet the requirements of current healthcare guidance.

1.3. There are issues reported with respect to compliance to current Scottish Health Technical Memoranda (SHTM) guidance, the commissioning of the theatre systems and some health and safety concerns.

1.4. Concerns have also been raised by NHS GGC regarding the deviations from current guidance and the proposed derogations from current guidance.

1.5. The ICE building is being developed by Glasgow University and NHS GGC are a tenant on one floor, which houses the theatres and an area of another which houses the post-operative recovery bays.

1.6. HFS visited site on 4th June 2019 and this report is based on the information gathered on that date plus information listed and received separately. Photographs from this site visit are shown in Appendix 1.

1.7. The guidance used to benchmark the installation and commissioning information is SHTM 03-01 Part A: Ventilation for healthcare premises – design and validation.

1.8. This report is based on the information provided by NHSGGC ICE project team.

2. Executive summary

2.1. There have been difficulties in commissioning the four theatres to meet the requirements of current guidance, SHTM 03-01, and several compromises/derogations have been made by NHS GGC to try and progress this matter.

2.2. The construction team have attempted several solutions to balance and commission the systems in Ultra Clean mode and conventional mode without success.

2.3. It is recommended that commissioning of the systems is effectively taken back to zero and all the changes (documented or otherwise) are removed and the theatres are recommissioned. Any issues should be resolved as part of this process.

2.4. A proposal to fit Constant Air Volume equipment to solve these problems has been suggested, but it is not clear if these will have a positive impact or not. The designer appears to have some reservations regarding these and no reference site or installation has been found. If it is decided to try these Constant Volume Units then, at no cost to NHSGGC, these should be tried in one theatre first, but only after the systems have effectively been reset as per 2.3 above. The inclusion of the CAV equipment will have an impact on project completion (due to procurement and additional commissioning and validation)

2.5. There is concern over the removal of the low level extract in certain rooms and the health and safety of staff with respect to exposure to anaesthetic gas.

2.6. There is concern over the noise level in the theatres and the ability of operating theatre staff to concentrate for any significant period of time.

2.7. Given recent event elsewhere in the campus, there is concern that the filters in the Air Handling Units are not correctly installed as per the SHTM, which may lead to a higher than normal bypass leakage.

2.8. The condition of the new theatre Air Handling Units are noted as in “average” condition by the validation contractor. It is not considered that this appropriate for a new installation.

3. Information

3.1. Each theatre is served from a dedicated air handling unit (AHU) located in the roof plant room. There is no recirculation of exhaust air at the AHU (as per guidance), but there is the facility for heat recovery via a heat exchanger box on each of the units. The air is ducted in from the outside and distributed to the theatres via insulated ductwork.

3.2. As a result of difficulties in commissioning the UCV systems in each of the theatres, particularly when switching between UCV and “conventional” modes, the University of Glasgow’s mechanical services designer has suggested that an additional constant air volume (CAV) system be installed.

3.3. It is intended that the theatres will operate normally under UCV conditions and be “set-back” to “conventional mode” when the theatres are not being used to allow a speedy return to UCV conditions if an emergency operation requirement occurs.

3.4. This means that the theatre AHU will run continuously.

4. Correspondence

4.1. In their email of 28th May 2019 to BAM Construction, Hulley and Kirkwood note that the supply air volumes to the Prep /SPS and anaesthetic rooms are in excess of 10% above the figures noted in SHTM 03-01 and have advised that this is a derogation, but in their opinion acceptable.

Comment is also made regarding the noise levels in both UCV and conventional modes and although no figures are quoted, it is noted that these are higher than those in SHTM 03-01, but in their opinion a derogation and acceptable.

They consider all the theatres, noting for each that the supply, extract and pressure regimes are generally acceptable by exceeding the targets set in SHTM 03-01, with the exception of specific areas where no correction factors (for the test equipment) have been applied.

4.2. In their email of 29th May to BAM Construction, Hulley and Kirkwood note their pros and cons" of installing constant volume (CV) dampers to alleviate the issues being experienced. These are listed in Appendix 2.

It is noted that Hulley and Kirkwood expressed reservations regarding the installation of the CV dampers to resolve the balancing uses and that they had discussed the matter with the UCV manufacturer who did not advocate this provision.

4.3. In BAM construction's email to The University of Glasgow of 29th May 2019, they note that in their opinion there are two options to demonstrate compliance.

The first notes that the sound levels are higher than the SHTM and all other areas are compliant. They consider a derogation to be a way forward.

The second suggests the installation of CV dampers, noting that Hulley and Kirkwood have raised concerns regarding this. If this was adopted as a solution, then it is recommended to try in one theatre before progressing.

4.4. NHS GGC provided copies of the validation results of the four theatres in their email of 6th June 2019. Each of the theatres were tested by Correct Air Solutions Ltd on behalf of NHS GGC. Each of the new theatres have been rated as "average", which is defined by Clean Air Solutions as" Air volumes and room pressure differentials approximate to the original design values; supply air diffusers clean but extracts visibly fouled; most pressure stabilisers clean and operating correctly; some of the indicators on the surgeon's panel not working; minor faults in the fabric and décor of the suite. Action: Maintenance action required."

4.5. The validation reports highlight the following in relation to all four theatres:

- There is a hole left for a high level extract in the prep room due to a change in room definition. This should be a low level transfer grille as per the SHTM.

- A ceiling grille has been fitted in the anaesthetic room, this should be a low level extract.
- There is no mechanical ventilation in the scrub room and the pressure stabilisers are fitted at high level and not low level as noted in the SHTM.
- It is suggested that the door between the scrub room and the theatre be automatic to prevent contamination of theatre staff's hands.
- The general condition is noted as average with the maintenance quality noted as "good".
- UVC measurements were not carried out by Correct Air Solutions. This has been done by the manufacturer.
- The AHU control strategy is under review.
- Noise is also noted as a failure with respect to the values quoted in SHTM 03-01.
- The following tables indicate areas which do not comply with the requirements of SHTM 03-01, particularly theatres.

Room	**Theatre A**		**Theatre B**		**Theatre C**		**Theatre D**	
	Conventional	UCV	Conventional	UCV	Conventional	UCV	Conventional	UCV
Theatre	84% (21 ach)	94% (23 ach)	78% (18 ach)	77% (18 ach)	95%		78% (18 ach)	77% (18 ach)
Anaesthetic	112%				97%	94 %		
Prep (SPS)	135%	126 %	114%	114 %		96 %	114%	114 %
Dirty utility	96%	96%			92%	92 %		

4.6. Copies of Flowtech's commissioning certificates have also been provided. These figures note that for theatre A two extract terminals are reading 182% and 229% of design whilst another is at 55% of design. The sheets also note that the grilles had to be shut down or increased to achieve pressure when in UVC mode. The supply grilles for the same theatre are showing over 120% of design volume. These trends are replicated for all theatres.

4.7. The commissioning tests by the UCV system manufacturer, MAT FM, suggest that there were noise issues and HEPA filters were replaced and fan speeds were reduced to try and eliminate noise issues. It is noted that all systems for all theatres are shown as "PASS"

4.8. From the AHU drawing ref FLAKT WOODS 0013570-5 that a rotary heat exchanger has been installed for the "theatre floor general". There is no mention of a purge section as noted in SHTM 03-01. All theatres have plate heat exchangers.

5. Derogations from guidance

5.1. NHS GGC have confirmed that due to the various non compliances with the specification and inability to meet the requirements of STM 03-01 various derogations have been agreed. These include: -

- Reduced physical space (due to floor plate restrictions).
- Removal of low level extract ventilation in anaesthetic or scrub areas.
- Removal of lay-up facility.
- AHU filters located on the wrong side of the air-stream.

5.2. It is also noted that NHS GGC may be asked to consider further derogations for the following: -

- Higher noise levels than in guidance.
- Higher pressure regimes in the theatres and ancillary spaces (which may cause health and safety issues for theatre staff).
- Remove the ability to have defined conventional and UCV modes.

5.3. The air handling units are fitted with two filters namely classification M5 and F8. HEPA filtration to classification H13 is provided at the UCV. M5 filters are known as coarse filters and generally used as a pre-filter where there is a high risk of large particulate which may cause damage to the components of the AHU.

5.4. It should be noted that SHTM 03-01 advises that the filters should be installed correctly with respect to air flow and (SHTM 03-01 p53, 4.117) mounting frames should be designed such that the airflow pushes the filter into its housing to help minimise bypass. This is not the case with the solution currently installed, and could be considered a risk given issues elsewhere on the campus and organisms found in the ventilation systems.

6. Conclusions

6.1. From the information provided it is clear that there are issues with the design, installation and commissioning of the theatre systems, otherwise they would be balanced and functional by now.

6.2. There are several derogations noted as concessions by NHS GGC in an attempt to move the installation and commissioning forward. Some of these derogations may cause unintended consequences which have health and safety implications. The removal of low level extract to aid recovery of medical gases is a case in point and this may be a COSHH matter and aesthetic gases are subject to occupational exposure limits.

6.3. It is not known whether the installation of constant volume dampers will provide a solution to some or all of the issues as the UCV manufacturer has not confirmed this solution's validity. The design engineer does not think this is a viable option and as it is their design they should confirm if this an acceptable solution. A way forward may be try what has been suggested and try the addition of a constant volume solution on one theatre to test its practicality. This should not be to any financial cost to NHS GGC. It should be noted that this solution will introduce significant delay to the project handover.

6.4. There are potential issues with the air handling units. The filter housings are not installed on the correct side of the air stream. This may mean that there is bypass, which can allow particulate to circumvent the filtration. This should be noted in the context of the recent fungi issues at QEUH. The AHU serving the general theatre floor (not the theatres themselves) is fitted with a thermal wheel; there is no note of a purge section on this wheel and this type of energy saving device, whilst efficient, does carry the risk of cross contamination of the supply and extract air streams. It is questioned why this additional risk was included in such a sensitive environment.

6.5. The air handling units have been classed as "average", which we consider for a new installation to be unacceptable. It may be prudent to have an independent assessment on the air handling units and their compliance with SHTM 03-01.

6.6. The noise levels in the theatre suits which have been observed would make it very difficult for the theatre staff to concentrate for any significant length of time. It is our opinion that there should be no derogation from the SHTM figures.

6.7. There have been a significant number of attempts to balance the system. It is our opinion that the systems should be effectively reset in compliance with the guidance given in SHTM 03-01 to provide a base setting to measure against and re-commissioned from scratch.

7. Appendices

7.1 Appendix 1

Images taken 4th June 2019

Image ref	Image	Description
1.		Typical UCV canopy with equipment arm shown.
2.		Typical theatre showing UCV canopy, electrical / medical gas pendant and surgeon's panel.
3.		Typical UCV theatre with exits to ancillary rooms, XRAY and laser sockets.

Image ref	Image	Description
4.		Typical UCV theatre with exits to ancillary rooms which is difficult to open due to pressures and theatre ventilation return.
5.		Typical AHU

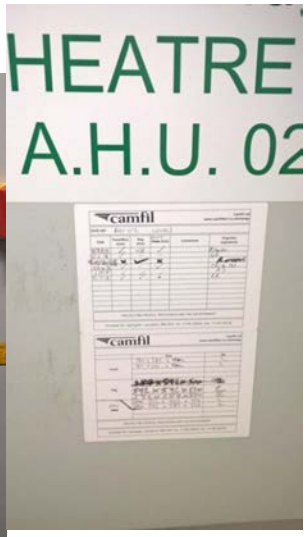
Image ref	Image	Description
6.	 	Typical AHU control panel and filter check list
7.		Typical pre filter

Image ref	Image	Description
8.		Typical main filter
9.		Fan variable speed drives. LHS image is supply. RHS image is extract.

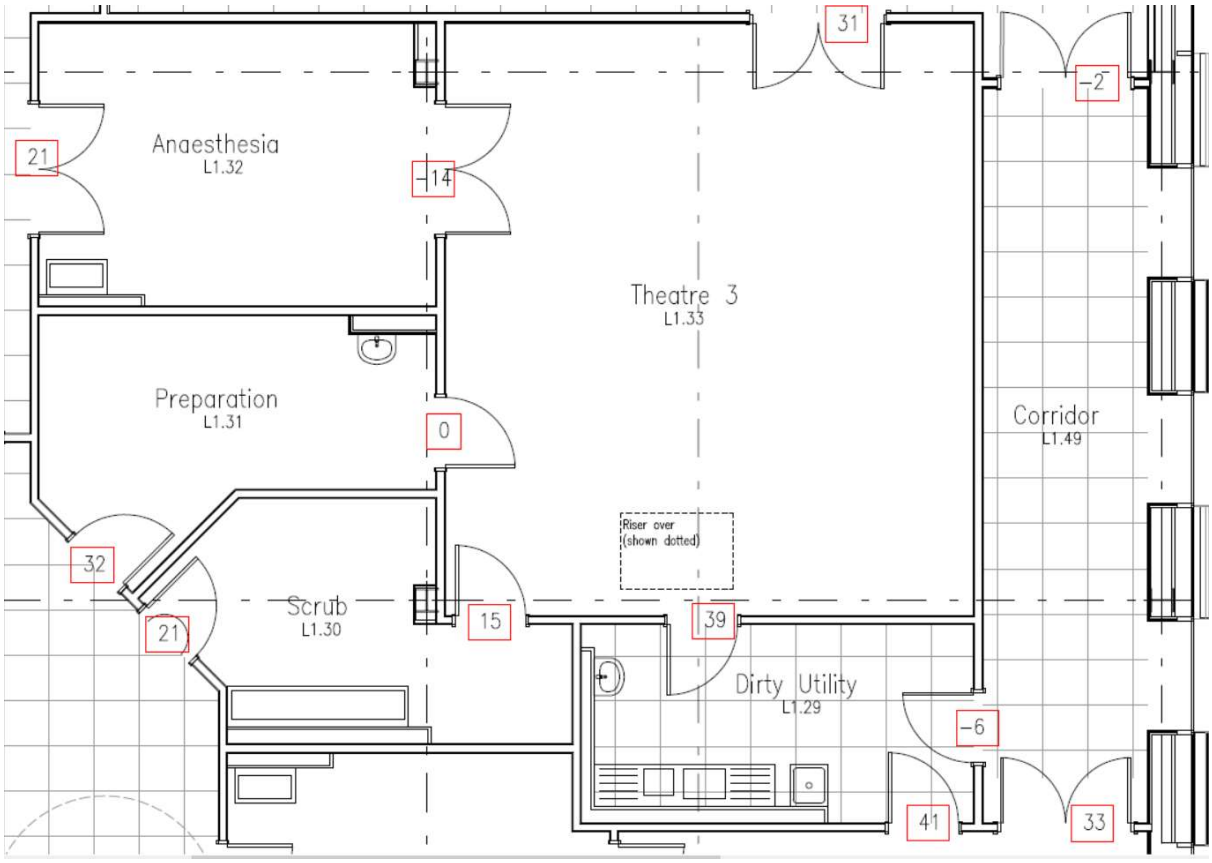
7.2 Appendix 2

Hulley and Kirkwood pros and cons of installing CV dampers

Pro	Con
In theory the air volume to the operating room supply would be maintained at a constant air volume irrespective of the mode selection between UCV and conventional mode.	The constant volume damper will operate within a +/-6% accuracy tolerance hence there could potentially be anything up to a 12% difference in air volume delivered to the theatre when changing from UCV to conventional mode. This would be a larger deviation in volumes than the current 'traditional' fixed damper installation.
It should be possible to reduce the UCV fan speed for the canopy in conventional mode for quieter running. (Note that theatre noise in UCV mode would be unchanged)	The CV dampers require a minimum upstream static pressure to operate effectively. This may require the artificial closing of the 'traditional' volume control dampers in the supplies to the SPS and Anaesthetic rooms in order to generate the higher upstream static duct pressure. This may result in damper generated noise and higher AHU fan speeds hence increased energy use and less motor capacity to counter filter dirty conditions.
	The CV dampers incorporate moving parts that respond to changes in the dynamics of the theatre ventilation. There is a possibility that the CV dampers may interact with the theatre pressure stabiliser dampers and/or the main duct pressure transducer in a harmonic action resulting in continuous or extended oscillation whenever a door is opened/closed within the theatre.
	The CV dampers will self-generate noise within the ductwork system. While this will likely be attenuated by the UCV canopy and filters for the theatre hence will make no change to the theatre noise however there may be some 'back noise' in the ducts to the SPS and Anaesthetic rooms

7.3 Appendix 3

Typical theatre layouts:



Julie Rothney

From: Williams, Craig
Sent: 07 July 2015 14:04
To: Powrie, Ian; Peters, Christine; Inkster, Teresa (NHSmail)
Cc: Kane, Mary Anne; Walsh, Tom
Subject: RE: A&C Commissioning data (email 1 of 2)

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Ian

I think the review of these should be taken forward by the group that Ann Harkness is pulling together, if not we can arrange to meet separately and go through the detail

Best wishes

Craig

From: Powrie, Ian
Sent: 07 July 2015 13:02
To: Williams, Craig; Peters, Christine; Inkster, Teresa (NHSmail)
Cc: Kane, Mary Anne
Subject: A&C Commissioning data (email 1 of 2)

Craig/Christine/Teresa,

Please find attached the full set of commissioning data records for Isolation rooms and theatres.
Let me know if you need any input\support from me?

Regards

Ian

I. Powrie

Ian Powrie,
Sector Estates Manager,
South Glasgow Hospitals Campus,
1345 Govan Rd,
Glasgow,
G51 4TF,
Direct 1: [redacted]
Direct 2: [redacted]
Mob: [redacted]

SBAR: Preventing Orthopedic Surgical Site Infections Review

Dr Christine Peters
22/12/15

Consultant Microbiologist
Infection Control Doctor QEUH

Situation
The GGC ICT have been asked to assist the Orthopedic team to ensure all appropriate measures are in place to minimize the risks of Orthopedic Surgical Site Infections (SSIs) following concerns regarding increased rates of infection.

Background
An increase in orthopedic infections was observed by Orthopedic surgeons at the QEUH and an internal ST6 audit found a rate of 4.8 % for a mixed case load of trauma cases from June , July, August 2015 cases . National SSI surveillance also picked up on an increase in Hip arthroplasty infections during the month of August with a 4.5% rate for Hips and 4.8% repair neck of femur.

Assessment

A variety of multidisciplinary investigations were carried out to establish current practices, systems and facilities relevant to the minimization of the risk of SSIs in orthopedic theatres and wards :

- SSI surveillance review by Surveillance data team 6/11/15
- Ward Environmental audit Ward 10B by Infection Control Team
- Peer Theatre Audit 1/12/15
- Infection Control Theatre 9, 10,13, Environmental Audit 2/12/2015
- Joint walk around theatre suite with ICD, ICN, Anesthetists, Orthopedic Consultants, Estates and Theatre nurses and manager 10/12/15
- Estates review of reported ventilation faults position statement 14/12/15
- Air flow testing observed by Dr Peters, Dr Crawford and Dr Pace 21/12/15

The aim of these investigations was to ensure that current practices are in line with evidence based best practice to reduce the risk of SSIs in orthopedic procedures, and included a focus on the HPS key recommendations for reducing SSIs which are generic to all surgical procedures (1) .

The role of specialist ventilation and theatre practices are recognized to be important for reducing infections during orthopedic procedures, particularly when prosthetic material is used. Therefore the theatre design, ventilation and theatre practices were also investigated.

A table summarizing the multiplicity of issues explored is appended. Of note:

- Actions were identified for both ward staff and theatre staff in terms of improvements in practices such as hand hygiene, use of PPE, decontamination of equipment , and inappropriate placement of personal effects. These are foundational

elements of infection control and establishing good practice with SIPS will ensure a firm basis for reducing risks of SSIs.

- Skin preparation is key to reducing SSI and HPS recommend the use of 2%chlorhexidine in 70% isopropyl alcohol. Currently 0.5% chlorhexidine is being used. A proposal to change to the recommended solution strength will be taken to the Infection Control SMT to be taken up to Board level.

- There was a clear issue identified with the operation of the automatic doors throughout the theatre suite which were opening and closing in an uncontrolled manner. This issue was prioritized for action due to the likely impact on airflows in theatre, as well as privacy and dignity for the patients and the operational difficulties the problem was clearly causing all staff groups. There is a program of work planned in early January to address these defects.

- The design of the shared prep room did not fit with the current use of that room. It was recognized that this is a complex matter that requires further liaison between theatre users, estates and infection control to agree a way forward to ensure that the use and design match.

- The Theatre attire policy was a matter of extensive discussion and will be extended to delineate exact routes where non –blues are permitted with an associated risk assessment. The GGC Uniform & Dress Policy does not preclude leaving theatre areas in blues however it is required that those leaving in blues change before reentering a theatre in QEUH. Footwear used in a theatre should **not** be used out with the theatre suite. Mixed uniforms are allowed in certain areas such as recovery to allow operational viability, however a general level of awareness amongst staff regarding the purpose of theatre attire will aid in the proper minimization of contamination risks.

Recommendations

1. All actions to be taken forward as per summary table
2. National guidance on the use of 2% chlorhexidine skin preparation should be raised at Board level as currently 0.5% is used across all sites
3. SSI rates are to be re-audited by the orthopedic team , and include regular audit of time of procedure, thermal regulation, glycaemic control, prophylaxis timing and anticoagulation
4. SSI Surveillance is extended to include light surveillance at the QEUH of Reduction of long bone fracture for 3 months in 2016
5. Infection Control, Estates and Theatre management continue to work together to finalize the use and spec of the shared “prep room” as a matter of urgency.
6. Microbiological sampling takes place as per GGC policy after work is completed on the doors in the theatres [6]

SUMMARY OF ISSUES IDENTIFIED AND ACTIONS TAKEN

Highlighted in red are **HPS Key Recommendations for prevention of SSIs** [1]

Ward

	Assessment	Action	
Pre –surgical wash	Not directly audited however it was noted that day patients do not get information to wash prior to surgery . Not relevant to trauma cases.	Audit of pre theatre wash on wards Include information to patients to wash prior to surgery as part of pre op information	TBA Surgical teams
CRA for MRSA	Information on audits not available	Audit CRA including trauma, if MRSA positive change prophylaxis to vancomycin	
Body Hair removal - no razors	Razors not used	Confirmed	
Wound dressing in place for 48 hours	Reported to be current practice unless clinically indicated. Not audited	Audit as key recommendation	Ward staff
Aseptic technique and hand hygiene when changing dressings	Reported by ICNs as being difficult to audit/observe practice due to single rooms on wards	Peer practice reviews	Ward staff
Ring fencing of beds	Lead ICN and Ward Charge nurse identified beds to be ring fenced on 10B for Orthopedic trauma cases	Bed managers informed of ring fencing of the beds identified	Completed by ICN Lynn Pritchard
SIPS	Ward SPE audit carried out by ICT highlighted breaches in practice with an previous Amber audit. A repeat audit 4/12/15 scored green on 10C , however hand hygiene and staff knowledge were red, at 62% and 64% respectively	ICNs working with ward staff re action plans coming out of ward audits	Lynn Prittchard, continuing
Single side rooms	100% single side room provision enables segregation of patients	Staffing level issues remit of managers and normal escalation	

	on the wards. Nursing staff report increased time involved in nursing on these wards and raised concerns re staffing levels	protocols for these issues to be followed	

Theatre

	Assessment	Action	
Normo-thermia (>36C)	Forced Warm Air technology used to maintain normo-thermia. No indications that there have been failures	Audits of normo-thermia to continue as programmed. Initial review of literature no indication increased SSI with forced air warming although mechanisms plausible. However no change in practice in use of forced air warming at QE. Need to contact manufactures regarding any maintainance programme of filters.	John Crawford SPSP
Glycaemic Control in Diabetics (<11mmol/l)	No indication of problems	Ongoing audit Programme Periop bundle measurements on all three demitting sites were discontinued due to demonstration of reliable implementation. These are to be reinstituted and will include (Ab timing, razors, glycaemic, temp control)	John Crawford
Antibiotic prophylaxis (single dose cefuroxime1.5g less than 60	Recent Pharmacy Audit showed good compliance with choice of antibiotic in elective orthopedic surgery in line with local	Antimicrobial pharmacists to carry out audit of prophylaxis in Trauma patients including timing	Lead Antimicrobial Pharmacist Lee Stewart , in January

mins)	policy, however Time is not included in audit (less than 60 mins before blade to skin)		2016
Skin Prep (2% chlorhexidine in 70% isopropyl alcohol)	0.5 % chlorhexidine in use as picked up by peer audit Peer audit identified that some surgeons prep foot and others do not Agreement to standardize practice to include foot in skin prep based on the logic that un-prepped skin may increase shedding of skin bacteria into theatre environment , whilst acknowledging that there is no concrete evidence to indicate a direct correlation with SSI rates Use of drapes non-consistent , iodophore drapes have evidence of reduction of infections, non-impregnated drapes do not	Change skin prep agent to 2% chlorhexidine (Unless allergic) to be taken to Board as a recommendation for all surgical skin prep Surgical colleagues to discuss and agree on implementation of prepping of foot and use of drapes.	Michelle Carr Christine Peters Mr Kelly
O2 Saturation >95%	Regular monitoring , no indications of issues	nil	
Anticoagulation	Changes in anticoagulation protocols has been linked with increased hematomas and infection rates in other hospitals. Surveillance data team identified increase rates of hematoma formation, however clinicians advised there had been no changes to protocols.	Audit data to include anticoagulation therapy and any variance in practice	Orthopedic surgeons
Wound covered with sterile dressing	Current practice is to cover wound with sterile dressing – choice of dressing Surgeon's choice No issues identified	To be incorporated into peer reviews for audit purposes	
Hand Hygiene	Peer audit highlighted the	Hand hygiene education	Completed by

	hand hygiene rate of 21% in medics, however the recent IC audits showed levels of 96%	given to consultant staff at grand round	Stefan Morton Hand hygiene audits continue as programmed
Operative time	Surgeons reported increased length of operations and junior staff operating	Consultant to be present at trauma operations and estimated time frames to be adhered to as much as possible and monitored Theatres to look at historical data from opera	ATS
Sterile packs	NO issues reported regarding sterile packs such as ripped outer covers	nil	
Traffic through theatres	Peer audit highlighted a large volume of traffic going through the prep room to theatre with large numbers of door openings . Traffic through theatres is know to increase rates of SSIs (2)	Theatre staff to minimize the number of door openings during operative time Develop instruction as to best routes into theatre as below	
Mobile phones	Peer review highlighted use of wifi mobile phones in theatres. All items going into theatres such as phones need to be decontaminated before taking in or taking out of theatre and if becomes contaminated . Hand hygiene after handling device (2)	Review of recommendations for decontamination of phones.	Anne Kerr completed recommendation
Doors	Automatic doors have presented many problems with doors opening unexpectedly and repeatedly in a number of theatres, which will disturb the airflow and pressure differentials	Ian Powrie , Michelle Carr and John Crawford have met with the door manufacturers and a program of work has been agreed to re-program the automatic doors	Ian Powrie with door manufacturers To be completed by 15th January (tentative

	throughout the suite, potentially increasing air contamination. When the doors are switched off they are difficult to open. Banging of prep room doors occurs due to high pressure in prep room Prep room doors to corridor do not have closing mechanisms and are often left open which allows the air flow to be reversed from the theatre into the sterile store Theatre doors to corridor do not shut fully and remain open by a few inches even when "shut", again this will affect the pressure differentials and airflow in theatre	Door closing mechanisms to be put in place	date)
Ventilation	Surgeons reported cut outs of UCV systems Theatre 7 software interface problem rectified Theatre 8: fire alarm interface casing micro interuptions to theatre pressures lasting 1 second. Unlikely to cause changes in airborne contamination due to the the UCV canopy remaining operational. Engineer identifying cause of glitch. Theatres 10,13,14 : BMS system information did not confirm evidence of plant failures.	Faults reported to estates investigated and position statement issued Process for reporting faults has been clarified and any future observed failings need to be reported immediately to Estates to investigate cause and to enable full risk assessment of the situation with regard to both intra operative patient risk and theatre closure	Ian Powrie Completed

	UCV systems passed validation November 2015		
Layout/ Design	"Preparation rooms" designed as shared sterile stores with positive pressure to theatres. (3)Doors not interlocking. . Currently used differently in different theatres: Never used for lay up but used for: • Printing • Storing equipment such as clippers, trolleys, plaster trolleys, and many other items (see photos) • Sterile packs • Sutures • pillows • Clinical waste found in domestic waste in theatre 13 audit indicating clinical waste going into sterile store Some hand-washing sinks in prep rooms not used at all – risk of dead leg in water system Operating rooms, some extracts blocked by desks, may affect the proper mixing of air and air exchanges in corners of theatres	Further multidisciplinary discussion is required to look carefully at the options for use and potential for alteration of the shared prep rooms, bearing in mind currently positive pressure to theatres when doors closed, and negative when door to corridor is open. Desks in theatres to be moved round so as to not block extract in corner. Further smoke testing required in all theatres and microbiological testing in operating room after doors are fixed	Ian Powrie, Christine Peters, Michelle Carr, John Crawford
Personal belongings and inappropriate	Nearly every prep room entered on walk around had non-sterile non-	This practice was highlighted to theatre manager and education	Michelle Carr

items in Prep room	clinical items stored in it, including wrapping paper, hand bags, packed lunches, water bottles, make up, personal gadgets	for staff to be rolled out to ensure these practices do not recur	
Entrance to theatres	Some theatres do not allow the door to the scrub room to be used	Further discussion required to reach agreement regarding most appropriate route into theatre taking into consideration the pressure differentials and air flows.	Christine Peters with Theatre team
Bulk sterile stores	All sterile store cupboards doors propped open on walk around. No information on bulk store ventilation. Obvious shortage of storage space, shelving full of sterile packs being stored out in corridor and all storage facilities extremely full , making maneuvering of equipment challenging , and corridors being utilized for storage	Doors should generally be kept closed when not in use. Signage to be put up to this effect Ventilation parameters for store cupboards to be checked ?scope for increasing storage facilities	Michelle Carr Ian Powrie

Other Estates issues	Theatre audits highlighted minor issues with scuffing of walls and doors	Standard referral to Estates	Estates
Theatre attire	Much discussion around this. Theatre scrubs to be worn in all restricted corridors within theatre suite and to the semi-restricted areas of recovery and day surgery admission unit. Day surgery and recovery are mixed uniform areas .This is to allow operational running of the suite. There are exceptions to this to allow everyday clothing	Theatre attire policy will be re-written Clog cleaners to be	Michelle Carr

	(NOT jackets) within one corridor ONLY to allow access to changing rooms and coffee rooms from the anesthetic department Noted automated clog cleaners not plumbed in Clogs in changing room noted to be contaminated and stained with body fluids Blood noted on corridor floor , from un-cleaned clog Masks noted to be dangling round necks out of operating rooms	plumbed in Clog cleaning policy to specify method of cleaning Mask policy highlighted with staff	Ian Powrie
Blood bank	Concerns were raised that the blood bank was placed where ward staff were accessing it , immediately outside theatres , wearing ordinary clothes. The blood bank serves the "stack" wards and needs to be readily accessed in emergencies by blood services . This may preclude time to change into theatre scrubs.	Only MLAs to access the blood bank from out with theatres, who have been trained to ensure they are aware of cleanliness of theatre suite and the need to not deviate from the direct route to the blood bank.	John Crawford

References

1. **HPS Targeted Literature review** What are the key infection prevention and control recommendations to inform a surgical site infection (SSI) prevention quality improvement tool?**.**

http://www.documents.hps.scot.nhs uk/hai/infection-control/evidence-for-care-bundles/literature-reviews/ssi-review-2015-02.pdf

2. AORN Guidelines for Peri-operative practice 2015 : Theatre attire
3. Guide to Elimination of Orthopedic Surgical Site infections AN APIC Guide 2010
4. Department of Health HTM 03-01 2007

http://www.his.org.uk/files/4713/7907/0658/HTM_03-01_Part_A_Specialised_Ventilation_for_Healthcare_Premises.pdf

5. NSS SHTM 03-01 http://www.hfs.scot.nhs.uk/publications-1/engineering/shtm-03-01/
6. HIS Working Party Report Microbiological Commissioning and Monitoring of operating theatre suites. *J Hospital Infection* 2002 52:1-28

SCOTTISH HOSPITALS INQUIRY

RESPONSE ON BEHALF OF DR TERESA INKSTER

TO PROVISIONAL POSITION PAPER 12

POTENTIALLY DEFICIENT FEATURES OF THE VENTILATION SYSTEM OF THE QEUH/RHC

I. INTRODUCTION

1. This response to Provisional Position Paper 12, Potentially Deficient Features of the Ventilation System of the QEUH/RHC ("Ventilation PPP") is submitted on behalf of Dr Teresa Inkster in accordance with the procedure set out at paragraphs 1.12 to 1.15 of the PPP. References herein to chapter and paragraph numbers and to defined terms are to such numbers and terms used in the Ventilation PPP unless otherwise stated.

II. CHAPTER 6: VENTILATION SYSTEMS IN WARDS

QEUH General Wards

Room Air Change Rate & Room Air Pressure

2. **Paras. 6.7-6.9 and 6.10-6.11:** As acknowledged at paragraph 6.3 of the Ventilation PPP, the Infectious Diseases Ward on Level 5 and the Respiratory and Cystic Fibrosis Ward ("Respiratory") on Level 7 at the QEUH "may be considered as specialist wards". As such, they require to be provided with negative pressure isolation rooms for the management of pulmonary TB and other airborne infections. These negative pressure rooms require 10 ACH. Isolation rooms on Infectious Diseases Wards require a pressure of -5 Pa and isolation rooms on Respiratory Wards require to be 10 pascals below the ambient air pressure. The failure to provide such rooms with these specifications on either Ward should be considered a potentially deficient feature for the purposes of Glasgow III.

3. By way of background, it is understood that negative pressure isolation rooms were included on every floor in the original plans for the new hospital. These plans were developed with input from Drs Redding and Hood. In relation to the planned provision of negative pressure rooms for Respiratory, reference is made to the attached Notes of the Infection Control

Meeting dated 18 May 2009 (*see* Appendix 1). However, the negative pressure isolation rooms for both Wards were replaced by PPVL rooms in Critical Care. It is understood that the rooms in Critical Care will be the subject of a supplemental PPP. Therefore, any comments on the potentially deficient features applicable to these rooms will be provided in response to that separate supplemental paper.

4. Table A1 of Appendix 2 of SHTM 03-01 Part A provides that infectious diseases isolation rooms should have an ACH of 10 and a pressure of -5 Pa. Therefore, the fact that at handover in 2015 all rooms on the Infectious Diseases Ward had the same ACH as the general wards, i.e. 2.5 ACH, and were at a pressure of "0 or slightly -ve relative to the corridor" rather than the required -5 Pa, show that no negative pressure isolation room built to guidance was provided on this specialist Ward. This failure should be considered a potentially deficient feature.

5. It is acknowledged that there is no guidance specifying the number of negative pressure isolation rooms which are required on an Infectious Diseases Ward. The number is a clinical decision and will depend on the size of the unit and other factors. However, of relevance is the fact that the Brownlee Centre based at the Gartnavel General Hospital in Glasgow had 4 negative pressure isolation rooms. It is reasonable to assume that an equivalent number should have been provided at the QEUH. Instead, the Infectious Diseases Unit at the QEUH is the only such unit in the country with no isolation rooms on the Ward.

6. In relation to Respiratory, negative pressure isolation rooms are required for the management of pulmonary TB (*see* the NICE Tuberculosis Guidance (2016) at pp. 94-95). Slightly negative pressure is insufficient for these purposes. Air changes should be 10 /hr and the pressure should be 10 pascals below the ambient air pressure. Again, the fact that at handover in 2015 all rooms on the Respiratory Ward had the same ACH as the general wards, i.e. 2.5 ACH, and were at a pressure of "0 or slightly -ve relative to the corridor" rather than 10 pascals below the ambient air pressure, show that no negative pressure isolation room built to guidance was provided on this specialist Ward. This failure should be considered a potentially deficient feature.

QEUH Ward 4B – Bone Marrow Transplant ("BMT") Unit

Room Air Pressure

7. **Paras. 6.91-6.93:** The problems experienced with the pressure of the Pentamidine room in Ward 4B require to be included as an additional potentially deficient feature for the purposes of Glasgow III.

8. The drug Pentamidine can be toxic to staff and passers-by. Therefore, rooms used to provide nebulised Pentamidine treatments require to be at negative pressure so that the drug is not released into the corridor. In December 2015, when room pressures on Ward 4B were being checked for infection control purposes, it was noted that the room designated for Pentamidine treatment was at positive pressure (+4.5 Pa) rather than negative pressure. Reference is made to the two email chains titled "Pentamidine Room" which cover the period 1 to 4 December 2015 which are provided in Appendices 2 and 3. The problem with the pressure of this room was a health and safety issue rather than an infection control issue.

9. It is not known how long the room had been at positive pressure before the problem was identified in December 2015. However, of note is the fact that the same issue was identified at the end of June/beginning of July 2015. At that time, according to an email from Peter Moir dated 29 July 2015, Brookfield advised that they had been able to adjust the system to provide a negative 1.5 Pa pressure to the room (*see* Appendix 4).

Airlock Entrance to Ward

10. **Para. 6.97:** The failure to provide an air lock entrance for Ward 2A at handover is correctly identified as a potentially deficient feature for the purposes of Glasgow III at paragraph 6.38 of the Ventilation PPP. However, the failure to provide an airlock entrance to Ward 4B of the QEUH at handover in 2015 should also be considered a potentially deficient feature.

11. As outlined in paragraphs 6.73 and 6.74 of the Ventilation PPP, it was originally intended to provide accommodation for adult haemato-oncology patients in Ward 4B. However, it was then decided that these patients would move to Ward 4C and the adult BMT unit would be provided in Ward 4B. Accordingly, there was no COS for the BMT unit and the Adult Haemato-Oncology COS was used for the design and construction of Ward 4B. Therefore, regardless of the change in patient to be accommodated in Ward 4B, both Wards 2A and 4B were originally designed and constructed to accommodate haemato-oncology patients,

with the only difference being that Ward 2A would accommodate paediatric patients and 4B adults. On this basis, the COS used for both wards should have included the provision of an airlock.

12. As a matter of good practice an airlock entrance to Ward 4B should have been provided. First, despite accommodating less BMT patients than Ward 4B, Ward 2A had such a feature. Second, the Beatson West of Scotland Cancer Centre BMT Unit had an airlock entrance to the Ward. Given that Ward 4B was to replace the Beatson, it should have been built to the same if not better standard than the Unit it was replacing.

QEUH Ward 6A - Decanted location of the Schiehallion Unit

13. **Para. 6.135:** Issue is taken with the description of the decant of patients from Ward 2A to Ward 6A as a potentially deficient feature for the purposes of Glasgow III. As noted at paragraph 6.134 of the Ventilation PPP, Ward 6A was never intended to accommodate immunosuppressed children but was originally designated as an adult rheumatology ward.

14. It is submitted that it would be more accurate to describe this potentially deficient feature as the lack of contingency planning at local and national level to deal with the situation where patients in a specialist unit require to be decanted.

III. OMMISSIONS FROM THE VENTILATION PPP

15. It is submitted that the following features of the system, which are not included in the Ventilation PPP, should also be considered by the Inquiry to be potentially deficient features.

Deficiencies with Ward 2A ventilation system and whether these extended to other Wards

16. In October 2018, Innovated Design Solutions were instructed to assess the ventilation strategy in Ward 2A. The resulting report identified "numerous significant deficiencies/inadequacies appertaining to the existing system installation".[1] The following

[1] Bundle of documents for the oral hearing commencing on 12 June, Bundle 6 – Miscellaneous documents, Feasibility Study Regarding Increasing Ventilation Air Change Rates within ward 2A, prepared by Innovated Design Solutions, dated 24 October 2018, p. 676.

deficiencies identified in this report and which are not included in the Ventilation PPP should be considered as potentially deficient features for the purposes of Glasgow III:[2]

- **Problems with ductwork:** Extract ductwork derived from the Ward 2A air handling unit was utilised to serve numerous 'dirty' type spaces (i.e. toilets, shower rooms, dirty utility rooms, disposal rooms, cleaner stores, etc) on various floor levels. This was deemed to be a very abnormal strategy which differed from design methodology adopted within other areas.
- **The use of thermal wheel devices:** While regarded as an acceptable technique for energy recovery within SHTM 03-01, Innovated Design Solutions stated that they would be hesitant with regards to the appropriateness of the use of thermal wheel devices in Ward 2A, especially when air cleanliness would appear to be of vital importance in terms of patient safety.
- **Other "significant" discrepancies identified by Innovated Design Solutions:** limitations in terms of air handling unit fan selections, the installation of single supply and extract fans within a unit serving numerous floor levels and acute facilities, substantial irregularities in terms of extract air volumes and undefined ductwork distribution pressure classification.

17. Further, the fundamental unanswered question of whether these deficiencies in the ventilation system extend beyond Ward 2A to other Wards at the QEUH/RHC should also be considered a potentially deficient feature for the purposes of Glasgow III.

PPVL Rooms in General Wards in RHC

18. In the RHC, three PPVL rooms were built on the ground floor, level 2 and level 3 rather than negative pressure rooms. These rooms were meant for the isolation of paediatric infectious diseases patients. However, PPVL rooms cannot be used for the management of airborne infections.

19. As explained above in relation to the adult general wards at the QEUH, the applicable guidance, Table A1 of Appendix 2 of SHTM 03-01 Part A, provides that infectious diseases

[2] Bundle of documents for the oral hearing commencing on 12 June, Bundle 6 – Miscellaneous documents, Feasibility Study Regarding Increasing Ventilation Air Change Rates within ward 2A, prepared by Innovated Design Solutions, dated 24 October 2018, pp. 676-677.

isolation rooms should have an ACH of 10 and a pressure of -5 Pa. Again, as with the adult ward, the number of rooms required is a clinical decision. The problem with the provision of PPVL rooms rather than negative pressure rooms was first identified in 2015. The fact that at handover in 2015 these three rooms were at positive pressure should be considered a potentially deficient feature.

20. In May 2019, the three PPVL rooms in the RHC were retrofitted to become negative pressure facilities.

Failure to validate the operating theatres in RHC at handover in 2015

21. At several points in the Ventilation PPP the failure to carry out validation of the ventilation system in certain wards at handover in 2015 is identified as a potentially deficient feature.

22. At handover in 2015, there was no validation of the operating theatres in the RHC. This should also be considered a potentially deficient feature for the purposes of Glasgow III. The deficiency was identified in May 2016 when Dr Inkster took over as lead ICD and steps were taken to address the problem. Reference is made to the attached email chain titled "Theatre air sampling" dated 25 May 2016 and 15, 20 and 22 June 2016 (*see* Appendix 5).

Endoscopy Procedure Room at QEUH

23. Two potentially deficient features arise in relation to the endoscopy rooms at the QEUH. First, the rooms were designed as treatment rooms (with 10 ACH) when they should have been designed as procedure rooms (with 15 ACH). The ACH for an "endoscopic procedure room" is specified as 15 ACH in Table A1 of Appendix 2 of SHTM 03-01 Part A. The problem with the design of the rooms was identified by Dr Inkster in October 2018. Reference is made to the attached email chains: (i) "endoscopy ach" dated 14 May 2018 and 10 October 2018; and "Endoscopy/bronchoscopy QEUH" dated 12 and 14 June 2019 (*see* Appendices 6 and 7).

24. Second, in June 2019, it was identified that the ACH for one of the endoscopy rooms (room 2) was low, 7.6 rather than 15 ACH. Reference is made to the attached email chain "Endoscopy/bronchoscopy QEUH" dated 12 and 14 June 2019 (*see* Appendix 7).

Critical Ventilation Systems not validated or subject to annual verification

25. In accordance with SHTM 03-01, ventilation systems serving the following areas are considered critical:

- Interventional radiology
- Aseptic pharmacy
- Cardiac catheterisation rooms
- MRI
- Post mortem room

26. At handover in 2015, there was no validation of these areas of the QEUH/RHC. This should be considered a potentially deficient feature for the purposes of Glasgow III.

27. In addition, no annual verification of the ventilation systems of the above areas was undertaken post-handover. This should also be considered as a potentially deficient feature for the purposes of Glasgow III.

Failure to deliver in accordance with Clinical Output Specifications ("COS")

28. From a review of the documents provided in Bundle 16 – Ventilation PPP, the following failures to deliver in accordance with the relevant COS have been identified and should be considered as potentially deficient features:

(a) According to the QEUH Renal Ward COS, it was intended that "[t]wo single rooms per ward will have associated gowning lobbies, for infection control purposes (source and protection)."[3] It is assumed that this reference is to the PPVL rooms. There are three renal wards (4A, half of 4C and 4D). However, there are only two lobbied rooms in one renal ward. Therefore, an inadequate number of isolation rooms (two rather than six) were provided in this area, i.e., the number differed from the COS. Further, it is understood that the two rooms provided were designated for infectious BMT patients, therefore further reducing the number of isolation facilities available for the renal cohort.

[3] Bundle 16 – Ventilation PPP, p. 1624, at 2.1.1.

(b) Similarly, the QEUH Renal Ward COS states that there should be four lobbied rooms (it is assumed PPVL rooms) in the higher acuity renal ward.[4] It is understood that these were not provided.

(c) According to the General Adult Wards COS, it was intended that "1 room per ward will be used for isolation purposes and will have an associated gowning lobby."[5] This was not delivered. In addition, the lack of isolation rooms on the general adult wards should be considered a potentially deficient feature.

IV. CONCLUSION

29. Dr Inkster will be happy to provide further input, information and/or clarification as required.

Helen Watts KC and Leigh Lawrie, Advocate

On behalf of Dr Teresa Inkster

17 April 2024

Appendices:

1. Notes of the Infection Control Meeting dated 18 May 2009
2. Email chain titled "PENTAMIDINE ROOM" dated 1 and 2 December 2015
3. Email chain titled "Pentamidine room" dated 2 to 4 December 2015
4. Email titled "HAEMATO ONCOLOGY – LEVEL 4 WARD B WORKS" from Peter Moir dated 29 July 2015
5. Email chain titled "Theatre air sampling" dated 25 May 2016 and 15, 20 and 22 June 2016
6. Email chain "endoscopy ach" dated 14 May 2018 and 10 October 2018
7. Email chain "Endoscopy/bronchoscopy QEUH" dated 12 and 14 June 2019

[4] Bundle 16 – Ventilation PPP, p. 1626, at 2.1.3.
[5] Bundle 16 – Ventilation PPP, p. 1636, at 2.1.

NHS Greater Glasgow and Clyde

Infection Control meeting

Hillington Project Office – Monday 18th May 2009 at 1pm

Notes of Meeting

Present

Tom Walsh
Heather Griffin
Stephen Gallacher
Fiona McCluskey
Annette Rankin
Sandra McNamee
Pamela Joannidis

The purpose of this meeting was to review the advice given to date by infection control and agree a final infection control position with regard to the New South Glasgow Adult Hospital areas shown below:

- Isolation Rooms
- Renal Dialysis
- Day Beds
- Theatre Recovery
- Endoscopy

Isolation Rooms – New South Glasgow Hospital

The group reviewed the paper produced by Drs Redding and Hood and Annette Rankin. The following was agreed as the final infection control position
1) Isolation rooms for the New South Glasgow Hospital are as follows:

Haemato-oncology -
Sealed ward with hepa filtration positive to the rest of the hospital

Respiratory (serving rest of medical)

3 negative pressure sealed rooms (without ante rooms)

Rheumatology/gastro undertake similar therapies but clinicians had not requested any isolation facilities. Project team to check with Gastro and Rheumatology clinicians that they area comfortable that 3 rooms is sufficient for all needs.

NB post meeting note - Clinicians in Gastro and rheumatology do not feel that they need any isolation rooms, think the 3 in respiratory is plenty)

Renal inpatient wards
2 positively pressure sealed rooms with negatively pressured anti- room

A&E
2 negative pressure sealed rooms (without anti-rooms) with patients being transferred to HDU if required

Critical Care (includes ICU/Surgical and medical HDU)

10 isolation rooms with anti-rooms - as per user request.

(NB It was agreed that no isolation rooms were required for CCU , surgical, orthopaedics or the Acute Assessment Unit).

Renal Dialysis
Users have requested that the layout of the 30 stationed renal dialysis unit be the same as the Stoghill ACH Dialysis Unit due to be opened next month.
The group therefore discussed and agreed to the unit being three open plan rooms with 8 "chairs" and 6 side rooms although it was noted that the spacing between "chairs" would have to be 3.6m² .

Day Beds

Medical day Unit (MDU)
There is a user preference for an open plan MDU. The group discussed the option of having the Medical Day Unit open plan with 1 single side room. This was agreed with the understanding that the space between bed/chair areas would be the standard 3.6m².

There are day beds planned within the renal, haemato-oncology and dermatology wards with shared toilets. The layout of the 4 bedded day rooms were discussed with infection control reps at a meeting on 28th November 2008. The advice at that point was for 3 sided open front cubicles.

Renal and Dermatology.
Discussion took place regarding the activity and types of procedures undertaken – these included blood transfusions, iron infusions, line insertions, renal biopsy and biologics infusions

The only concerns were based around line biopsy and line infusions (or similar procedures) being carried out in open plan areas. After consideration it was thought that glass partitions would make no difference and therefore it was therefore agreed that the renal and dermatology day areas could be open plan.

Haemato-Oncology

The haemato-oncology ward has 4 day beds planned within the ward area, the day procedure which will be undertaken within this area are considered by the users to be unsuitable for the Medical Day Unit.

However Given that the haemato-oncology ward is planned to be a Sealed ward with hepa filtration positive to the rest of the hospital infection control requested that the project team contacted users again and raised the potential for cross infections from the day patients to the inpatients to see if these day cases could be moved to the Medical Day Unit. Further information was also requested regarding the procedures which would take place.

The project team will contact the lead nurse of these specialities to discuss further and give feedback to infection control.

Theatres Recovery (40 spaces) and Endoscopy recovery (4 spaces)

The question was raised if the recovery areas could be an open plan – again as long as the spacing was kept to the correct levels (3.6m2) then the Infection Control team thought this acceptable.

RE: PENTAMIDINE ROOM

Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20)

Wed 02/12/2015 13:22

To: Moir, Peter <Peter.Moir@ggc.scot.nhs.uk>;

Cc: Mccolgan Melanie (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted]; Campbell Myra (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted]; David Wilson [redacted]; Loudon David (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted]; Cruickshank Anne (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted];

Hi Peter,

I met Myra earlier and she has confirmed that no further Pentamidine treatments will take place in the unit until the room is reconfigured.

This is a health and safety issue rather than an infection control one but I think it would be useful to have a gauge on the door to alert staff should the pressure fail. The pentamidine room in the Beatson on the GGH site has an electronic gauge, so something similar would be ideal. This can be fitted at a later date and will not affect the transfer of patients back across.

One further question I have is in relation to Hepa filtration in the new unit. Myself and Dr Cruickshank had a brief teleconference with HPS this morning and one of the queries they had was around which grade of Hepa filters we have ? - can you confirm

Thanks for your help

Kind Regards
Teresa

Dr Teresa Inkster
Consultant Microbiologist and Infection Control Doctor
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

From: Moir, Peter [redacted]
Sent: 02 December 2015 11:11
To: Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20)
Cc: Mccolgan Melanie (NHS GREATER GLASGOW & CLYDE - SGA20); Campbell Myra (NHS GREATER GLASGOW & CLYDE - SGA20); David Wilson; Loudon David (NHS GREATER GLASGOW & CLYDE - SGA20)
Subject: RE: PENTAMIDINE ROOM

Teresa

A48974691

Looking back to July 15, when the BMT situation arose, Brookfield was asked to check the airflows in Ward 4B and also the Pentamidine Room. At that time they were able to adjust the airflow in Room 004 and to achieve a negative pressure to the corridor of around -1.5pa. I have double checked with Brookfield this morning, they have confirmed that it was room 004 that was set up for the service as this was the room they were using, evidenced by an encapsulated A4 sign on the door noting Pentamidine etc and do not enter. Room 004 is the Intrathecal Treatment room and is fitted with a fixed ceiling pendant. Hence the reason for my question from Monday.

I propose**, unless any tells me otherwise**, to have the rooms returned to their designed use, the Pentamidine Room will be HOW-003 and Intrathecal Room HOW-004. On this basis HOW-003 will be reconfigured by Brookfield to operate with its 10 a/c hr and at a negative pressure to the corridor at around -1.5-2pa.
Note the Intrathecal room also operates at 10 ac/hr and should have balanced pressure to corridor.

The requirement for a room pressure gauge (analogue or digital) for the Pentamidine Room is not noted within the standard NHS ADB specification nor as far as I can see in any of the briefing information issued to Brookfield, as such none has been fitted. A gauge was not requested when the upgrade specification was discussed. If a gauge is desirable for this room the service will require to raise a change request and I can have it priced by Brookfield. What I can confirm is that the gauges are not off the shelf and dependant on whether it is to be connected to the main Ward 4B panel in the staff base, or standalone on the BMS system will be a period of 6-8 weeks from placing an order till it will be in operation.

Myra – Can you please confirm that HOW-003 will be the Pentamidine Room, I want Brookfield to return and check the room pressures and make any adjustments asap.

Teresa, if want to meet and discuss let me know.

Regards

Peter

From: Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted]
Sent: 01 December 2015 12:23
To: Moir, Peter; Campbell, Myra
Cc: McColgan, Melanie
Subject: RE: PENTAMIDINE ROOM

Peter - when we checked the pressures in these rooms both were positive - 003 was a bit lower than 004 at around 2.5pa. We should have an electronic gauge on this room similar to the ones on the BMT patient rooms - can one be fitted?

Kind Regards
Teresa

A48974691

Dr Teresa Inkster
Consultant Microbiologist and Infection Control Doctor
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

From: Moir, Peter [redacted]
Sent: 01 December 2015 12:15
To: Campbell Myra (NHS GREATER GLASGOW & CLYDE - SGA20)
Cc: Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20); Mccolgan Melanie (NHS GREATER GLASGOW & CLYDE - SGA20)
Subject: PENTAMIDINE ROOM

Myra

There is some confusion as to which room is being used for Pentamidine Treatment, Brookfield belief it is room HOW-004; I believe it is HOW-003 as per the attached drawing and as per the Board's instruction in 2013 to alter the room air pressure from balanced to negative (to corridor) with high air change rate.

To confirm I believe HOW-003 is the Pentamidine Treatment Room, can you confirm.

Thanks

Peter

From: Peter.Moir[redacted] [redacted]
Sent: 01 December 2015 12:38
To: Moir, Peter
Subject:

A48974691

****

****
****

RE: Pentamidine room

Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted]

Fri 04/12/2015 13:10

To:McColgan, Melanie [redacted]

Cc:Cruickshank, Anne [redacted];Morrison Anne (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted];Campbell, Myra [redacted]

Jo Paterson and David Mains

Teresa

Dr Teresa Inkster
Consultant Microbiologist and Infection Control Doctor
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

From: McColgan, Melanie [redacted]
Sent: 04 December 2015 13:03
To: Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20)
Cc: Cruickshank Anne (NHS GREATER GLASGOW & CLYDE - SGA20); Morrison Anne (NHS GREATER GLASGOW & CLYDE - SGA20); Campbell Myra (NHS GREATER GLASGOW & CLYDE - SGA20)
Subject: RE: Pentamidine room

Hi Teresa
Yes, lets discuss Monday, who in H&S have you escalated to?
Regards
Melanie

From: Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted]
Sent: 04 December 2015 12:02
To: McColgan, Melanie
Cc: Cruickshank, Anne
Subject: FW: Pentamidine room

Dear Melanie - please see email thread below re Pentamidine room FYI. We can discuss this further at Mondays meeting. This is not an infection control issue as such but it is a health and safety one as staff will have been exposed to Pentamidine gas .

I have escalated to H+S colleagues, estates and Brookfield for immediate action . Anne Parker and Grant Mcquaker are also aware. The team were given assurances back in July that this room had been rectified and patients have been attending for Pentamidine treatments between then and now.

Is there anyone else I need to inform at this stage?

Going forward I have requested that Brookfield fit a pressure alarm and an electronic pressure guage so that staff can confirm the pressure is negative.

Kind Regards
Teresa

Dr Teresa Inkster
Consultant Microbiologist and Infection Control Doctor
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

From: Campbell, Myra [redacted]
Sent: 03 December 2015 10:24
To: Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20); Mains David (NHS GREATER GLASGOW & CLYDE - SGA20)
Cc: Cormack Karon (NHS GREATER GLASGOW & CLYDE - SGA20); Thomson Karen (NHS GREATER GLASGOW & CLYDE - SGA20); Paterson Joseph (NHS GREATER GLASGOW & CLYDE - SGA20); Moir Peter (NHS GREATER GLASGOW & CLYDE - SGA20); Powrie Ian (NHS GREATER GLASGOW & CLYDE - SGA20)
Subject: RE: Pentamidine room

We do not allow pregnant os asthmatic staff to administer Pentamidine.

From: Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted]
Sent: 03 December 2015 10:04
To: Mains, David; Campbell, Myra
Cc: Cormack, Karon; Thomson, Karen; Paterson, Joseph; Moir, Peter; Powrie, Ian
Subject: RE: Pentamidine room

Thanks David.

I can confirm that the room has been taken out of use.

I am unsure how long this room has been at positive pressure - I have copied in Ian and David who can advise on this. I don't think it is fitted with a pressure alarm currently.

Kind Regards
Teresa

Dr Teresa Inkster
Consultant Microbiologist and Infection Control Doctor
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

From: Mains, David [redacted]
Sent: 02 December 2015 15:52
To: Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20); Campbell Myra (NHS GREATER GLASGOW & CLYDE - SGA20)
Cc: Cormack Karon (NHS GREATER GLASGOW & CLYDE - SGA20); Thomson Karen (NHS GREATER GLASGOW & CLYDE - SGA20); Paterson Joseph (NHS GREATER GLASGOW & CLYDE - SGA20)
Subject: RE: Pentamidine room

Hi Teresa / Myra,
Do we have any way of ascertaining how long patients have been treated in this room at positive pressure? The Facilities Management of the site may be able to assist as they can remotely monitor most environment factors.

I do not have access to the ward COSHH assessment, so could someone advise regarding the potential risk factors esp. for more susceptible groups of staff, e.g. pregnant or asthmatic.

We need to establish who has been exposed and for how long prior to deciding on any further potential actions.

While the use of this substance may fall under H&S via the COSHH regulations, this would appear to be a clinical protocol that has not been followed and as such I am copying in my colleagues from clinical risk for additional comment.

Would I be correct in assuming that the room is no longer in use for the administration of nebulised pentamidine as it does not comply with the clinical guidance?

Thanks

David Mains
Lead Health & Safety Practitioner
Acute Services - South Team
NHS Greater Glasgow & Clyde
Office [redacted]
Mobile [redacted]

From: Inkster Teresa (NHS GREATER GLASGOW & CLYDE - SGA20) [redacted]
Sent: 02 December 2015 13:52
To: Paterson, Joseph; Mains, David
Subject: Pentamidine room

Dear both,

I am writing to inform you about a treatment room used for nebulised Pentamidine treatments in ward 4B at QEUH.

Whilst checking room pressures for infection control purposes myself and a colleague noted that the room designated for Pentamidine treatment was at a positive pressure (+ 4.5 Pascals) rather than a negative pressure .

Although ward 4B has moved back to the old unit whilst remedial works are taking place patients requiring Pentamidine treatments have still been using this room.

Given that the room is at positive pressure there is a risk that staff+/- patients may have been exposed to this gas.

Can I leave this with you to follow up. The best person to contact from the unit for more info is Myra Campbell - [redacted]

Kind Regards
Teresa

Dr Teresa Inkster
Consultant Microbiologist and Infection Control Doctor
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

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Email from peter Moir

HAEMATO ONCOLOGY - LEVEL 4 WARD B WORKS

29 July 2015
13:48

Subject	**HAEMATO ONCOLOGY - LEVEL 4 WARD B WORKS**
From	Moir, Peter
To	Jenkins, Gary
Cc	Williams, Craig; Powrie, Ian; Parker, Anne; Campbell, Myra; Morrison, Anne; Clark, Andrew; 'David Wilson'; Loudon, David; 'Gillon Armstrong'; Alasdair Fernie
Sent	29 July 2015 13:37

Gary

An update on current position;

Works - I visited the works on Level 4 this morning and confirm Brookfield has set up the perimeter of the works by sealing off doorways as required by the HAI Scribe review and documentation. An airlock has been established at the east end of the ward and the extract ventilation is running to create a negative pressure within the ward to stop dust migrating into Ward 4C – the Haemato Oncology beds that remain in the adjacent ward, and also the surrounding corridors.

Materials Supply – materials will be delivered to the Laboratory Block yard and taken through the basement to a designated lift in Core C and up to level 4. Brookfield are liaising with Jim Magee from FM to manage this process and minimise impact on AGV operation.

Water - taps will be run during the works at agreed frequency to meet Legionella regs.

Up-rated AHU motor and gear – I have asked for confirmation that the equipment will continue to supply air to the room to achieve 5-10pa when the HEPA filter has reached the end of its service life. I await a response from Brookfield. I have also asked to be provided with the manufacturers recommendations on service life and replacement intervals for the HEPA filters. Note maintenance regimes will require to match the recommended replacement intervals.

Digital Gauges – I have issued a PMI to Brookfield to establish feasibility of installing digital gauges, noting requirement to maintain the current programme. I have supplied them with the details of the manufacturer of the gauges in the Beatson ward. I have requested that an audible alarm is linked, to sound after a pressure drop of circa 5 minutes as requested. I think the main challenge here is the availability of digital gauges to meet the completion date of end September. I will keep you updated on progress, if digital gauges cannot be sourced in time then the magnahelic type as fitted elsewhere in isolation rooms around the hospital will be supplied and installed.

HOW-039 Clean Utility – I have issued a PMI to Brookfield to establish the cost to hand door to this room, fit hold open stay to door linked to fire alarm system and disengage number lock. I don't have a feel for what this may cost. It would be the intention to have this work undertaken before end of September, as stated a change request will need to be signed off for this.

3 No Shower Spaces – remedial works to these showers have been completed by Brookfield.

24 Single Rooms – works will be carried out in the 24 rooms as per my email 21st July enclosing Brookfield's

proposals, I will highlight the key points;

- Install plasterboard ceilings, sealed at perimeter, taped and filled joints and painted with anti-bacterial paint.
- Access hatches will be provided in the ceiling for access to services as required, these will be sealed with silicone.
- Light fittings in the ceiling will be fitted with IP44 diffuser and further sealed with silicone.
- En-suite shower/WC grid ceiling retained, and service grilles and tiles will be silicone sealed, on advice from our Technical Adviser that access not required above for regular maintenance.
- Rooms to achieve 5-10 pa + differential pressure to corridor of ward.
- Pressure gauges will be fitted to individual rooms (in corridor outside each room) to show pressure in room, see note above, type to be confirmed.
- New HEPA filters will be supplied and installed to the 24 single rooms, these will receive a DOP test.
- New motors, inverters and other kit will be fitted to the main AHU for Ward 4B, Brookfield has confirmed that they anticipate achieving a minimum air change rate of 6 per hour.
- Air permeability testing of each single room has been requested by the Board, this is not a requirement as rooms not isolation standard, cost to be borne by Board.
- On completion the air system will be cleaned and fully tested with swab samples being taken. AHU filters changed. Tests to ensure 5-10 pa air pressure differential being achieved. Supply of commissioning data.
- All finishes made good and full sparkle clean of ward at completion for inspection by Board team.

Pentamidine Room – I have checked the project specification, the original room data sheet for this room notes balanced pressure (to corridor). However a Board project manager's instruction (PMI 259) was issued as a clarification in December 2013. This noted that the room should operate at a negative pressure to corridor (no value noted) and that the design supply/extract ventilation rate of 125 lit/sec should be adjusted to deliver the negative pressure within the Pentamidine Room. Brookfield has confirmed that they have been able to adjust the system to provide a negative 1.5pa pressure to the room (negative to corridor) with an air flow through the room of 10 air changes per hour.

To summarise, I can confirm Brookfield are proceeding to make changes to Ward 4B based on the above criteria and the documentation issued on 21st July. Unless I hear to the contrary by 2pm on Friday 31st July the above will be the basis for verifying the installation prior to handover by Brookfield to the Board for a deep clean followed by particulate tests undertaken by Craig Williams and his team sometime in first week of October.

If you require any further information please let me know.

Regards

Peter Moir
Deputy Project Director

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

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

Inkster, Teresa

From: Redfern, Jamie
Sent: 22 June 2016 11:57
To: Dawes, Heather; Johnston, Elaine
Cc: Joannidis, Pamela; Inkster, Teresa
Subject: RE: Theatre air sampling

Can we look to have this matter addressed asap folks?

Let me know if any issues. CC me into the agreed plan with Pamela and Teresa

Cheers

Jamie

Jamie Redfern
General Manager, Hospital Paediatrics & Neonates

Patient safety starts and ends with the person we serve.

From: Inkster, Teresa
Sent: 20 June 2016 17:38
To: Redfern, Jamie
Cc: Joannidis, Pamela
Subject: FW: Theatre air sampling

Hi Jamie - sorry to have to escalate this to you . See email thread below. It would be useful if we could gain access to theatres for air sampling. This was never performed as part of the original commisioning. More importantly we are required to do this for haematology JACIE accreditation . As I have indicated in the emails below we have lab staff willing to do this out of hours to minimise disruption.

Kind Regards
Teresa

From: Inkster, Teresa
Sent: 15 June 2016 08:36
To: Johnston, Elaine; Dawes, Heather
Cc: Joannidis, Pamela; McVeigh, Alanna; Powrie, Ian
Subject: RE: Theatre air sampling

Hi - I have not heard back from anyone regarding theatre air sampling. Alanna has been in touch as this is a requirement for JACIE accreditation . Would it be possible to arrange access . We have lab staff who would be happy to do this at weekends or in the evening to avoid huge disruption.
Kind Regards
Teresa

From: Inkster, Teresa
Sent: 25 May 2016 11:07
To: Johnston, Elaine; Dawes, Heather
Subject: Theatre air sampling

Dear both

I have recently taken over from Craig Williams as lead ICD. An outstanding action is air sampling of theatres in RHC. We will need to obtain a set of air sampling results for each theatre as part of validation.

I appreciate that this will be logistically difficult given that these theatres are in use. It is possible that I could get sampling performed out of hours (evening) or on a weekend . Can you let me know what your preference would be . Each theatre would probably take about 20 mins to do

Kind Regards
Teresa

Dr Teresa Inkster
Lead Infection Control Doctor NHSGGC
Training Programe Director, Medical Microbiology
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
[redacted]

RE: endoscopy ach

Mcallister, Paul [redacted]

Wed 10/10/2018 16:32

To: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE) [redacted];

No problem. Bear in mind this was over 4 years ago… 7 months before handover so things could have changed. I'll let you know.

Paul

Paul McAllister **IEng MCIBSE, BEng (Hons)**
Interim Site Manager Operational Estates

Queen Elizabeth University Hospital
1345 Govan Road
Glasgow
G51 4TF

Tel: [redacted]
Mob: [redacted]

From: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE) [[redacted]]
Sent: 10 October 2018 16:29
To: Mcallister, Paul
Subject: [ExternaltoGGC]Re: endoscopy ach

Thanks Paul
Teresa

Dr Teresa Inkster
Lead Infection Control Doctor NHSGGC
Training Programme Director Medical Microbiology
Dept of Microbiology

Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

From: Mcallister, Paul [redacted]
Sent: 10 October 2018 16:28
To: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE)
Subject: RE: endoscopy ach

Thanks Teresa, I'll pick this up with Ian.

Based on the handover documentation all treatment rooms were commissioned at 14.5 air changes or greater.

I've carried out a check on this myself and will do a short report on what I've found for the theatre/ endoscopy team. Would you like kept in the loop?

Paul

Paul McAllister **IEng MCIBSE, BEng (Hons)**
Interim Site Manager Operational Estates

Queen Elizabeth University Hospital
1345 Govan Road
Glasgow
G51 4TF

Tel: [redacted]
Mob: [redacted]

From: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE) [[redacted]]
Sent: 10 October 2018 15:59
To: Mcallister, Paul
Subject: [ExternaltoGGC]Fw: endoscopy ach

FYI. Im not sure if this is fully compliant - see below
KR
Teresa

Dr Teresa Inkster

Lead Infection Control Doctor NHSGGC
Training Programme Director Medical Microbiology
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

From: Powrie, Ian [redacted]
Sent: 14 May 2018 14:27
To: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE)
Subject: RE: endoscopy ach

Teresa,

The Design is for 10 ACH supply and 8 ACH extract resultant is that endoscopy room is (+)2 ACH. To the corridor.

I have run a quick check on the commissioning data which states that the rooms achieved between 100 – 106% of the design value.

Hope this helps.

Regards

Ian

I. Powrie
Deputy General Manager (Estates)

Queen Elizabeth University Hospital Campus
1345 Govan Road
Laboratory Medicine & FM Centre
Glasgow
G51 4TF

PA Elaine McNeil: [redacted]
Direct : [redacted]
Internal [redacted]
Mob: [redacted]

A48974691

From: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE) [redacted]
Sent: 14 May 2018 09:54
To: Powrie, Ian
Subject: [ExternaltoGGC]endoscopy ach

Hi Ian - do you have any info regarding air changes in endoscopy at QEUH/RHC. There is an issue at GGH and I need to check spec of other units

Thanks
Teresa
Dr Teresa Inkster
Lead Infection Control Doctor NHSGGC
Training Programme Director Medical Microbiology
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

Re: Endoscopy/bronchoscopy QEUH

INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE)

Fri 14/06/2019 08:10

To: Steele, Tom [redacted];

Cc: Devine, Sandra [redacted];

1 attachment

RE_ endoscopy ach - INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE).pdf;

Hi Tom,

All I have is the email trail attached where I had queried the design criteria (10 ACH) with Paul Mcallister. You will note he states they were commissioned at 14.5 ACH and that futher info was to follow. I have been asking for this for some time now and also via the TUMM group . I then got the reports from Jim Guthrie from validation done April 2019.

The design criteria is an error, it seems they have been designed as treatment rooms (10 ACH) rather than endoscopy rooms (15 ACH). However despite that it does look like they were commissioned higher as rooms 1 and 3 have air changes of 13.37 and 12.8. We just need to make sure in the future H & V validate against an ACH of 15

The concern is why room 2 is so low at 7.6, so if we could look into that.

I have just received interventional radiology results so I will review those.

Still waiting on the reports for the PPVLs in QEUH

Kind regards
Teresa

Dr Teresa Inkster
Lead Infection Control Doctor NHSGGC
National Training Programme Director Medical Microbiology

A48974691

Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

From: Steele, Tom [redacted]
Sent: 12 June 2019 19:41
To: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE)
Cc: Devine, Sandra
Subject: RE: Endoscopy/bronchoscopy QEUH

Teresa, thanks for sharing this, do you have access to previous years' data to show any trends? In the meantime I have asked for some commentary on the results. We will seek to remedy the situation ASAP

Regards Tom

Tom Steele | Director of Estates and Facilities
| NHS Greater Glasgow and Clyde | JB Russell House | Gartnavel Royal Hospital | 1055 Great Western Road | Glasgow | G12 0XH
t: [redacted] **| e:** [redacted]

From: INKSTER, Teresa (NHS GREATER GLASGOW & CLYDE) [[redacted]]
Sent: 12 June 2019 16:12
To: Traquair Smith, Ann [redacted]; Harkness, Anne [redacted]; Davidson, Scott [redacted]
Cc: Devine, Sandra [redacted]; Balfour, Alison [redacted]; Valyraki, Kalliopi [redacted]; Pritchard, Lynn [redacted]; Joannidis, Pamela [redacted]; Steele, Tom [redacted]
Subject: [ExternaltoGGC]Endoscopy/bronchoscopy QEUH

Dear all,

I have received validation reports for the three endoscopy rooms in QEUH. Based on the recorded air changes room 2 should not be used for bronchoscopy currently , unless the patient is at the end of the list to allow for adequate dilution. The air change rate is low at 7.6 ACH/ hour, should be 15.

Kind regards
Teresa

Dr Teresa Inkster
Lead Infection Control Doctor NHSGGC
National Training Programme Director Medical Microbiology
Dept of Microbiology
Queen Elizabeth University Hospital
Glasgow
Direct dial : [redacted]

SCOTTISH HOSPITALS INQUIRY

GLASGOW III

RESPONSE TO PPP 12 VENTILATION

BY THE CUDDIHY AND MACKAY FAMILIES, CORE PARTICIPANTS

INTRODUCTION

PPP 12 relates to ventilation. As is explained in part 4 of Direction 5 this necessarily involves two important stages in respect of the ventilation system:

(1) it is necessary to understand what features of the ventilation systems require to be considered by the Inquiry, and

(2) to determine the extent to which any such feature is or was in an unsafe condition, in the sense that that feature presented an additional risk of avoidable infection to patients.

At the first stage of this process the Inquiry will need to decide whether any particular feature of the ventilation system of the hospital is or was unsafe in the sense that the feature presented an additional risk of avoidable infection to patients and as such can be identified as a "potentially deficient feature". It is those "potentially deficient features" that the Inquiry will consider.

THE FOUR QUESTIONS POSED :

1. Whether the description of the ventilation system contained within the PPP is accepted as being correct and if there are points in respect of which the Core Participant challenges the description of the system, specifically what the points of disagreement are and what evidence exists to support the position taken by the Core Participant;

2. Whether the description of any potentially deficient feature is accurate notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense;

3. Where the PPP describes the date or dates upon which a potentially deficient feature became known to a particular person or organisation whether the Core Participant accepts that date of knowledge or offers an alternative date notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense; and

4. Whether there are any other features of the ventilation system which should be considered by the Inquiry to be potentially deficient features and what evidence exists to support that conclusion.

GENERAL OBSERVATIONS REGARDING THE WARDS UNDER SCRUTINY

1.8 Wards considered in the PPP.

It is noted that the following wards are to be considered:

(i) General Wards (including Level 5 – Infectious Diseases and Level 7 – Respiratory) (QEUH)

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

(iii) Ward 2B - Paediatric Haematology and Oncology – Day Care Unit (RHC)

(iv) Ward 4B - Bone Marrow Transplant (BMT) (QEUH)

(v) Ward 4C - Haemato-oncology & Renal (QEUH)

(vi) Ward 6A - Decanted location of the Schiehallion Unit (QEUH).

Whilst acknowledging the intention to provide a separate paper with regards Ward 2A BMT and PICU, it is considered that the above list does not include those other wards used by patients treated under the umbrella of the Schiehallion, especially when such patients are neutropenic and/or immunocompromised. For example, when patients were decanted from ward 6A in January 2020 due to concerns with that environment, they moved to occupy the Clinical Decision Unit, where their 'in-patient' treatment was maintained.

Therefore, it is suggested that the Clinical Decision Unit should be included in the wards included in PPP 12 and the related hearing.

In addition, many patients treated within the Schiehallion are, from time to time, displaced to other wards within the paediatric hospital (RHC) due to either capacity issues within Schiehallion or some other medical reason, such as surgical procedure. Therefore, the following additional wards within RHC should also be included in PPP12 and the related hearing. These wards also require to provide an environment that is fit for the purpose of treating neutropenic and immunocompromised patients.

Wards 1E- Cardiology

Ward 2C- Acute Receiving Unit

Wards 3A- Neurosurgery, Neurology, Complex Respiratory, Long-Term Ventilation, Complex ENT, Endocrine, Metabolic and Eating Disorders

Ward 3B – General Surgery, ENT, Cleft, Maxillo Facial, Plastics, Ophthalmology, Gastroenterology)

Ward 3C – Renal, Dialysis suite, Urology, Orthopaedics, Diabetes, Medical Paediatrics, Rheumatology, Non-LTV, Complex Respiratory)

Ward 4 – National Child Psychiatry In-patient Unit

Evidence heard during Glasgow 1 and Glasgow 2, highlighted the need for portable HEPA filters to be placed within rooms/areas where Schiehallion patients would be treated, out with the Schiehallion unit. This was often referred to as the ‘Schiehallion protocol’.

Therefore, it is suggested that these additional wards must be considered for potential deficient features from the point of handover in 2015, reflecting on each of the elements of the ventilation system detailed within the PPP, as well as those additional features detailed in this submission.

The inclusion of these additional wards is supported by the Innovated Design Solutions report from 24 October 2018, which, following analysis of the current ventilation strategy within upper areas of Ward 2A (Mid-Ward & TCT areas), concluded with the identification of a

number of potential deficiencies and crucially, recommended the review of the hospital where such patients were treated.

We invite the Public Inquiry to consider each of the listed ward areas in PPP 12, as well as the additional ward areas identified in this submission, to establish whether they were examined post October 2018 as suggested by the external experts. This may identify further potential deficient features, e.g. existence of thermal wheels (something acted upon by NHSL and evidenced during Edinburgh 3), extract ductwork distribution being utilised in ways not intended, misidentification of Chilled Beams and Extract Fan Units.

ANSWERS TO THE FOUR QUESTIONS POSED

1.Whether the description of the ventilation system contained within the PPP is accepted as being correct and if there are points in respect of which the Core Participant challenges the description of the system, specifically what the points of disagreement are and what evidence exists to support the position taken by the Core Participant;

We agree in principle with the outline of the ventilation system within PPP 12 although would wish to add some further aspects which we believe are critical within the system but are not explained within PPP 12. (See 4 below)

2.Whether the description of any potentially deficient feature is accurate notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense;

Note- Chilled Beams (page 12- Supply Air Terminals-Innovated Design Solutions Report)

We consider that it is important to ensure that identification of Chilled Beam Units (CBU) is accurate. Reference is made to the investigation by Innovated Design Solutions in October 2018, where misidentification of features were highlighted:

'*Primary supply air is delivered into each bedroom space via a ceiling mounted double type Swegon Parasol heating/cooling comfort module, apparently supplying exactly 40l/s in the*

majority of instances. It should be noted that comfort modules are not chilled beams, as incorrectly identified within record documentation, albeit functionality is very similar.'

Therefore, the Inquiry may wish to ensure that documentation referenced, accurately identifies such features.

6.4 - 6.6 HEPA Filtration

It states within this section that 'general wards' requirements are non-HEPA. As such it is deemed that this is NOT a potentially deficient feature.

We do not agree with this statement. As noted above, at times, 'general wards' are used for immunocompromised/neutropenic patients. At section 5.12 it clearly states that immunocompromised or neutropenic areas of a hospital require HEPA filtration. Therefore, wherever those patients are treated, there MUST be HEPA filtration. This was a consistent request by clinicians when patients from ward 2A were displaced to other 'general wards. The Inquiry is therefore requested to consider such instances in general wards as a potential deficient feature.

6.8 Room Air Change Rate

We invite the Public Inquiry to consider whether desire to ensure the hospital was energy efficient and met desired Scottish Government targets, influenced decisions that rendered the room air change rates a potentially deficient feature. This supports the assertion that the manner in which the system is operated is a potentially deficient feature.

6.15 Annual Verification.

PPP 12 suggests that there was no annual verification until 2018/2019. However, information from internal email communication suggests that the validation/verification of certain wards were incomplete, lacked engagement with the relevant specialisms, with omissions around HEPA filtration. There has also been criticism around effective governance of this process. (internal email NHSGGC 18 June 2019). PPP 12 is silent as to this being a potentially deficient feature. We invite the Inquiry to consider this as a Potentially Deficient Feature that should be considered during Glasgow III.

6.37 Air Lock to Ward (2A)

Ward 2A was accessed and egressed from both ends of the ward. This comprised a 'formal' entrance from the corridor adjacent to Ward 2B and there was also an informal entrance/exit situated at the Teenage Cancer Trust end of the ward. Therefore, it is considered that this a potential deficient feature between 2015 and September 2018.

6.47 Ward 2B

The majority of the patient group attending Day Care are immunocompromised and neutropenic. Day care is the first port of call for those attending Schiehallion to commence their chemotherapy regime and these patients would be within ward 2B for several hours, until such time as a bed was ready within ward 2A. BMT patients would also attend Day Care and therefore, ward 2B should be considered as having had a series of potential deficient features between 2015 and 2018. Indeed, when the Schiehallion unit, including Day Care decanted to ward 6A on 26 September 2018, portable HEPA filters were a feature within Day Care which supports the belief that they were required.

The Inquiry is invited to consider this within Glasgow III, especially as the 2019 upgrade resulted in the installation of HEPA filtration and the 2024 Specification review highlighted further deficiencies within Ward 2B, especially with Air Change Rates being 2.5 ACH which is below the NHS Guidance of 6 ACH.

6.100 Commissioning and Validation (Ward 4B)

PPP 12 is silent with regards annual verification between 2016 and 2018. Evidence from various sources confirms that verification across the hospital was never carried out and therefore we invite the Inquiry to consider this as a potentially deficient feature.

6.134 QEUH Ward 6A

PPP 12 suggests the environmental conditions on ward 6A QEUH were the same as those found in Ward 2A.

We do not agree with this. Evidence that was heard at Glasgow I and II and contained within 2019 SBAR (submitted by Microbiology Department) indicated that the environmental conditions of Ward 6A were NOT similar and had a detrimental impact on patients, families and staff. The Inquiry is invited to review this statement and consider the environment of 6A as a potentially deficient feature.

6.140 Room Air Change Rate Ward 6A

The air change rate between 2015 and 2018 was designed for a general ward however was below the NHS Guidance of 6ACH. This further supports the point above that the environment was not the same as ward 2A.

3.Where the PPP describes the date or dates upon which a potentially deficient feature became known to a particular person or organisation whether the Core Participant accepts that date of knowledge or offers an alternative date notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense; and

We have no comments in response to this question.

4.Whether there are any other features of the ventilation system which should be considered by the Inquiry to be potentially deficient features and what evidence exists to support that conclusion.

We invite the Public Inquiry to consider the following additional features of the ventilation system to be potentially deficient features as identified within the expert report provided by Innovated Design Solutions on 24 October 2018. Such additional potential deficiencies should be considered across ALL listed wards and suggested additional wards. This reflects the recommendations made by the experts from Innovated Design Solutions. Further, concern was raised by microbiologists following such recommendation, especially around Wards 5C and 5D with potential exposure to risk of patients and staff at that time.

Extract Air Ductwork (Page 10 Innovated Design Solutions)

'Of particular note, it was identified that extract ductwork distribution derived from the Ward 2A air handling unit is utilised to serve numerous 'dirty' type spaces (i.e. Toilets, Shower Rooms, Dirty Utility Rooms, Disposal Rooms, Cleaners Stores, etc.), on various floor levels. This is deemed to be a very abnormal strategy, differs from design methodology adopted within other areas, and should be investigated further.'

Thermal Wheels (page 22, section 7, Innovated Design Solutions)

'Moreover, whilst thermal wheel devices are regarded as an acceptable technique for energy recovery within SHTM 03-01, we would be hesitant with regards to the appropriateness of application in this instance, especially when air cleanliness would appear to be of vital importance in terms of patient safety.'

'Furthermore, we anticipate the majority of AHU's installed within the building are also equipped with thermal wheels (i.e. Critical Care, General Theatres, Theatre Recovery, Endoscopy, Ultra CT Suite, Nuclear Medicine, etc.). Again, we recommend this be further investigated/considered against the use of facilities.'

Extract Fan Units

Furthermore, as AHU 20A provides extract from multiple Toilet facilities, we would expect this unit to be equipped with standby facilities (i.e. if ignoring potential risks associated with cross-contamination).

This issue is possibly applicable to other systems installed within the building.

AHU

'We would also emphasise the probability of these issues/inadequacies being applicable to other air handling equipment installed within the A&C Hospital.'

Manner in which systems was operated.

It is the case that even where legislation, regulation, guidance, expert opinion and evidenced good practice exists, it is the manner in which the system is operated that influences whether the system will be effective in achieving its objectives.
A series of reviews, legislative and statutory reports have concluded that the way the ventilation system was designed and subsequently operated was very abnormal (Innovated Design Solutions), the system was not verified after commission (various- Director General Letter to ALL NHS Boards 29 January 2019), no annual validation checks were carried out, features were installed in favour of energy efficiency but with significant risks to patients (Innovated Design Solutions), dysfunctional ventilation controls within each room (Witness Evidence Glasgow 1), lack of compliance with SHTM standards and lack of inter-departmental information exchange to enable informed decision making and appropriate risk mitigation measures (SBAR Action Plan submitted to Care and Clinical Governance Committee on 5th December with updated position as of January 2019); lack of confidence around ward pressures impacting airborne pathogen infection control (internal NHSGGC email communication 08 January 2019), follow up to Innovated Design Solutions recommendations to review other areas of QEUH/RHC (internal email communication)

Other

We invite the Inquiry to consider the Health & Safety Executive as a source of information and evidence that may support whether potential deficiencies were existent within wards and further, whether such deficiencies contravened legal requirements, placing patients at increased risk.

It is understood that HSE served notice on NHSGGC with regards to Ward 4C, one of the wards listed in PPP 12, stating *"You have failed to ensure, so far as is reasonably practicable, that the ventilation system within ward 4C is suitable and sufficient to ensure that high risk patients who are vulnerable to infection are protected from exposure to potentially harmful airborne microbiological organisms."*

In addition, it is also understood that HSE served an improvement notice with regards to concerns around another ward. Again, it is suggested that such information may assist in determining whether identified features were potentially deficient.

Documents that PI may wish to consider in support of the above submission.

- SBAR Action Plan submitted to Care and Clinical Governance Committee on 5th December with updated position as of January 2019

- NHS GGC Internal email communication - Airborne Pathogen Infection Control (11 June 2021)
- NHS GGC Internal email communication - Discovery of Closure Documents (31 January 2019)
- NHS GGC Internal email communication - Estates Ventilation Ward 4C (07 December 2018)
- NHS GGC Internal email communication - Ventilation Wards 5C and 5D- (03 December 2018)
- NHS GGC Internal email communication - Critical Care Isolation Rooms- (May 2016)
- NHS GGC Internal email communication – Validation of Ventilation (18 June 2019)

THE SCOTTISH HOSPITALS INQUIRY

COMMENTS ON PROVISIONAL POSITION PAPER 12

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

1.1 We are invited to comment on Provisional Position Paper 12: Potentially Deficient Features of the ventilation system of the QEUH/ RHC.

1.2 We have been asked to direct ourselves to answer the four questions which are set out in paragraph 1.13.

1.3 In question 1 we are asked to say whether we accept the description of the ventilation system as correct. We have not been provided with any evidence of the testing of the ventilation system on the wards in question. In particular, for Ward 2A (Schiehallion) there is no evidence of the testing of the ventilation system either before the hospital was opened in 2015, or during the period up to when the patients were moved to Ward 6A during November 2018, or after the works were carried out in 2019.

1.4 We have been provided with the figures for a safe ventilation system required based on the NHS guidance. The NHS guidance has been the subject of intense and detailed analysis in the recent Edinburgh hearings by numerous experts involved in the design and construction of the ventilation system at Edinburgh. What is clear and obvious is that the guidance has largely not been followed when the ventilation has been designed and constructed. That is frankly astonishing for a project of this nature.

Even more alarming is that NHS Greater Glasgow and Clyde appear to have agreed to the lower unsafe ventilation requirements contrary to the NHS guidance.

1.5 We need our own ventilation expert to assess the factual evidence, moreover the expert evidence in light thereof and advise where the ventilation system failed to meet the relevant safety requirements. The fact that so many experts were asked for advice and comment on the guidance and how it was applied in the Edinburgh hearings goes to the heart of why it is essential the Core Participants who we are instructed by ought reasonably to have access to their own independent ventilation expert. This request has been refused by the Inquiry.

1.6 The same reasons that we set out in the comments on PPP11 (water) are equally applicable here in relation to ventilation.

1.7 The Inquiry are aware that NHSGGC have access to experts to comment on the water and ventilation reports and documentation produced by the Inquiry and, in addition, have instructed an expert on the issue of IPC. Despite being publicly funded they do not require to seek the Chair's approval for doing so. The issue of equality of arms arises.

1.8 We wish to instruct our own experts to allow us to be in a position to represent our Core Participant clients' interests by considering the Inquiry experts' reports. Our water expert will need to consider the documentation that has been provided by the Inquiry. This is essential to assist with the questions that we have been asked to address in PPP11. We are unable to properly do so without expert input. Neither counsel or the Core Participants we represent have particular experience or expertise in hospital built environments and the design, construction and technical issues associated with the planning, design (including technical aspects, scientific matters, application of guidance and relevant standards), commissioning and management of water and ventilation systems in a healthcare environment.

1.9 The four questions posed in PPP 12 at paragraph 1.13 present a challenge for us to answer as we simply do not know if the description of the ventilation system is accurate without an expert to advise us, or if the description of a "Potentially Deficient Feature" is accurate, or whether there are any other features of the water system which should be considered to be "Potentially Deficient Features". In addition, we have not been provided with any evidence of the testing of the ventilation system at any time from pre-opening in 2015 to the present date. This evidence is fundamental to the issues to be considered. It may be the case that there has been no testing of the ventliation system.

1.10 We have not been provided with a copy of the ventilation expert report from the expert instructed by the Inquiry. We therefore do not know whether the Inquiry's own expert considers the potentially deficient features set out in PPP12 are an accurate description of the system. We have asked to see the letter of instruction to the Inquiry expert and the list of the documents provided to the expert, but neither have been provided to us.

1.11 Since the outset of this Inquiry the patients and families have been said to be at the heart of this Inquiry. They have noted the numerous potential deficiencies and are hopeful that the issues are being identified, however their responses are based on trust and hope rather than informed views after receiving advice. They will not be properly informed without independent expert advice and guidance on both water and ventilation issues raised in PPP11 and PPP12 and the expert reports of the Inquiry.

1.12 In view of the refusal to allow the core participants to instruct experts an application will be made to the Chair.

1.13 Further, we cannot expect to be in a position to provide informed questions to the expert panel later in the year without access to our own experts so we may consider and where necessary query the methodology, the technical content of the evidence and also provide assistance with framing appropriate questions to ensure that

the patients and families position and concerns about the hospital are fully addressed. As stated above, we have of course no expertise on ventilation and water supply matters which creates a barrier to the patients and families most directly impacted by the water and ventiliation deficiencies.

Steve Love KC
Gavin Thornley
16 April 2024

Keoghs

Scottish Hospitals Inquiry

By Email Only: demt@hospitalsinquiry.scot

Our Ref: RIL.T10513091
Your Ref:
Date: 16 April 2024
Please Ask For: Ruth Lawrence
Email: [redacted]
Direct Dial: [redacted]

Dear Sirs

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

We write with reference to the 'Provisional Position Paper 12 - Potentially Deficient Features of the ventilation system of the Queen Elizabeth University Hospital and the Royal Hospital for Children' sent under cover of an email dated 28 February 2024.

We note that the Chair is likely to be invited by the Inquiry team to make findings in fact based on the content of the PPP and that any Core Participant or any other person holding relevant information is invited to seek to correct and/or contradict any material statement of fact which it considers to be incorrect and to point to what evidence exists to support the position taken by the core participant or other person.

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

"***1.8 The wards at the QEUH/RHC covered in this PPP are as follows: (i) General Wards (including Level 5 – Infectious Diseases and Level 7 – Respiratory) (QEUH)"***

- Infectious Diseases was not part of the QEUH design brief. The Schedule of Accommodation for Level 5 (copy enclosed) provided for four generic Medicine Wards. There was no clinical brief for an Infectious Diseases ward provided as part of the Employers Requirements.

- Level 7 was in the briefed Schedule of Accommodation as a Generic Medicine Ward.

"1.8 The wards at the QEUH/RHC covered in this PPP are as follows:… (iv) Ward 4B - Bone Marrow Transplant (BMT) (QEUH)"

- This was a change to the original brief introduced as a Compensation Event (Nr51) Oct 23 (copy enclosed), during construction and which significantly changed the design philosophy, working within constraints of already constructed works. Multiplex advised on the constraints / maximum

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air changes / pressures available. Post handover further works were done to correct defects, but the system would not meet fully compliant BMT requirements and NHSGG&C were aware of this.

"1.8 The wards at the QEUH/RHC covered in this PPP are as follows:… Ward 6A - Decanted location of the Schiehallion Unit (QEUH)."

- This was not part of the construction contract brief but was a post completion change by the Board on use of rooms.

"The Design Process… For context, it is necessary to refer to some design documents and processes…"

- It should be noted that an additional design constraint was set in order to control / reduce energy consumption. The Employers Requirements set a target of 80Kg $CO2m^2$ that drove a low energy solution where practical. Please find enclosed 'NSGACL-Appendix M&E4_iss1_rev.pdf' – the Employers Requirements Appendix M&E.4 Sustainable Design Considerations.

"3.20 … The Inquiry team have been unable to locate any specific contractual provisions in the Employer's Requirements for the validation of ventilation equipment in the QEUH/RHC contract documents. It is not known if this reflected standard or accepted practice at the time. However, there is a validation process set out within Draft for Consultation SHTM 03-01 Part A (2009)[33]."

- No specific contractual provisions in the Employer's Requirements were necessary because the requirement for a validation process was set out within Draft for Consultation SHTM 03-01 which was included in the Employer's Requirements.

"3.27 Although the Employer's Requirements stated that the QEUH and RHC would have natural and mechanical ventilation[41], the Inquiry team understands that parties must have agreed at some stage to have a fully mechanical ventilation system…"

- A sealed building was agreed in order to meet the energy modelling as set out in the Clarification Log (a copy of the 'Clarification Log (final agreed for contract)' has been referred to in the PPP and so we do not enclose a further copy.

"5.15 The number of ACH is not an exact science. Ultimately, it is a compromise agreed between contributors (including engineers and IPC professionals). The number of ACH agreed in the NHS Guidance is based on research conducted by Owen Lidwell and his research group in the 1970s. It is simply an agreed consensus that the stated level of ACH within the NHS Guidance provide a safe environment for patients; it does not necessarily follow that failure to comply with the stated level of ACH will always be a risk to patients. That said, non-compliance may create a risk to patients[66]."

- As part of general consultation on the scheme, advice was sought from Professor John Hood, and with guidance from Peter Hoffman at Health Protection Agency it was noted that ACH in general areas is about temperature control, and not for any infection issues. This guidance was

provided for renal dialysis which was multi bedded bays which have a higher risk of infection than in single bedrooms. Please find enclosed 'Renal Ward Ventilation Note.pdf.

"6.28 The Draft for Consultation SHTM 03-01 Part A (2009) standard of 10 ACH for critical/neutropenic areas, was derogated to 2.5 ACH. This is a potentially deficient feature for the purposes of Glasgow III."

- There was no agreed derogation to any air changes other than 6ACH down to 2.5. The initial clarification text question notes, *"Ward Air change to be 6AC/HR, currently shown as 2.5AC/HR which is not in compliance with SHTM 03-01."* The audit train in the Clarification Log clearly indicates that the clarification was only related to areas with 6ACH briefed, stating, *"Providing 6 air changes is energy intensive and not necessary".*

"6.32 The M&E Clarification Log (2010 ItP) – Final also derogated from room pressure differentials as noted on pages 3 and 4 of the Log where it is stated that "(rooms could also be at slightly negative pressure to corridor)". GGC agreed and noted negative pressure was to be created in the design solution[85]. This is a potentially deficient feature for the purposes of Glasgow III."

- There was no agreed derogation to any air pressure regimes other than in rooms where ACH was derogated to 2.5. The initial clarification text question notes, *"Ward Air change to be 6AC/HR, currently shown as 2.5AC/HR which is not in compliance with SHTM 03-01."* The audit train in the Clarification Log clearly indicates that the clarification was only related to areas with 6ACH briefed, stating, *"All accommodation is single bedrooms and therefore the need for dilution of airborne microbiological contamination should be reduced (rooms could also be at slightly negative pressure to corridor). Providing 6 air changes is energy intensive and not necessary."*

"6.80 The 2013 change order stated that the ward area required HEPA filtration to same standard as the current haemato-oncology ward[97]. The COS for haematooncology stated that patient bedrooms defined as 'side rooms for neutropenic patients' should have HEPA filtration. In any event, HTM 03-01 Part A (2007) guidance requires H12 (HEPA filtration) for neutropenic wards such as 4B."

- NHSGG&C's response to the proposed design in response to the Board change of use confirmed the rooms requiring HEPA Filters. Please find enclosed 'Haemato-oncology - Board response 250713.pdf' containing NHS GG&C comments / brief requirements for HEPA Filtration informing Multiplex design response for Level 4.

"6.81 On 23 June 2010, GGC notified[98] Multiplex in relation to a change to the Works Information which relates to HEPA filtration to remove HEPA filters for 8 single room wards in Haemato-oncology ward and this was implemented on or after 16 September 2010[99]."

- Compensation Event 014 (copy enclosed) confirmed this change.

"6.85 However, all other spaces in ward 4B including the corridor had no HEPA filtration. This is a potentially deficient feature for the purposes of Glasgow III."

- As set out above, NHSGG&C's response to the proposed design in response to the Board change of use confirmed the rooms requiring HEPA Filters. 'Haemato-oncology - Board response 250713.pdf' contains NHS GG&C comments / brief requirements for HEPA Filtration informing Multiplex design response for Level 4.

"6.88 The Inquiry team considers that the effect of NHS Guidance was that 10 ACH was required in Ward 4B."

- Multiplex confirmed as part of the design solution that Air handling unit 31 AHU63 located within Plantroom 31 on Level 3 was at maximum performance achieving 6ACH. Please find enclosed 'Ward 4B Multiplex Design Statement.pdf'. NHSGGC did not instruct replacement of the AHU or an increase in main riser ductwork.

Currie & Brown also takes this opportunity to respond to each of the four questions posed in PPP 11 as follows:

1. *Whether the description of the ventilation system contained within the PPP is accepted as being correct and if there are points in respect of which the Core Participant challenges the description of the system, specifically what the points of disagreement are and what evidence exists to support the position taken by the Core Participant.*

   Subject to the points made above and whilst also noting that it professes no M&E expertise, Currie & Brown accept that the description of the ventilation system contained within the PPP is correct.

2. *Whether the description of any potentially deficient feature is accurate notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense.*

   Currie & Brown accept the accuracy of the descriptions of the potentially deficient features notwithstanding that it may not accept that the features described are potentially deficient or deficient in any sense.

3. *Where the PPP describes the date or dates upon which a potentially deficient feature became known to a particular person or organisation whether the Core Participant accepts that date of knowledge or offers an alternative date notwithstanding that the Core Participant may not accept that the feature described is potentially deficient or deficient in any sense.*

   The PPP does not describe the date(s) upon which any potentially deficient features became known to Currie & Brown. The date(s) that any potentially deficient features became known to any other persons or organisations is outside Currie & Brown's knowledge.

4. *Whether there are any other features of the ventilation system which should be considered by the Inquiry to be potentially deficient features and what evidence exists to support that conclusion.*

   Currie & Brown do not consider that there are any other features of the water system (including drainage) which should be considered by the Inquiry to be Potentially Deficient Features.

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

Yours faithfully

Keoghs LLP

New South Glasgow Hospitals Scheme

Hospital	Floor	Department	Designed Area m²
Adult	B1	BASEMENT FM FACILITIES	3,980.9
Adult	B1	BASEMENT COMMUNICATION	2,796.5
Sub-total			**6,777.3**
Adult	0	MAIN ENTRANCE	3,522.5
Adult	0	ACCIDENT & EMERGENCY DEPARTMENT	2,408.1
Adult	0	ACUTE ASSESSMENT 28 Bed CLUSTER	1,101.3
Adult	0	ACUTE ASSESSMENT 30 Bed CLUSTER	1,203.7
Adult	0	ACUTE ASSESSMENT GENERAL RECEIVING CLUSTER	1,686.7
Adult	0	ACUTE ASSESSMENT Complex Needs Cluster	110.2
Adult	0	ACUTE ASSESSMENT OPD CLUSTER	134.8
Adult	0	ACUTE ASSESSMENT SUPPORT CLUSTER	409.5
Adult	0	PHARMACY DISPENSARY	264.9
Adult	0	RADIOLOGY GROUND FLOOR - ED & OPD Support	1,959.4
Adult	0	OPD GROUND FLOOR - REHAB & THERAPY DEPARTMENT	1,475.7
Adult	0	OPD GROUND FLOOR	1,475.6
Adult	0	MEDICAL ILLUSTRATION	184.2
Adult	0	DECONTAMINATION	70.3
Adult	0	GROUND FLOOR FM FACILITIES	256.7
Adult	0	GROUND FLOOR COMMUNICATION	1,405.9
Sub-total			**17,669.5**
Adult	01	STROKE WARD	1,326.0
Adult	01	CRITICAL CARE - GLOBALLY SHARED FACILITIES	1,211.4
Adult	01	CRITICAL CARE: ICU/HDU (Medical & Surgical) AREAS	3,686.5
Adult	01	CRITICAL CARE: CCU AREAS	1,070.6
Adult	01	MEDICAL DAY UNIT	766.5
Adult	01	OPD FIRST FLOOR	3,432.8
Adult	01	RESTAURANT	611.5
Adult	01	SANCTUARY	97.9
Adult	01	RADIOLOGY FIRST FLOOR - Inpatient Support	3,134.0
Adult	01	RADIOLOGY - Joint Nuclear Medicine	816.1
Adult	01	FIRST FLOOR FM FACILITIES	128.7
Adult	01	FIRST FLOOR COMMUNICATION	1,823.6
Sub-total			**18,105.6**
Adult	02	DERMATOLOGY WARD	1,171.4
Adult	02	THEATRES	6,785.3
Adult	02	ENDOSCOPY	534.7
Adult	02	OPD SECOND FLOOR - DERMATOLOGY & DAY CASE	909.8
Adult	02	OPD SECOND FLOOR - RENAL DIALYSIS UNIT	1,588.7
Adult	02	DECONTAMINATION	425.2
Adult	02	MEDICAL PHYSICS	787.2
Adult	02	PLANT	5,488.6
Adult	02	SECOND FLOOR FM FACILITIES	198.1
Adult	02	SECOND FLOOR COMMUNICATION	1,612.8
Sub-total			**19,501.9**

New South Glasgow Hospitals Scheme

Hospital	Floor	Department	Designed Area m²
Adult	03	MEDICAL RECORDS	12.8
Adult	03	PLANT	8,736.5
Adult	03	THIRD FLOOR FM FACILITIES	1,352.6
Adult	03	THIRD FLOOR COMMUNICATIONS	1,378.8
Sub-total			**11,480.7**
Adult	04	RENAL WARDS	2,137.8
Adult	04	RENAL 16 Bed Ward & Day Unit	966.0
Adult	04	RENAL 20 Bed Higher Acuity (Level 2 Ward)	1,078.5
Adult	04	HAEMATOLOGY-ONCOLOGY WARD	977.4
Adult	04	FOURTH FLOOR WARD SUPPORT CORE	515.2
Adult	04	FOURTH FLOOR COMMUNICATION	720.4
Sub-total			**6,395.4**
Adult	05	MEDICINE WARD A	1,204.5
Adult	05	MEDICINE WARD B	1,204.2
Adult	05	MEDICINE WARD C	1,202.8
Adult	05	MEDICINE WARD D	1,218.6
Adult	05	FIFTH FLOOR WARD SUPPORT	566.5
Adult	05	FIFTH FLOOR COMMUNICATION	652.7
Sub-total			**6,049.2**
Adult	06	RHEUMATOLOGY WARD 01	1,204.5
Adult	06	MEDICINE WARD 02	1,204.2
Adult	06	MEDICINE WARD 03	1,202.8
Adult	06	MEDICINE WARD 04	1,217.3
Adult	06	SIXTH FLOOR WARD SUPPORT	565.7
Adult	06	SIXTH FLOOR COMMUNICATION	652.6
Sub-total			**6,047.2**
Adult	07	MEDICINE WARD 05	1,204.3
Adult	07	MEDICINE WARD 06	1,204.3
Adult	07	MEDICINE WARD 07	1,202.7
Adult	07	MEDICINE WARD 08	1,217.5
Adult	07	SEVENTH FLOOR WARD SUPPORT	559.8
Adult	07	SEVENTH FLOOR COMMUNICATION	658.2
Sub-total			**6,046.8**
Adult	08	ELDERLY/MEDICINE WARD 09	1,204.3
Adult	08	ELDERLY/MEDICINE WARD 10	1,205.6
Adult	08	ELDERLY/MEDICINE WARD 11	1,202.9
Adult	08	ELDERLY/MEDICINE WARD 12	1,216.9
Adult	08	EIGHTH FLOOR WARD SUPPORT	563.1
Adult	08	EIGHTH FLOOR COMMUNICATION	652.7
Sub-total			**6,045.5**

New South Glasgow Hospitals Scheme

Hospital	Floor	Department	Designed Area m²
Adult	09	MEDICINE WARD 13	1,205.0
Adult	09	MEDICINE WARD 14	1,205.9
Adult	09	MEDICINE WARD 15	1,202.9
Adult	09	MEDICINE WARD 16	1,217.9
Adult	09	NINTH FLOOR WARD SUPPORT	555.4
Adult	09	NINTH FLOOR COMMUNICATIONS	652.2
Sub-total			**6,039.3**
Adult	10	SURGERY WARD 17	1,205.4
Adult	10	SURGERY WARD 18	1,206.1
Adult	10	SURGERY WARD 19	1,203.2
Adult	10	SURGERY WARD 20	1,217.8
Adult	10	TENTH FLOOR WARD SUPPORT	565.6
Adult	10	TENTH FLOOR COMMUNICATION	652.4
Sub-total			**6,050.4**
Adult	11	SURGERY WARD 21	1,205.5
Adult	11	SURGERY WARD 22	1,206.1
Adult	11	SURGERY WARD 23	1,203.3
Adult	11	ENT WARD 24	1,217.9
Adult	11	ELEVENTH FLOOR WARD SUPPORT	565.5
Adult	11	ELEVENTH FLOOR COMMUNICATION	652.2
Sub-total			**6,050.5**
Adult	12	PLANT	3,375.5
Adult	12	TWELFTH FLOOR FM SUPPORT	-
Adult	12	TWELFTH FLOOR COMMUNICATION	581.4
Sub-total			**3,956.9**
Total Adult Hospital			**126,216**

New Southern General Hospitals

Compensation Event #10675

Status: Closed

Notification

Notified By

GGC01.NSGLP.pmoir on 2 Oct 2013

Notified To

BCL01

Proposed Compensation Event?

No

Under Dispute?

No

Type

60.1(1)-Change to the Works Information

Title

CE 051. Adult Hospital - Level 4 Zones 512, 513 & 514 HEPA Filtration

Description

The Board confirm acceptance of proposals set out in PMI 228 and confirm the design and adaptations to this are should be taken forward and incorporated into the finished building by the contract completion date for Stage 3. The agreed value for these works is £569,001.49 excluding VAT.

Reply By

23 Oct 2013

Decision

Request to submit quotation

Quotation Request Assumptions

The agreed value for the works is £569,001.49 ex.VAT

Quotation #1

Proposed Cost

£569001.49

Accepted Programme affected?

No

Delay to the Completion Date?

No

Delay to a Key Date?

No

Alteration to Accepted Programme?

No

Quote Response Assumption

A48974691

N/A

Quotation Submitted By

on

Reply By

16 Oct 2013

Outcome

An acceptance of a quotation

Outcome Comments

N/A

Assessment / Implementation

Proposed Changes to Price

£569001.49

Proposed Changes to Completion Date

N/A

PM Agreed Changes to Price

£569001.49

PM Agreed Changes to Completion Date

Documents

Document Name

Haemato-Oncology Change Costing Summary rev G (October 2013).pdf

Description

Final Agreed Level 4 Haemato Oncology Quote

File Type

application/pdf

Uploaded

On 17 Oct 2013 by BCL01.NSGLP.jbailey

QEUH – Ward 4b Upgrade Works

Introduction

This documents sets out the works to be carried out to upgrade the 24 bedrooms in the Haemato-oncology Ward (4b) on Level 4 of the Queen Elizabeth University Hospital to achieve between 5 and 10 pascals differential pressure between the bedrooms and the corridors.

Works to be carried out

In order to provide a sealed room, which will assist in achieving the required 5-10 Pascals differential pressure, an MF ceiling will be installed within the 24 bedrooms. The ceiling will be taped and painted and sealed at all interfaces with adjoining walls and services. The ensuite rooms currently have a grid and tile type ceiling which will be retained but with the services and tiles silicon sealed.

The current recessed down lighters within the room will be fitted with a diffuser to provide an IP44 rating.

The current ventilation system (Air handling unit 31 AHU63 located within Plantroom 31 on Level 3) serving Ward 4b is currently at its maximum performance and achieving approximately 6 air changes per hour. To ensure that there is some additional capacity within the supply unit, the motors, inverter drives (run and standby) and associated electrical supply will be upgraded. This will assist in achieving the desired room differential pressure (5-10pa) and allow for additional resistance as filters degrade. All filters within the AHU will be changed prior to re-commissioning and the AHU and supply duct work re-cleaned.

The current HEPA filters within the supply diffuser housing within the 24 bedrooms will be replaced with new filters.

The users have requested a visual indication of room pressures, to achieve this a magnahelic type analogue differential pressure gauge (as installed in isolation rooms) will be installed at each room.

During the installation process we will carry out a daily “builders” clean to maintain a level of cleanliness and follow this with a sparkle clean prior to commissioning works commencing.

Maintenance Access

At present there are mechanical and electrical services running above the ceiling of the rooms, this is generally, ventilation ductwork, Smoke dampers, heating pipework, duct mounted heating coil, heating controls, domestic water pipework, medical gas pipework, electrical containment, WIFI data point, fire alarm void detector, Nurse call input / output unit. In order to gain access to the maintainable items and items that may need access for fault finding (fire alarm void detector, smoke dampers, heating controls, electrical trunking, duct mounted heating coil, data point) access hatches will be provided in the ceiling. These hatches will be sealed after the works are complete using silicon sealant.

The HEPA filters are installed within the supply air diffuser mounting and can be accessed by removing the diffuser from the room side.

QEUH – Ward 4b Upgrade Works

Commissioning & Validation

On completion of the installation works the commissioning period will commence. The following activities will be carried out:

1. The Air handling Unit and Supply ductwork will be cleaned and swab samples taken for analysis.
2. The AHU filters will be changed
3. The ventilation systems (supply and extract) will be re-commissioned (initially with the existing HEPA filters remaining to avoid any possible degradation during commissioning) and room differential pressures measured to ensure 5-10pascals are achieved
4. The existing HEPA filters will be changed and challenge tests (DOP) will be carried out on each filter.
5. Room pressures will again be measured and adjusted if required and the magnahelic gauges calibrated.
6. The ward corridor to the non-ward areas (Core C, Core G and Core A corridor) differential pressure will be measured to ensure a positive pressure is achieved.
7. Commissioning results will be collated and uploaded to Zutec

At various stages throughout the process we will invite the NHS Project Team to witness the commissioning/ tests etc.

Once the above items have been completed the area will be handed back to the NHS to allow a deep clean and microbiological testing to be carried out.

From: Hood, John
Sent: 25 October 2010 12:02
To: Hood, John; McCluskey, Fiona; Stewart, Jackie; Williams, Craig
Cc: Seabourne, Alan; McNamee, Sandra; Walsh, Tom
Subject: RE: Ventilation

Importance: High
Dear All,
Just had a useful conversation with Peter Hoffmann at the HPA. He is happy with the proposal that chilled beams are employed in this renal dialysis area. He explained that the suggested 6 ACH per hour is really for temperature control and not for any infection control issues (i.e. not dilution and removal as I mentioned below). He agrees that any more invasive procedures should take place in an appropriately ventilated treatment room.
He also suggested that the problem that you have in the existing areas in the ACADS might be helped by employing 'terminal diffusers that have less directional flow' .
Sorry for the delay and I hope this information is helpful.
Kindest regards
John Hood

-----Original Message-----
From: Hood, John
Sent: 21 October 2010 11:53
To: McCluskey, Fiona; Stewart, Jackie; Williams, Craig
Cc: Seabourne, Alan; McNamee, Sandra; Walsh, Tom
Subject: RE: Ventilation
Importance: High

Sorry not really happy with reduction of ventilation in a dialysis area to 2.5 air changes per hour. Air changes are about dilution and removal. The issue in other ACH units seems to be about **temperature control** - not airchanges per say. A normal ward area would be expected to have at least 6 airchanges per hour. I would like to discuss the issues with my colleague and expert Peter Hoffmann from the HPA. Unfortunately he is leave at the moment and will not return until Monday 25 October, when I will try to contact him.
Kind regards
John Hood

-----Original Message-----
From: McCluskey, Fiona
Sent: 21 October 2010 10:05
To: Stewart, Jackie; Williams, Craig; Hood, John
Cc: Seabourne, Alan; McNamee, Sandra; Walsh, Tom
Subject: RE: Ventilation

Hi

Are you able to confirm the decision regarding the ventilation for the Renal Dialysis Outpatient area? This information is needed now as a matter of urgency for the Full Business Case.

Kind Regards

Fiona

Fiona McCluskey
Senior Nurse Advisor
New South Hospitals Project
Top Floor
Construction Offices
(off Hardgate Road)
Southern General Hospital

NHS Greater Glasgow and Clyde

New South Glasgow Hospitals (NSGH) Project

INVITATION TO PARTICIPATE IN COMPETITIVE DIALOGUE

VOLUME 2/1

APPENDIX M&E.4
SUSTAINABLE DESIGN CONSIDERATIONS

CONTENTS

1.0 Introduction

During the design development of the new hospital facilities various investigations, reports and discussions have taken place. The purpose of this section of the Employers Requirements is to summarise this information to assist the Contractor in addressing this key element of his design.

Given the nature of this subject the fact that it has to form a fundamental keystone of the contractor's proposals and is significantly influenced by the Building Design Solution. It is critical that the Contractor treat these notes as guidance only and provide bespoke solutions within his design solution.

The proposals shall be closely linked to the BREEAM excellent rating requirement, refer to paragraph 3.10.4 and the low carbon tracker which is provided under separate cover.

2.0 General Obligations and Objectives

The sustainability and low carbon designs are fundamental to the design quality evaluation of the project and bids will be scored significantly on these aspects. This section sets out the requirements.

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 operational energy targets which are to be met as part of the building acceptance procedures.

The process for integrated design, calculation and modelling, disclosure and auditing is set out in this section and confirmation of acceptance of these procedures without qualification or condition is an explicit part of the tender evaluation.

Refer to the main contacts of Volume 2/1 and the associated appendices for Building and M&E Services.

It is the contractor's responsibility to provide commentary and clear proposals in the submission on any actual or perceived conflicts in requirements.

In general terms the contractor shall:

- Implement an Environmental Management System (EMS) in line with the principles of ISO 14001 accreditation in relation to the design, management construction materials procurement, supply chain management and site processes for this project
- Respect the local landscape and protect natural habitat and species taking due account of the UK Biodiversity Action Plan;
- Avoid sources of ionising and electromagnetic radiation and any design features associated with sick building syndrome;
- Develop and implement a Site Waste Management Plan (SWMP) in line with DEFRA and WRAP guidance
- Maximise the opportunity for waste minimisation, through design and in construction, following good practice guidelines.
- Maximise the opportunity for incorporating higher levels of recycled input into components, and for high waste recovery (reuse and recycling)
- Maximise efficient and effective removal and transport of waste;
- Adopt maintenance regimes which maintain optimum performance;
- Avoid the use of harmful building products and processes;
- Undertake integrated low carbon and passive design
- Explore the use of prefabricated elements to achieve good quality control, ease and speed of installation and flexibility for future use.

The Contractor shall comply with the following NHS and related publications:

- The Development of a Local Environmental Strategy in line with Sustainable Development in the NHS;
- Environmental Management Policy for NHS Scotland (SEHD) 2002; HDL (2006)21, and the documents referred to therein.
- Encode;SHTM 07-02
- Carbon / Energy Management in Healthcare
- BREEAM Healthcare. The following publication provide guidance in the approach to design and procurement and will be useful/essential in the low carbon design and BREEAM Environmental Purchasing in Practice guidance for organisations September 2002
- Good Corporate Citizen (Sustainable Development Corporation publication)Sustainable Development in the NHS
- "The Green Book" APPRAISAL AND EVALUATION IN CENTRAL GOVERNMENT Treasury Guidance LONDON: THE STATIONERY OFFICE
- The Role of the Physical Environment in the Hospital of the 21st Century: A Once-in-a-Lifetime Opportunity (a) Roger Ulrich*, Xiaobo Quan, Center for Health Systems and Design, College of Architecture, Texas A&M University Craig Zimring*, Anjali Joseph, Ruchi Choudhary, College of Architecture, Georgia Institute of Technology

2.1 Materials resources efficiency

NHS Greater Glasgow and Clyde is committed to improving the environmental performance of their construction projects. Designs and specifications should consider the environmental impact of all elements of the design including choice of materials. One important contribution to sustainability goals is the efficient use of finite natural resources, diverting waste from landfill. This can be achieved by meeting good practice levels of waste minimisation and management throughout the project in accordance with WRAP guidelines and by adopting the most significant cost-neutral opportunities to increase waste recovery. Opportunities should be investigated under two streams:

- Reused and recycled content
- Site construction waste management and minimisation

Reused and Recycled Content

To deliver measurable performance, the contractor should exceed a threshold outcome defined as follows: At least 10% of the total value of materials used in the construction project must be derived from recycled and re-used content in the products and materials selected.

The contractor should identify and implement the most effective cost-neutral opportunities (Quick Wins) to increase the value of materials deriving from recycled and re-used content, and quantify the improvement in the total recycled content above ‘baseline practice’ for the project. The contractor shall specifically investigate the use of demolition material resulting from existing structures on site to contribute and exceed this target.

Further definition of recycled content and the most common quick win opportunities can be obtained from WRAP published guidance. To assess the baseline recycled content level of the project and identify the quick wins, the WRAP Net Waste Tool should be utilised.

Waste Minimisation and Management

The Contractor is required to implement where possible cost-effective methods of good practice waste minimisation during the design of the project and thereafter during construction. As a minimum, the Contractor should:

- Identify appropriate methods of waste minimisation in design before detailed design commences and report to the Contract Manager on the economic and practical implications of adopting these methods during the development of the design.
- Agree with the Contract Manager which methods of waste minimisation to implement at the appropriate design stage and demonstrate how the methods have been incorporated into the design.
- Include a list of measures within the Site Waste Management Plan (see requirements below) to minimise waste generated from on-site operations (for example, damage, theft etc) and demonstrate how these measures have been implemented.

The Contractor is also required to meet specified minimum waste recovery rates for the waste streams with the largest cost-effective recovery potential (selected Quick Wins). The Contractor is required to identify and agree with the Contract Manager the key opportunities for Quick wins on the project and set minimum recovery rates to be achieved. Specifically, the Contractor's responsibilities (in association with his trade sub-contractors and waste management contractors where appropriate) shall:

- Identify, and continually review as the pre-construction design develops, the waste streams with the largest cost effective recovery potential and estimate likely recovery rates for each waste stream
- Agree with the Contract Manager before the commencement of construction those waste streams that will provide the most significant opportunities for cost-effective recovery (to be known as 'selected Quick Wins') and the minimum recovery rates to be adopted for the project
- Meet the agreed minimum recovery rates for the selected Quick Wins unless otherwise agreed in writing by the Client
- Measure waste arising during the works and compare with the minimum recovery rates set for the project and then report these findings to the Employer's Agent
- Appoint trade sub-contractors and waste management contractors with the same liability as under the Employer's Requirements to meet minimum recovery rates (where applicable) and to support the Contractor to measure, monitor and report actual waste arising during the works

To assist the effective delivery of the above requirements, the Contractor should develop and implement a Site Waste Management Plan (SWMP) to achieve good practice waste management on the project. Specific Contractor responsibilities will be to:

- Provide and agree a methodology with the Contract Manager before detailed design commences regarding how the SWMP will be developed and implemented with specific reference to the constraints of the project, the management of these constraints, their supply chain, programme of key steps and reviewing performance. This should take into account good practice guidance published by WRAP and other organisations;
- Develop the SWMP as the design progresses in accordance with the agreed methodology for completion prior to construction commencing. A copy of the completed SWMP should be provided to the Contract Manager prior to construction commencing
- Implement the SWMP during construction in accordance with the agreed methodology
- Ensure compliance of all appointed trade sub-contractors and waste management contractors with the legal requirements under the Duty of Care regulations and take all reasonable actions as appropriate for non-compliance.

The SWMP should be developed and implemented following the DEFRA and WRAP guidelines and incorporating the good practice measures above. Implementation of the SWMP can be facilitated through the use of the WRAP Template (Excel based freely available template) for SWMPs. The Contractor is free to use other tools or templates for implementing the SWMP.

Where relevant, the Contractor should employ a systematic approach to good practice in the recycling and re-use of locally available construction, demolition and excavation waste materials (on-site and from nearby sites) – for example, applying the methodology outlined in the Demolition Protocol (published by ICE, London Remade and Envirocentre).

Further guidance on recycled content, good practice waste management and minimisation and the SWMP can be obtained from WRAP and Envirowise.

2.2 Low Carbon Design – General Requirements

2.2.1 General Requirements

The contractor shall implement fully an integrated approach to low carbon design as contained in section 2.1. In summary this is as follows:

- Project plans to include requirements for low carbon design, energy targets and auditing at key stages.
- Set and record a design and operational energy target for each project.
- Undertake calculation and modelling of the target at key stages
- Cooperate with monitoring and review mechanisms for the design and operational energy target and note that failure to provide calculations and failure to meet targets are contractually significant.
- Use a set of ADB sheets as a model to set the project requirements and negotiate these with users. Use in conjunction with the overarching technical brief.

- Use a design monitoring tool such as a tracker to ensure the brief is being adopted.
- Use the modelling specification to ensure adequate reporting and consistency of results
- Confirm that the appointed team, team leader and individuals working on the project have a sufficient skill set and access to adequate software for the demands of the project.

2.3 Design Energy Targets

2.3.1 Design energy targets

1. The design energy target is an asset rating of no more than 40 as per Part L2A EPC classification this is required for BREEAM excellent and could lead to Design compliance with Scottish Building Regulations Section 6.1 and an approximate Scottish EPC Asset Rating of B.

2. The operational energy target is 80kgCO2/m2 per annum as measured at the incoming energy meters to the energy centre and taking into account the emissions from the actual performance of any CHP plant which may be installed when calculating and measuring electrical consumption.

3. This target relates to the new building, taking into account the efficiency of the central plant in the energy centre and district mains interconnecting the two. The seasonal efficiency used in the calculation must accurately reflect the chosen plant, the proportion and availability of low and zero carbon technology and the efficiency of the distribution mains. All these must be clearly reported and supported by manufacturer's details and designers modelling calculations.

4. The energy calculation shall be undertaken using a full dynamic model to level 5. See following section for modelling requirements.

5. Formal reporting is required at the following key points

    a. Façade development and 1:100 layouts – the comparative energy implications of different window sizes, glazing types, shading, natural ventilation solutions, passive cooling, daylighting etc should be considered and reported to the client. This is the most critical stage as once a scheme proceeds to detail design; the opportunity for iteration is lost. Architects must present façade and internal layout solutions which address energy implications and not just aesthetics and functionality. Note that the design programmes must allow enough time for this process. The calculation methodology would be full dynamic modelling of rooms and façade modelling

b. Early detail design/ full business case: once the façade is set and layouts are reasonably agreed, the full model should be built. The contractor should understand clearly that models will need to be revised and iterations undertaken. The detailed energy prediction must not be left until late in the detailed design to avoid additional work. Permission to proceed to detailed design will not be granted until the contractor can confirm that the stated design and operational energy target will be met. Note that if BREEAM excellent is required, confirmation from the assessor for the business case that the scheme is in line to achieve the rating will be unreliable without confirmation of the energy score.

c. Late detail design: the contractor must confirm through revision to the above model that the design meets the design and operational energy targets

d. Late construction – the as built model should be produced which will provide the final EPC and the operational target confirmed based on actual equipping.

6. Operational energy – at each of the above reporting stages, a check on the operational energy target should be calculated on the following basis as a minimum: Build up the likely energy use from the design targets. This needs a thorough understanding of the defaults in the NCM methodology. Once the building is modelled, the model shall be corrected for the actual zone usage as agreed during the competitive dialogue process and realistic and auditable allowances made for equipping. Any other variables to the design model to predict actual usage shall be declared and agreed with the client's auditor. The contractor is however free to propose alternative methodologies provided that they are likely to predict accurately actual energy use.

7. All calculations and models shall be open access and available at any reasonable time for evaluation by the client's auditor.

8. Training and awareness of energy issues relating to the building shall be given by the contractor to the building users and the maintenance staff – the format and content of this shall be established through the competitive dialogue process

9. Operational energy shall be measured and reported for every 3 months for 3 years from occupation of the building by the contractor with weather normalisation undertaken by reference to an agreed thermal model containing actual weather data for the year in question. Should operational energy be found to exceed predicted operational energy, then investigation and remedial action will be required to be undertaken by the contractor

10. The investigation shall consist of the following: a report shall be prepared consisting of monthly logs from each sub meter for 3 months which shall be compared with predicted usage to detect where excessive energy use is occurring. This shall be followed by a review meeting with the clients' auditor to discuss findings and agree corrective action.

11. If findings are not conclusive, further logs and reports shall be undertaken until a clear cause can be identified. If a clear cause cannot be found within 6 months of the start of the investigation, further investigation shall be undertaken which may include, but not be confined to thermographic imaging, data and environmental logging either by the BMS and/or external loggers, by behavioural auditing and monitoring of usage, manufacturer's reports and similar non intrusive methodologies.

12. If causation is behavioural, evidence shall be presented and the client will undertake training of staff and users.

13. If causation is due to building services systems, commissioning, building fabric or any other matter relating to design and construction of the facility, the contractor shall undertake remedial action including recommissioning, replacement and upgrading as may be required to reduce the energy consumption to the operational target, and log energy usage for at least 12 months to demonstrate that corrective action has been successful.

14. The design energy target is based on the National Calculation Methodology which includes standardised operational data. Hence further operational energy targets are also set which relate to actual usage of the hospital.

2.4 Operation Energy Targets

To be verified at design stage also and include all areas/volumes relative to the new facilities:

- 55 GJ/100 m^3

2.4.1 Modelling requirements

Modelling shall be undertaken at the stages required above for energy, thermal comfort and daylighting, complex ventilation solutions and facade development.

The following extract from CIBSEE AM11 provides a useful basis of expectation with respect to reporting of modelling results. The contractor shall:

1. Undertake frequent meetings with the client to determine modelling requirements.
2. While only relevant data should be presented, it is necessary for the modeller to be aware of a more detailed interpretation, e.g. to avoid the possibility of presenting peak temperatures occurring during an unoccupied period.
3. In the case of several design variants, clearly define the reference case against which parameter variations have been made.
4. Quantify where possible — e.g. number of hours of overheating, lux level contours for standard overcast sky.
5. Explain results — e.g. if a model change increases energy consumption, explain the causes.

6. Presentation: each report should have:

   (i) statement of objectives
   (ii) summary of main findings
   (iii) brief details of relevant capabilities of program used (with version number etc.)
   (iv) description of the model, including a description of how the model was formed and the principal operational characteristics (with reference to details in appendices)
   (v) details of the assumptions made in the model and results of sensitivity analyses where appropriate
   (vi) clear description of design variations tested and changes made
   (vii) graphical and tabular results (see examples in case studies in section 6 of CIBSE AM 11)
   (viii) Conclusions against stated objectives; outline pros and cons of design variations.

All the above must be reported at a point in the design process where changes to provide a more energy efficient design can still be undertaken without abortive design costs.

Methodology requirements:

The overarching requirement is that the results of modelling are appropriate for the stage of design, reliable and reproducible. The reporting required is above and the methodology, applicable to any form of dynamic modelling including CFD, is as follows. A more detailed methodology can also be found in CIBSE AM11 and IEA Annex 21 from which the following is a summary.

Requirements for modelling are as follows:

1. The process should use the same software and version of software throughout the process to enable comparison to be made. This should be explicitly stated in each report.

2. The objectives of the study should be defined and agreed.

3. The extent of modelling should be clearly defined and agreed in advance – it should be clear whether sample rooms, whole floors or whole buildings have been considered and whether individual zones, activities and systems have been incorporated.

4. All approximations and assumptions must be explicitly stated and peer reviewed. If the limitations of the program being used mean that assumptions and approximations will not yield a reliable outcome, the modelling should not proceed and alternative programmes with adequate capability should be selected.

5. Sensitivity analysis shall be undertaken. This shall include as a minimum consideration of different weather scenarios, changes to occupancy patterns and where appropriate, the sensitivity of key assumptions, simplifications and approximations.

6. A record shall be kept as output from the programme of all data input, and of all non alterable data. When iterations are undertaken, QA procedures shall be used to ensure that only the iterated factors are changed. Where outcome is critical, duplicate models shall be iterated to ensure consistency of results.

7. The architect and or engineer must know exactly what the building will be used for. Any special features which may influence the design or its performance (e.g. atria, pool, orientation, need for 100% fresh air ...) should be identified and agreed with the client. The level of thermal comfort should established and agreed with the client (e.g. room temperatures should not go below 18 OC in winter for longer than 2 hours at a time, or higher than 26 ^{o}C in summer for more that 50 hours in total, but not on successive days, similar criteria for humidity, glare and level of lighting).

8. Each and every aspect of design, as defined in the modelling brief should be considered and defined (e.g. what is meant by overheating, what is the objective with respect to energy use etc.).

9. The iterations that should be considered should then be established and recorded – for example, increasing or decreasing % glazing, altering orientation, increasing mass, effect of different weather files etc.

10. The method of presentation should be agreed with the client – this may be graphical, 3D, 2D etc, but expectations should be managed and agreed in advance.

11. When interpreting the results, the output data must be clearly understood. For example definition of the time for which results are reported and, if appropriate, the way results are averaged over the reporting period must be clearly defined and understood. For example, the number of hours of overheat must be for occupied hours only.

12. Error checking shall be undertaken for larger and complex simulations. Errors of an order of magnitude can be trapped by using simple tests and range checking. For example, comparing the results of a steady state simplified calculation of the total heat loss of a building, with that of a dynamic program when used to emulate steady state may reveal order of magnitude errors in the input.

13. Comparison of results with those of previous similar projects would always help identify major errors. For example, building floor area entered as a separate input item could be checked against the sum of floor area of rooms within the building.

14. The qualifications, training and experience of the modeller and their peer reviewer should be appropriate of the simulations and programmes being used and these should be stated in each report.

2.4.2 Overarching technical specification for low carbon design

2.4.2.1 General considerations

1. This section provides a statement of expectations and processes relating to achieving low carbon design. It is not intended to override any HTM or NHS publication, statutory standard, ISO or BS, and must be used with the professional judgement of architects and engineers. It does not endorse any product or system.

2. Designers and constructors must assume that compliance with the required performance will be demonstrated in operation. There will be post-completion certification of conformance with design objectives, and that compliance will be contractually significant.

3. The building must comply with all statutory requirements.

4. In all cases where advice is offered below, designers, constructors and operators shall satisfy themselves that the advice is relevant and appropriate, and is consistent with all their professional duties and statutory requirements.

5. Designers shall state all grant-aid, design support sources and tax-efficient arrangements they have accessed / intend to access in the design, construction and operation of this building.

6. Advice is given that design considerations should, wherever possible, favour simple and robust design solutions that can be reasonably be expected to survive in competent low carbon emissions operation for extended periods. Design approaches that depend on the long-term availability of specialist labour, equipment and materials are not preferred. It is appreciated that the simple and robust design solutions may not achieve the lowest possible achievable carbon emission during operation. The designers shall identify such situations, and prove that the proposed solution offers the lowest cost of ownership.

7. Note that where temperatures are referred to, these are operative temperatures as defined in CIBSE Guide A, except where there are direct quotations from HTM standards.

8. The responsibility remains with the contractor to ensure that the individuals in the team have the required level of competence to undertake the tasks to produce the desired outcome. If a shortfall is identified, then the client should be notified at the earliest opportunity.

3.0 The Priorities for Low Carbon Design

The priorities are broadly as follows in order of the least amount of capital expenditure for the most amount of carbon saved, although position in the list should not be seen as an absolute as importance will depend on clinical usage:

- Passive / demand items are focussed on reducing carbon demand and are the highest priority in considering strategy
- User expectations and requirements, including foreseeable changes in use / occupancy
- Building form and orientation, massing
- Function relationships and internal planning of clinical/non clinical spaces to ensure that areas which can benefit from daylighting and natural ventilation are position on the periphery
- Structure thermal properties, including exposed mass
- Architectural arrangements for maximising use of daylighting to displace artificial lighting
- Passive ventilation strategy
- Reduced Air Leakage
- Exposed Mass
- Glazing Spec
- Increased Shading
- Increased Insulation
- Controlling equipping loads (this may occur earlier in the list for buildings with high equipment loads)
- Heat recovery (this may occur earlier in the list for buildings with high fresh air requirements)
- Lighting Controls
- Building services controls
- Metering and monitoring

Overall site energy strategy and choice of central/ decentralised plant, CHP, cooling strategy.

Choice of distribution media
Solar Hot Water Generators
Local CHP
Other renewable energy sources

It is essential that each heading is considered from feasibility stage through to final design and action taken. The low carbon design tracker shall be used as a reporting tool through the design process and developed to encompass the construction and operational phases. Each item should be considered in terms of whole life cost and not just capital expenditure.

3.1 Methodology

The design approach to be adopted is:

- Target energy and water efficiency measures to reduce resource demand through best practice design and passive design strategies.
- Locally offset the minimised resource demand through effective supply from Low and Zero Carbon (LZC) technologies and water recycling.

3.1.1 Essential tasks

1. Project management structure – ensure this includes a project management tool for low carbon design and that the manager is tasked and reports to the project board regularly on progress
2. Programme – ensure this allows for modelling and reporting in time to modify the design to meet energy targets
3. Budget structure – allow report and modelling cost, whole life costing, cost for renewables if appropriate and sufficient cost for addressing as many of the low carbon factors above, noting that many may not increase the cost above conventional design if addressed early enough in the process
4. Targets/KPI's – set before appointing team and ensure team have adequate skills, expertise and enthusiasm.
5. Tools – use management tools such as trackers and ensure team have access to adequate WLC data and modelling tools. Ensure that WLC data is appropriate for task, There is serious concern that the majority of existing WLC data refers to single action / single benefit source data, that is not appropriate where sequencing of savings is involved when multiple benefits exist / seasonal aspects apply.
6. Key stage audits – set these at the outset
7. Measuring outcome – as above
8. Sustainability auditor – appoint/ second to each scheme.

3.2 Passive Design Strategies

Passive design strategies should be considered in order to reduce energy demand associated with cooling and mechanical ventilation by offsetting building cooling loads whilst proving fresh air for occupants.

Successful passive design relies on early coordination of the architectural design and building services solution. Typically openable windows equivalent to 5% of the gross internal floor area of a space could be required. This can be on one side if the space is less than 7m deep. For spaces between 7m-15m deep, the openable windows should be on opposite sides of the space and distributed evenly to promote cross-ventilation. For spaces greater than 15m deep an internal atrium is typically required to ensure adequate cross flow of air.

Facade performance and solar shading should also be considered to optimise thermal performance, reducing solar heat gain, while maintaining a good level of daylight and limiting the risk of overheating.

With regard to daylight the building façade should be analysed to aid the selection of an appropriate glazing type and the positioning of fenestration with the objective of maximising daylight penetration.

Where natural ventilation is proposed for clinical areas a Computational Flow Dynamic (CFD) model shall be provided to confirm projected operational performance.

3.3 Technical Considerations – minimum standards technical brief for low carbon design

3.3.1 Daylighting

1. At least 80% by floor area of the staff and public areas has an average daylight factor of 2% or more.

2. At least 80% by floor area of the occupied patient's areas (dayrooms, wards) has an average daylight factor of 3% or more.

3. The provision of daylight shall be designed in accordance with the guidance in CIBSE Lighting Guide 10 Daylighting and window design, BS8206 Part 2 and the BRE Site Layout Guide.

4. All electric lighting fittings to perimeter areas shall incorporate linked dimming to take full advantage of daylight

5. Transient and unoccupied areas such as stores, utility rooms etc. shall not be located on the perimeter of the building if there are internal occupied areas which could benefit from daylighting.

6. Clinical areas with controlled environmental conditions, e.g. operating theatres, delivery rooms or pathology where solar gain will increase the air-conditioning load should not normally be day lit as above but may benefit from a limited view of sky.

7. Visual comfort shall be in conformance with best practice identified in EN 12464.

8. The maximum solar gain from beam radiation, averaged over each occupied space, in May, June, July, August and September is not to exceed 25W/m2 at any time during occupied hours.

9. Designers shall identify surface reflectances for building fabric, fixtures and fittings that form the basis of their calculations that identify daylighting as the main source of lighting energy, and require these to be maintained during repair and refurbishment.

10. Designers are advised that they should give high priority in their design progress to the avoidance of 'blinds-down / lights-on' use of main spaces by occupants.

3.3.2 Artificial lighting

1. The most efficient light source should be chosen appropriate to the usage. Tungsten and tungsten halogen sources should not be used.

2. A DEER value within the values for level A should be achieved calculated in line with the Society of Light and Lighting Guide 2 following the procedure in section 1.2.2 of that document for at least the minimum areas stated.

3. Occupancy or presence controls should be used to intermittently occupied areas over 4m2 unless there are overriding health and safety concerns. Areas such as toilets, en-suites, internal corridors, ward kitchens etc. should incorporate for this type of control. Controls must be accurately positioned and of sufficient quality to avoid lighting going off when persons are present in the space. Lights must strike immediately to adequate levels.

4. Reduced levels of lighting to a specified minimum may be appropriate with presence controls to step up the lighting level on detection of presence in situations where there is a requirement for lighting at all times such as main ward corridors, hospital street etc.

5. Daylight dimming controls should be provided to all areas benefiting from adequate daylight, in conjunction with presence or occupancy controls where possible.

6. Time and/or photocell controls should be provided to all external lighting.

7. Areas should not be over lit – there needs to be a balance between standardisation of fittings across a scheme and choosing the most appropriate fitting for a particular area.

8. There is however scope for variation in lighting levels and colour to specific areas such as prescription writing and long stay patient areas to reduce the risk of errors and improve recovery and mental well being. For fuller detail refer to “Lighting and Colour for Hospital Design” (Dalke, Littlefair, Loe)

9. Switching zones should enable sub areas in larger spaces to be controlled separately, for example sets of up to 4 workstations in open plan offices, serveries and dining areas, reception and waiting areas. Manual controls should be local to occupants where possible.

10. Visual comfort shall be in conformance with best practice identified in EN 12464.

11. Designers must explicitly identify the building’s overall annual effective W/m2 for artificial lighting during working hours, taking full account of displacement of artificial lighting energy by daylight. (4 W/m^2 displacement shall be the maximum unless otherwise agreed.

12. Every opportunity shall be taken to use localised task lighting with lowered overall light level including switch able override to the presence detection on signal.

3.3.3 Heating during occupied hours (including circulation spaces)

1. The heating system (including but not necessarily limited to heating emitters and controls) shall not input paid-for heating energy to any occupied spaces that contribute to space temperatures to more than 2ºC above the desired inside temperature for more than a total of 20 minutes on any day.

2. If boilers are used as the source of energy for heating, then the total standing losses of the boilers and heating distribution system must not exceed 15% of annual heating energy consumption during occupied hours.

3. Heating energy calculations shall identify the energy (kWh/m2.year) required for the required occupancy related volumes of ventilation air, the extent of heat recovery (kWh/m2.year) on ventilation air, and identify the contribution of each source of internal gains (kWh/m2.year).

4. Designers shall identify the maximum fan power (if any) during occupied hours in Watts/litre.second, and the average annual fan power during occupied hours the heating season in Watts/litre.second. Designers should identify how the full benefits of variable speed control of fan volume are to be achieved.

5. Designers shall identify the peak energy consumption of pumps Watts/litre.second), and identify the annual pumping energy (kWh/m2.year). Designers are advised that they should identify how the full benefits of variable speed pumping are to be achieved.

3.3.4 Pre-heat energy and pre-heat rate of rise – intermittently occupied areas of buildings

1. Pre-heat energy should be minimised whenever possible by allowing internal gains to overheat the building the previous day's occupancy by up to 2ºC, and to use this stored heat to minimise or avoid the need for pre-heat energy.

2. Optimum start accuracy should achieve the desired inside temperature within 30 minutes of the start of occupancy for more than 60% of heating starts during the heating season.

3. The rate of rise of internal air temperature of the building and its contents, when unoccupied, under design conditions, must not be less than 0.3ºC per hour.

3.3.5 Air infiltration

1. The air infiltration maximum allowable infiltration rate shall not exceed 5m3/m2 of façade at 50Pa and testing shall be undertaken as required in the Scottish Technical Handbook 6 for projects where air tightness values have been specified which are lower than that which can be satisfied by robust detail methods

2. Designers using draught lobbies shall explicitly consider the separation between internal and external doors. Door separation and closing times must be arranged to minimise the possibility of both doors remaining open with single person passage.

3. In buildings with mechanical ventilation, inside to outside air pressure differences shall be adjusted such that the maximum air velocity though fully open main doors is less than an average of 0.2m/s under non-gusting wind conditions.

3.3.6 Hot Water Service

1. Fossil fuel based hot water service shall be achieved at a system efficiency that exceeds 50%. That is, heat in the hot water issuing at taps must be greater than 50% of the fuel input.

2. Electrically heated hot water boilers for occupant's use in making hot drinks should not have a standing loss exceeding 10W per occupant

3.3.7 Summertime overheat - design considerations

1. The use of mechanical cooling shall be avoided wherever possible. HTM 03-01 requires that “patient areas only should not exceed 28Cdb for more than 50 hours per annum” but also that “it can generally be assumed that for a naturally ventilated building, the internal temperature will be approximately 3 K above the external shade temperature. For a building with simple mechanical ventilation, the internal temperature can never be less than the external shade temperature and will invariably be higher. Where calculations indicate that internal temperatures will exceed the selected design for a period that exceeds the building design risk, methods of reducing temperature rise should be implemented. Options include:

    - reducing solar and casual gains;
    - the use of chilled beams or ceilings;
    - increasing ventilation rates; or
    - providing mechanical cooling.
    - In some situations it may be possible to alter the thermal mass of the structure to “move” the peak temperature event time so that it occurs outside of the occupancy period.”

2. From the above it can be concluded that a fully cooled building is not necessary to satisfy the HTM and that passive options must form part of the decision making process. A report on the options must be submitted at feasibility stage and enhanced at Stage C before decisions are made to fully mechanical cool any areas other than those listed in HTM 03-01 as requiring mechanical cooling

3. Calculations using appropriate building physics tools must be supplied. In line with BREEAM expectations, credit HEA10, full dynamic simulation is required at detailed design stage with an appropriate weather file for the area,

4. There should be differentiation between areas requiring cooling and areas which can be satisfied by either natural ventilation, mixed mode or mechanical ventilation. Where practically possible, even within a department, cooling should be provided only to the areas having a clinical need and all other areas supplied by other means.

5. Differentiation in system provision should also be made between areas which are continuously occupied, areas to which 24 hour access is required, but which may not be continuously occupied and areas which are intermittently occupied. For further information see sections 4 and 5 of HTM 07-02.

6. The onus is for the designers to be able to demonstrate numerically that the chosen solution is the most carbon efficient that will satisfy the application for each type of accommodation and to design the building accordingly. Reporting by exception is required to highlight to the client where compromise has to be made and to justify why it has been necessary.

7. Whilst infection control is paramount, and the requirements of HAI SCRIBE and HBN 30 must be adhered to, designers should note that there is a body of research which indicates that in low risk situations effective natural ventilation is very much more effective than mechanical ventilation which has not addressed fully reverse flow, failure and poor maintenance issues.

3.3.8 Natural ventilation

1. Where used, the strategy should be developed along with the building footprint. See section 4 of HTM 07-02 for a detailed treatment of the requirements.

2. Air velocities adjacent to occupants must not exceed 0.5m/s for natural ventilation

3. Where natural ventilation is proposed for clinical areas a Computational Flow Dynamic (CFD) model shall be provided to confirm projected operational performance.

3.3.9 Humidification and humidity control (requirement subject to discussion during competitive dialogue)

1. Note that HTM03-01 does not require humidification to any areas including operating theatres, except for specialized applications. Humidification and humidity control adds significantly to both capital and operational energy and maintenance costs and therefore, in line with the HTM, there should be a presumption against the provision unless a special need can be established.

2. The HTM does require however that provision for retrofit of humidification is made to operating theatre air handling units in terms of space and capped drainage. (clause 3.14)

3. For most developments, this means that there is no longer a requirement to maintain a steam distribution network to serve steam humidifiers, unless required elsewhere for process loads such as sterilisers.

4. The HTM further states that in terms of full temperature and humidity control that “Room temperature and humidity sensors control the heater-battery, humidifier, cooling coil and a re-heater-battery in sequence to maintain a specific room condition regardless of the room load. This is very expensive in energy and can rarely be justified. In healthcare it is only likely to be considered for specialized research facilities.” (clause 4.89)

5. For operating theatres, note that the HTM allows the supply air humidity to swing between 35% and 70% saturation (clause 7.19) and the room humidity to swing uncontrolled between 35% and 60% saturation. This allows the most efficient mode of operation and coil sizing to be chosen.

6. All psychometric sizing and controls strategies should therefore take the above into consideration.

3.3.10 Energy recovery devices

1. Energy recovery devices should be fitted to all fresh air systems and all extract systems over and including 1m3/s operating for more than 12 hours /day and plant space allowances and location of supply and extract systems must be calculated to allow this provision by the most efficient means possible. Lack of space on new developments for this provision is not acceptable as a reason for failing to fit a suitable device and architects should make adequate provision for plant rooms and distribution ductwork.

2. HTM 03-01 gives minimum efficiencies for devices and suitable device applications.

3. Controls should allow for recovery of cooling as well as heating energy where applicable.

4. Process heat recovery shall be included where practical to reduce energy e.g. Clinical System Cooling, Specialist water treatment etc. The Contractor shall allow for all interfacing with the specialist and shall provide all heat recovery and interface plant.

3.3.11 Air-conditioning and ventilation systems and controls

1. Filtration standards should not be specified beyond that required by HTM03-01 as this adds maintenance cost and increased energy use. There should be a balance between the cost of the filter and the cost of energy in setting the maximum dirty filter resistances for the BMS alarms – this may vary depending on the motor rating and cost of replacement filters.

2. Note that HTM 03-01 does not specify outright belt driven fans – there are options for direct driven fans as long as provision for prevention of over-temperature by a thermister and lockout relay is made. When selecting a fan drive type, whole life costing should be applied taking into consideration the efficiency of the fan and motor selection and heat gain to the supply system as direct drive fans are often more efficient overall than belt driven, even taking into consideration the heat gain to the air.

3. Note that HTM03-01 does not require belted running standby fans except for life critical applications – see clause 4.61. This again reduces the energy consumed by the fan.

4. When comparing air handling units, total system pressure should be compared and preference given to the selection with the lowest total and lowest fan power as this will provide the lowest fan running costs over the life of the plant. There can be considerable variation between manufacturers due to coil selection and configuration of units

5. Frost/fog coils should, in accordance with HTM 03-01, be set to operate at minimum off coil temperatures to maximize heat recovery efficiency.

6. Humidifiers where fitted should be interlocked with cooling coils to prevent simultaneous operation. If there is no dehumidification function, heating and cooling coils should also be interlocked.

7. Local cooling systems should be interlocked with heating within the space to prevent simultaneous operation.

8. Systems incorporating mechanical cooling and ventilation systems providing a cooling function should be controlled such that simultaneous heating and cooling cannot take place when heating is provided by a separate system.

9. Air velocities adjacent to occupants must not exceed 0.25m/s for forced ventilation systems

10. Advice is given that ceiling level ventilation with substantive opening area within 150mm of ceiling level should be provided to minimise hot air trapped at ceiling level if natural ventilation is used. If the hot air is trapped at ceiling level, this will increase the internal environmental temperature.

11. For intermittent buildings only, if fans are used for night-time cooling, it is not expected that fan power should exceed 0.4W/litre.second, or that ventilation rates exceeding 10ach/hr be used. Noise from fans used for night-time cooling must not cause annoyance to occupants of neighbouring properties. Refer to planning guidance – increase generally less than 5db at boundary over existing night time level.

3.3.12 Electrical energy other than lighting

1. The ratio of electrical energy consumption in kW when un-occupied to kW when occupied (excludes pre-heat and essential loads) must be <7%.

2. High efficiency motors should always be specified for new developments.

3. When selecting transformers and selecting the location, consideration should be given to the transformer efficiency. Oil filled transformers, if a suitable location can be found away from buildings, are more efficient than dry transformers as well as being more compact and require less ventilation. Consideration of losses should be part of the evaluation.

4. Cable installations should be specified according to the guidance of British Standard 7450:199120, equivalent to IEC 1059:1991, 'Economic Optimisation of Power Cable Size', which gives useful guidance on the optimum costing of cable installations. This standard needs to be a requirement of management procurement policy and included in contractual documents in order to avoid the false economy of 'lowest first cost' attitudes. The standard points out that: 'Rather than minimising the initial cost only, the sum of the initial cost and the cost of losses over the economic life of the cable should be minimised.

For this latter condition a larger size of conductor than would be chosen based on minimum initial cost will lead to a lower power loss for the same current and will, when considered over its economic life, be much less expensive.'

3.3.13 Medical and Non medical equipment selection process

1. BREEAM credit Ene15 for non medical equipment shall be achieved.

2. For medical equipment, a schedule shall be prepared identifying any major energy consuming items (>3kw heat rejection to plantrooms or occupied spaces and/or >10kw rated total energy input) For these items, tender schedules shall require an estimate of energy consumption per year or per cycle as applicable and preference shall be given to the product having the lowest energy consumption provided that the item's performance meets specified requirements.

3. For all equipment, priority must be given to the use of equipment that does not require close control of temperature and humidity.

3.3.14 Computer and other heat generating equipment

1. Provision must be made for direct extract of heat by duct from equipment cabinets in server and communications equipment rooms and where possible for imaging equipment cabinets.

2. Process equipment plantrooms such as sterilizers, reverse osmosis, renal etc should be located on external walls with provision for natural ventilation to remove heat. Mechanical cooling to such spaces must be avoided unless no viable alternative exists.

3. The design team should ensure that adjacent spaces do not suffer from unacceptable heat gain from any plant or equipment areas.

4. Any form of equipment likely to cause additional load to cooling or an unacceptable summertime temperature should be located in a ventilated or unoccupied separate space. This includes items such as photocopiers, chilled water dispensers, refrigerated cabinets etc all of which can reject heat into occupied spaces.

5. All process pipework likely to cause a heat gain to a plant room or occupied space should be insulated.

6. Equipment cabinets must be specified for direct extract from top of equipment cabinets.

7. Priority shall be given to free-cooling over mechanical cooling.

8. Computer and communication rooms shall have a PUE (Power Utilisation Efficiency) no more than 1.6.

9. Subject to fire, acoustics and infection control considerations, consideration should be given to heat recovery from equipment gains into occupied spaces during the heating season.

10. Note must be taken of recent papers from authoritative sources such as Intel, Sun, HP and Cisco that identify supply air temperatures in computer rooms without loss of reliability. Where permitted, external air may be the cooling medium for all but the hottest days.

3.3.15 Metering and monitoring

1. Metering shall be provided as required by BREEAM credits E2 and E3, but in addition a strategy shall be provided by the design team in collaboration with the site energy manager at the start of detail design to ensure that the metering provision not only accounts for the substantive energy uses but also provides cost centre information that is helpful to the client in controlling energy use in operation.

2. Metering shall include power, gas and cooling at all large scale medical equipment.

3. All Energy meters to report to the BMS with integrated target and actual consumption maps provided for each element and point of use.

3.3.16 Cooling Systems

1. If it is established as defined in preceding sections that there is a net cooling need that cannot be met by any combination of fresh air, night cooling, thermal mass alone, then some form of cooling system will need to be considered.

2. Water extracted from bore hole without further upgrading through heat pumps should be considered early in any scheme likely to require cooling as this will require comprehensive site investigation which should be undertaken at feasibility stage.

3. If this is proved not to be viable, ground linked, ground or water source heat pumps should be considered, with storage options to offset peak loads and take advantage of off peak tariffs. .

4. Absorption cooling linked to CHP is to be included in the life cycle cost review to ensure that it is careful costing against a realistic load profile for both cost and carbon savings to ensure that it sized and engineered correctly to provide a meaning full input into the low energy strategy.

5. Chilled water temperatures should be evaluated based on cooling alone unless there is a proven specialized system need for dehumidification.

6. Heat gains to chilled water mains must be calculated and minimized when calculating running loads. Externally run unshaded mains or mains run adjacent to hot services in unventilated spaces will not be considered acceptable.

7. Designers are expected to calculate and specify economic thickness of insulation and continuity of vapour barriers to all chilled services.

8. All the above should be considered as part of a detailed feasibility steady which will be required prior to any agreement to proceed based on conventional chiller system.

3.3.17 Energy profile of alternative products and systems

1. Where through ongoing value engineering alternative products or systems are being proposed, the Contractor and his design team must ensure that an equivalent or better whole life carbon performance will be achieved and should be prepared to commit to the client in writing that this is the case.

2. This applies not just too individual components but also to consequential effects for example, the effect a reduction in specification of glazing has on lighting, heating and cooling carbon emissions.

3.3 Building Form and Fabric

The building fabric should be considered as a passive method of limiting unwanted heat transfer. The construction materials and U-values should be selected on this basis. In addition the thermal mass of the structure should be considered as a possible heat sink to store energy which can then be released slowly over time in order to stabilise internal room temperatures and reduce heating and cooling demands.

The building air permeability should be reduced beyond maximum allowable levels in the Building Regulations, from 5 $m^3/h/m^2$ 3at 50Pa. This is to be subject to air pressure testing to demonstrate achievement at practical completion.

3.4 Energy Efficiency

The following measures should be considered for the hospital as a minimum in line with best practice building services design:

3.4.1 HVAC

- Where mechanical ventilation is required outdoor air rates to be 12 l/s/person and supplied via a variable flow system based on occupancy detection.
- Energy recovery on all exhaust air streams.

- Free cooling systems.
- High efficiency, modularised, variable flow, central plant providing water for heating and cooling.
- Thermal zoning with individual time and temperature controls.
- Direct cooling of equipment where possible.

3.4.2 Lighting

- T5, energy efficient lamps, with high frequency dimmable ballasts to supplement day lighting.
- Control of artificial lighting via user friendly manual and automatic control by means of photocell, time clocks, PIR, localised 'on/off' and dimmable switching.
- Efficient external lighting that switches off automatically; building access lighting to be a minimum of 50 lamps lumens/watt and car parks 70 lamps lumens/watt.

3.4.3 Potable Water

- Design risk assessments to be provided to back up any use of flow restrictors on sanitary ware.

- Shut off valves to toilet blocks to reduce potable water consumption.

3.4.4 Materials

- Insulation to have a Global Warming Potential (GWP) and Ozone Depleting Potential (ODP) of zero.

3.5 Low Energy HVAC

As noted above the use of comfort cooling should be avoided where possible. If required low energy options should be considered such as;

Chilled Beams/Chilled Ceilings (with suitable mitigation to avoid condensation risk)

Take advantage of higher chiller plant COP's due to the chilled water operating temperatures. A further advantage is the improved thermal comfort.

Low Energy Motors

Inverter Drives

Etc.

3.6 Displacement Ventilation

To again reduce air handling fan energy and take advantage of higher chiller plant COP's due to the chilled water operating temperatures. This system could lead to an improved internal environment quality as pollutants could be removed directly from the space without further mixing of air.

3.7 Low & Zero Carbon Technology

Feasibility studies are to carried out into the potential use of low and zero carbon technologies to reduce carbon emissions associated with the operation of the building. The following example technologies are to be considered;

- Solar Water Heating

  - to preheat domestic hot water.

- Ground Source Heat Pumps

  - to meet heating and cooling demands.

- Combined Heat & Power plant

  -to meet electrical demand, heating and cooling loads (absorption chiller)

- Biomass Boiler

  -alternative fuels to reduce carbon emissions

- Wind Power & Photovoltaics

  -renewable electricity generation

3.8 ADB sheet process relating to environmental conditions and low carbon design

3.8.1 General principles to apply to ADB sheets

The ADB sheets are a fundamental tool for briefing a design team and have considerable contractual significance in many cases. The environmental sheets in the set should bring together the requirements of the various SHTMs and confirm the overall technical brief for the scheme as well as incorporate any special requirements particular to the scheme. The standards ADBs may conflict with the technical specification requirements.

The contractor shall update the environmental section of the ADB sheets in line with current HTMs, CIBSE guides, in particular LG2, and address the following issues. A sample set will be made available during competitive dialogue.

1. Temperatures are, in general, stated as absolute values. This does not allow a range which can be beneficial when considering passive options.

2. Temperatures are often not defined for summertime - these need to be added.

3. The temperature measure is not defined – this should in general be operative temperature as defined in CIBSE guide A

4. Hours of operation of area and thus plant operating hours and hours for which casual gains are to be applied are not defined. Whilst this may be in the access statement, the actual usage of the room needs to be more closely defined for calculation rather than access purposes.

5. The environmental section of sheets is not up to date with latest HTMs or HBN's. It is understood from the administrator of the ADB sheet licenses that this is planned in the current year, but in the meantime for live projects, designers must bring the set into line.

6. There is no option to qualify whether an area should be naturally ventilated, mixed mode, or mechanically cooled – this should be explicitly stated and agreed with users and client's project manager.

7. Daylighting standard should be specified.

8. Occupancy is defined but not in all cases. It should be clear in all cases from the sheets what level of occupancy is to be assumed for the purposes of environmental calculations.

9. The quality of lighting and mode of control is not defined. General principles can be set but for frequently occurring or specialised rooms, more detail may be useful.

To address the above issues, the following is suggested.

1. State a range for summer temperatures in line with HTM 03-01, relevant HBN's and CIBSE guide A. This has been undertaken for the sample set

2. As above

3. A definition sheet has been provided.

4. Hours of plant operation and occupancy to be stated on each room environmental data sheet. See sample template.

5. This has been undertaken for temperatures and humidity which affect low carbon design for the sample set but needs to be undertaken for all other environmental data such as water, acoustics, fire etc.

6. This can be stated in the notes on the room environmental data sheet. See sample template.

7. This can be stated in the notes on the room environmental data sheet. See sample template.

8. For all sheets other than in transient spaces, state the number of occupants with the room name (as is normal for many spaces). If this is unrepresentative of normal occupancy, for example in a waiting area, where seats may be provided for a maximum, but average is lower, this can be qualified in the notes on the room environmental data sheet.

3.8.2 Definition sheet for use with Room Environmental Data ADB sheets

1. Hierarchy of documents relating to the environmental conditions shall be, in order of precedence: statutory standards, latest issue of HTMs, HBNs and any directives, advice or other documentation from the DoH or NHS, the overarching technical specification and finally ADB sheets. Should any conflict in requirements arise, it is the responsibility of contractor to make the client aware and provide best practice advice in the resolution of the requirements.

2. All temperatures stated are operative temperatures.

3. Where lighting levels are stated, refer also to the maximum point illuminance, UGR and position of measurement in table 1 of SLL lighting guide 2.

4. Where summertime temperatures are stated, the upper limit stated is not to be exceeded for more than 50 occupied hours. This does not imply that mechanical cooling is required unless all other means of reducing overheat are not viable. Where mechanical cooling is required, this should be stated explicitly. See clause 3.24 of HTM 03-01.

5. In some instances a range of temperatures is given over which the temperature can float. If this range is in italics, this is the range over which the temperature should be capable of being controlled in line with appendix 2 of HTM 03-01. Care should be taken in evaluating simultaneous plant loads in that the peak plant load is not likely to be the summation of the extremes of the stated range.

6. Unless humidity is stated, the humidity should be assumed to be uncontrolled. Humidity should only be specified where there is a specialised need - see HTM 03-01.

7. Filtration standards shall be based on appendix 2 of HTM03-01. Note that these are supply filtration standards. There may be specific environmental pollution issues or infection risk issues which require either extract filtration as well or increased supply filtration standards. These should be briefed specifically for areas affected.

3.9 BREEAM requirements

3.9.1 Process and general issues

The contractor shall undertake a BREEAM Healthcare assessment of the main hospital development. The client has employed a BREEAM Healthcare assessor to undertake monitoring of the assessment and assist the client in provision of client side information. The contractor shall however employ their own assessor to undertake the assessments through to final certification. All costs associated with this including all BREEAM QA fees, licensing, training and any other charges that BRE may levy in the course of the contract shall be included in the contract cost.

Where BREEAM Excellent is referred to, this shall mean the final certificate rating obtained following post construction review.

The requirement is to achieve a BREEAM excellent and the contractor shall ensure that the design, management, processes, coordination and execution of the works achieve this rating.

3.9.2 Resources, access and information

These requirements shall be read in conjunction with the full BREEAM for Healthcare 2008 manual which is freely available from the BREEAM website. The scheme shall be registered as a 2008 assessment, and the design stage assessment completed within 5 years of registration.

The main contractor shall provide all necessary resource, staff, materials etc to fulfil these obligations, including attendance to the client's assessor for periodic site visits and review meetings as may be requested by the client's Contract Manager and as may be required to satisfy the client's assessor that the process is being undertaken in a timely and satisfactory manner. Review meetings must be attended by the contractor's assessor and project manager. Progress reports, predicted and actual running scores shall be made available to the client's assessor as requested, and in any case not less than every three months.

The contractor shall make available to the client's assessor any evidence in used in support of the assessment on request and within 2 weeks of such a request being made.

The BREEAM certificates at design and post construction stage shall, on receipt be immediately issued as original documents to the client's project manager. 2 copies are required.

Access to the site shall be permitted at all reasonable times subject to safe access being possible to facilitate building/ site inspection and photographic. Site inductions & personal protection equipment should be provided for all building / site inspections, with complete access to all areas.

The contractor shall assist and be proactive in obtaining information from the client. The clients and their assessor will endeavour to provide all required information. Some client side credits may however not be possible to provide due to regional and organisational factors. The client side credits which are to be achieved shall be agreed during competitive dialogue. The remainder of the credits which are required for the excellent rating shall include a margin such that the achievement of the rating is not wholly dependent on the client side credits. This margin shall also be agreed during competitive dialogue.

The detailed requirements set out the contractor's responsibilities, however it is the contractors responsibility to ensure that the latest version of BREEAM Healthcare 2008 is used, which may vary these requirements and to ensure that all addendums, variations and process notes are incorporated in the assessment and reports.

3.9.3 Changes

Where changes have occurred since design stage assessment for whatever reason, the amended features should still comply with the BREEAM requirements.

It is required that no changes to any feature, design, process, material , supplier etc. which affects the BREEAM score shall be implemented unless the impact is fully disclosed to the Contract Manager and clients assessor and an updated score provided to demonstrate that the excellent rating has not been compromised.

3.9.4 Compulsory and Mandatory credits

The standard mandatory credits required for excellent ratings must be achieved. These are not specifically noted through the following text as BRE may vary these from time to time.

In addition, credits which may not be mandatory, but which contribute to low carbon design shall also be achieved. These are as follows:

Man 1 commissioning – 2 credits
Man 12 Whole life costing – 2 credits
At least one credit for Hea 1 Daylighting
Hea 7 - Potential for natural ventilation – 1 credit
Hea 10 - Thermal comfort – 1 credit
Ene 1 – CO2 emissions 6 credits (these are mandatory for excellent rating)
Ene 2 – sub metering of substantial energy uses – 2 credits (1 credit mandatory for excellent rating)
Ene 3 – sub metering of areas – 1 credit
Ene 4 – external lighting – 1 credit
Ene 5 – LZC technologies – 2 credits, which includes for 10% of the total building energy demand to be met form a LZC source, unless otherwise instructed by client. (1 credit mandatory for excellent rating)
Ene 8 – Lifts – 2 credits
Ene 15 - provision of energy efficient equipment where part of the contract– 1 credit

All other credits are to be achieved at the discretion of the contractor and shall be evaluated against cost, benefit and clinical or operational need as required to achieve the excellent rating.

4.0 Low Carbon Technologies

4.1 Solar Water Heating

Solar hot water heating is considered potentially suitable for the development as there is year round domestic hot water demand, during daytime occupied hours, that can be meet without the need for gas or electrical plant.

Solar thermal panels could be roof mounted, ideally south facing at an angle between 30 º and 40 º, and could capture solar energy to generate domestic hot water.

The system comprises of; thermal panels, distribution pipework, pump and storage cylinder. A gas boosted standby system cold also be included to ensure supply and avoid legionella risk.

4.2 Ground Source Heat Pumps

Ground Source Heat Pumps (GSHP's) should be considered for the development to reduce the central plant heating and cooling loads. An underground network of piping could allow the earth to be used as a heat source/sink.

Energy recovered or removed from the earth could be upgraded via an electrically driven heat pump in order to generate useful water temperatures for both heating and cooling.

The heat pumps would be terminal and linked to the water loop or the heat pumps could be central and the water loop connected to terminal fan coil units...and/or....active beam system etc.

A closed loop system has been considered as a potential source. The closed loop system circulates water (or another fluid) through a system of buried pipework exchanging heat with the earth, the borehole field being located in the substantial landscape areas of the new development.

Geothermal Bore hole testing has been undertaken as part of the SI works and reference should be made to these results when undertaking evaluation of this potential heating/cooling source.

4.3 Co-generation/Tri-generation

Co-generation should be considered for the development to reduce the site CO_2 emissions. Co-generation is the production of electricity on site using a reciprocating gas engine combined with the effective use of the heat produced in the electricity generation process.

It is considered suitable for this application as the waste heat recovered can be used to meet the space heating and domestic hot water demand ...and/ offers the opportunity for the waste heat to be coupled with an absorption chiller, in tri-generation mode, to generate chilled water to meet the cooling demand.

Co-generation is a very efficient way of generating electricity, heat and cooling from natural gas, which has the lowest greenhouse gas co-efficient of the fossil fuels, a 15-40% energy saving is achieved compared with the separate production of electricity and heat.

The associated CO_2 emissions are further substantially reduced when bio-fuels are considered.

It should be noted that the current outline designs for the laboratory building consider the use of tri generation which could obviously be adopted elsewhere on site.

4.4 Biomass

Biomass has been considered for the development as an alternative fuel to gas for the boilers. Biomass fuel is typically either wood chips or wood pellets and as a replenishable source which absorbs CO_2 it is considered a carbon neutral fuel. Wood chips or wood pellets could be used in the boiler to directly generate hot water for space and domestic hot water heating.

Current investigations have suggested that the transport movement associated with biomass could impose some significant site traffic issues. As a consequence this solution has not been developed. However, the potential use of bio liquid fuel is a potential solution and should be evaluated.

4.5 Wind Power

Electricity generation via wind power could be considered for the development as a CO_2 free method of generation. A building mounted wind turbine is considered most appropriate due to development location...or a standalone wind turbine is considered most appropriate due to the development location.

Wind power is a very effective method of electricity generation and outputs range from Watts to Megawatt outputs. The rotation of the blades drives a generator either directly or via a gearbox using a DC to AC inverter to supply the development directly, charge batteries for future consumption or supply the grid.

Excess electrical consumption can be sold back to the grid which could improve the system payback or alternatively stored. A grid connection could be provided as back up as wind power is an intermittent supply.

The exemplar building form would appear to offer real opportunities for wind turbine usage, however we would draw attention to the Planning Condition 35 which refers to the requirements to comply with Aviation Authority Guidelines and the helipad requirements.

4.6 Photovoltaics

Electricity generation via Photovoltaics (PV) is considered a potential source for the development as a CO_2 free method of generation. Electricity could be generated from solar energy via semiconductor cells mounted on roof (and/ or) facade integrated. These could be ideally south facing at an angle between 30° and 40°.

Multiple PV connected modules could be required, with a maximum achievable efficiency of 15-18%. The DC output could be converted into an AC output through an inverter for direct use or to charge batteries. A grid connection could be provided as back up as it is not expected that the PV's could meet the whole building load.

4.7 Rainwater Collection

Rainwater collection should be considered for non clinical areas to offset potable water demands for toilet and urinal flushing. Rainwater collected from the roof of the development filtered and then stored in a tank potentially located in the main building basement.

The storage tank would be topped up with mains water when the collected rainwater cannot meet demand. The mains water top controlled by an electronic level indicator incorporating an overflow to the sewer during times of high rainfall.

The system can reduce potable water use and subsequent water and sewer charges.

09080_IBI-N_PMI228 Proposal
22 July 2013

- all rooms denoted * hepa-filtrated
- ward cross over at mid point as agreed
- door to end of ward retained
- mid ward corridor doors already included
- additional glazed screen as requested
- extended nurse station desk as requested
- cleaners room incorporate in lieue of equipment bay
- office reduced to 5pax

VOID

ATRIUM VOID

Should remain in room

✓ Rooms RENW046 RENW041.

Plumbing for dialysis facility to remain in these rooms including media panels

IN ORIGINAL PLANS
Rooms
RENW190
RENW193
RENW195
RENW198
RENW202
WERE PLUMBED FOR DIALYSIS — THIS IS TO REMAIN including media panels

✓ preferred option for glazed vision panel

Alternative option to incorporate glazed vision panel

Equipment Bay replaced with cleaners room

A48974691

New Southern General Hospitals

Compensation Event #5056

Status: Closed

Notification

Notified By

GGC01.NSGLP.pmoir on 16 Sep 2010

Notified To

BCL01

Proposed Compensation Event?

No

Under Dispute?

No

Type

60.1(1)-Change to the Works Information

Title

Adult Hospital - Haemato-Oncology Ward Air Filtration CEN 014

Description

Board confirm change to their requirements for HEPA filter provisopn to 8 No single room wards in HA ward. Refer PMI/General/021 Sypro ID No. 370.

Linked to Early Warning

6954 - NHS/EW/008 - Oncology Ward - Specialist Ventilation

Is Early Warning Appropriate?

Yes

Reply By

7 Oct 2010

Decision

Request to submit quotation

Quotation Request Assumptions

Please provide a quotation for removal of the above equipment.

Quotation #1

Proposed Cost

£-6400.00

Accepted Programme affected?

No

Delay to the Completion Date?

No

Delay to a Key Date?

No

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Alteration to Accepted Programme?

No

Quote Response Assumption

above quote is nett of overhead and profit

Quotation Submitted By

on

Reply By

30 Sep 2010

Outcome

An acceptance of a quotation

Outcome Comments

N/A

Assessment / Implementation

Proposed Changes to Price

£-6400.00

Proposed Changes to Completion Date

N/A

PM Agreed Changes to Price

£-6400.00

PM Agreed Changes to Completion Date

A48974691

New Southern General Hospitals

Compensation Event #20242

Status: Closed

Notification

Notified By

GGC01.NSGLP.sfrew on 29 Apr 2016

Notified To

BCL01

Proposed Compensation Event?

No

Under Dispute?

No

Type

60.1(1)-Change to the Works Information

Title

CE 173 - ADULT HOSPITAL - WARD 4B/HAEMATO-ONCOLOGY WARD - ALTERATION TO BOARD

Description

The Board confirm acceptance of the design fees and request that BMCL progress PMI 471 (i.e. establish the feasibility, estimated costs and programme of works to achieve the revised spec as agreed by DWL). Agreed cost £14,416.99 inclusive of OH&P but ex VAT.

Linked to PMI

5453 - PMI 471 ADULT HOSPITAL - WARD 4B/HAEMATO-ONCOLOGY WARD - ALTERATION TO BOARD REQUIREMENTS

Reply By

20 May 2016

Decision

Request to submit quotation

Quotation Request Assumptions

Agreed cost £14,416.99 inclusive of OH&P but ex VAT.

Quotation #1

Proposed Cost

£14416.99

Accepted Programme affected?

No

Delay to the Completion Date?

No

Delay to a Key Date?

No

Alteration to Accepted Programme?

No

Quote Response Assumption

N/A

Reply By

13 May 2016

Outcome

An acceptance of a quotation

Outcome Comments

N/A

Outcome Submitted By

GGC01.NSGLP.sfrew on 29 Apr 2016

Assessment / Implementation

Proposed Changes to Price

£14416.99

Proposed Changes to Completion Date

N/A

PM Agreed Changes to Price

£14416.99

PM Agreed Changes to Completion Date

Assessment Made By

GGC01.NSGLP.sfrew on 29 Apr 2016

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 22 - Core Participant Responses to PPPs

Volume 1

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