Scottish Hospitals Inquiry
Witness Statement of
James Leiper

This statement was produced by the process of sending the witness a questionnaire with an introduction followed by a series of questions and spaces for answers. The introduction, questions and answers are produced within the statement.
The witness responded to as many of the questions within a limited time period. Where there is reference to a question not being answered, this means the witness was not able to respond fully within the time period.

Personal Details

NAME:
James Stewart Ballantyne Leiper.

QUALIFICATIONS:
2022- Present-Infrastructure-and-Projects-Authority-(IPA)–Certificate-of-Accreditation–2022-2025-IPS-Accredited-High-Risk-Review-Team-Member–Review-Large-Public-Sector-Capital-Projects.

1994-present-Chartered-Engineer-and-Member-of-the-Institute-of-Healthcare-Engineering-&-Estate-Management.

1990-1995-Glasgow Caledonian University-Glasgow. -Bachelor of Engineering Degree - First Class Honours.

1984–1987-GlasgowPolytechnic. -Diploma-in-Building-Services-Engineering.

1980–1981-Stow-College. -Institute-of-Management-Services-Certificate-in-Management, -and-City-&-Guilds-Certificate-in-Work-Study.

1972–1977-Anniesland-&-Stow-College-of-Engineering, -Glasgow-City-&-Guilds-Full-Technological-Certificate-in-Plant-Engineering.

PROFESSIONAL-HISTORY:

Dec-2018–Present--AHEEM-Ltd.—Managing-Director-and-Consultant-Advisor-in-Healthcare-Engineering-&-Estate-Management.

May-2018–Aug-2023—NHS-Greater-Glasgow-&-Clyde. -Project-Manager/Technical-Adviser-Part-Time.

June-2015–April-2017-NHS-National-Services-Scotland. —Strategic-Director-of-Facilities-in-Health-Facilities-Scotland.

Feb.2005–June-2015—NHS-Fife. —Director-of-Estates, -Facilities-&-Capital-Services.

1994–2005--Head-of-Estates--NHS-Tayside.

1989–1994--Deputy-Estate-Manager—Royal-Alexandra-Hospital-NHS-Trust, -Paisley.

1987–1989--Senior-Estates-Officer—Inverclyde-Cowal-&-Bute-NHS-Unit, -Greenock.

1980–1987--Estates-Officer—Renfrew-General-Acute-NHS-Unit, -Paisley.

1976–1980--Fitter--Yarrow-Shipbuilders, -Scotstoun-Glasgow.

1972–1976--Apprentice-Fitter—Barclay-Curle/Yarrow-Shipyards,-Scotstoun,-Glasgow.

SPECIALISM:

General Building Services Engineering - no specific specialisation.

Professional Background

2 Professional role(s) within the NHS

A I am currently retired from employment within the NHS. I occasionally carry out some periodic consultancy work within and associated with the NHS.

3 Professional role(s), if any, within the wider NHS, including National Services Scotland

A I was previously the Director at Health Facilities Scotland between 2015 and 2017, Director in NHS Fife 2005 to 2015, Head of Estates in NHS Tayside from 1994 to 2005. Between 1980 – 1994 I held posts of Hospital Engineer/Estates Officer (7 years), Senior Engineer (2 years) and Assistant Unit Works Officer/Deputy Estates Manager (5 years) all within the Argyll & Clyde Health Board. All of this following an engineering apprenticeship and a few years' experience as a Fitter in the Glasgow Shipyards.

4 Professional role(s) within QEUH/RHC

A I was a part-time project manager/technical adviser with NHS GGC between May 2018 and Aug 2023.

5 If Applicable, area(s) of QEUH/RHC in which you worked/Work

A Estates Department

6 If applicable, role(s) and responsibilities within the above area(s)

A I was originally appointed under a 6 month contract which was extended several times, (all part-time employments, temporary contracts) helping with various pieces of work at QEUH, carrying out investigations and giving general assistance in a number of hospital systems and building fabric issues and helped progress SCART compliance, Risk Assessment, Planned Maintenance, Governance etc.

7 If applicable, who did you report to? Did the person(s) you are reported to change over time? If so, who and when did it change?

A Initially, I reported to Mary Anne Kane, Interim Director of Estates & Facilities, (PPFM). The reporting line manager changed from time to time depending on the work I was undertaking. I reported, over the time of my employment, to Mary Anne Kane, to Tom Steele after he was appointed as the Director of Estates & Facilities on 1st October 2018, to Elaine Vanhegan, Director of Corporate Services & Governance, to Gerry Cox, Assistant Director of Estates and Property (until he retired in 2022) and latterly to Hazel McIntyre, Head of Capital Services until Aug. 2023

8 If applicable, who selected you for your role(s)? When were are you selected for your role(s)? Please describe the selection process for appointment to this/these roles?

A Initially, Mary Anne Kane then through an HR engagement process with Susan Chisolm, Recruitment Lead NHSGGC. Late May 2018 around 29th. I was engaged for a period of 6 months to provide some assistance.

9 Had you worked with any members of the QEUH/RHC project team/estates team or management prior to your role(s) at QEUH/RHC? If so, who had you worked with before this current role? When did you work with this/these colleague(s)? What role where are you in when you worked with this/these colleague(s)? How long were you colleagues in this these previous role(s)?

A I had worked with Alan Seabourne when we both started work in the NHS in January 1980. We were both employed by the then Argyll & Clyde Health Board. Mr Seabourne was a 'Hospital Engineer' based at Johnstone Hospital and I was a Hospital Engineer based at the Royal Alexandra Hospital, covering the 'Paisley hospitals'. Although not in daily contact, we carried out some professional training at the same time. At this time, I also worked with David Bratty and James McQuade in the same Health Board. Brian Gillespie was my line manager when I worked in the Inverclyde Cowal & Bute Unit of the Argyll & Clyde Health Board in 1989 and we again worked together in NHS Fife around 2010. During employment in my previous posts and in

connection with meetings of national technical groups, I collaborated with a number of people that were involved in many parts of the NHS in Scotland, including some people involved with the QEUH/RHC project and the Department of Estates & Facilities and others employed with all of the NHS organisations in Scotland. By way of explanation, I was the Chair of the Scottish Engineering Technology & Advisory Group, (SETAG), where the Heads of Estates across the NHS in Scotland would meet together. This began from the time SETAG was started in 2003, until I became to Director at Health Facilities Scotland in 2015. On this group I collaborated with Brian Gillespie, Ian Powrie, Gerry Cox, Alan Gallacher and other senior Estates Engineers, e.g. George Curley. When working at HFS, I then stopped chairing SETAG and became the Chair of the Strategic Facilities Group, (SFG), which worked in a similar manner to SETAG, but with the Directors of Estates & Facilities in the NHS Boards. At these Groups, I collaborated with Tom Steele, Mary Anne Kane, Alex McIntyre, David Loudon, George Curly and others over the years. My staff at HFS included Eddie McLaughlan, Ian Storrar, Geraldine O'Brien, John Connolly and John Wright. I met up with various colleagues at conferences and training events etc and as the Director of HFS, I hosted several of the Scottish National Conferences.

10 What is your current professional role? Provide details of your role responsibilities and how long have you worked in this role?

A I am not currently directly employed. I am largely retired. I undertake periodic small pieces of consultancy work. This has been ongoing since 2018. I have provided some voluntary input to IHEEM over the last few years.

Taking on the role at QEUH/RHC

11 When did your involvement commence with QEUH?

A 28th May 2018.

12 How did this involvement come about? Who initially contacted you?

A Mary Anne Kane and I had been NHS colleagues for many years. She was aware that I was retired and she asked me if I would be available provide some short-term assistance within the QEUH on a part time temporary contract.

13 What was the nature of your involvement at QEUH in around July 2018? When was this explained to you and by whom?

A There were a number of issues that had emerged relating to fabric and engineering systems at the hospitals. I was working on reviewing the application of technical guidance in the Board and how the Board was complying with various aspects of technical guidance. I was diverted from this to assist with responses to information requests coming into the Board. Health Facilities Scotland, (HFS), were in the process of writing a report, 'Technical Review, Water Management Issues, NHS Greater Glasgow and Clyde, Queen Elizabeth University Hospital and Royal Hospital for Children', and produced a final draft for comment dated May 2018. Part of this process required NHSGGC to respond to questions and further requests for information being asked, initially by HFS and to make comment on the initial draft of the document produced by HFS, for factual accuracy.

There were also information requests and questions coming in to the Board from the Scottish Government, (SG). The SG had invoked the National Support Framework on the 20th March 2018 and Health Protection Scotland, (HPS), at the request of the SG, was to lead an investigation into the hospital's ventilation system and also to provide support to the Board and to produce a joint report with HFS. Questions were also coming in from the media seeking information on issues related to the hospital and there were also Freedom of Information requests. I was asked by Mary Anne Kane to

help respond to questions and provide comment on the HFS report and to help provide responses to their questions.

I was asked to participate on a Water Safety Group, to help progress work related to the hospital's water system and to try to coordinate and manage the responses to the questions coming from the various sources. This Group was chaired by Jonathan Best, Chief Operating Officer, and participants were Mary Anne Kane, Interim Director of Estates and Facilities (PPFM) and Tom Walsh, Infection Control Manager. Minutes were taken by Allyson Hirst. As part of the work associated with this, I was involved in reviewing the hospital's Written Scheme and Water Safety Policies and commenting on the management structure related to the hospital's water systems. From memory, I also attended some Water Safety Group and IMT meetings.

On the 12th July 2018 I was asked by Jane Grant, CEO, to carry out an investigation into issues relating to water, including the 2015 DMA Canyon Water Risk Assessment. On 19th July I met with Ann McPherson, Director of HR to organise support for me to undertake the review and Ms McPherson confirmed arrangements on 31st July. Gillian Gall, HR Officer would provide support and Allyson Hirst was to take notes of meetings etc. That same day I started to put together a set of standard questions. After a brief discussion with Gillian and Ally on 3rd Aug., we put together a list of people that I thought would be helpful and I sent them a draft of the question set to assist in setting up interviews with the available key staff.

I had also been asked by Mary Anne Kane if I could coordinate assistance for Annette Rankin, Nurse Consultant Infection Control at HPS who was writing a report with HFS on Ward 2A ventilation systems. Annette had asked for information on number of air changes in each room, air pressures, corridors vented/not vented, complaints about humidity/over-heating on the ward, conversion from PPVL to Isolation Rooms, general airflows, PPM, compliance and any risk issues.

Later on, I would provide assistance on various other issues emerging that needed some progress. The other areas covered included, ventilation and water systems, filtration, windows, floor-coverings, doors, fabric, including roofing, planned maintenance, SCART, governance, policies and procedures, filtration, pneumatic tube system, energy centre operation, etc.

14 What were the issues or concerns, if any, regarding either the water or ventilation system at QEUH/RHC prior to your involvement?

A There had been a number of patients who had contracted infections in the hospital. There had been single infections and clusters of infections in ward 2. I believe it was suspected that some infections could have been caused by microorganisms associated with water/ventilation and there was a concern that there may have been contamination in the hospital's water and/or ventilation systems. Investigations had begun prior to me starting in May 2018 and the Board had sought assistance from HPS and water experts Susanne Lee, Tom Makin, Tim Wafer, AE(W) Dennis Kelly and other specialists on ventilation systems such as Peter Hoffman. There was concern emerging, highlighted perhaps through the scrutiny and investigations into the water system that mitigation of the risks associated with the recommendations of the 2015 DMA Canyon Water Risk Assessment had not been implemented. There was some concern around the ventilation systems in some locations in the hospital, highlighted I understand, by an Aspergillus infection in a patient in ward 2 around July 2018.

Ventilation System – Ward 2A QEUH Report October 2018

15 We have a copy of your draft Ventilation System, Ward 2A QEUH Report from October 2018. Please refer to this. The report states that you were commissioned in July 2018 to provide comment on the ventilation system at QEUH ward 2A by the NHS GGC Interim Director of Facilities. We understand that at the was this Mary Anne Kane, is this correct?

A Yes.

16 Had you worked with Mary Anne Kane previously?

A Indirectly and on occasion within the NHS.

17 If so, what was the nature of your prior working relationship with Mary Anne Kane?

A In national collaborations, conferences etc, particularly with the Strategic Facilities Group, we had collaborated in various national initiatives, e.g. Establishing SCART question sets risk levels, (particularly on Soft FM Services), Benchmarking, Strategic Laundry Contingency plans etc.

18 What issues, if any, were there with the ventilation system in ward 2A that required comment?

A An email of 31st July 2018, from Mary Anne Kane (MAK) to me, copied to Ian Powrie and Alan Gallacher indicated there had been historical concerns about the functioning of the ventilation system in ward 2A/B. Annette Rankin of HPS had indicated to MAK (mid-July 2018) that the Scottish Government had asked for ventilation to be included in the report HFS/HPS were working on. There had apparently been previous feedback from clinicians that the unit was not fit for purpose. Despite not initially having a brief on what information HPS might require, MAK asked me to link with Ian Powrie to begin to look at the situation.

19 Why were you selected for this role?

A I wasn't informed why I was selected. The Estates team were very busy and under a lot of pressure. I had effectively only been working with GGC for a very short time and I was part time, (only a few weeks in total). I had only been in the hospital once or twice, so I didn't have any knowledge about the hospital layout etc. and was therefore reliant on others for guidance and information. This was perhaps the reason why I was asked to link in with Ian Powrie to get information from him.

20 Were HPS/HFS involved in your instruction? If so, explain how and why?

A Not directly. HPS had requested assistance from Mary Anne Kane and she asked me to link with I Powrie to get a response.

21 What background information was provided to you by NHSGGC prior to you carrying out this review?

A I can't recall receiving any formal background information prior to the review but Mary Anne Kane and I had a conversation on 3rd August 2018 when she gave me some background information. Ian Powrie provided me with information and I got some other information from ZUTEC records via Shiona Frew.

22 What was the remit of this report?

A Annette Rankin had asked Mary Anne Kane for information on ward 2, e.g. number of air changes in each room, air pressures, corridors vented/not vented, complaints about humidity/over-heating on the ward, conversion from PPVL to Isolation Rooms, general airflows, PPM, compliance and any risk issues. I understood that HPS was to produce a report and this information might, along with other specialist's reports and technical information, assist considerations in that process.

It is noted in a minute of the Water Review Meeting (Technical), "Ventilation – IP and JLeiper are working to pull together for information on ventilation to assist AR with her report including PPVL/isolation change – the facts as they are will b presented to AR."

23 How were you instructed to prepare the report? If in writing, please provide the Inquiry with a copy of this written instruction letter?

A I can't recall receiving any formal instruction on how to prepare the report other than, in conversation with Mary Anne Kane, for it to be readable, not overly technical and to have some comment and explanation.

24 At 1.1 of your report, you write that you were commissioned 'to provide comment on the ventilation system in the QEUH, Ward 2A'. What did you understand the meaning of 'to provide comment' to mean?

A To provide 'readable' information. The comments provided were intended for background information, decision making and some comment on guidance.

25 To what extent, if any, was you report intended to be a technical review of the ventilation system at the QEUH?

A The report wasn't intended to be a 'technical review'. Technical reviews on 2A and 2B were carried out around that time by others on ward 2 ventilation systems and I believe Tom Steele had initiated a detailed review t[redacted] when he started in October 2018.

26 What infection control considerations did you take into account when preparing this report?

A I was aware there had been issues with infections contracted by patients which some believed may have had a source in the hospital systems.

27 Prior to writing your report did you visit Ward 2A? If so, on how many occasions did you visit Ward 2A, and when did these visits take place, how long were they in duration?

A I recall visiting ward 2 with Ian Powrie. I was having trouble trying to understand the ward configuration. It was a fairly short visit.

28 What level of detail were you instructed to review the ventilation system in Ward 2A?

A It wasn't so much 'an instruction', but it was suggested to me that the report would be helpful if were less technical and offered some comment and explanation.

29 How detailed do you consider your report to be? Why is it this level of detail?

A I don't consider the report to be detailed. The level of detail given was simply attempting to relate the information I had got, largely from Ian Powrie, and the provision of information to offer views and comments to stimulate consideration by others. B) I think it was generally, fairly peripheral in relation to the other technical data that had been provided previously in addition to the specialist technical reviews being carried out on the ventilation systems. I had only been there a short time and had no real personal experience or appreciation of the hospital systems. I had genuinely attempted to reflect the information communicated to me and to provide comment and decision making but given my lack of familiarity with the hospital or its systems, I am now aware that I had misinterpreted and incorrectly recorded information provided to me about the ward configuration which led to a number of inaccuracies within the report.

30 Who did you interview or speak to from NHSGGC estates staff, if anyone, for the purpose of carrying out this review? If so, provide details of staff, including names, occupation along with the reason you interviewed them, what information regarding Ward 2A were the individuals able to provide you?

A I didn't 'interview' individuals in relation to this. I met with Ian Powrie and the information I got on the ventilation systems was largely provided by him through conversations and I tried to access records on the ZUTEC system.

31 How compliant were individuals with your request for interview?

A Ian was very busy and he was about to go on leave, but he spent some time giving me information about the ventilation systems. I believe he had previously reviewed the ventilation system.

32 What difficulties, if any, did you have speaking with any members of staff? If so, whom?

A I can't recall having problems speaking to people in general, apart from arranging time to speak to people with busy diaries.

33 Who did you interview or speak to from NHSGGC infection control staff, if anyone, for the purposes of carrying out this review? If so, provide details of staff, including names, occupation, along with the reason you interviewed them, what information regarding Ward 2A were the individuals able to provide you?

A As stated above, I didn't 'interview' anyone in relation to the report. B) I do recall speaking with Teresa Inkster, Consultant Microbiologist, who had asked about whether the 'slightly negative pressure' could be made 'positive' as she was concerned about the implications of 'negative' air flow in relation to 'neutropenic' patients and I had referred her to Ian Powrie. I also wanted to meet with her get some general appreciation to the nature of the microorganisms that she had been referring to.

34 What difficulties, if any did you have speaking with any members of infection control staff? If so, whom?

A I don't recall any difficulties, apart from those related to time and availability.

35 If you did not speak to infection control staff explain why?

A I spoke to Dr Inkster, but not specifically in relation to the information to be contained in the report. I think the conversation was on a more general basis. I was on the Water Safety Group along with Tom Walsh.

Design of ventilation system – Ward 2A

36 Who was responsible for the ventilation system design? Explain your answer.

A I understand that this would have been Brookfield Multiplex. B) It was a design and build project and Brookfield Multiplex were the 'main contractor' and hence, had the prime responsibility for the design-risk on what was being designed to deliver against the Board's construction requirements and clinical output specifications, augmented by changes via derogations, or agreed changes through, for example, compensation events. From memory, I think the design was by ZBP, consulting engineers. Mercury Engineering were the M&E contractor on the project.

Ward 2A layout and sections

37 What was your understanding of the different sections of Ward 2A at the time?

A I had no familiarity with the hospital and had difficulty in appreciating how the ward was configured and how the different sections of the ward and the rooms were identified. I was therefore reliant on others for information and what information I could get from records. I had genuinely attempted to understand the layout of the ward, but I was uncertain, at the time, that I had accurately understood and captured the information. Because of these uncertainties, I asked Ian Powrie to check the draft paper for errors and factual accuracy.

38 To what extent has your understanding changed, if at all, now?

A The passage of time has not helped memory, but I my understanding now is that: The whole of the Ward 2A/B is the Haemato Oncology unit which, I understand, is called the 'Schiehallion' unit and not the title of only ward 2A or 2B as I had mistakenly thought at the time.

I believe Ward 2A is a ward with in-patient bedrooms and ensuite facilities for Cancer care for young people and children. Ward 2B - Day Care Unit and the national Bone Marrow Transplant Ward. I had misunderstood the information I

had about the ward, which I think contributed to my misunderstanding about the purpose and configuration of the single rooms.

39 What was the patient cohort in each of these sections?

A My understanding is that the Schiehallion Unit cares for young patients being treated for cancer and blood disorders. Ward 2A – In-patient Cancer care for young people and children and Ward 2B – Bone Marrow Transplant Unit and the ongoing day care of ‘cancer-patients’ that had possibly been cared for in ward 2A.

40 At section 2.2 of your report you state ‘Schiehallion does not have Chilled Beam Units’ to what extent, if any, do you consider that statement is inaccurate?

A I regret that it is inaccurate. I had attempted to accurately reflect the information I had, but my lack of familiarity with the hospital looks to have led to my misunderstanding. I had genuinely tried to get it right, but obviously misinterpreted and/or incorrectly recorded the information I had about the ward configuration, which resulted in inaccuracies.

41 To what extent, if any, is it accurate to state that Schiehallion Unit, in respect of inpatients has chilled beam units except BMT rooms?

A Ward 2A has, I believe, air supplied via Chilled Beam Units to ward 2A mid-ward and Teenage Cancer Care rooms.

42 At paragraph 2.3 of your report, you describe the Teenage Cancer Trust as not having chilled beam units but having ‘heating/cooling comfort modules’. Describe the difference between heating/cooling comfort modules and chilled beams. Include details of the difference between the two units, any differences that you are aware of in delivery of air supply. Further confirm why they are routinely referred to as chilled beam units.

A I now think that the TCT does have CBUs which were delivering 3 Air Changes per Hour (ACH). My confusion about the ward’s configuration is again reflected in what is written here. B) I do not have detailed knowledge of

the differences between these modules but I understand they have a similar operation; both, I believe, have two sections within the units to heat and cool a primary air supply. Comment from other ventilation specialists indicated that the ‘comfort modules’ installed in ward 2A had been incorrectly identified as Chilled Beam units. C). I am not able to confirm why they are routinely referred to as CBUs.

Guidance

43 What experience do you have of interpreting contracts?

A From time to time over the course of my time with the NHS, I have had to read and seek to understand contracts and contract documents and have been involved in deriving the Board’s Public Sector Comparator and Construction Requirements on several projects. I have been involved in creating the technical specification for tender documents and also the operational, ongoing management of PFI/PPP contracts.

44 Throughout section 4 of your report, you make reference to contractual interpretation and application of guidance. What experience do you have in dealing with such matters?

A I do not consider myself to be a specialist in Contracts or in Contract Law or in any specialist elements of guidance. However, over time, working in the NHS earlier in my career, I have previously operated as an Authorised Person in the specialities of Sterilisation and Decontamination, Medical Gas and Vacuum Systems and for High Voltage systems all of which required an intimate appreciation of the applicable guidance, Approved Codes of Practice, Regulations and other Statutory Instruments. I have periodically been involved with the planning and delivery of a number of large hospital construction and refurbishment projects, HUB projects, etc. At various points in my NHS career, I have used JCT80, Engineering Contracts and Scottish Minor Works contracts. I have contributed to, and occasionally have personally written or contributed, technical specifications related to Design & Build, (D&B) and PFI projects’ tender documents. At one point in the mid-1990’s, I wrote the

technical specification and was part of the small team that formed and negotiated, what I understand to have been the first PFI project in Scotland. I have contributed to the formation Public Sector Comparators and to working up Board Construction Requirements for some PFI/PPP contracts. I do not however, have any direct experience with the 'Competitive Dialogue' utilised in the initial stages of this (NECIII) project in NHS GGC.

I have been directly responsible for the operational management of PFI/PPP contracts. During my time at HFS, I chaired a national group with participation from the Scottish Government, the Scottish Futures Trust, Health Facilities Scotland and contribution from Board's that were 'clients' with 'live' PFI/PPP contracts, looking at the implications and responsibilities of various contracts that were operating in Scotland. I also had some peripheral input to the formation and review of the several iterations of the Frameworks Scotland Framework, initially applying the NEC III form of contract. I have participated in the assessment of tender returns and appointment of contractors and consultants.

I was responsible for the operational maintenance of hospital engineering systems for decades, which required a good understanding and application of guidance, approved codes of practice, regulations and statutory instruments. I have undertaken the assessment of tender returns in the NHS both internally and also connected with private sector providers. I have undertaken reviews of major organisational change and capital projects in Scotland, England and Northern Ireland. I contributed occasionally on the preparation of some elements of NHS guidance and management systems. Given the hundreds of NHS guidance documents, before you begin to consider British and European Standards, guidance produced by the Health & Safety Executive, professional institutions etc, good practice guides, manufacturer's guidance and recommendations, approved codes of practice, regulations and statutory instruments, etc, it is difficult to comprehend any one person being totally conversant with all documents, but all of these episodes in my 43 year career

have provided opportunity to gain some reasonable experience with contracts and the application of guidance.

45 What documentation did you consider when preparing your report?

A I can't recall all of the documentation considered, but the documentation referred to in the report included: SHTM 03-01 Parts A&B, SHPN 04 Sup 1, SHFN 30, Manufacturers Information on comfort cooling modules and other project logs, e.g. ME clarification and derogation logs. There was further documentation considered, such as the engineering specification section. As background I referred to SHPN 054 (Facilities for Cancer Centres). I was attempting to find out what had been specified and to try to compare this with what had been delivered. I also contacted the Building Services Research and Information Association, (BSRIA), to try to get information about the research that was carried out to establish the defined air change rates in the HTM guidance. I was trying to find out if there was an air change rate at which the expected conditions being delivered at the recommended air change rates would fail to deliver a safe environment. BSRIA helpfully engaged in some discussion and provided me several research papers etc that I read as background information.

46 What is your understanding of the guidance being referred to as a mandatory consideration?

A My understanding is that guidance, cited in a contract for application in the project, would make it a 'mandated consideration' because it would be a contractual requirement. Other guidance, recognised as a 'Code of Practice', (particularly those cited in legislation) would presumably be, because of their nature, a mandatory consideration.

47 You distinguish between the HTM and the SHTM guidance in your report. You state that the HTMs were cited in the contract but were 'applicable in Scotland' what differences are there, if any, between the ventilation requirements for immune suppressed patients in the HTM and the SHTM guidance? For example, are different air change rates specified in the guidance?

A In the 'comments' I made on section 4.2 of the report, I say that HTMs, " … are normally 'not applicable in Scotland'. This comment is not intended to draw comparison with the content of the documents, (the technical content of HTMs and SHTMs are normally (but not always) the same or similar). Sometimes, there is guidance produced in Scotland which is not used in England or in the other nations of the UK. The point I was trying to convey was that the process of disseminating technical guidance in Scotland was, historically, through Health Facilities Scotland, (HFS). This process, undertaken by HFS, would consist of HFS scrutinising the HTM, as the 'source guidance document' and making any amendments, perhaps to reflect Scot's Law and Scottish Building Regulations, Water Regulations etc, (which are different in Scotland), and also, if appropriate to make updates or amendments to the detail of the source HTM guidance, if appropriate, to create the new SHTM. So, normally, the NHS in Scotland would refer, in the first instance, to the Scottish guidance, as this would have gone through this process. HFS, I recall, in their technical investigation report on the QEUH, (that we were commenting upon shortly after I started with NHSGGC), actually made the same point about the HTM guidance being 'non-applicable in Scotland'. I recall, HFS had left this as a simple statement in their draft report. I was attempting to provide background to the possible thought process by the Board when creating its project documentation to have included HTMs and not the SHTMs as one might have expected. I was explaining the point, in the comments of the report, that there would probably have been a strong desire by NHS GGC to include the latest guidance as a source of reference for the project. At the time of constructing the project documents, I was suggesting that the HTMs were extant, but the process to create the SHTMs, although apparently imminent, had not been completed.

So, the respective SHTM 03-01 did not exist at this time. My position was that, although ‘not normally applicable in Scotland’, the HTM, by virtue of the fact it was included in the project documentation, effectively made the content of the HTM applicable for reference and application as it was now a ‘contractual requirement’.

48 At paragraph 4.3 you state, The HTM, in the absence of the SHTM, the publication of which were expected imminently, might have been considered a reasonable substitution.’ To what extent, if any, was the QEUH having regard to the HTM guidance in the absence of the SHTM?

A See response to question 47 above.

49 How compliant were the areas of Ward 2A with the relevant HTM guidance at the time you wrote your report? If so, which areas? Provide details of non-compliance. If any areas were non-compliant describe the potential patient impact.

A I had personally made no detailed compliance assessment of ward 2A. I was attempting to gather information and provide comment on it. I had information that patient rooms in ward 2A had air change rates approximating to 3ACH. The guidance required general wards to have 6 ACH (SHTM 03-01 Part A Appendix 1 Recommended air-change rates). Inadequate air change rates can increase the infection risk to patients from the healthcare environment they are being cared in.

50 What is the overarching principal of the SHTM guidance?

A SHTMs intend to give best practice, advice and guidance on the design, installation and operation of specialised building and engineering systems healthcare facilities and their appropriate application is intended to help duty holders to fulfil their duty of care.

51 How important is patient safety according to the guidance?

A The appropriate application of the SHTM guidance is intended to assist the duty holder to fulfil their duty of care to those affected by the systems etc that

the guidance covers. So, patient safety is an essential, core aspect of the ambition of the guidance.

52 To what extent did the contract seek to comply with the HTM guidance?

A The compliance with guidance was, from memory, cited in the project documentation.

53 To what extent, if any, did the contract intend that the guidance ought to be complied with?

A See response to Q52 above

54 You state that 'Boards need to be more specific about the outcomes they require'. What specification would you have expected to have come from the Board? If such specification did not come from the Board, what did the Board seek to rely on?

A I do not know how the outcomes were determined or by whom. I imagine the outcomes where developed by inputs from various sources, perhaps built up and the output specifications agreed through specialists and technical committees? I believe that further clarification of the extent of responsibilities would help avoid the ambiguity that has been apparent in several important areas, e.g. responsibility for compliance with legislation and or guidance, responsibility for aspect of soft landings, being more specific about the detail of tagging of assets, the creation and testing of Planned Maintenance Programmes, Building Maintenance Systems prior to handover. Detailing the good practice measures during construction, e.g. keeping pipe ends capped to avoid dirt getting into systems, ensuring builders rubble is not tipped into the sewerage system, perhaps by specifying a camera survey of the drains prior to handover? But I did not take part in the design or specifications related with this project and therefore cannot comment on the extent to how these details were communicated and expressed.

55 What is the potential patient impact of non-compliance with the SHTM?

A The SHTM guidance is intended to provide ‘best practice’ and appropriate compliance with the SHTM would imply that best practice was being achieved. Logically, non-compliance with SHTM guidance would mean that something other than the ‘best practice’ intended by the SHTM guidance was not being applied. It was commonly held, in the NHS Estates, that ‘guidance could be varied, if it could be defended’, which meant that any derogation from guidance would need to be able to be demonstrated to be as good as, or exceed the standards achieved by compliance to the guidance.

Difficulties emerge when the guidance becomes outdated, or when the guidance lags behind the ‘science’, e.g. if research deviates from, or even suggests that the guidance is in error, the guidance is unable to be altered. This scenario is particularly exposed when perhaps, one set of guidance is refreshed and updated and other guidance, which may give comment on the same systems or facilities, is not. In this scenario there is the possibility that some aspects of the guidance will be out of step with other similar guidance. With the current technology, presumably, there is the ability to update information in real time, but this ability has not yet been embraced to my knowledge, with respect to updating guidance. Inevitably, therefore, written guidance will always suffer from this weakness. In addition, guidance is not generally written as ‘a specification’ and will demand, to a greater or lesser extent, interpretation in how it is applied or even derogated. All the more reason to meticulously record how the guidance is being employed and particularly, when it is varied.

Recommended air flows

56 At paragraph 4.5 of your report you state that ‘ventilation rates commonly being delivered to the rooms in the hospital are in the range 2.5-3 ACH’ to what extent did the statement apply across the rooms in ward 2A?

A From memory, the air change rates only in the rooms that had chilled beams installed were restricted to 2.5-3 ACH, but my understanding was that the chilled beam technology had been installed in other areas of the hospital that would have been considered ‘high risk areas’.

57 How many air changes would you have expected to see in the in-patient area of Schiehallion unit?

A Based on SHTM 03-01, if the in-patient area of the Schiehallion unit was to care for patients with immune deficiency I would have expected to see a minimum of 10ACH at a 10Pa differential pressure.

58 How many air changes would you have expected to see in the Teen Cancer Trust unit?

A If the patient area of the TCT unit was to care for patients with immune deficiency I would have expected to see a minimum of 10ACH at a 10Pa differential pressure, but if this was a general ward/day unit, 6 ACH would be applicable.

59 How many air changes would you have expected to see in BMT areas of ward 2A?

A If the in-patient area of the BMT unit was to care for patients with immune deficiency I would have expected to see a minimum of 10ACH at a 10Pa differential pressure.

60 To what extent, if any, did air changes of 2.5-3 ACH comply with SHTM/HTM guidance applicable to the patient cohorts in Ward 2A? If not, why was this not stated in the report?

A I don't believe 2.5-3ACH complies with guidance. I believe I gave some commentary about the application of the guidance and I copied the air change recommendations from the guidance into the appendices of the report.

61 To what extent, if any, did non-compliant ACH in ward 2A patient safety in Ward 2A? If so, how so? If not, why not?

A The effect on patients of having a reduced air change rate, I believe, cannot be determined with any certainty, but I do not understand why it would have been thought appropriate to introduce a potential risk rather than to have deigned out the associated implied risk of reducing a recommended air change rate.

62 If not, what physical characteristic(s) of the ventilation system in ward 2A prevented it from achieving SHTM compliant ACH?

A The use of the CBUs curtailed the air change rate to the capacity of the units.

63 At page 8 paragraph 4.5 in your comments, you write, 'The extent of the Board's agreement to Brookfield's proposal is not explained in any detail or expanded upon. It is easy to read what the text in the Clarification Log says, but one is now left only to speculate about what was actually meant by the text'. In preparing your report, to whom, if anyone on the Board did you explore this issue with? If so, what was the response/position? If you did not speak to the members of the Board, why not?

A From memory, I only had conversation with Ian Powrie and Mary Anne Kane. The comments are based on the knowledge I had at the time. I wasn't particularly aware of the roles and responsibilities of others in connection with the build-up of the project's design.

64 To whom, if anyone, did you speak at Multiplex employee(s) to find out their understanding. If you did not speak to Multiplex employee(s), why not?

A I did not speak to anyone at Multiplex. I did not consider it appropriate at that time to make a connection with Multiplex.

65 Describe your understanding of any discussions between the Board and Multiplex in reaching agreement regarding this derogation?

A I did not view records that afforded this level of clarity. It would be helpful if the records of a project offered a clear audit trail, not only of the decisions taken, but the reason why decisions are taken with an explanation about the objective of the decisions that were taken. This would perhaps be further improved with a record of other options considered with a reasoning of why the chosen option was preferred and the other options not.

66 To what extent were you aware of the Board and Multiplex consulting with ICP professionals to agree derogations?

A I think I became aware at a later stage, through an email that I came across, that there may have been some communication between Infection Control and Peter Hoffman about the derogation, but there was no detail that I can recall that indicated what was discussed, what questions were asked or what detail was provided, but there seemed to be an indication that the suggested proposal was acceptable.

67 In your report at page 10 paragraph 12 you state, ‘but one might conclude that a lesser priority was taking precedence’ what did you mean by this?

A The context of this was the position I was considering in relation to the achievement of a BREEAM and how this would have been affected by the derogation associated with chilled beams and the restricted air change rates. The installation of CBUs, because of the associated energy savings expected to be achieved by them against the potential energy demand of a full air delivery from central air handling plant, would give benefit in the achievement of the BREEAM target, (which is referred to in the derogation). I would personally consider that the achievement of a recommended air change rate

would have been a greater priority. I therefore concluded that the ‘lesser priority was taking precedence’ when the BREEAM energy benefit was accepted, whilst at the same time also accepting the inevitably compromised air change rate.

68 What were the consequences, if any, of air flows not being reviewed?

A The consequences of not providing the recommended air flows are that the protective environment intended by the provision of the recommended air flows might be less effective. I don’t understand what is meant by ‘not being reviewed’.

69 To what extent was the ventilation system adequate to protect the patient cohort at the time? If so, explain why. If not, why did the report not state this?

A The ventilation regime required for immune-compromised and neutropenic patients (Ref SHTM03-01) is 10ACH at 10Pa pressure differential. For Isolation Rooms, the direction of flow would be stipulated depending on whether Source or Protective Isolation is required. If the patients being cared for in the ward were immune-compromised and or neutropenic, 10ACH with +5 to10Pa pressure would be the expected ventilation regime to be applied, e.g. in ward 2A.

The reason for my uncertainty about layout etc, (is explained elsewhere in my statement) and I think this is perhaps why I wasn’t as specific as I perhaps could have been in the report. If the facility was considered to be a General Ward, (e.g. Ward 2B) the recommendation would be for 6 ACH, but in making the decision to consider a ward being a ‘General Ward’, one would also need to consider the foreseeable incidence or likelihood of neutropenic or other ‘high-risk’ or immune-compromised patients being cared for and/or ‘boarded’ on that General Ward, and whether this would be sufficient to consider the application of higher air flow rates (i.e.10ACH) and protective environments. The report largely attempted to focus on Ward 2 but the wider hospital’s ventilation systems for general wards, would then be deficient in respect to

the recommended 6ACH as they would all have been at around 2.5-3ACH due to the installed CBUs.

70 At page 10 paragraph 12 you state that 'The CBUs installed would not function effectively at flow rates above 40 Ltrs/sec and the central Air Handling Unit has a limited capacity which is presently close to its maximum. It will not therefore be possible to improve the ventilation rates with the currently installed ventilation system.' What was the potential patient impact? How HTM/SHTM compliant were the ventilation rates achieved at the time you prepared your report?

A The supplier's literature for the units specify the flow rate capacities for each of the units and the type installed in this instance had a 40l/s specification. I understand that the Air Handling Units (AHUs) and the ductwork systems had been designed to deliver air flows at this rate. The '20% spare capacity' that had apparently been an original ambition for engineering systems, (which may at some point have been generally reduced to 10%, as being thought to be closer to common industry practices) appears not to have been applied, as I learned that the installed systems were already at their peak performance levels, i.e. at maximum capacity.

I appreciate that the choice of the CBU may have been a way of producing ventilation/heating/cooling to the standards specified by the Board and to avoid the necessity of installing significantly larger AHUs. Whether this was an astute decision or not, will presumably be an area of focus for the Inquiry, but I also didn't understand why the spare capacity, that appeared to be an original ambition of the Board in the Board's Requirements, (which would have provided a degree of resilience in the system had this been applied to the installed systems), was now not evident in the installation. The limited capacity of the ventilation system inferred that any increase in ventilation rates, would not be possible, either from the installed AHUs or through the installed ductwork distribution system. A change of AHU plant, if considered appropriate, might be difficult, but more achievable than increasing the duct sizes (to accommodate increased air flow) which were installed in already

congested service risers and routes. The potential impact to the patients being cared for in an environment with incorrect air changes (e.g.< 10ACH, when they should have been at least 10ACH), or air changes that are less than 50% of those recommended in the SHTM, (e.g. 2.5-3ACH, when they should have been 6ACH), would be very difficult to be specific about, but they would technically, be potentially exposed to a greater risk of infection, because the dilution of the bio-load of the room would be sub-optimum to that which would be achieved if the air changes had been at a rate recommended by the guidance. My conclusion was that the ventilation rates were not compliant with the SHTM guidance' recommendations.

71 In the final paragraph at page 10, you make recommendations regarding a Module which can deliver 55 ltrs/sec and up-sizing of the AHU, you then further explain that 'One would need to fully comprehend the benefit to be achieved by increasing the ACH and to balance the net benefit gained against the impact of the costly, disruptive process to achieve it.' What would be the benefit to patients in increasing ACH?

A The unit that had been fitted was limited to delivering 40l/s equating to around 2.5ACH. In the document I looked at, there was only one larger unit; one that would deliver 55l/s. The comment about getting further information about what improvement a 55l/s unit could make to the ACH, was, I believe, more of a suggestion than a recommendation. I was discussing what options might be available to the Board if it was considered necessary to change the system to improve the patient environment.

Rule of thumb suggested that an increase from 40 to 55l/s would not (more than) double the current 2.5ACH to achieve compliance with the recommended 6ACH, but a circa35% increase might make a desirable improvement to the ACH without having to change all of the AHUs and ductwork, if indeed there was sufficient capacity in the existing installation even to accommodate the 15l/s additional air flow. My suggestion about balancing the benefit etc, was merely indicating that (if there was capacity in the central plant to install the larger CBU) there would need to some

consideration about making what would be a significant expenditure to change all of the existing CBUs to larger units, perhaps needing to upgrade heating, cooling and electrical services, altering ceilings etc to take a larger unit, which would also be highly disruptive and not without risk in an operational clinical environment. So, I was just suggesting that, if this was something that might be worthy of consideration, all of these other issues would also need to be considered, not least of which would be that the ACH would probably still not achieve the desired 6 ACH, even at the end of a costly and disruptive exercise.

72 What should be the primary focus, cost or benefit to patients/ protection of safety?

A Patient's protection and safety should always be the primary focus. The effective stewardship of public finance is always an essential component of the Board employee's responsibilities, so achieving the 'best value' is always part of the equation, but a cost saving, (even when it is called 'value engineering'), should never be applied when the result is that patient, (staff or other occupant's), safety is compromised and patients and others are effectively put at an increased risk of harm.

73 To the best of your knowledge were any of the recommendations acted upon? If so, when, by whom and detail your involvement.

A From memory the changes to plant and systems that were made around 2020 were not specifically the result of this report. There were expert reports conducted on the installed ventilation systems and I imagine that the changes that were eventually made were based on the findings of these expert findings. More likely perhaps, that changes were led by HFS report and confirmed in a review report carried out by WSG Consultants (July 2020). Others may be better placed to advise. I was asked to give some input to the consideration that was made on initial findings and on design proposal options of the expert reports, but the tendering and installation of new plant and systems were carried out by others.

Chilled Beams

74 In your report at page 3 you state that the Schiehallion Unit does not have chilled beams, why did you state this?

A I thought that the name Schiehallion referred to only ward 2A. I had obviously misinterpreted / misconstrued the information that I was given.

75 What difference, if any, is there between chilled beams and swegeon parasols?

A (Not answered)

76 Please refer to **Estates Communication Bundle page 953 sub paragraph d** Ian Powrie states that there ae chilled beams in the Schiehallion Unit, to what extent, if any, were you aware of Mr Powrie's view?

A I refer to my answer to Q74. Mr Powrie will be correct. I understand now that Ward 2B is also part of what is called 'Schiehallion'.

77 What is the SHTM guidance for the use of chilled beams in healthcare settings?

A The use of Chilled Beams is allowed by SHTM guidance. SHTM 03-01 Part A, para 2.40 says, "Consideration should be given to the ease with which specific types of chilled beam units can be accessed for cleaning having regard to the need to control the infection risk. The impact of maintenance requirements on room availability should also be considered."

78 What is the SHTM guidance for the use of chilled beams in the areas used to house immune compromised/ suppressed patients?

A The current SHTM guidance doesn't disqualify the use of CBUs but their use in these clinical areas will need to be signed off in writing by the Ventilation Safety Group, (VSG), and the guidance around using CBUs is more extensive than it had been previously. The current SHTM also notes that patients with compromised immune systems as susceptible to fungal infection. The current SHTM indicates that condensation can be developed in CBUs under certain conditions. I imagine, given this guidance that it might be difficult in getting

VSG approval in these circumstances for the installation of these units. So, interpretation is required as everything that is allowed, is not always beneficial. The guidance at the time I was writing also did not advise against their use. SHTM 03-01 Part A, Page 26, paragraph 2.39 stated, “Care should be taken in positioning chilled beams to ensure the avoidance of cold draughts particularly when used in the cooling mode. The control settings should ensure that the external elements of the beam are always above dewpoint.”. Whilst the older guidance is not as detailed as the current guidance, there should presumably have been an awareness about the potential to create condensation. I imagine too that there would have been a knowledge, particularly by Microbiology colleagues, that condensation could be a problem that provided conditions for fungal growth.

When seeking agreement to the derogation that led to the installation of the CBUs, it is not clear whether this potential, was identified and discussed with Infection Control or Microbiology, particularly since the humidity controls were not installed with the Units. In addition, one must consider carrying out the maintenance of CBUs in busy clinical wards and the impact on room occupation when access to the unit is required for cleaning and maintenance. So, in consideration of the risk assessment that is to be applied under the latest guidance, one might consider that a similar process might have been applied under the old guidance, even though it wasn’t actually written down, and some thought given to the implications to patient care as a primary focus rather than achieving the most cost effective solution and the best BREEAM contribution. I did not see evidence that this had happened.

79 Had you experienced working with chilled beams in healthcare settings prior to QEUH?

A Yes, on occasion, but these were largely installed in non-clinical settings, e.g. General office settings, Laboratories, Laundries.

80 What are the benefits of using chilled beams in a healthcare setting?

A The latest SHTM indicates that, ‘Active chilled beams can provide an energy-efficient means of controlling environmental conditions.’

81 What impact does the use of chilled beams have on the air changes rates in a room?

A The ACH is limited to the capacity of the CBU; 40l/s in this case.

82 How did the use of chilled beams impact patient protection from infection in ward 2A?

A Where fitted, the CBU’s would have limited the ACH with a respective reduction in the protective environment which could have been provided by a greater air change rate.

83 How did the use of chilled beams in ward 2A contribute, if at all, to higher levels of infection in patients? Explain your answer.

A I don’t know.

84 Why were chilled beams used in Ward 2A?

A I don’t know.

Risk Issues

85 Explain your understanding of potential ‘cross infection’ between patients vacating and occupying the same room where chilled beam units are used.

A I recall there was a concern that fibres from the room could find their way into the CBU and be later reintroduced to the room. If the room was occupied by another patient at this ‘later time’, I understand, there was a possibility of microorganisms on the fibres from one occupancy could then be ‘shared’ with the second occupant. This is a slightly different consideration to that applied to the infection risk associated with the possible infection route of Fungal spores being sourced in the condensation (or leakages from pipe connections) and then ‘raining’ into the room, but logically, any condensation

could presumably be the vehicle for transporting fibres back into the room for its next occupant.

86 In your report at paragraph 5.2 you state the SHTM (see above) recognises there is an issue with dewpoint control and specifically advises that the CBU operates under controls that ensure “that the external elements of the beam are always above the dewpoint.”

A The point I was trying to convey was that the SHTM had recognised that there is a potential issue with condensation from these units. This suggested to me that consideration about the associated risk and the potential to include controls to mitigate the risk (that the SHTM was highlighting), i.e. dewpoint controls, might have been a reasonable expectation. I did not see any documentation related to this consideration.

a) Explain what issues, if any, can be experienced in relation to dewpoint controls.

A If dewpoint controls had been fitted, this could have mitigated the risk that the SHTM was highlighting. I believe this is achieved by maintaining the temperature of the cooling coil above the dew point.

b) If applicable, how did this issue impact Ward 2A?

A I’m not sure what the experience was specific to ward 2A. From memory, I understand CBUs were installed in other locations in the hospital that were considered to be ‘high risk’ clinical locations.

c) What issues/ concerns, if any, did you witness concerning lack of dewpoint controls in ward 2A?

A I did not witness issues.

d) What measure(s), if any, were in place at the time of writing your report, in ward 2A to mitigate this issue?

A I believe some changes to the control of the central AHU were taken to minimise the potential of humidity consequences at the patient’s rooms.

87 What cleaning regime for chilled beams was in place in respect of ward 2A? How and where is this recorded?

A Generally, I understand that where CBUs were installed, particularly in 'high risk' areas a cleaning regime was put in place, but I can't give details about the actions that were carried out in detail. The access to get into the rooms to carry out the cleaning of the units would be problematic, as patients would be required to vacate rooms, which is a hard, time consuming exercise to organise in a busy hospital.

88 What concerns, if any, did you have regarding the cleaning regime for chilled beams at QEUH/RHC?

A I cannot answer this question.

89 Have these concerns been addressed, if so by whom, detail your involvement.

A I cannot answer this question, other than the difficulty in getting access for cleaning units in patient rooms in a busy hospital and ensuring no additional risk to the patients due to the cleaning process and the increased risk to patients due to the disruption to their care and the necessity to undertake a cleaning process to mitigate infection risk (which would presumably written up in the HAI Scribe Assessment).

Installed Ventilation System

90 Explain the importance of achieving positive pressure rooms, in rooms housing immune compromised patients?

A Patients that are susceptible to infection due to their clinical condition, (e.g. immune compromised), whom do not themselves pose a risk of infection to others, need to be cared for in 'protective' environment that disallows air flow from adjacent spaces into the patient's room. This is achieved by maintaining the pressure of the patient room to be positive to its adjacent spaces. In certain circumstances, i.e. where there is a lobby at the entrance to the patient bedroom, the room can be 'neutral' to the lobby, if the lobby is positive to its adjacent corridor.

91 Explain the relevant guidance that should be followed?

A SHTM 03-01 Series of guidance. There are a list of other references at the end of the guidance documents, which would apply appropriately.

Scottish Health Planning Note 04 - In-patient Accommodation: Options for Choice - Supplement 1: Isolation Facilities in Acute Settings, Sept 2008, indicates that, the purpose of this guidance:

1.4 This Supplement to SHPN 04: 'In-patient accommodation: options for choice', provides guidance on the facilities required for isolating patients on acute general wards.

1.5 For infection control purposes, a single room without en-suite is better than no single room at all. However, the guidance in this Supplement is based on best practice and describes how a single room can be enhanced to provide an effective isolation facility for patients on acute general wards. The Supplement has two aims:

- to set a standard for new-build facilities.
- to provide Health Boards wishing to convert existing accommodation with simple design options that can be implemented relatively quickly and cost-effectively.

1.6 This guidance:

- explains how a single room with en-suite sanitary facilities can be enhanced to provide effective isolation for patients with infections that could be transmitted within healthcare.
- describes how an enhanced single room with en-suite facilities and a ventilated lobby can provide an isolation suite for patients who have airborne infections or who need to be protected from them.

Also, the document indicates, "1.10 This Supplement does not describe the specialist facilities required in infectious disease units or on wards where severely immuno-compromised patients are nursed. Guidance for these facilities will follow in a further Supplement to SHPN 04".

So, the emphasis of this guidance, is intended for how single rooms on general wards can be utilised to isolate patients. I believe origin of the

guidance was mainly to provide information about how a hospital's general wards might be utilised in the event of a pandemic, e.g. Bird Flu, where more than the 'normal' amount of isolation facilities might be required with little lead time to provide the scale of facilities that went far beyond that which would 'normally' be required.

92 Explain your understanding of the impact of installing an extract grille on the ceiling in patient rook, and a further extract within the ensuite? What impact did this have on the air flow in patient rooms in ward 2A?

A The normally expected configuration would be for the cascade of air to be from 'clean to dirty', i.e. from lobby to patient's room to en suite. The positioning of spill vents (i.e. above the door between the lobby and the room and normally low on the door between the Patient's room and the en suite) will encourage an effective air-flow through the patient's room and exiting through the extract placed in the en-suite).

If the main extract is placed in the patient's room on the ceiling and the air is provided from the lobby at high level, there may be circumstances where an effective circulation might be compromised, with the air-flow remaining at high level in the room and being extracted without being appropriately circulated within the room. In addition, the extract in the en suite was much lower than the main extract. This would have satisfied the requirement to have extract in the en suite but may not have provided the normally expected flow from the patient's room to the en suite and the flow, under these circumstances could have been from the en suite back into the patients room. The effect of this would raise the possibility of smells etc being encouraged back into the patient's room, but also, if there was a fan failure on the extract particularly, air could be drawn from the common extract systems (i.e. any extract systems having a common connection the particular en suite extract), into the patient's bedroom. This is particularly problematic if there is any common connection between 'clean' and 'dirty' extract systems, which I understand was the case in this installation, (i.e. the extracts from clinical spaces ('clean' extracts) had a common connection with non-clinical spaces ('dirty' extracts).

93 To what extent, if any, was this compliant with SHPN 04-01 guidance?

A In my opinion, it is debatable if the installation is 'compliant', being a new installation and not one that has been converted from a single room (i.e. where the installation might have been originally installed and then converted). The installation one might have expected would be for the main extract for the space to be located in the ensuite attached to the room. In this case, the main extract is in the patient's bedroom, which is 'recognised' by the guidance, I believe, as a layout that might afford a 'normal' single room to be used isolation facilities on an Acute General Ward, when the facilities were under pressure, for example, during a pandemic. I don't know why this layout was apparently considered an appropriate layout when the system is being designed 'from scratch', with the option to design a layout that, I believe, would normally be provided (with the flow from the lobby to the room and the corridor, to the bedroom, to the ensuite and if no lobby was being provided, for some reason, the patient bedroom would be 'positive' to the corridor and the ensuite).

94 At page 13, paragraph 6.2 you write that 'placing the extract grille on the ceiling of the patient's bedroom might lead to an airflow which does not effectively flow over the patient. Protection of staff caring for the patient may therefore be compromised.' Explain how this potentially impacted the patients and staff in ward 2A?

A If there is a requirement for 'source' isolation, which I understand there was in one of the isolation rooms, where the patient might be themselves 'infectious', ideally the airflow would be designed to flow over the patient and then go to extract. This could be achieved, for example, by placing the extract behind the 'head' of the patient's bed, meaning that the airflow would help protect not only those in adjacent rooms, but also those members of staff that might be in the room caring for the patient. This ideal air flow route may not be as effective if the extract is placed on the ceiling, where there is a potential, depending on the respective position of the supply ventilation, of 'short-circuiting' the room with a portion of the air flow going between supply directly

to the extract at ceiling level. This is a theoretical possibility I was drawing attention to as part of my observations.

In addition, one also needs to consider the implications of air flow if a fan fails, e.g. a supply fan or an extract fan. What would happen to the air flow in these circumstances in both a protective or source isolation room? The design should ideally, as far as possible, still ensure the safety on the patient in these circumstances, e.g. at worst, the room could be designed to be 'neutral' in the event of a fan failure. Also, in the circumstances of fan failure of the ensuite extract, where the main extract, if placed in the patient's bedroom, keeps running there might be the risk of drawing odours from the ensuite, back into the patient's room and if there was a common duct from ensuite extract, the potential may exist for drawing air from other adjacent spaces back into the patient's bedroom, giving risk to a possible cross-infection route. In addition, if the extract in the patient's room is greater than the extract rate in the en-suite, there is a potential to draw air back from the en-suite back into the patient's room. This would be a particular risk in the event of fan failure, which might make the situation worse, particularly of the 'clean' and 'dirty' extracts were run into a common duct system, which I was told was the case in hospital locations.

95 What was the impact of this, if any, on patients in ward 2A?

A I cannot answer this question but see response to Q94 above.

96 What additional potential risks, if any, did the use of two extract grilles, pose to patients?

A I cannot answer this question.

97 What impact, if any, did this have on the room pressure in ward 2A? In turn how did this impact on patient safety in Ward 2A?

A I cannot answer this question.

98 At page 14, paragraph 4.4 you write ‘where immunocompromised patients are to be accommodated, such as in transplant units or specialist cancer units, there could be a need for positive pressure isolation rooms.’ You then further write, ‘Comment: This has not apparently been taken into account in arriving at a solution provided’.

a) Explain what you meant by ‘apparently not taken into account’?

A I understood that patient rooms, where vulnerable patients were being cared for, had been provided where the air flow was flowing into the room, rather than cascading from the room to adjacent spaces, e.g. corridors.

b) What was the impact, if any, of this not having been taken into account?

A Increased patient risk and non-compliance with guidance.

99 At page 14 of your report, you do not make any specific recommendations in respect of the extract grilles, why not?

A I can’t recall why I didn’t make a specific recommendation for consideration to be given to moving the extract grille into ensuites, but this might have been because further investigation would have been required to determine if this would have been appropriate with the circumstances of the existing installation. I had made comment that could possibly have initiated these considerations by others. Similarly, in relation to the resilience of the systems, thermal wheels etc. I did suggest an urgent need to update the technical guidance, perhaps to make clearer the recommendations around ventilation installations.

Single point of failure

100 Why was a single AH unit with a single point of failure used in the TCT?

A I cannot answer this question.

101 You make recommendations such as introducing a second AHU and removal of chilled beams and replacement with a new duty/standby AHU. Were either of these recommendations followed up on? If so, by whom, and what was your involvement?

A I did not make recommendations to introduce a second AHU nor did I recommend replacement of the CBUs. I did recommend that the practicality of undertaking these actions should be explored, if these actions considered appropriate to improve the patient environment. The implications of undertaking such invasive works in an operational hospital are huge, particularly if the changes considered appropriate applied to all high risk areas and perhaps, to all ventilation installations.

If a special environment is required to ensure the safety of the care being provided to a patient and that environment is provided by a ventilation system, what is the potential impact on a patient's safety, when a system fails, or is being isolated to undertake planned and/or reactive maintenance, cleaning etc? Will the patient still remain in a space that is no longer functioning to provide the protective environment necessary for their safety? Will patients then need to be 'boarded' elsewhere during failure and or maintenance of the ventilation plant? Will alternative appropriate isolation facilities be available at the time of failure or maintenance activities? Who will organise and administer all of this? What happens in the event of an out of hours failure? These in my opinion, are some of the thought processes to go through when considering whether to go for a 'duty/standby' AHU arrangement or whether the associated risk to patient safety is 'acceptable' during the time it will take to get people on site and organise a replacement fan, or fan drive etc (some of the other options outlined in guidance that could be considered).

Again, I am not aware that subsequent actions that took place to replace ventilation plant and systems in the hospital, were as a direct result of my recommendations. Other reports were carried out be ventilation specialists and I think it more likely that these other reports would have been the source/reason for changes that were carried out. I was asked to provide internal feedback on technical reports, produced by others, and also to be at meetings where the options were being considered.

102 Was this recorded in the Board's risk register?

A I cannot answer this question

Corridor Ventilation

103 Why were split air conditioning units selected for use at the nurses station?

A I cannot answer this question.

104 Why was their use discouraged following a safety action notice?

A From memory, there was a previous Safety Action Notice that suggested the potential for condensation to be formed on cooling coils and then introduced in aerosol form into the patient environment. If this was considered a possible risk, this was perhaps a reason for cooling not being provided at the nurses station in Haemato Oncology.

105 How does/can the use of split air conditioning units impact patients and staff, if at all?

A I refer to my response to Q104. The patients are perhaps more susceptible to aerosol transmission in the air, but some staff may also be at greater risk than the general population if they have particular medical conditions or lifestyles, e.g. smokers, people with chest complaints, e.g. asthma, male, which are recognised as presenting a higher risk to Legionella infection.

106 To what extent, if any, have concerns regarding temperature in ward 2A been properly addressed by Ian Powrie?

A I cannot answer this question.

107 What are the benefits, if any, of introducing a positive pressure protection lobby in Ward 2A from an infection risk perspective?

A PPVL can provide both source and protective isolation. A lobby also provides the opportunity for gowning and decontamination/discard of gowns, handwashing etc before entry to and exit from the patient bedroom.

Thermal Wheels

108 What is your understanding of the SHTM guidance for the use of thermal wheels in healthcare settings?

A The guidance allows their use in appropriate locations.

109 What is the SHTM guidance for the use of thermal wheels in areas used to house immune compromised/ supressed patients?

A Guidance does not disallow the use of thermal wheels. Guidance is ‘silent’ on locations where their application might be appropriate. In these circumstances, the designer should assess the appropriateness of their installation, or whether an alternative heat recovery installation might be more appropriate.

From the latest SHTM 03-01 part A (2022) –

Page 64 – para 8.66, Air extracted from operating suites should not be recirculated as it may contain malodorous contaminants. **Note**: Where thermal wheels are used for energy recovery, the small leakage across them from extract to supply should not cause odour problems and is not considered aerobiologically significant. In any event, all the air supplied will pass through the final filter.

Page 99, para 9.66 - For most systems in healthcare premises, a plate heat exchanger, “run- around coil” system or thermal wheel would be appropriate. Selection should be based on the relative locations of the supply and extract units, ease of maintenance and practicality. Cleaning access will be required to both sides of any energy-recovery device. **Note**: Plate heat exchangers are the preferred option as they require the least maintenance to retain their energy transfer efficiency. Thermal wheels may be used, as the degree of air transfer from extract to supply is not sufficient to cause aerobiological problems and in any event the air will be filtered before being supplied to the user. Run-around coils are used when the supply and extract units are separate or in case of space problems.

Reference in the contract’s Engineering Specification recommended consideration of the use of Thermal Wheels, ‘where appropriate’.

110 Had you experienced working with thermal wheels in healthcare settings prior to QEUH?

A Yes.

111 What are the benefits, if any, of using thermal wheels in a healthcare setting?

A Energy efficiency / conservation and contribution to BREEAM targets.

112 What impact does to the use of thermal wheels have, if any, on the air changes rates in a room?

A Their inclusion into a ventilation system will inevitably present a resistance to flow, but this should be taken account of in the design, were all of the resistances created by all of the ventilation components, e.g. length of ductwork sections, bends, batteries, dampers, filters (clean and ‘dirty’) etc. The air delivery system would then be appropriately designed to provide the required pressure in the airflow to overcome the system resistances and deliver the required air flow rates and the desired velocities.

113 How do the use of thermal wheels impact patient protection from infection in ward 2A?

A There is a commonly held view, which is backed by evidence, I understand, that Thermal Wheels, (TWs) properly installed might be safe in all clinical installations, despite there being a recognition the air leakage might occur between extract and flow sections of the TWs, which, 'is not thought to be significant'. The significance of this potential could be from a perspective of energy transfer or in relation to the potential to transfer microorganisms. I understand that it is considered that the risk of any transfer of microorganisms between extract and flow would be caught at a filter, downstream of the flow section of the TW I understand the logic being applied, but all risk of possible cross contamination between extract and flow could be eliminated by using a Run-Around Coil (RAC) for saving similar amounts of energy, where the potential for cross contamination between air flows does not happen. Also, the effectiveness of minimising the potential of air flow mixing will rely on the efficiency of brush seals fitted against the TW, which presumably, will deteriorate through time and use.

In addition, the necessity of having to undertake periodic cleaning of the TWs, will necessitate the isolation of the ventilation plant to allow access for the cleaners, with all of the complications this will have to the patient environment, (although in fairness, the coils on a RAC will require periodic cleaning too). If the efficacy of the filter housing is compromised by the filter unit not being 'locked in' and 'sealed' to the filter housing, which may allow air from the TW to bypass the filter, there is a possible route and source of infection to the immune compromised patients in the ward. (As an aside note, from memory, WSG highlighted in their 2020 report that, in the system(s) they inspected, cam-locks were missing, meaning that there was a potential for air to bypass the filter media). For all of these reasons, I believe the energy-capture installation with the lowest risk would be the RAC. The decision in favour of TWs over a RAC, might be heavily influenced by the difference in the capital cost between the two options. Personally, I would prefer to eliminate the risk, irrespective of how small it is, but I appreciate that the economic

considerations might be thought by some as being acceptable to influence the decision to employ TWs if they believed that the associated risk was acceptable.

I never saw evidence of this kind of assessment / consideration, although it may have been applied and perhaps not recorded in the information I reviewed. I felt that the engineering specification was practically influencing the choice of a TW because of the efficiency parameters recorded in the document, which tended to be satisfied by a TW but not a RAC (Reference (hard copy) Document: New South Glasgow Hospitals – Specification Ventilation System – Ref: ZBP-XX-XX-SP-524-303 – Status: Construction T3 – Rev: B – Date: August 2012).

114 How did the use of thermal wheels in ward 2A contribute, if at all, to higher levels of infection in patients?

A I cannot answer this question.

115 Why were thermal wheels used in ward 2A?

A I cannot answer this question, but presumably as a energy efficiency measure.

116 What further action, if any was taken following your report in respect of thermal wheels?

A I don’t know.

Handover

117 In your report you discussed that required HEPA filters had not been provided or incorporated in the PPVL supply Terminal Grille in the Lobbies for each of the Isolation facilities. How did it come to be that HEPA filters were not provided/ incorporated? Would that be considered a derogation or not? If so, are you aware of whether this derogation was signed off by the Board? Provide as much detail as possible.

A I cannot answer this question.

118 Why was validation of room air permeability in the isolation rooms not initially carried out?

A I cannot answer this question.

119 What are the potential consequences, if any, in terms of patient safety, of validation not having been carried out?

A Validation is required to assess how the various commissioned components of the ventilation system will work together to deliver the designed outputs and functionality, e.g. How effective is the control system, e.g. the BMS system, the Fire system, e.g. operation of fire dampers, alarms, Cooling and Heating systems etc. Without validation, there is no assurance that all of the components of the ventilation systems will deliver the outputs and functionality expected from the design. There are numerous implications for patient safety, if all of the systems don't function safely.

120 Who was aware, if anyone, that validation was not carried out?

A I cannot answer this question.

121 how did the lack of validation affect guidance compliance, if at all?

A I cannot answer this question.

122 To what extent are you aware of any other aspects of the ventilation system in ward 2A that were not validated at handover? If so, provide as much detail regarding the impact too guidance compliance and potential patient exposure to risk?

A I cannot answer this question.

123 the system for monitoring the differential pressures was not installed at the Nurses Station, as discuss at page 18 of your report. To what extent did this meet the compliance requirements of SHPN 04-01?

A SHPN 04 Sup1 V10, Sept 2008, Page 17 Para 4.6 The object should be to keep the ventilation systems as simple as possible. Standby fans or motors are not required for either supply or extract. This is because the system as designed is robust enough to withstand fan failure without significantly compromising the level of protection. A flow sensor should be fitted to each system that will alarm on fan failure at a designated nurse station and the estates department.

SHTM 03-01 para 9.229 Visual indication that the AHU is operating within its prescribed parameters should be provided in critical areas at a manned staff location, for example, the reception or staff base. These need only take the form of a green light to show the system is operational and a red light to show that it is not.

So, not having these indicators at the nurses station would, in my opinion, be a ‘non-compliance’, particularly in relation to SHPN 04 Sup 1 as this applies directly to Isolation Rooms.

124 The conversion of PPVL to positive pressure in respect of isolation rooms was completed in March 2018.

a) What was your understanding of the background to this work being carried out?

A I’m not really aware of the detail of this or the background other than what was communicated to me and I recorded this and made some comment about it.

b) Why was positive pressure in isolation rooms not provided at handover?

A I cannot answer this question.

c) What is the consequence, if any, for the respective patient cohort not having positive pressure isolation rooms?

A I cannot answer this question.

d) Prior to the conversion works being carried out, how did the isolation rooms comply with the relevant SHTM guidance?

A I cannot answer this question.

e) To what extent, if any, are you aware of this being signed off by the Board prior to or immediately following handover?

A I cannot answer this question.

f) If so, why were the isolation rooms accepted without being positive pressure?

A I cannot answer this question.

Commissioning at Handover

125 At page 21 you write, that 'the technical oversight of the commissioning process, appears to have been deficient in several important areas' Provide details of the deficiencies and the areas impacted, include patient impact, guidance compliance.

A The lack of commissioning tests witnessed / signed off by the client, the inclusion of permeability testing, some of which, I understand was still being worked on well after handover and also the lack of validation.

126 When did the Sector Estates Management become aware that the commissioning process was deficient?

A I cannot answer this question.

127 What action was taken by Estates following this finding?

A I cannot answer this question.

128 What retrospective rectification was carried out and by whom? Who ordered this rectification?

A I cannot answer this question.

Planned Preventative Maintenance (PPM)

129 Describe the issues, if any, as you saw then, regarding PPM, Computer Aided Facilities Management (CAFM) and ZUTEC. In doing so, explain the impact this had on asset tagging, the consequences of any issues surround PPM & CAFM.

A My understanding is that ZUTEC was provided by Brookfield Multiplex as a solution of their contractual obligation to provide a CAFM system, which would encapsulate to PPM for the hospital. Each asset that is to be maintained should be specifically identified (i.e. tagged). This is the foundation for building the system of Planned Maintenance. Without appropriate identification of an asset, there is no effective way to plan or track any work being done on an asset. My understanding is that there was a ‘grace period’ after handover, within which a system had to be provided with the PPM loaded onto the system.

If the tagging is inaccurate or inappropriate, the foundation of the PPM would be dysfunctional effectively meaning that the PPM would be impractical to use.

130 Who was responsible for carrying out asset tagging?

A I believe it was a contractual obligation for Brookfield Multiplex.

131 When did it become apparent that asset tagging had not been carried out and to whom did it become apparent?

A I understand that it was an ongoing issue at handover and Mr Powrie was the person liaising with Brookfield Multiplex trying to get the problem resolved.

132 Describe your understanding of the impact of lack of PPM? Explain the potential impact to operations and potential patient impact.

A Ideally, the amount of unplanned reactive maintenance is minimised by Planned Maintenance of assets. The lack of planned maintenance inevitably means that the level of reactive maintenance is increased and it may also have compliance implications. Patients' care might be indirectly impacted due to increased asset failures which might affect the clinical services required to provide their care, (e.g. a failure of the PTS). If there were failures of assets providing a protective environment for patients, e.g. failure of an AHU, (without built in contingency arrangements), may give rise to an increased infection risk to patients.

133 What are the legislative/guidance requirements for PPM? At the time of writing your report did Ward 2A comply with the SHTM in this regard?

A The Health and Safety at Work Act 1974. There are requirements not to harm people from activities. The Management of Health & Safety at Work Regulations. There is a requirement to appropriately maintain systems in a safe manner. These responsibilities and obligations might be partially delivered through a reactive maintenance approach, but a planned maintenance is the most appropriate application. I'm not able to comment on the maintenance activities in ward 2A. Other Regulations also apply to the to the requirements to maintain systems.

134 Who was responsible for putting PPM in place?

A I cannot answer this question.

135 Are you aware of when PPM was put in place, and by whom?

A Usually, PPM is built up over a period of time from various sources, e.g. guidance recommendations, good industry practice, manufacturer's information. So, there is no specific date when you could say that PPM 'was put in place' unless the PPM is produced as a package as part of the contract. In these circumstances, the PPM system would be 'loaded' with the PPM regime for all properly identified assets and this would be 'ready to go' as

soon as it was required, i.e. operational PPM in place as soon as plant and systems are running. In my opinion, a planned maintenance, pre-agreed between the provider and the client, should be initiated as soon as plant and systems start to run (or are filled with water in the case of water systems, for example), which would be prior to handover in most cases, to ensure appropriate maintenance is in place over the whole life of the systems.

This could be achieved with a positive collaboration between the client's in-house team and the provider's contractors. If this was done, the PPM would technically already be in operation at the time of handover and would be much more effective than starting from 'scratch' at the point (or beyond the point) of handover of the hospital. This scenario would also allow the opportunity to refine any issues or ambiguities in the maintenance programmes, ensure PPM systems are running well and are fit for the purposes of appropriately maintaining all of the plant and systems to recognised standards, being consistently compliant with statutory obligations and it could also inform the level of technical and financial resources necessary to deliver the necessary programmes.

On this occasion, I understand that Brookfield Multiplex were to provide the PPM system and had a 60 day lead in period after handover to have this provided. I understand that their solution to this requirement was to provide the ZUTEC system. However, because of the issues experienced in tagging of assets (i.e. the identification of assets) and the troublesome experience with the functionality of the ZUTEC system, the ability to build up a PPM programme was not able to be effectively established at an early stage and the use of the ZUTEC PPM was delayed until the issues being experienced could be sorted out. I was aware that the Estates team attempted to create programmes of maintenance, tracking activities on spreadsheets etc. (Jim Guthrie had records of flushing of water systems, for example) and they were also responding to Reactive Maintenance Requests coming into the department from 'Users'. I was told that PPM information provided on ZUTEC was not in a 'user friendly' format and that it was 'taking days' to get any PPM

from the system. At handover, the excessive demands and the time available to the team did not allow the circumstances where focussed attention could be applied to getting things sorted, so the process of establishing, what one might consider to be an effectively operating, comprehensive maintenance regime. During my time with NHS GGC I worked with Alan Gallacher and a few other Estate's people to help improve the coverage of PPM (late 2018).

M&E Clarification Log

At page 24 of your report, you state:

This is a 'Pre Contract' clarification Log. Given the scale of the derogation from the SHTM recommendations, one may have a reasonable expectation that the Board's Technical Advisors, (Wallace Whittle and / or Currie & Brown) would have fully assessed the implications of the proposal and scrutinised it in detail and advised the Board accordingly. A complication in the technical adviser arrangements at that time, was ZBP, (Brookfield's M&E Designers), went into receivership mid-contract and their 'design liability' was apparently assumed by Wallace Whittle's London office. This arrangement was put in place to allow a separation of independence of the two roles that Wallace Whittle were now performing, because of a potential conflict of interest.

136 Describe in detail the scale of the derogations from SHTM recommendations.

A I am unable to describe the 'scale of the derogations from SHTM recommendations', but the one I focussed on was the derogation of the recommended air change rates in the SHTM 03-01.

137 What was the role of Currie and Brown/ Wallace Whittle as technical advisors?

A I cannot answer this question.

138 Who was responsible as technical advisor for NHSGGC? Should the have been aware of derogations? Would you have expected then to have given advice regarding the derogations to the Board?

A I cannot answer this question.

139 What advice would you have given if you had been in the role of technical advisor?

A I cannot answer this question. I do not have all of the information that was available at that time to allow an informed response.

140 You state that Ward 2A is not compliant with SHTM03-01 having 2.5ACH, who signed off this derogation and why?

A The Board signed it off but I cannot answer the question why.

141 How accurate is Brookfield Multiplex's comment that 'providing 6 air changes is energy intensive and not necessary'? Explain your reasoning.

A Providing 6 air changes is more energy intensive (Generally, the provision of larger, more energy intensive plant would be required to provide the necessary ventilation rates if CBUs were not installed) , but I would disagree with the statement that it is 'not necessary'.

General - Ventilation

142 The ventilation report was delayed pending the L8 waster assessment taking place at the same time. What are your views, if any, on the effect this delay had on the operation of the ventilation system and patient safety?

A The ventilation report wasn't delayed 'pending the L8 water assessment taking place at the same time'. I was asked to carry out a brief investigation into what had happened to the '2015 DMA Canyon Risk Assessment Report'. The work I was asked to do on the ventilation was 'observational' to provide comments to assist consideration of others preparing a report. I don't consider the information contained in the report would have had much, if any

significance to the operation of the ventilation system. The ventilation system was being reviewed by other ventilation specialists.

143 Why did the L8 water assessment Take priority?

A See answer to Q142 above for context. It had just recently emerged that there was a Risk Assessment report carried out in 2015 by DMA Canyon that had recommendations that had not been appropriately actioned; nor had it apparently been communicated out with the Estates Department.

144 Who determined this priority?

A I don't know.

145 When you completed your report who did you deliver it to?

A Jane Grant

146 Are you aware of your report having been shared with infection control staff? And if so, to whom?

A No. I can't recall being advised about, to whom, if anyone, this report was shared with.

147 How aware where are you of concerns being raised by members of staff, clinical and/ or non-clinical, at NHSGGC regarding the operation and safety of the ventilation system in ward 2A? If so, what were these concerns, when did you become aware of these concerns, and who held these concerns?

A Mary Anne Kane had, in conversation in August 2018, told me that Brenda Gibson, the 'Lead Paediatrician' did not consider that 'Wards 2A & 2B were fit for purpose'. However, from memory, I can't recall if this view was expressed of the facilities at handover or at a later point in time. In conversation with Ian Powrie, I believe Ian expressed concern about the capacity and resilience of the installed system, but I can't be certain of when this was. I am aware that Teresa Inkster led investigations into the adult and paediatric BMT in 2015. I was also aware that there were concerns in May / June 2018 about the ward's environment following a spike in infection rates and that new patient

admissions had been curtailed as a precaution and patient treatments had been affected. There was concern about biofilm growth in the drains of the ward's water appliances. Action was being taken (which started on 5th June) to undertake a room by room decontamination with Hydrogen Peroxide Vapour to 40 rooms in Wards 2A&B. Chilled Beams had been sampled for contamination, but results of samples had returned 'negative'. The Scottish Government had recently requested that HPS conduct a formal investigation into Wards 2A&B.

148 What work was carried out following the recommendations in your report?

A I am not aware of any work being carried out as a direct result of my report. Work and various actions were already being taken prior to my involvement, which continued after my involvement.

Review of issues relating to hospital water systems risk assessment

149 We have a copy of your review of issues relating to hospital water systems risk assessment dated the 26th of September 2018 refer to estates communication bundle document 134. The report states that in August 2018 the board CEO asked you to review the context circumstances relating to the boards response to DMA risk assessments findings. Who was the boards CEO at the time?

A Jane Grant

150 What was the background to you being commissioned to review the context and circumstances relating to the boards response to DMA risk assessments' findings?

A The background was: NHS GGC just had 'special measures' implemented by the Scottish Government in March 2018, installing an Oversight Board to 'support' the NHS GGC Board. This meant that everything relating to activities of NHS GGC was receiving additional, detailed scrutiny, particularly relating to the issues that were emerging and the concerns being expressed in the media, all of which had attracted a great deal of negative public attention. I

think that HFS, in their draft report, after having received a bundle of electronic information from Ian Powrie that had included a copies of the DMA risk assessments, had highlighted that recommendations in relation to DMA water risk assessments should be completed.

I believe this may have emerged, through a comparison of the recommendations of the 2015 and 2017 DMA Canyon risk assessments, that there was little difference in the recommendations, which had the implication that the initial recommendations had not been actioned appropriately. I understand that the information about the DMA risk assessment had been brought to the attention of Jane Grant, who had challenged Mary Anne Kane about the apparent lack of action on the recommendations of the report. Ms Kane had told Ms Grant that she had not known anything about the report and would need to find out more about it. Ms Kane had discussed this situation with Ian Powrie and Alan Gallacher and I understand that this discussion led to the realisation by Ian Powrie that the report had not been actioned appropriately, nor had it been communicated above him in the management line, which meant that no one in the management line (above Ian Powrie) was aware that this report existed. In addition, there was no indication, that I was aware of, that the initiation of the request to get the risk assessment carried out at the behest of the 'Project Team' (i.e. relating to the minute of a meeting of, I think, a technical sub-group of the project had seen the report at some point), had been followed up by anyone on the Project Team to find out what had happened. In March 2018 the Scottish Government formally requested HPS to investigate and report on wards 2A&B.

151 Why where you selected for this role?

A I don't know. I wasn't informed why I was selected to carry out the investigation.

152 Were HPS/HFS involved in your instruction? If so, explain how and why?

A I am not aware of HPS/HFS being involved in any instructions given to me in my time at NHS GGC (apart from being told that comments about ventilation

might assist consideration by Annette Rankin at HPS, but I was not aware of any influence or request by HFS/HPS related to instructions given to me when I was at NHS GGC.).

153 What background information was provided to you by NHS GGC prior to you carrying out this review?

A I met with Jane Grant initially, (12th July 2018) and she asked me to conduct an investigation into what had happened with the DMA Canyon Risk Assessment Report. I had indicated that, from what I knew about the differences in the two DMA reports (2015 and 2017), it appeared that the 2015 report might have been missed, but I would try to find out not only 'if' it was missed, but also try to make some assessment about 'why' it might have been missed. This was a short meeting in her office. She was aware that Estate's staff were under a great deal of pressure and was mindful about the possible additional pressure an investigation like this might bring upon staff. She asked me to meet with Ann McPherson (Director of HR) to discuss how the investigation might be implemented. I had access to files on ZUTEC. I had read and highlighted salient comments on a Risk Assessment, (dated May 2017), carried out by Dennis Kelly, the Board's AE(Water) in May 2017, which, I understand was the AE's first involvement with the QEUH/RHC water system. He had made several references to the DMA Canyon 2015 risk assessment, encouraging actions to conclude the DMA recommendations.

154 What was the remit of this report?

A On 19th July 2018 at 17:00Hrs, I met with Ann McPherson in her office in the JB Russell Building to discuss the proposed investigation. It was suggested I look into activities from 2014 and to try to find out 'who got what, and when' and use a template of questions to also try to find out 'why' things happened. A list of people to be asked these questions at set interviews would need to be developed which would be informed by 'who was involved' at the time. She indicated that the investigation 'may, or may not lead to disciplinary action', if this was appropriate, but this was not the primary reason for the investigation. The primary reason for the investigation was about the 'incident and to

establish the facts'. It was expected that the investigation would take 3-4 weeks. I was informed that I would be supported by 'admin and HR' during the investigation and that Ms McPherson would now try to organise this support for me. I wrote to Ms McPherson on 31st July asking for an update on her progress with organising support for the investigation and she informed me (on 31st July), that Gillian Gall, HR Officer at NHSGGC would provide HR support and Allyson Hirst (Nee Barclay) would 'scribe' the proposed interviews.

I contacted Ms Gall and Ms Hirst on 31st July and I developed a draft question set for the basis of the interviews. I sent the draft questions to Ms Gall and Ms Hirst and met with them both on 3rd August to discuss the question set and develop how the investigation would proceed and a template communication was drafted to be sent to those that were to be interviewed. It was considered that staff might be nervous about what might emerge from an investigation like this and Gillian would therefore make consultations with Staff-side representatives about what was being proposed. I began with an initial discussion with Ian Powrie on 3rd Aug about whom it might be appropriate for me to speak with, knowing Ian would be on the list of people to be interviewed. The draft questionnaire, from memory, was communicated to Staff side as a matter of courtesy.

155 Was the remit provided to you in writing? If so are you able to supply the inquiry with a copy of this written remit?

A No. There was no 'written remit'.

156 At 1.1 of your report, you write that you were to 'review the context and circumstances of the Board's response …' What did you understand the meaning of the 'review' to mean?

A See answer to Q154.

157 What inspections or investigations of the physical water system did you carry out prior to writing your report? How many occasions did you visit QEUH/RHC for the purposes of preparing this report? When did these visits take place, how long were they in duration? What aspects of the water system did you review?

A I did not undertake any physical inspection of the water system in connection with writing this report. I wasn't reviewing the physical water system. I was reporting on what happened to the DMA Risk Assessment report and explored the circumstances surrounding why the response to the report was apparently lacking.

158 At paragraph 1.4 you refer to your report as being a 'brief review', why was did you view the report as a brief review? Was this part of your remit? Did the curtailed nature of your inquiries hinder the fulfilment of the remit of your instruction? Were there things you would have liked to have looked at, but could not, or areas that you would have liked to have looked at in more depth? Please provide details.

A I was trying to find out what happened with a report delivered to the Board. I was carrying out a high level report trying to corroborate facts where I could. I was not examining the information I got in much detail. It was always expected to be a brief review and originally anticipated to take around 3-4 weeks, but the allocation and availability of HR and Admin support, the consultation with staff side and the availability of people on the interview list, (due to annual leave and other commitments etc), meant that the timescale of information gathering took longer than expected. The recorded information had to be checked for accuracy by me and then put to the individuals to agree that the information fairly reflected what they had said. I then had to consider the information I had gathered and I had then to shape it into a report with the findings I considered appropriate.

159 Did you interview or speak to any members NHS GGC estates staff for the purposes of carrying out this review? If so, provide details of staff, including names, occupation along with the reason you interviewed them, what information regarding the DMA risk assessments were the individuals able to provide you?

A a) Yes. b) Colin Purdon, Estates Officer, Mary Anne Kane Interim Director of Estates and Facilities, Ian Powrie Estate Manager, Jim Guthrie Estates Officer, Melville McMillan Estates Officer, Phyllis Urquhart Compliance Officer, Tommy Romeo Estates Officer and William Hunter General Manager. Some individuals were interviewed as they were directly involved in the operational management of engineering systems or were the line managers of individuals. The information they provided me with formed the basis of the report that I produced. They gave me information about their professional role and experience, where they were and what they and others were doing in the lead-up to the handover of the hospital, what they and others did, or did not do, in relation to the DMA risk assessment and what they had been doing since then. The information they gave was on the basis of their testimony being confidential and non-attributable.

160 Were the individuals compliant with your request for interview?

A Yes. Most were very open in providing information. Some were a bit guarded and whilst they answered questions to the best of their recollection, they did not offer much additional comment.

161 Did you encounter any difficulties speaking with any members of staff? If so, who?

A I would perhaps have liked to speak with a few others to seek further triangulation, clarification, or corroboration but this was difficult as they had left NHSGGC, retired, moved to other organisations or were external to the organisation. David Bratty, Alan Seabourne, David Loudon, Frances Raft etc, but I felt I had sufficient information to arrive at reasonable conclusions.

162 Did you interview or speak to any members of NHS GGC infection control staff for the purposes of carrying out this review? If so, provide details of staff, including names, occupation along with the reason you interviewed them, what information regarding the water system and the DMA risk assessments' were the individuals able to provide you?

A No.

163 Were there individual(s) you would like to have spoken to, but did not get the opportunity to do so? If so, who would you like to have spoken to, and why? What do you think they could've added to your investigations?

A See answer to Q161.

164 Why were you not able to speak to retired staff or staff no longer employed by the board? What impact did this have the outcome/ findings of your report?

A Speaking to others could have corroborated some important detail and might have been able to confirm and / or corroborate some of the other information I had, but I thought that the information I had was sufficient to arrive at reasonable conclusions. Therefore, I did not request to speak to retired staff or staff no longer employed by the Board.

165 At paragraph 1.4 you write 'it is thought that a good level of confidence can be assumed in the accuracy of the high-level findings' given that you were unable to speak to members of staff call my how where are you assured of the accuracy of your findings? How much of a degree of confidence did you have in your own findings? We are there areas where your level of sighting what is relatively low, and you had to work off best estimates? If so, did this impact your confidence in your findings?

A I tried to corroborate the information I was getting from more than one source. I generally assumed that the information I was getting, for the most part, was each individuals' best recollection of what had happened from their own perspective and I think it helped that people were assured that information provided would be in confidence and non-attributable. I thought I had a good level of confidence to arrive at the conclusions I reported. The area of greatest

difference was in people's recollection of the actual physical receipt and passing off of the risk assessment report. Had I concluded that I should recommend disciplinary action as being appropriate, I think I would have had to seek more conclusive findings, but since that was not the case, I was relatively confident in the findings.

166 Did you have difficulties speaking with any members of infection control staff? If so, Whom?

A No. I did not speak with any members of infection control staff as part of the investigation.

167 If you did not speak to infection control staff explain why?

A From the information I had, Infection Control staff were not included in the process of procuring or receiving the DMA Canyon Risk Assessment report and therefore didn't need to be included in the investigation about what had happened to the report.

168 Are you aware of a forensic review having been carried out following your report? If so, please describe your understanding of the findings. If not, are you able to confirm why this recommendation was not followed up by NHS GGC?

A I am not aware of any further forensic review of the situation surrounding the actions related to the receipt of the DMA Canyon report having been carried out as a follow-up to my report. I am not able to confirm why further scrutiny was not applied nor am I aware of the considerations that were applied in arriving at that conclusion.

The water system at QEUH

169 What did you understand to be the main sources, guidance, regulations etc for governing the operation of the water system?

A There are many sources of legislation, regulations and guidance that are applicable for governing the operation of water systems. There are fairly comprehensive lists of references of these Acts, Regulations, and various guidance documents, Codes of Practice, British & European Standards etc, listed, for example, at the end of the ACOP L8, SHTM 04-01Parts A&B and HSG 274 (particularly Parts 2 & 3) and these documents also give guidance on the important and necessary areas of compliance.

I won't replicate all of these here. From an operational perspective, the documents, SHTM 04-01 Part B (and several other parts of the 04-01 series) and L8, HSG 274 would be helpful references governing the operational management of hospital water systems. The principal legislation relating to water systems is the Health and Safety at Work etc Act 1974. The Management of Health and Safety at Work Regulations 1999 and the Control of Substances Hazardous to Health Regulations 2002, (made under the HASAW Act), make specific requirements for risk assessment.

These regulations apply to the control of Legionella, embodied in the Approved Code of Practice and guidance document, 'Legionnaires' disease: The control of Legionella bacteria in water systems', (known as ACoP L8, mentioned above). I understand that the Water Supply (Water Quality) (Scotland) Regulations 2014 has implications for water system operational management, but the focus of this legislation is largely focussed on the supply of water. The Water Supply (Water Fittings) (Scotland) Byelaws 2014 has implications for the materials used in a water system (which should be compliant and 'approved', by the 'Water Regulation Approval Scheme, (WRAS).').

170 What, in your view, are the most important requirements which those sources set?

A The important overarching requirement is to have a structured, risk-based approach to the management of water systems and for trained, competent and formally appointed people to comprehensively apply the associated guidance to satisfy statutory requirements and, as far as reasonably practicable, maintain and operate safe systems, remove and / or mitigate identified risks and to keep appropriate records including systems' drawings, risk register etc, which should all be reflected in a Written Scheme supported by Standard Operating Procedures. All of these operations, such as the organisation's Water Safety Plan, (as now reflected in BS 8680 (2020) Water Safety Plans), should be overseen and co-ordinated by a Water Safety Group with appropriate reporting lines (reflected in the WSG Terms of Reference) to ensure appropriate organisational governance oversight.

171 Who has ultimate responsibility for the operation of the water system at QEUH?

A The Chief Executive has ultimate responsibility as the Duty Holder. The practical, day-to-day management / implementation of policy aspect may be delegated but the ultimate responsibility cannot be delegated.

172 When you first encountered the water system at QEUH, was the allocation of that responsibility made clear in the arrangements in place for operating that system?

A I didn't initially examine the overall structure and how this was applied in the organisation as a whole, but I became aware that the existing water management structure was not sufficiently clear and improvement in the QEUH/RHC structure could be made by further formal training and formal appointments to defined positions of responsibility within the water management structure.

173 What would you expect to see in place, in order for responsibility to be properly allocated?

A The typical basic structure of hierarchy of responsibility, in order of responsibility, can be viewed in SHTM 04-01 Part B (July 2014), page 37, which indicates the CEO as the Duty Holder carrying 'Ultimate responsibility', with the operational aspects of this role delegated to the Management Team – Duty Holders (Accountable for the Operational Policy). Independent Legionalla Risk Assessor/Professional Advisors and Authorised Engineer Professional Assessor. A Designated Person (Water) carrying executive responsibility (and preferred chair of the Water Safety Group, (WSG)). A WSG undertaking a co-ordinating role for water safety, with input from the Consultant Microbiologist. A typical hierarchy is, the Responsible Person (Water) (and optional Chair of the WSG) is placed under the WSG, then the Authorised Person(s) (Water) (Estates Officer) and then Competent Persons (Water), Maintenance Technicians, Contractors, Tradespersons etc under the Authorised Person (Water). The typical structure, given in the SHTM would need to be applied in a way that suited a complex organisation the size of NHSGGC and the typical structure would need to be practically applied to ensure a proper and practical oversight of all of the water systems, in all properties within each of the Sectors of the organisation and to adjust the structure to reflect any significant changes or additions to the organisation's property portfolio.

174 Who was the duty holder at the time of handover of QEUH/RHC in January 2015? Who was the duty holder at the time of carrying out your report?

A The CEO at the time of handover in January 2015 was, I believe, Mr Robert Calderwood. I don't know, to whom the day to day responsibilities of the Duty Holder would have been designated to at this time, but this might have been Mr Grant Archibald and Mr David Loudon (as recorded in the DMA document 'Written Scheme for Legionella Control' - Queen Elizabeth university Hospital (Adult) & Royal Hospital for Sick Children – December 2016 Update). Mr Archibald was the Chief Operating Officer and Mr Loudon was the Project Director / Director of Estates & Facilities until he left the organisation in

December 2017. I understand that Mr Loudon was appointed as Project Director in June 2013 to replace Mr Seabourne, who retired in July 2013; following the retiral of Mr McIntyre in 2014, I understand that Mr Loudon became the project Director & Director of Estates and Facilities. It is his professional role that leads me to conclude that the day to day responsibilities of the Duty Holder may have been within his role, but I don't know if this was formalised. At the time of me carrying out my investigation and producing my report, Ms Jane Gant was the CEO. I am not aware of arrangements to delegate Duty Holder day to day responsibilities to another individual following the departure of Mr Loudon in December 2017. I am aware that Ms Kane became the Interim Director of Estates & Facilities after Mr Loudon left the organisation. Mr Loudon and / or Ms Kane would be able to confirm the nature of any handover discussion or reference to Duty Holder (water) responsibilities.

175 To what extent was it clear that the obligations to appoint an authorised person/ designated person for water/ competent person for water/ authorised engineer for Water, required to discharge water supply safety, had been complied with at the time of writing your report? What awareness did you have as to when these roles had been filled? If there are any delays in filling these roles was this a factor in any deficiencies that you identified?

A At some point in time, (I can't recall when exactly), I became aware of an audit, carried out by Dennis Kelly, the Board's AE (Water), which might be helpful in providing some context/background to this answer. On 4th May 2017, Dennis Kelly (AE(Water)), produced a 'Legionella Management and Compliance Audit – Domestic Water Systems for the QEUH. He records the 'Staff Interviewed' (at QEUH) as Tommy Romeo, Estates Manager and Phyllis Urquhart, Compliance Manager. I understand, from subsequent conversations with Dennis Kelly, that this was the first time he had been involved with the QEUH. The 'Executive Summary' in his audit said, "Given the findings of this audit, and the gaps in the existing risk reduction systems and processes, in the event of a legionella based incident at the hospital NHSGGC would not be

in a strong position with regards to its stance on risk reduction and compliance with existing guidelines. The Hospital is now in full use.

The current risk assessment was completed over two years ago and prior to the hospital being fully opened. There is therefore a need to complete a new risk assessment, and from that, define the required tasks in a new and updated written scheme. It is worth noting however that there is not a complete absence of risk reduction processes and procedures at the hospital. There is an existing system in place. This system was created by the previous Estates' manager. The system does contain many of the required monitoring and control tasks and these are being recorded in a paper-based log book. However, the system appears to be in places haphazard. It took some time to go through the paperwork and define what was happening in the hospital from a water point of view. There are tasks missing and also there does not appear to be an escalation and recoding of remedials process. As the hospital is extremely large and complex, it may be beneficial, and may also increase efficiency and levels of compliance task completion, if an electronic based planning, control and recording process for the legionella-based risk reduction processes and procedures was considered.

There are recommendations below for improving the execution and recording of the required tasks and for clarifying some of the confusion and the issues that exist in the current paper-based system. With regard to competency, there is an urgent need for training to be delivered to the Estates' manager who currently appears to hold the responsibility for the delivery of the required processes and procedures. There is a lack of clarity in the paper-based system of who is accountable for what and of the competencies of the involved NHS GGC staff and the contractors that are used. It should be pointed out that there in not an authorised person for water in post at the QEUH. In summary, there is currently a delivery of many of the perceived required processes and procedures. However, it needs to be reviewed in order to meet the required compliance standards, and to ensure that a

reduced level of risk is maintained. The delivery of the processes should be based on a new risk assessment.

This will help to define the actual current requirements which will be defined by the risk assessment. There is also a need to clarify the management structure, and also to ensure that all involved personnel, from both NHS GGC and also contractor's staff are trained and have an adequate level of competency in order to deliver the required level of water-based risk reduction in the QEUH".

I am not aware where, or to whom this report was escalated to, or if it was escalated. I also became aware, (I can't recall when, but this may have been in connection with another piece of work I was asked to do later on, to refresh the Board's Written Scheme for Water), of a DMA document, 'Written Scheme for Legionella Control - Queen Elizabeth university Hospital (Adult) & Royal Hospital for Sick Children – December 2016 Update'. Within this document, there was a Written Scheme Hierarchy Appointment Timetable, with names beside each of the designated positions. (Within the document there is no reference about who initiated the 'Update', nor to whom it was provided (apart from a footer, which said, 'Ensure all actions are recorded and stored in the L8 Legionella Logbook, QEUH WSG (2016), Written Scheme (Legionella)'. Given that this document was an 'update', it demonstrates that various functional management requirements were recorded as being present in NHSGGC.

When I started with NHSGGC, some point early in my work in connection with my assistance on responding to the Draft HFS report around June 2018, I asked Mary Anne Kane about the water management structure at the QEUH/RHC. Her response indicated that there remained similar weaknesses, (e.g. on training and formal appointments to designated water roles), such as those identified by Dennis Kelly in his audit from the previous year. I suggested to Ms Kane that urgent action would be necessary to get people trained and suggested that she should quickly initiate a training programme

for Estates staff. I suggested inviting trainers into the hospital to deliver the training to groups of staff (rather than sending individuals away to training facilities). This would save time and in getting the necessary numbers of staff trained and formally appointed.

I sent excerpts of guidance documents that I had highlighted and provided brief comment on, to give a broad appreciation of the statutory requirements relating to the management of water systems. I also provided templates of formal AP appointment letters and some other documents that I thought might help appreciation of requirements. Ms Kane made the necessary arrangements and at the time of writing my report in September 2018, I was able to report that, “the training of all appropriate staff on water systems has been completed: All necessary formal appointments have been made: There is a robust management structure in place for the management of the hospital’s water systems: The latest report from the independent Authorising Engineer records significant improvement in the Board’s approach: The recommended actions from the L8 Risk Assessment have been successfully managed..”.

176 To what extent was it clear that the roles required in respect of legionella required to discharge water supply safety had been complied with at the time of writing your report?

A Please refer to the answer to Q174 and Q175 above.

177 Were are the lines of responsibility clear?

A Please refer to the answer to Q174 and Q175 above. At the time of writing my report, the lines of responsibility had been clarified and improved.

178 If not, what in your view was lacking from them?

A Please refer to the answer to Q174 and Q175 above. Arguably, the solution to the issues identified with the management structure in assessments and audits, should have been implemented prior to the handover of the hospital. Had the water management structure for the QEUH/RHC been in place at the

time the water systems were filled with water, (at the latest), and in place preferably prior to the filling of the systems, in order that the filling of the systems could be planned and executed in partnership with the contractor, the necessary operational preparedness (i.e. training, formal appointment etc of Designated internal roles etc) along with the input of the Board's AE(Water) would have had the opportunity to seamlessly pick up the management of the water systems at the handover of the hospital. Also, arguably, had the formal management structure been in place at the run up to handover, the handling of the 2015 DMA Risk Assessment and the subsequent follow-up actions may have been significantly improved.

179 How clear was it to you that arrangements were deficient?

A Please refer to the answer to Q174 and Q175 above.

180 Did you consider recommendations for improvement of them to be within your remit?

A Yes. Please also refer to the answer to Q174 and Q175 above.

181 If so, what actions are you aware of being taken by NHS GGC in order to improve the situation?

A Please refer to the answer to Q174 and Q175 above. I was impressed with how quickly Ms Kane acted and resolved a situation that was in need of improvement after I brough this to her intention.

182 What effect did your actions have?

A Please refer to the answer to Q174 and Q175 above. I think my input was helpful.

183 In your view, have any such short comings been fixed?

A Yes. The current situation at the hospital is, I believe, commendable, and the management of hospital water system is exemplary.

Water Executive Group July 2018

184 Please set out your understanding of the requirement to have a water executive group in place for governing the water system at QUEH.

A I don't believe that there is a 'requirement' to have a 'Water Executive Group' in guidance.

185 From when what is the water executive group in place?

A I think that the Water Executive Group (WEG) started on or before the 18th July 2018 and ran to 18th September 2018. There is a, however, a reference in the Minute of the Water Review Meeting (Technical) of the 8th June 2018, that the Water Executive Group's first meeting was planned for 15th June 2018.

186 What was the purpose/ intention of the water executive group?

A I think the WEG may perhaps have been thought appropriate from the consideration of recommendations made by Susanne Lee in the report she produced in April 2018 to review and improve the activities of the Water Safety Group and to have greater input from Infection Control. In addition, the demand for information being requested from the Scottish Government, the Oversight Board (formed under the national support framework's 'special measures', invoked by the SG in March 2018), Health Facilities Scotland, Health Protection Scotland, Media and the Board's own internal senior management, was significant and it was increasingly difficult to ensure the appropriate information was being gathered and produced to answer the questions being asked within timescales that were required, e.g. for FOI requests.

I believe it was considered necessary to coordinate and track the information going to the various requesters. It was useful to have a record of what information went to whom and when that information was provided, as there were many duplicate requests (even from the same sources, but perhaps by different people). The tracking of the information being sent out helped to ensure the organisation had appropriate records, which also assisted on

compliance with FOI and GDPR obligations. The WEG was chaired by Jonathan Best, Chief Operating Officer for NHSGGC, which also gave a direct oversight link to the Board's Executive Team.

The group picked up the various actions being noted and actions to resolve issues, get information, etc, were identified and were taken forward by the teams of the individuals represented, e.g. Estates and Facilities via Ms Kane and Infection Control via Mr Walsh. In an SBAR dated 5th July 2018, written by T. Walsh to J. Best, there is a recommendation which says: "To provide optimum support to the internal and external review processes a structured approach to communication, review and management of documentation, and local coordination of resources is proposed. This will be led by the Interim Chief Operating Officer supported by the Interim Director PPFM and the Board's Infection Control Manager. The Board's Infection Control Manager will act as a single point of contact for both internal and external colleagues.

The coordinated approach will focus on three primary and interlinked work streams: 1. Review and management of all relevant documentation and written communications to support the SG commissioned external review and the GGC internal review. 2. Ensure that the QUEH/ RHC water reports have been reviewed and all actions are either completed or in the process of being enacted with clear evidence, and 3. Liaison with and support to the internal review process when commissioned. Regular meetings, (2 or 3 per week), have been arranged to monitor and review progress given the high priority and tight timescales". This, I believe, would reflect the intended purpose of the Group.

187 Did you participate in the water executive group? From when?

A Yes. June/July – Sept 2018.

188 How well did the group function? Did the group achieve appropriate engagement among necessary participants?

A I think that the group functioned well and helped to manage and keep track of communications. The group participants collaborated well to gather the necessary information to answer all of the questions timeously and to initiate appropriate actions.

189 Were its activities properly recorded?

A Yes. Allyson Hirst (Nee Barclay) took and recorded notes of each meeting.

Water Review Meetings July - September 2018

190 Please set out your understanding of the purpose of the water review meetings which took place between July and September 2018.

A I understand the notes of the 'Water Review Meetings' were for the Water Executive Group. My understanding of the purpose of the Group is described in the answer to Q186 above.

If the meetings referred to here, refer to the Meetings that were designated the, 'Water Review Group (Technical)', Chaired by Mary Anne Kane, the purpose of that group was, as I read in a 'Timeline with reference to HFS Water Management Issues Technical Review', notes that, "6.4.18 Water Review Group (Technical) convened as a subgroup of IMT". The meeting gave Ms Kane a better appreciation of actions taking place and allowed 'a space' where all of the actions being taken by Estates in relation to the water systems could be discussed. I believe Alan Gallacher tracked the various action on a 'Smart Sheet' spreadsheet.

191 Describe your role and involvement in the water review meetings between July and September 2018.

A In relation to the Water Executive Group – my role was to help with a review of applicable guidance and also to support Ms Kane (from an Estates perspective), to update the group on activities that I was directly involved in

and to carry out any actions that were assigned to me. With regard to the Water Review Group (Technical), I recall attending one or two meetings. My role at these meetings was fairly peripheral and to offer occasional observations and to helpfully engage with anything I thought appropriate.

192 How well did the meetings function? Did the meetings achieve appropriate engagement among necessary participants?

A I think the Water Executive Group meetings functioned well and served the desired purpose. The Estates and Facilities and Infection Control departments were directed/informed via Ms Kane and Mr Walsh respectively. The Water Review Group (Technical), I attended, had a quite an intense atmosphere, which I put down to the emerging serious and unique issues they were trying to address. The meetings were attended by a large number of people including various people from Estates & Facilities, Microbiology (Dr Inkster Dr Hood), Infection Prevention and Control (S Devine), HPS (A Rankin) and HFS (Ian Storrar and Eddie MacLaughlan) and Clinicians.

193 Were its activities properly recorded?

A Allyson Hirst (Nee Barclay) took notes of the meetings.

Water Incident 2018

Refer to estates communication bundle Page 938 when considering your answers. It was noted on several occasions to the SHI team that access to the Estates Communication Bundle could not be achieved. An attempt was made to 'reset' access to the bundle, but this didn't work either (confirmed again by me to Tom Gallagher on 9th July 24), so answers are provided without the advantage of accessing this information. The issue was resolved on 10th July.

194 At the time what was your understanding off the water concerns which emerged at QEUH/RHC in 2017 2018? In relation to the concerns:

a) When did the concern arise? Put set a timer.

A I think suspicions started to emerge in January 2018.

b) Nature of the concern?

A I believe that a patient infection was related to an unusual microorganism (i.e. not routinely encountered) in January 2018. I think this caused Microbiology colleagues to look back at a similar infection in the same patient group that had taken place in 2017, which had, at that time, I think, may have been considered as an isolated, single incident.

c) Possible cause of concern?

A Others may be able to more accurately answer this question, but I think that the cause of concern was that the source of the microorganism (Cupriavidus, I believe, from IMT Minutes) might have indicated a second case from the same kind of unusual organism indicating the possibility of contamination in the hospital water system and if this was the case there was an urgency to try to determine if the possible source was localised or otherwise. From IMT minute in March 2018 it was noted that Stenotrophomonas and Sphingomonas had been identified on ward 2A.

d) What actions were taken in response to concern?

A IMT - Water tests were carried out in the water tanks and in the Aseptic Pharmacy. Both tests were negative. Testing of taps and showers. Water testing frequency was significantly increased particularly in 'High Risk' patient areas. One water outlet tested positive. Twice daily cleaning of taps with 'Achticlor' in 2A. Shock dosing with Silver Hydrogen Peroxide took place and shower heads and taps were replaced as a precaution and shortly afterwards. A week later (on 16th March 2018 according to the timeline and IMT minutes, confirmed by the HPS report) the decision was taken to fit Point of Use (PoU) filters to the water appliances and these were fitted in 21st March 2018. It was noted in the IMT minutes that communication with the parents of patients was to take place via Emma Somerville, who was to inform them that a problem with the taps had been identified and was being rectified and it was

recommended that the Parents and patients should ‘still use bottled water for drinking and washing hands’. This was obviously a precaution that had been implemented before 6th March 2018. The use of patient showers on ward 2A had restricted from 9th March 2018 according to the minute of the IMT dated 9th March.

e) How sufficient were these actions?

A At this point in time, I think the team thought they were dealing with something fairly localised, hypothesised to be potentially related to ‘tap cleaning’ and they were following what they thought to be reasonable actions in line with what is reflected in guidance. Retrospectively, if the hypothesis arrived at is not accurate, the focus of action on one particular activity, e.g. tap cleaning, might be masking attention to more meaningful action that may be required elsewhere.

f) Can you identify any specific feeling which led to any concerns?

A Personally, it was concerning to me that NHS Scotland had, for years, been ‘looking’ for Legionella and then after the ‘incident in Belfast’ we were concerned about looking for Legionella and Pseudomonas when water-testing took place. I was concerned that the references I was hearing about other potentially harmful, possibly water-based microorganisms, that were largely not recognised in any testing protocols in any hospital, that I was aware of, could have such a concerning patient impact, particularly to patients with significant health issues who perhaps could be most vulnerable due to the suppressed nature of their immune systems.

Report - High level findings.

195 What was the implication of the change from a PPP to Treasury funded procurement model on the post contractual arrangements for FM service provision?

A I believe that the decision to change to a treasury funded project may have been announced in 2007, (at the time of writing the report I had thought that

the change had been taken around 2009/10). The main post-handover implication of the change was that the responsibility for the operation and maintenance of the new hospital would revert solely to NHS GGC.

I have responded to this question based on my experience and knowledge developed over my career working on capital and revenue funded projects.

Had the project been a PFI/PPP, the post-handover arrangements would normally have reverted to a third party Facilities Management (FM) contractor/provider. Commonly, the post-handover FM provider, in the PFI/PPP model, would be the FM part of the Project Company (the special purpose vehicle under the PPP/PFI model) e.g. the Project Company contracts with the FM Provider for the provision of the FM services (the FM Contract) This approach, I understand, intended the benefit the Project Company by ensuring an ongoing business income over the period of tenure of the PFI/PPP agreement, which could routinely be 20-25 years. The monthly payments, made by the NHS under this model to the Project Company under the Project Agreement, would, I believe, have a capital component which effectively paid off the project debt to the funders, along with a profit element, over the time of the contract.

Another component of the monthly payment by the NHS would be a ‘Service Charge’ for the maintenance and operation payment, which would be built up from life cycle estimations for systems and fabric over the life of the project, to maintain the fabric and systems to ‘Condition B’, (a defined measure of condition) together with a profit element. At the end of the 20/25 year contract period, the hospital would then be ‘passed over to the NHS ownership’ in a ‘good condition B’. The arising Capital Charges relating to the asset would be minimal as the deterioration of the asset value would be amortised over the period of the Project Agreement. At the end of the Project Agreement there may, or may not be, (depending on the terms of the contract), a termination payment to the Project Company. There would be performance measures on the condition, response times to correct reported defects, designated annual

expenditure on various aspects like decoration, floor covering replacement, maintenance contracts etc.

These measures would be reported on routinely by the Project Company and would attract and oversight management of the NHS to ensure all of the contract provisions were being appropriately delivered at the agreed Service Charge.

The benefit of this model to the NHS is related to the transfer of risk. If the FM Service Provider is part of the Project Company's organisation, they will often seek to minimise the risk level over the life of the FM contract. In order to minimise this risk, the early engagement and collaboration between to construction contractor and the FM contractor parts of the PPP model can be observed. The FM contractor will seek to influence the construction contractor's supply chain and choice of 'higher quality' materials and systems being installed during construction, to minimise the intensity and cost of the life-cycle responsibilities, the cost of which will often dwarf the cost of the initial capital procurement cost.

The construction contractor must balance to desire to satisfy the demands of their 'partner' FM provider whilst maintaining their Guaranteed Maximum Price for the project, so it is not solely demand led by the FM Provider. If the project is Treasury funded, the handover of the hospital, once constructed, is to the NHS. There are post-handover responsibilities for the Project Company (and Sub Contractors), for snagging issues and defects, but the operational management, maintenance responsibilities and costs are largely now carried by the NHS. The incentive to consider the installation of high quality systems, elements of fabric, components, equipment etc, in order to minimise the life-cycle risk is significantly reduced, with the potential commensurate impact on the NHS. The setting of budgets and resources within the NHS is rarely, if ever, 'built from the ground up' to relate to a life-cycle model.

196 Explain what you meant by ‘the timing and the level of consultations with the Board’s estate professionals could have been earlier and more deliberately intensive’. What would the impact of earlier and more deliberate intervention of been?

A It needs to be recognised that a construction like the QEUH/RHC places huge demands on the ‘in-house’ team, whom are normally already extremely engaged and busy with doing what they normally do routinely without having to deal with all of the new demands placed in them due to the new hospital being built.

This is particularly the case on a ‘brown-field’ development, where the construction of the new buildings on the site, directly impact on the normal operation of the facilities in the retained estate. Bearing in mind the intentional and deliberate, early inclusion of the contractor’s organisation of their partner service provider, the reasons for which I tried to explain earlier in my response, one might have considered that a similar, inclusive approach would be taken to ensure that those picking up the post-handover operational and maintenance responsibilities, might have the opportunity to influence the contractor’s supply chain decisions and the considerations being made about the quality of the fabric, systems, equipment, components etc, that were forming part of the contractor’s design deliberations. Ideally, the greatest influence can be generated by the client as these considerations are being formed early in the procurement process. From the time the contract is signed, there is normally a diminishing opportunity to influence what will be installed, particularly if the implication of this influence has cost and / or time implications.

I appreciate that there were multi-disciplinary consultations, but I learned that the consultations/communications with the technical managers, (i.e. Ian Powrie and Brian Gillespie) that were put in place early, were, I understand, fairly minimal. In January 2009, Mr Gillespie (working at Inverclyde Royal Hospital) and Mr Powrie (working at Glasgow Royal Infirmary) were asked to offer ‘high level’ comment on the project brief. Other input and attendance at

project meetings representing Estates and Facilities, was, I understand, Alex McIntyre. Mr McIntyre was an able and capable NHS manager; I understand engaged in working up early estimates for Hard FM resources for the new hospital. I'm unsure what engineering, technical experience / expertise Mr McIntyre would have been able to contribute to the process. Brian Gillespie left the organisation on 31st March 2010. This, I understand, remained the situation until Ian Powrie was seconded to the Project Team in January 2013.

197 What design weaknesses in the water system that you identify in carrying out your report?

A The principle focus of my report was to try to find out what had happened to the DMA Risk Assessment Report. I did not personally review the technical design of the water system. Some of the weaknesses were highlighted in the DMA report and reflected elsewhere in other assessments. The extent to which my voice contributed to the identification of water system weaknesses and operation difficulties, were, I believe, limited to reflection and some brief comment on the findings of others.

198 What involvement did the Board's Estate professional managers have in the design of the water system? How could early inclusion of the boards estates professional manager have improved the design aspects of the water system?

A I refer to my response to Q195 and Q196 above.

199 At paragraph 2.3 you write that 'aspects of the design of the water system and some of the components installed have the potential to contribute to proliferation of microbiological contamination'. What components of the water system contributed to the potential for microbiological contamination? How did this occur?

A I learned from others, e.g. DMA Assessments, Dennis Kelly AE(Water) and HFS Report comments, etc. that some design / installation weaknesses were apparent. These included cap ends missing from lengths of pipework being installed into water systems during construction allowing dirt and potential contaminants to be 'installed' with the pipework; that there had been

Malleable or Cast Iron, components, e.g. valve bodies and flanges etc, and there was also a section(s) of steel pipework included in the water system installation. There were issues related to a variation of the grade of stainless steel pipework installed in the system. Ian Powrie also showed me, what appeared to be part of a brick that was removed from a Pressure Reducing Valve (PRV) following it being dismantled.

I received corroborated information that the main filtration system had been problematic in operation and that the filtration plant had been by-passed when the system was charged with water. There were some 'Ethylene Propylene Diene Monomer', (EPDM), rubber components fitted to appliances, e.g. Arjo rise/fall baths, dishwashers. These are not approved in the 'Water Regulations Approval Scheme', (WRAS), as they have the potential to support microbiological growth in water systems. I understand that the pipework drops from the main flow pipework to appliances were, in some locations, greater than the allowed dimensions.

The by-pass pipework configuration at the water tanks was, from memory, problematic and the balancing of the water tanks had to be redone to minimise the risk of stagnation in the main water tanks. These issues were, I understand, compounded by the experience of valves not operating effectively, valve stems shearing, valves not providing their intended isolation when repairs were attempted. Temperature variation, out-with recommended limits, in the water systems and calorifiers was a common issue identified in the DMA Risk Assessments, in addition to the presence of a number of dead-legs in the water systems.

200 What was the resource estimation methodology you refer to? What impact did this have on the Estates' team?

A The resource estimation methodology I refer to is, one that was reflected to me, where the resources available do not reflect the actual, factual and determined, life-cycle demands of the hospital's fabric, systems and equipment requirements, but one that more closely aligned to the resources that existed at the time. This, together with other contributary issues, I believe, directly detracted from the ability of the team to effectively respond to the inevitable demands placed upon them and to allow them to assess and undertake the improvements they had to make to the systems that had been provided to them. The service that they did provide was only delivered by the compensation of working excessive hours over a protracted period of time.

201 At paragraph 2.5 explain what you meant by 'some project outcomes and adversarial responses by the contractor to some requests by the board might have been improved by a higher definition of some of the boards requirements'.

A I refer to the explanation within my answer to Q195 and Q196 above in relation to the influence that a FM Service Provider might have on the quality of the design and the choice of the quality level of materials, plant and equipment, etc. When the interpretation and application of elements of the guidance is largely within the domain of the contractor, in a design build situation, the choices made by the contractor can be influenced by the level of their post contract responsibilities and whether these will persist for a relatively short interval or for an extended period of time.

Also, after handover, I understand that there was a contractual obligation on the contractor to provide a 'Soft Landings' assistance for a short period of time. By this time, I was told that most of the contractors had vacated the site. There was a process set up to allow the reporting of matters that the in-house team were experiencing where they believed that the contractor would be obliged to provide assistance and to resolve the identified problems.

Presumably, there would have been reference to this, ‘Soft Landings’ arrangement in the contract agreement. The experience of this arrangement, in fairness, varied from person to person. Some had a good experience where the contractor responded and delivered what they would have expected. Others felt that the system was severely flawed. Their opinion was that so much time was wasted, arguing with the contractor, who in their view, often had an intransigent and argumentative approach about the interpretation of what their obligations actually were, that they often did not actually invoke the Soft Landings arrangement, believing that they would be quicker just to deal with the issues at hand on their own. My assessment of the situation was that the intention of the Soft Landings arrangements were laudable, but that a better definition of obligations and responsibilities would help to remove the ambiguity that allowed the contractor to waste time arguing about whether or not it was appropriate for them to respond. To clarify the terms where the Soft Landings would be applicable, I thought, would be helpful within my report.

202 What were the project outcomes and what impact did they have?

A The choices of the contractor about the quality of the installations of various systems, e.g. pressure systems pipework installed without the requisite CE marking, the ‘CAFM’ system provided, the CHP plant that was persistently problematic, the installed cooling system that didn’t work, the failures of glazing units that fell from the building to the ground, wiring problems, battery problems and early obsolescence of the AGVs automated/robotic delivery systems, floor-covering problems, problems with the quality of doors, issues with wall construction and cladding (the list is not exhaustive), not to mention the identified shortcomings of the ventilation and water systems, may have had some source in the design applied and the quality of the plant and the systems that were installed. I also refer to my response to Q195 and Q196 above in relation to ‘Soft Landings’. The time wasted arguing with the contractor, without much confidence of a favourable outcome, only delayed response to the issue causing the problem. This could have impacted the response time to resolve issues. These issues could have directly impacted the service to the hospital’s clinicians and patients.

203 What were the adversarial responses by the contractor, and what impact did they have?

A I was not provided with the detail of any specific issue, the 'adversarial response by the contractor' was a general reflection on what was viewed by some to be the contractor's general attitude to, what were considered to be the reasonable requests being made for assistance during the Soft Landings period. I think the impact of the negative response experiences were to diminish further the confidence in the contractor.

204 Which of the Board requirements could have been improved by higher definition and why?

A I recognise and appreciate that the NHS, during the compilation BCRs cannot be overly prescriptive about specifications, for fear that the design risk, carried by the contractor, might then be 'assumed by'/'diverted onto' the client. But, despite the difficulties, there is a real, urgent need to improve what happened in the Glasgow and in the Edinburgh hospitals. Perhaps, for example, more closely defining the terms of the Soft Landings obligations of the contractor might have removed / reduce the apparent ambiguity. Perhaps closely defining the situation where Soft Landings would *not* be applicable might be easier than trying to cover all of the eventualities where it would be applicable?

205 Describe the recognised management structure that you would expect to see for the functional management of a hospitals' technical systems. Describe the different roles and responsibilities you would expect to see.

A With respect to the general staffing and management structure in hospitals, there is no set model. The variation in service delivery, the size and complexity of all of the various healthcare institution does not allow a set structure or a standard number of staff for any particular facility. In the 1980's there was a standard, (PTB9/78) which related the number of engineering staff to the technical systems, plant and equipment.

This was removed as a standard around 1985 as part of a wage negotiation and thereafter, the assessment of staffing compliment was then a ‘management decision’. A professional benchmarking of similar facilities could be the basis of forming an opinion about the resources that might be deemed appropriate for creating a reasonable structure. If the time was afforded to make such a base assessment, it could then be reduced or added to, by making some decisions about specialisms that need to be covered to satisfy the Board’s statutory obligations to effectively and professionally manage its facilities. Despite all of the debate about the wider estates structure, guidance recommends the technical management structure related to various systems, which largely follow the same model which I reflect and comment upon in my answer to Q173 above.

A similar system of defined responsibilities, the appropriate training and formal appointment of designated Authorising Engineers, Responsible persons, Authorised Persons, Competent Persons etc are recommended for all of the technical systems, including High and Low Voltage Electrical systems, Sterilisation and Decontamination, Pressure systems, Confined Spaces, Medical Gas and Vacuum systems, Lifts, Ventilation and Water systems. It was this form of management structure I was referring to. Arguably, as I say elsewhere, had this structure been defined, organised and put in place prior to handover, the clearly defined responsibilities would have, I believe, made a significant difference to responses in general, but particularly to the response to the DMA Risk Assessment Report. All of these recommended technical responsibilities, should be part of the equation adopted when establishing the general technical management and operational structure for the hospital to ensure that all of the technical systems are appropriately maintained and operated in a safe, compliant, operational condition.

206 Did you see this structure in place at QEUH/RHC?

A I refer to the response to Q205. There is no set standard for the general structure for an Estates Department, but the technical systems management structure for water systems (reflected in my answer to Q173 above) required some improvement (also reflected in my answer to Q174 above). I did not investigate the wider technical management arrangements but I was aware there was a functioning Water Safety Group and assumed there were Responsible Persons etc in other parts of the organisation.

207 What, if anything, was lacking from the structure in place at QEUH/RHC? What was your understanding of why this was lacking?

A I refer to my answer in relation to Q173 and Q174 above. I don't know why it was lacking but had it been recognised as an important requirement to have a technical water management structure in place for the QEUH/RHC before handover the issues that emerged may not have been so challenging.

208 Describe your understanding of staffing levels of the estates team at the QEUH/RHC?

A <u>From 2012- Laboratory Building</u>

My understanding of the staffing levels in the lead up to, and after, the handover of the hospital was: The Laboratory building had been constructed and handed over to the Board in March/April 2012 and became fully operational in July 2012. The Energy Centre had not been handed over at this point. The site works for the hospital had begun in February 2011, so the hospital construction was over a year into construction. In August 2012, Ian Powrie moved from his position in Glasgow Royal Infirmary to take up a post at QEUH. He was not given any induction for his new post. His responsibilities at this point included managing the maintenance activities in the Laboratory (Labs) Building. Mr Powrie, I understand, had 2 Technicians assigned to him to assist him with these responsibilities. Mr Powrie told me that the Labs had many basic engineering problems, e.g. the Labs ventilation systems automatically shut down when the external temperature reached -6^{o}C. Mr Powrie, I understand, relayed this as a potential problem with the hospital

ventilation and the external design temperature for the hospital ventilation was changed to -12^{o}C. Also, these was no appropriate operational electronic maintenance system in place with related maintenance programmes necessary to undertake and record maintenance activity.

Labs – PPM

Because of this Preventative Planned Maintenance, (PPM), was 'non-existent'. He was aware that maintenance would be essential, not only to comply with guidance and legislation, but also so that warranties (which were only valid if the systems were appropriately maintained), would not be invalidated. The ZUTEC system did not have the ability to automatically generate PPM job cards. He said that he highlighted this problem to Mr Seabourne and also to Wallace Whittle. He spent two years working with IT colleagues to move the Lab assets on to the system, because Brookfield Multiplex had not 'tagged the assets'. His attention on the Labs Building inhibited his ability to effectively contribute / comment to / on the project. He had been doing this via Wallace Whittle (M&E Engineers). Mr Powrie initiated a managed service contract for the Labs around January 2013 and set up a largely paper-based PPM system in the absence of a functional CAFM system.

QEUH/RHC – Secondment

It was around this time that Mr Powrie was seconded to the Project Team, without any formal induction and he 'handed off' the responsibilities he was carrying for the Labs building to others. At this time Mr McIntyre agreed with Mr Powrie that he (Mr Powrie), would be the Sector Estates Manager Designate and he would take over this role after the project was concluded.

Resource Plan for QEUH Campus

Mr Powrie was asked to work up a resource plan for the new hospital and he based his assessment on the Scottish average to produce, what he thought, would be an appropriate to service the new hospital. The resources he identified were greater than the available resources in the demitting hospitals

that were intended to transfer to the new hospital. His estimation of the finance required was based on what would have been the same as the PPP 'life-cycle' estimations. Mr Powrie indicated that he 'negotiated' with Robert Anderson, the Facilities Finance Manager to add a further [redacted] revenue funding to existing estimates, which then meant that staffing budget would be [redacted] and [redacted] for maintenance services, maintenance contracts etc. The funding that was provided (even with the 'additional' funding) was, according to Mr Powrie, insufficient to cover all of the service contracts required to maintain installations, equipment etc, which meant that 'things had to be prioritised and juggled a bit'.

Maintenance Service Contracts

I had seen a spreadsheet that related to a [redacted] requirement for the required maintenance contracts for installed plant and equipment.

Communication of Resource Report

Mr Powrie advised that he thought that Mr Loudon, (who was appointed as the Project Director in June 2013), took Mr Powrie's concerns about resources seriously and that he took these concerns to the Board's senior management. I understand that Mr Loudon told Mr Powrie that he had been told that the budgets had already been set and the feedback to Mr Powrie by Mr Loudon was, 'run with it just now and make a case once the hospital was up and running'.

Initial Estate Management Resources

Mr Powrie advised that, in partnership with National Education for Scotland, (NES), he developed and introduced and programme of 'fast-tracking' Estate Managers and 5 people were recruited to Band 7 Estate Officer positions, 'from the shop floor'. One of the individuals had apparently been a Supervisor, but the other four had no Estates Management experience. Jim Guthrie (mechanical/plumbing) was promoted to Band 7 Duty Shift Manager – day to day operation and moved to the new hospital 'for acclimatisation' around November 2014. Melville MacMillan came to QEUH from IRH and in Jan

2015, he was working shifts (nights and days) as Duty Estates Manager after completing familiarisation training. Others that transferred, were, I understand, Daryl Connor (electrical), Paul McAllister, (electrical), Tommy Romeo, (electrical).

Initial Roles & Responsibilities

Colin Purdon, suggested that, initially, Jim Guthrie led on water issues and that Tommy Romeo took over these responsibilities from Jim Guthrie, when Mr Guthrie left the QEUH (at a later date). Ian Powrie was line manager for this team.

After Handover

Mr Powrie, Mr Guthrie and Mr MacMillan indicated that over 200 contractors had to be 'signed in' to the site (on 27th Jan 2015) with Risk Assessments and Work Permits as required, then 'signed out'. Administration associated with this was significant. Standard Operating Procedures were developed for reporting problems. Reports were going through the helpdesk and then getting reported back to Brookfield Multiplex. A defect log was managed by Estates.

PPM

Mr Powrie indicated that the contractor has a 60 day 'lead-in' after final completion to provide a functioning PPM system. This, in my opinion is astounding! So, effectively, prior to handover NHSGGC had a functioning PPM system for the retained estate and at hand over, the PPM system was not functional. Both PPM systems were incompatible for the automatic transfer of data. PPM on ZUTEC was in the form of spreadsheets and, according to Mr Powrie, many of the PPM checks on the ZUTEC system were not required. There were14,500 tags for assets, but Mr Powrie said that Brookfield hadn't tagged any assets, so, none of the associated assets could be associated with the PPM. The identification of the assets is a fundamental requirement for PPM to be able to function. Mr Powrie indicated a further

20,000 tags had to be purchased to make the tagging more accurate and functional.

Staffing Availability

Mr Powrie indicated that he couldn't get his full team on site, on a full time basis because they had decommissioning duties to complete in the demitting hospitals. Mr Guthrie advised that Brookfield Multiplex were still working on Water systems and calorifiers etc for around a year after handover. Mr Guthrie, despite not having and effective electronic system, started to take a 'paper record' of water temperatures etc.

Operational Issues

Mary Anne Kane indicated that things were taking weeks to be sorted, leading to significant operational challenges. For example, the AGV systems, (the robotic delivery/transport system), experienced frequent failures, requiring the immediate substitution of Porters to maintain the services, e.g. food deliveries, waste disposal etc. Similar levels of failure was experienced in the Pneumatic Tube System, creating severe problems for the Estates & Facilities department. Ms Kane indicated that Mr Powrie was filling in 'gaps' in the Soft Landings arrangements. She indicated that the arrangement didn't accelerate any issues and that the team were constantly 'fighting' for resolutions and she thought it only added friction and deteriorated relationships. She also cited issues with routine failures of the CHP plant, (which I understand was handed over 1 year late), to highlight where the 'Soft Landings' arrangements didn't work well. She said that contractors were not always compliant with site rules and she thought, in general, that 'expectations and accountability' were not adequately defined, which meant that issues were frequently unresolved.

It was around this time that the DMA Risk Assessments were handed over by DMA.

I learned that familiarisation was being given by suppliers on various systems (between November 2014 and January 2015). Mr Powrie indicated that a chap called Alastair Smith 'got involved with some of the witnessing'. He

thought Mr Smith was a consultant, working for the Board and he said that Mr Smith was ‘kept on’. I was provided with a list of post-handover work that the small team was involved in. Ms Kane engaged agency staff to undertake flushing of water systems between handover and the occupation of the hospital to try to improve water turnover in the water systems. All contributors to my investigation recounted all of the Estates staff working significantly excessive hours over an extended period of time, e.g. routinely 12 – 14 hours per day and often 7 days per week! I learned that the building suffered severe flooding episodes, with sewerage backing up from the main sewers into the basement. Each time they went to clear the blockage they found that the drain blockages were caused by builder’s rubble in the systems. I heard opinion from the team that manpower was insufficient to cope, but they had no choice other than to ‘get on with it’. Ms Kane indicated that Financial Savings in the form of CRES were still expected and posts were not being filled.

I heard that there were gaps in people’s availability as they had to go through ‘induction training’ before they could get on site. In addition to all of the emerging operational problems, the Estates Team were trying to manage a large number of modification requests coming in for all over the hospital in addition to the larger post contract modifications, e.g. fitting televisions etc. Medium Temperature Hot Water pipework was apparently manufactured on site and did not have the requisite CE marking, which meant that it could not be certified under the Pressure Systems Regulations and Brookfield did not apparently have any records related to the pipework manufacture, despite allegedly saying that they did have records over an extended period in the lead up to handover and beyond. It fell to Mr Powrie to work with Zurich, (the Board’s insurers) to get the systems certified. In March/April 2015, Mr Powrie finalised the ‘Strategic Estates Plan’ he had been working on when seconded to the Project Team. From Late April 2015 the small Estates team were supplemented with agency staff to help with the migration from demitting hospitals and occupation of the new hospitals. I heard that the agency staff had no previous NHS experience.

209 Did the staffing levels of the estates team at QEUH/RHC meet your expectations? If so, how so? If not, how did differ from your expectations?

A I refer to my response to Q194 above for details. For clarity, my response is about the staffing levels of the estates team at QEUH/RHC leading up to and beyond the handover into the early occupation period of the new hospitals. Had I been the Director of the Estates & Facilities Service at this time, I would have been very concerned about the adequacy of the resources, both human and financial, do deliver the level of service and to cope with the additional demands placed upon the hospital. This was, I believe, compounded by the incapacity and /or absence of effective and functional computerised systems, which would have helped instead of hindered the team's activities. In June/July 2016, Mr Gallacher formed a Compliance Team to address SCART Compliance issues. I believe he moved to QEUH around November 2016. Mr Gallacher issued, what I think might have been the 2016 DMA Update document for everyone in the various parts of the Board to use as a template for a Written Scheme. The distinction between the responsibilities carried by Mr Powrie and Mr Gallacher, in retrospect, may have had some areas where clarification of where one stopped and the other started, and some definition of who was responsible for reporting what up the line management structure may perhaps have helped avoid any confusion that may have contributed to issues not being appropriately elevated.

210 Did you have concerns regarding the staffing levels in estates at QEUH/RHC? If you don't have concerns, how clear would it have been staffing levels were inadequate?

A I refer to answers to Q205-209 above. In fairness, additional funds were provided (albeit less than was arguably required) and the 6 additional agency staff to assist during the transition period were positive elements that demonstrated that the level of resources were at least clear to those that had arranged the additional resources. So evidently, despite the recognition of inadequacy being somewhat delayed, some attempt was made to help the situation, but this was possibly too little, too late.

211 How did any staffing level concerns impact the functional management of QEUH/RHC's hospital technical systems?

A I refer to answers to Q174-175 and the Q177 (which should have been the new number 163) and Q205-209 above.

212 In your opinion, did this pose an additional risk to patients, if so, explain how?

A It is very difficult to directly quantify an increased level of risk to patients associated to staffing levels without also taking the prevailing circumstances of demands placed on the staff into consideration. Had the hospital simply functioned efficiently, as one might consider a reasonable expectation (given that it was a brand-new hospital), with perhaps minor teething issues dealt with by a proactive partner contractor; if the operation of the energy centre, the Automated Guided Vehicles (AGVs), Pneumatic Tube Systems (PTS), ventilation controls and a number of other important systems had not been as problematic; if the identification and tagging of the assets had been accurate and appropriate and the CAFM and PPM systems etc had been 'operationally ready' and tested for functionality prior to handover; if the patient entertainment system had been installed during the contract and other post-contract alterations to rooms and a list of other problems that emerged shortly after handover, e.g. the repeated backing up of the sewerage system; the absence of CE marking on pipework systems etc, could have been avoided, the challenges may perhaps, have been more readily dealt with by the team. In the circumstances however, prevailing at the time at handover, in my opinion, meant that the small, relatively inexperienced team, was overwhelmed by the demands placed on it.

I personally consider that the time consumed in trying to deal with the post-handover issues that were either immediately apparent or those that seemed to emerge with monotonous regularity, led to a situation of the team being highly reactive to respond to problems rather than having the ability to operate in a more measured, planned and strategic manner. Their attempts to apply a more planned approach was, in my opinion, greatly inhibited by the lack of systems' functionality and the lack of operational preparedness. In my

opinion, the risk to the patients was more attributable to the issues that emerged from the hospital's systems, which was only compounded by the level of resource that was applied to manage them.

213 Who ought to have been monitoring staffing levels in the estates team at QEUH/RHC?

A The Director for the particular department carries the ultimate responsibility, to the Chief Executive, for the management of the department. The Chief Executive will carry ultimate responsibility for the overall staffing of the organisation, but I imagine there are many competing demands on a finite organisational resource.

The staffing model worked up through the Public Sector Comparator should potentially have been further refined by the subsequent detailed review carried out by Ian Powrie. Despite the gap between what Mr Powrie had proposed and the available resource it was possibly concluded that, if the operational phase ran smoothly (which was the reasonable expectation at the time), things could be 'juggled a bit' to 'get by'. This is not an uncommon approach in the wider NHS, in my experience. However, it appeared that the original resource estimates had already been adopted and there was an apparent reluctance to vary these original assumptions. I understand that Mr Loudon was supportive in seeking additional resources, but he was not apparently successful in persuading senior Executives to improve the established revenue position. So, I believe that it appears that an appropriate oversight was being applied, but possibly lacked the Executive support that would have improved the situation.

214 What led to the finding that that Estates team was inexperienced paragraph 2.7?

A I was informed that the staff in Mr Powrie's team had largely, recently been transferred and/or promoted from, for example, Supervisor roles into Band 7 Estates Officer positions. So, I concluded that the level of management experience at the Estate Officer level and familiarity with this massive new hospital's systems was fairly limited. In addition, the team were in the early stages of learning how to navigate the complex hospital layout and to begin to learn (on the job), the detail of how the hospital functioned. In saying this, I am not casting any aspersions on the technical competence of the people, whom all appeared to me to be 'good people' and keen to do a good job.

215 What was the consequence, if any, of the team being inexperienced?

A It is difficult to be specific about any particular consequences attributable to 'inexperience' other than to consider what might be logical conclusions of possibilities. In my view, the presumption about the level of experience is appropriate, but it does not reflect on the level of effort that was apparently applied by the team to learn on the job, which I think was considerable, nor does it reflect on the technical capability of the team when they were working in the Estates service, it is a reasonable conclusion that they would have been on a steep learning curve to become proficient at Estates Officer level.

216 Explain what you meant by 'they were overwhelmed by demand'?

A When a new hospital is occupied, there is routinely a big demand from User departments for a large proportion of minor tasks, e.g. moving shelves, building furniture, carrying out Portable Appliance Tests (PAT), sorting minor damages, installing a wide range of fixed equipment across the hospital and other smaller items that are spotted by staff as they move into their new accommodation that they feel they need to get changed or sorted. The in-house team would have been fully engaged with the 'normal' expectation, but in addition to these demands, Mr Powrie and the team were also responding to plant and system failures, (some of which are mentioned in my response to

Q212 above). In addition to this my understanding was that the team also had the following issues to administer:

- The access of over 200 contractor's and review all of their risk assessments and method statements associated with the works they were carrying out, which all needed to be controlled and overseen in the early period of time following handover.
- They were trying to establish Written Schemes and risk assessments, e.g. relating to L8.
- They were involved in flushing and testing of water systems and the sanitisation of water systems, which took place in all departments 2 weeks prior to occupation.
- They were trying to establish and implement the associated Written Schemes of Examination, (legal requirements), related Lifting Equipment and to the Pressure Systems and Safety Regulations (PSSR), which was further complicated due to the pipework in some of the Pressure Systems, e.g. the Medium Temperature Hot Water (MTHW) System, which did not have the required CE marking and certification, which in turn, led to complications with negotiating with the Board's Insurers (Zurich) in order to get the required certification the required to comply with the requirements of the PSSR, (the single action took around 2 years to reach a conclusion). I understand that Zurich played a pivotal role in undertaking assessments of the installed system to get it into an acceptable position.
- The team were tasked with tendering and installing a new Patient Entertainment System (PES), (i.e. bedside TV stations). This, I understand, was complicated because the Dwang positions (i.e. the fixing locations for wall mounted brackets located behind the walls of the patient bedrooms), were not routinely in the positions marked on the as fitted drawings, making the installation much more challenging.
- Various Service Contracts for various specialist plant and equipment had to be procured and implemented (all of this done on a prioritised basis due to the challenging financial resources provided for this provision).
- The team needed to support the installation and commissioning of '3rd party equipment', e.g. major elements of equipment like large items of medical

equipment, which needed connected to electrical and other supplies during installation and commissioning.

- Delivering required departmental ‘change of use’ from original design.
- The team was involved in the handover of the new Office Block and T&FL and provided support for the commissioning and occupation of these facilities.
- They procured and fitted out a new ‘Mop Laundry’ Facility inclusive of all of the installed equipment. There would have been under pressure to get this in to allow the Domestic Services to function effectively.
- The team were trying to manage defect reporting and they introduced a logging process to try to keep track of what had been reported, when etc.
- The team were responding to resolve ‘constant drainage issues’. This led to arranging and implementation of a CCTV survey of the sewers, which then led to the necessity to “remove ‘builders aggregate’ from all manholes / outfalls and the main sewer, right back to the Govan Road”.
- They were involved in the identification and solution to what they identify as a ‘contract omission’ for the shared lay-up prep interlock requirements.
- They were involved with raising defects to Brookfield Multiplex, one of which was concerned with what was considered to be a defect related to the non-compliance of the PPVL Isolation room facilities in the Adult Hospital.
- They then supported the rework of the Isolation Facilities in the Adult Bone Marrow Transplant facilities in the Adult Hospital.
- In addition to all of the above, there were emerging issues with the operation of the energy centre and the functioning of the Boilers, the Combined Heat and Power and Cooling systems. I understand there was a late handover of the final section of the energy centre.
- I understand that the way the Building Management System had been set up meant that there were a significant number of ‘high-level’ alarms coming through on the system and some work had to be done to ensure the ‘true’ emergency alarms, were not being ‘masked’ by many other less important alerts.
- There were issues related to floor coverings, doors and other elements of fabric.

- They experienced the occasional failure of large glazing units, some of which had fallen from the building into public areas, leading to large quantities of Heras fencing and scaffolding being installed to mitigate the risk from this issue.
- There were issues of leaking pipes.
- There were complaints about heating levels, which eventually led to the discovery that the Contractors had installed the signal cables (controlling the actuator controls of the ventilation systems) in the same containment as power cables, (despite this installation method not being recommended in the IEE Wiring Regulations). This had resulted in Electro-Magnetic Forces (EMFs) being induced into the signal cables, meaning that the actuators were not being appropriately controlled. The solution to this meant a degree of re-wiring to resolve the problem.
- There were issues with frequent breakdowns, battery failures of the AGV system, (i.e. robotic vehicles), used to deliver food trolleys, remove wastes disposal containers etc. It was eventually found out that the system provided was imminently obsolete, meaning that there was difficulty in procuring spares, new batteries etc, without any available alternative battery packs etc.
- Frequent breakdowns of the Pneumatic Tube System (PTS) were experienced requiring routine callout of specialist contractors to provide repairs and set the system back to work. There were also post-handover alterations made to the PTS system to establish direct routes between particular departments to avoid the impact of the regular experience of breakdown that was affecting the effectiveness of the clinical service. It was considered that the alteration made should actually have been provided to comply with the system originally specified, but this, I understand, was rejected by Brookfield Multiplex on the grounds that their interpretation of the specification had been satisfied with what they had already provided. I understand that the Board funded the alteration.
- The failures of AGV and PTS (mentioned above) had immediate unplanned implications for portering staff, who had to fill the gaps in service left by the equipment and systems failures.

- They had to repair holes in the fragile roof membrane of the ‘Burn-off Roof’ section that were caused by birds ‘pecking’ the membrane and eventually to deal with the failure of the installed test system that caused the roof to actually burn off.

All of these issues and others, not recorded here, contributed to my conclusion that the in-house team, and particularly Mr Powrie as the Estate Manager, were overwhelmed by the demands placed upon them. It is commendable, I believe, that the team compensated for the situation by working significantly extended hours over what I understand to have been, an extended period of time.

217 Are you aware of any action being taken to address the staffing levels and experience of the estates team following your report? If so, provide details of action taken and impact.

A I am aware changes were made to personnel and shift patterns in the time period between the initial handover in 2015 and the time of the writing of my paper, but I do not know the extent to the changes that happened (apart from the introduction of the Compliance Team under the leadership of Mr Gallacher). I understand Mr Gallacher was originally working from the Royal Alexandra Hospital, Paisley and started a Compliance Team around June/July 2016, (initially, I believe, to improve the focus on Statutory Compliance Assessment and Risk Tool (SCART) reporting). I believe he, and the Compliance Team function, moved to the QEUH around November 2016. I also understand that Mr Steele initiated a review of the Estates & Facilities Service when he became the Director of Estates and Facilities and this would have included some investigation into resources. However, this may not necessarily have been prompted by my report which was provided to Ms Grant earlier. Mr Steele was probably looking for a wider assessment than that focussed in my report.

218 At paragraph 2.8, when discussing the response to the L8 risk assessment are you writing about the response to the DMA Canyon 2015 report - **refer to bundle 6 - miscellaneous documents.**

A I am referring to a lever-arch folder that was shown to me during one of the interviews with a member of the Compliance Team, which contained a L8 Risk Assessment Plan with actions that related to the whole campus. From memory, it contained actions on removing little used outlets, dead-legs, flushing, etc. I observed that some of the actions contained within this L8 Risk Assessment Plan appeared to be similar to recommendations that had been made in the 2015 DMA Risk Assessment report. I speculated that some of the actions in the L8 Risk Assessment Plan might have been 'informed' by the DMA Risk Assessment Report. This might have implied that some action had begun on a response to the DMA 2015 recommendations and if this had been the case, it may have been the difference in the timing of the production of this Plan which could have overlapped with my investigation that led to the production of the DMA 2017 Report. This may explain why there was no reference to the Plan in the DMA 2017 report. The existence of this L8 Risk Assessment Plan, whether or not connected in some way to the DMA 2015 report, did indicate that there were appropriate actions taking place on the campus, despite the lack of evidence of a formal management structure being in place specifically for the QEUH/RHC facilities.

219 At paragraph 2.8 of your report, what staffing changes applied to the role that would have been responsible for carrying responsibility for implementing actions in response to the L8 risk assessment recommendations?

A Part of the information I gathered, leading up to writing the report, informed me that Jim Guthrie was particularly focussed on mechanical and plumbing related issues at the time of handover. Melville MacMillan was, at this time, I understand, also primarily focussed on mechanical and plumbing related issues. Both of the gentlemen came to the QEUH around November 2014. Mr Guthrie was promoted to be the Band 7 Duty Shift Manager (with day to day operational responsibilities for the site) and Mr McMillan transferred from the Inverclyde Royal Hospital to the QEUH. Others transferred/appointed around

that time were Darryl Connor, Paul McAllister and Thomas Romeo, all of who I understand had a focus primarily on electrical services. I understand all of the gentlemen had ‘acclimatisation training’ to help them familiarise themselves with the layout and services in the new Hospital. I understand this was concluded in January and only after this, was access allowed to the hospital. Prior to handover, Jim Guthrie made up sheets to record water temperatures. He had not been instructed to do this, but apparently considered this as his responsibility and he assumed that he would be the person with day to day responsibilities for the water systems’ management at the hospital.

So, my conclusion was that Jim Guthrie would have been the ‘lead’ for water supported by Mr McMillan from time to time. Also, at the time of writing the report, Mr Guthrie was actually the formally appointed water lead, which tended to support my conclusion about the originally intended arrangement of responsibilities. Mr Guthrie, left the QEUH in February 2017 to take up a new role at the RAH. Mr Guthrie handed over responsibilities for water systems to Mr Romeo. There was, I understand, a fairly short, informal handover between Mr Guthrie and Mr Romeo due to the annual leave and time availability of both gentlemen when they were on site at the same time. The handover between the two gentlemen could have been more detailed. This change, together with other staff movements may have contributed to what I thought was a confusion of roles and of the associated responsibilities. Arguably, had the formal recommended structure for water management been in place at the start (i.e. before and at handover), this potential confusion could have been averted.

220 What review did you carry out of the post-holder's training in reaching the finding that none had been trained to an appropriate level?

A I didn't carry out a review. The information was provided to me by the individuals themselves. From this information I understand that there had been no formal appointments made into the technical management roles for the QEUH/RHC and the training on water management that some had received had mostly been in connection with previous positions held. This training had not apparently been refreshed appropriately in the recent past.

221 What level of training would you have expected to have seen?

A There should be a comprehensive training programme for all staff carrying particular formal responsibilities for specific technical systems. Each person should have appropriate training for the particular technical system and have their level of understanding tested. Their level of competence and familiarity with the system they are managing should be assessed by the independent Authorising Engineer and following the AE's endorsement, the person would be appointed in writing with their responsibilities listed and they would then respond in writing to formally accept the role. The person should then have refresher training periodically; normally at 3 yearly intervals to ensure they are up to date with relative information, changes in guidance standards and legislation etc.

222 Given that to your report expressly only deals in 'High level' findings, does that suggest there are also 'low-level' findings somewhere? What 'low-level' findings did you make and what action was taken in response?

A The high level findings were a result of what was a high level investigation. I did not follow every element forensically, nor did I extend the investigation by seeking to continue with a further series of interviews in addition to those that were initially set up. I indicate in the report that if further detail is required, (e.g. to be more exact about who had possession of the report and to what extent did they examine it and use it; whether there was definitely a connection between the Plan I had seen and the DMA Report(s) etc), a more detailed examination would be required. I triangulated and corroborated what I

could during the one interview that had been arranged with each individual, HR, Staff Side Representatives and Admin and obtained what I considered to be sufficient information to support the high level conclusions I arrived at in the report or, where I did not have full corroboration for information provided, I worked on the balance of probability I considered logical and appropriate. I used terms like, ‘may have been’, ‘appear to have’, ‘were apparently’, ‘would have possibly’, etc, to infer a degree of speculation I was using to arrive at what I thought to be reasonable conclusions. There are no ‘hidden’ details or ’low-level’ findings.

DMA Canyon Report 2015/ Action Plan

223 Who instructed for 2015 report to be carried out?

A During my investigation, I came across a minute of, from memory, a sub-committee (maybe a Technical Committee??) of the project team, which recorded that a Water Risk Assessment should be organised. I recall that person this action was allocated to was Ian Powrie, although, logically, it may have been a contractual obligation on Brookfield Multiplex to provide such an assessment as an assurance that they had delivered a system that was ‘safe and fit for purpose’. During a conversation with Mr Powrie, I recall asking him about this and he said he didn’t personally recall this ‘instruction’ from the meeting, but he was clear that it was actually him who organised and procured DMA to undertake the Risk Assessment. This is also recorded in the DMA Risk assessment report, confirming it was Mr Powrie that had been responsible for initiating the Assessment on 6th January 2015.

224 What what's the purpose of the report?

A The DMA Canyon report was a ‘Pre-occupancy L8 Risk Assessment’ for ‘NHS Greater Glasgow & Clyde South Glasgow University Hospital’.

225 In carrying out your investigation did you establish who is the report was delivered to? If so, provide details of your findings regarding who received the 2015 report and how the findings were delivered to them?

A Ian Powrie and Jim Guthrie, (as noted in the DMA report), I had also received uncorroborated information that Melville McMillan was also in attendance, but this could not be recollected by Mr McMillan. Mr Powrie indicated that he thought that the report was to be taken forward by David Bratty. Mr Bratty was not interviewed to confirm this or not.

226 Who was aware of the existence of the 2015 report when it was delivered in 2015?

A The DMA people handed over the document to Ian Powrie and Jim Guthrie, so, all of those people definitely knew about it. Others who may have had knowledge of the report at some point in time, (at least an expectation of the delivery of a report at some point), could have been David Loudon, (as I understand it was Mr Loudon that had communicated with Mr Powrie to ask him to proceed to get the Risk Assessment done): Possibly Mr McMillan, (possibly at the handover meeting, but personally, I think more likely not to have been at the handover meeting but likely at a later point in time): Possibly David Bratty, when he became Mr Romeo's line manager at the QEUH, (as I understand Mr Bratty had some formal role in the Board's water management and I was told that a copy of the report had been given to him, but this was not corroborated).

After the delivery of the report, I believe that Thomas Romeo may have become aware of the report (when he took over the focus on water systems when Mr Guthrie left the QEUH to go to the RAH), but Mr Romeo's knowledge of the Report may have been impaired because of the informality of the short handover between him and Mr Guthrie. I also believe Alan Gallacher and perhaps members of the Compliance Team became aware of the report, at a point in time after it was delivered, but I'm unsure when this awareness happened. It was clear to me for the information I gathered that the report had not been escalated by anyone to Ms Kane.

The DMA report records that the DMA Risk Assessors were, ‘assisted on site by Ciaran Kellegher of Mercury Engineering, Ian Powrie, Jim Guthrie, Mel McMillan and Brian Lavery’. So presumably, all of these people would have been aware that the report was being produced. The DMA report also indicated that there was, ‘Variable levels of knowledge (of the systems being surveyed) as the site survey (was) being carried out immediately after handover and (that) Estates staff (were) still in (their) familiarisation period’, inferring that the Estates staff still had a way to go to become ‘familiar’ with the site.

227 Where was the report stored?

A I don’t know where physical or electronic copies of the report were stored.

228 What in your opinion ought to have happened at QUEH/RHC and within the estates team following receipt of the 2015 report?

A Given that the report was a ‘pre-handover risk assessment’ one might have considered that the correction of some problems may have had implications for Brookfield Multiplex to resolve, (e.g. to resolve plant failures in the heating system, that may have been the source of some temperature variation in the Domestic Hot Water system; resolve the issues causing routine operational failure of the filtration plant; removal of dead-legs, identification of calorifiers and other actions that might have been contractual defects and therefore would have been appropriate for Brookfield Multiplex to resolve), but where actions were, for example, associated with adjustment of controls etc, the most practical solution might have been better resolved by the in-house team.

Either way, the actions on the recommendations should have been given to a delegated lead, (e.g. the person responsible for leading on water issues, e.g. the Responsible Person (Water) had there been such a formal appointment), to form an action plan and organise the appropriate people to act and resolve the issues being highlighted, with actions being possibly being prioritised with the level of risk associated and practicality of achieving the required actions. It

would be reasonable for the report to have had oversight and control of the action plan through the Water Safety Group (WSG), receiving periodic reports on the progress of the action plan. The WSG would also serve to act as a communication route to alert to the Infection Control, Microbiology and Clinician representatives on the WSG and, if considered appropriate, to escalate information to other committees, (e.g. the Infection Control Committee) and appropriate line managers. The WSG could then have made any additions to the Board's Risk Register if this was considered appropriate.

229 Who was responsible for instructing the works to be actioned following the report?

A I think that the responsibility for water system compliance was perhaps harmed by what appeared to me, to be the confusion about who was responsible for the report, which appeared, at least in some way, to have been transferred to the Compliance Team under Mr Gallacher. Mr Gallacher, I learned, became responsible for the training of staff on water systems in order to get them into a position where they could be appointed into the formal roles. The 2017 DMA Assessment makes similar comment and also suggests that the communications between Operational Estates and the Compliance Team were poor.

230 At paragraph 2.8 in your report you state that 'there is evidence that this (the action plan) included actions on water systems, some of which were apparently informed by the findings were recorded in the L8 risk assessment'.

A Some of the actions I had seen in the water plan for the campus (in a lever arch folder) were similar to actions that might have been appropriate to address some of the issues highlighted in the DMA Canyon report and I speculated that these could have been informed by the DMA Canyon recommendations. I cannot recall the detail, but I felt at the time, on the balance of probability, that there was a strong enough possibility to conclude that this had apparently been the case. See further on my response to Q231 part h), below.

231 What evidence did you see of the action plan? Did you have sight of an action plan?

A I personally saw the action plan, on paper, in a level arch folder. It was a full folder, (about 6-7cm thick). I leafed through the folder briefly and observed some of the content.

a) Who advised that an action plan had been formulated?

A It was provided to me by Phillis Urquhart who was a member of the Compliance Team.

b) Who prepared the action plan?

A I understand that Mr Guthrie and Ms Urquhart prepared the plan, perhaps with input from George Walsh and Garry Cullan. (See response to part h) below for further information).

c) What actions were included?

A I cannot recall the content in much detail.

d) Explain what actions, if any, were apparently informed by the findings of the 2015 report?

A I cannot recall the content in much detail.

e) When were these actions carried out?

A I cannot answer this question, however, I did note in the report, at the time of writing that a high percentage of the required actions (related to the DMA recommendations) had been completed.

f) Who provided information regarding the action plan and actions to you?

A Phillis Urquhart

g) What financial allocations were used to progress actions?

A I am unsure whether the additional funding that I was advised had been provided, was directly related to this action plan, (it may have been, perhaps,

but others would be better placed to provide this information). I understand from the information I gathered, that non-recurring funding had been provided to Estates from Finance and that actions to remove little used outlets and other water related improvements accounted for a proportion of the expenditure of this funding.

h) You identify that the 'timing of these actions may have overlapped the survey to inform the 2017 DMA gap analysis'. Explain your understanding of what actions had been carried out/ commenced and when they were commenced, leading to the overlap that you refer to.

A I knew from the 2017 DMA report that, the 2017 DMA Assessment had started on 8th Sept 2017, but it was not actually handed over until 25th April 2018. So, it had taken nearly 8 months to complete the assessment. I believe this had taken longer than perhaps initially envisaged, due to problems with trying to get access into the now occupied clinical areas. The 2015 DMA report had been handed over on the on 29th April 2015.

I learned from Ms Urquhart that Water Action Plans, 'were in place when she arrived at the QEUH', albeit, that they were on paper and 'a bit haphazard'. The Compliance Team moved to the QEUH from the RAH around November 2016. I therefore thought it possible that the L8 Action Plan that I had seen (in the lever arch file) had, in some form, been present at, or before November 2016. I understand that Mr Guthrie had then worked with Ms Urquhart, (perhaps, as had been suggested to me, with input from other members of Mr Gallacher's team, i.e. George Walsh and Garry Cullan) to tidy up the Action Plan and I understand that they also worked on the water monitoring and testing regime.

I concluded that this would have been in late-2016 / early to mid-2017, which was in advance of the start of the DMA assessment (on 8th Sept. 2017, which would lead to the 'DMA Canyon 2017 Risk Assessment Report'). Given these timings, I therefore speculated that any actions associated the L8 Action Plan (in the lever arch folder) could have been informed by the DMA 2015 report

and potentially, could have been in-train, being planned or taking place, overlapping the time when DMA were doing their assessment for their 2017 report. Actions suggested by the 'level arch' Action Plan may possibly have been delayed because of the focus on and pressing nature of the other demands (explained elsewhere) that were still being experienced in the Estates Department. Also, because of the timings, the 'lever arch' L8 Action Plan could not have been informed by the recommendations of the DMA 2017 report, because it had not physically been handed over until April 2018. All but 3 of the 502 actions relating to both DMA Assessments were completed by 7th November 2018.

i) Please explain and provide detail to the following statement within paragraph 2.8: 'the transition between incumbents' changing rules was fairly informal and of short duration and probably delaying the progress on actions.' What changing rules? How did this impact in delaying the progress on actions?

A I was referring primarily to the handover of responsibilities between Mr Guthrie to Mr Romeo. I understand that Mr Guthrie left the QEUH to go to the RAH in February 2017. Mr Romeo, whom I understand, had been working on Medical Gas and Vacuum and other Systems, was to take over responsibilities for water. A 2-week handover period was anticipated between Mr Guthrie and Mr Romeo, but this was apparently curtailed to 1 week due to Mr Guthrie being on annual leave for one of these weeks. I learned that Mr Romeo's attention was drawn to level-arch folders, but there was apparently no detailed scrutiny of their contents. I concluded that this could have delayed the response to the actions necessary to progress the 'lever-arch' Action Plan.

In addition, I understand that there were changes in responsibilities between Operational Estates and the Compliance Team (effectively between Mr Powrie and Mr Gallacher). Also, around April 2018, I understand that Mr Romeo was designated to move to the RAH (I understand, it took several months to finalise his move) and that Darryl Connor was the person who then took over water responsibilities for water from Mr Romeo. Mr Connor was, I

understand, taken off the shift pattern he was working in order to assume these responsibilities.

232 What formal management structure would you have expected to have seen in place at QEUH/RHC?

A I would have expected to see a structure, in relation to water, noted in the DMA Canyon Pre-Tender Risk assessment in Section 10 in the 'Management Structure' section, which reflected the SHMT 04-01 Part G and L8 guidance, also replicated by DMA in their report.

The requirements for Authorised Person / Responsible Person appointments were also factored into the Strategy that Mr Powrie had produced earlier, (mentioned elsewhere in my evidence)

233 What, if anything, was missing from the formal management structure at QEUH/RHC?

A I understand formal structure had been put in place in the QEUH/RHC for Electrical Systems, I believe, because of recommendations made by Mr Powrie, as he had recognised that, without this role being in place, the continuing function of the hospital would have been severely affected if the system failed without anyone in place to find faults and operate the HV switchgear. The formally appointed management structure had not been in place for the QEUH water systems at the time of handover and this situation prevailed for some time. In reading for preparing my responses to this questionnaire, I note that the Water Safety Group had noted actions relating to the training and appointment of various people in each of the Sectors of the Board, but this is only apparently directly addressed by the AE(W), (appointed around 7th August 2014 – ref WSG Minute of 7th Aug 2014), post hand over of the new hospital. The Board's revised Written Scheme and Water Policy which had been developed over a period of time, was just being 'rolled out', (ref 6th October 2015 Minutes of the WSG). Therefore, actions were in train to create a management structure but this had not apparently been delivered at the QEUH/RHC at the time of handover of the QEUH/RHC.

234 What was the consequence of this, if any?

A I believe this led to a confusion about who was responsible for what and the subsequent implications for the management of the associated risk and the governance oversight of the hospital's water systems. It would also have implications for statutory compliance.

235 What other competing priority demands delayed the level of response to the DMA canyon 2015 report?

A I refer to my response to Q216 above.

Source of contamination

236 Look up paragraph 2.9 of your report, what routine monitoring results did you review in carrying out your report?

A I was aware that pre-occupancy water testing had taken place prior staff and patients occupying wards and departments between March and July 2015. Water systems had been tested and if clear, had been signed off for occupation by Infection Control/ Microbiology. If there were any elevated TVC readings or the presence of microorganisms present, appropriate decontamination actions were employed, systems were flushed and then retested. When they were appropriately clear, they departments were approved for occupation by Infection Control/ Microbiology. I cannot recall the detail of the spreadsheets containing the results of routine testing I looked at, but from memory, these looked to be fairly good. The routine testing and monitoring had apparently been improved by work that had taken place between Mr Guthrie and Ms Urquhart and the Compliance Team in 2016/17. The samples, I believe, were however only typed for Legionella, Pseudomonas, E.coli and TVC which was the routine testing in place in every hospital in Scotland where water testing was being applied. Testing frequency had been increased as one reaction to the emerging circumstances of infections in 2018 and the scope of the microorganisms that were being typed from the samples was widened when it became apparent that other 'unusual' microorganisms might have been present. The fact that testing

frequency was increased is, I believe, further good evidence to demonstrate that a water testing regime was already in place and the water testing was an agenda item in the Water Safety Group and recorded in the minutes of this group and also at the IMT meeting.

237 What measure of assurance were you provided that patient infections had largely good results?

A I can't recall any detailed scrutiny of patient related infections by myself, other than in general, from information being reported at meetings etc. In 2023, I was shown the spreadsheets with the hospital's water test results tabulated, with hundreds of sample results, being typed for an increased number of microorganisms and they were 'all green'. This, I believe, demonstrated that the actions taken, e.g. testing flushing, installation of Chlorine Dioxide dosing system and all of the other positive improvements made to the control and physical attributes of the water systems had contributed to the improvement in confidence of the systems' safe operation and management.

238 What explanation do you a tribute to the higher than expected levels of patient infections?

A I am not really qualified to provide 'a scientific explanation' about infections nor am I aware of the definite source of every microorganism that cause specific patient infections. My understanding however, is that it is an unfortunate consequence of the medical condition of patients, e.g. because of being immuno-compromised, that they are more susceptible to contracting infection. The nature of the treatment provided by the QEUH/RHC, being the national centre of treatment for a range of treatments, means that there is a higher incidence of patients with highest potential for susceptibility to infection being cared for in this hospital. So, because of this, I understand it is difficult to draw a correlation between the treatment centres within NHS GGC and other general hospitals in Scotland as NHSGGC tends to be treating the 'most ill' and the 'most susceptible' in much greater numbers. It is therefore a more complicated benchmark. I personally believe therefore, that there is all the more reason to ensure, as much as possible, the environments being

provided are designed and maintained to the highest standard and to ensure the effective function and resilience of the systems installed to sustain the safest possible environment. The other components of maximising patient safety include the associated operating procedures infection control and clinical practices associated with the care of the patients to, as far as possible, reduce the infection risk through a route of direct or indirect contact with the patient. There are other possible implications for patient infection for patients that are largely at home and attend hospital as a day patient or are in hospital, then at home, then back in hospital for short periods. I understand that a lot of potentially harmful microorganisms are ubiquitous in the atmosphere of the public domain and patients that are at home possibly have have a greater risk of exposure to these potential problems.

I understand that a small number of patient infections could, due to the known time frame of the development (incubation period) of microorganisms, be recognised as being nosocomial, because the patients had only been in hospital during the time frame of the organisms' incubation period, (other witnesses are more qualified to provide information about these circumstances). All of that said, it is essential to ensure, as far as reasonably practicable, that any possible source of harmful microorganisms is minimised in order to reduce the possible risk to the patients and other occupants of the hospital premises. The fact that harmful microorganisms were present, would indicate that the environment they were in was compatible with conditions that allowed their survival and, if these microorganisms were in different parts of the system, this would suggest that the compatible environment was not localised.

The prediction about whether the microorganisms came from the water system or were seeded during construction by dirt getting into the system, or from bypassing the filtration system or perhaps through human contact into the system, or the design of the system that included dead legs, low flow in tanks and or expansion vessels, the cleanliness of water storage vessels, or temperature fluctuations caused by plant failure or the way systems were set

up or poor controls caused by signal cables being installed in the same compartments as power cables, or from potentially problematic materials in the water systems, or because of a delayed response to recommendations, or because of the internal components and/or the internal surface of taps or the breakdown of internal surfaces of cast-steel water system components, or insufficient flushing, or delays in identifying the size of the problem, e.g. that it was perhaps a much wider problem than that initially hypothesised, or by not having appointed, trained individuals specifically responsible for the management and oversight of the water systems, or having one large system instead of a number of smaller systems, or caused by the piece of brick that was removed from a pressure reducing valve, or the level of maintenance on the systems or because there was no dosing system installed as part of the original installation, potential back-flow issues and routes of contamination between the waste and potable water systems, the presence of flexible hoses with EPDM materials installed into the water systems to connect appliances etc, etc, I believe, is infinitely complex.

All of these issues have implications for the presence and possible proliferation of microorganisms, but to determine the proportion of each and all of these issues and the relative contribution of each, or the extent to which two or more of the issues worked together to produce the various problems experienced, is, I believe, infinitely difficult. It is considered that harmful microorganisms can be managed in a way that minimises the risk of harm. It is therefore essential that all of these individual elements are eradicated through the design, construction and management of the systems and appropriate professional arrangements are put in place at the right time and being immediately operationally effective, particularly when the systems are charged and that the risks of all of these issues. All of this would be helped, I believe, by the NHS being a better, ‘informed client’, with the necessary engineering experience, expertise and input, at senior management level, to recognise when anything other than high standards are not being applied. From my personal understanding, I would attribute, at least, all of the above to the incidence of higher than expected levels of patient infections.

239 At 2.9 you're write: ‘the subsequent investigation by the board identified Microorganisms not normally investigated for under the national standard monitoring regime common across the NHS in Scotland and although not categorically identified as the source of infection, were thought most likely.’

a) What subsequent investigations were carried out by the board, what evidence did you see of this in carrying out your investigations which form the findings of your report?

A There are routine monitoring activities carried out by Microbiology, which, if infections are identified that are giving concern, would then be considered in concert with a Programme Assessment Group (PAG). If appropriate an Incident Management Team (IMT), would be set up to investigate any concerning incidents more fully. I understand, these actions would be triggered by parameters set out in the National Infection Prevention and Control Manual. Routine HIIART reports are provided to, I understand, the Board’s Acute Infection Control Committee, (I understand this to be a ‘formal Committee of the Board’). In relation to Ward 2A&B, in addition to previous voiced concerns from clinical staff about the patient environment, I understand that concerns were heightened by the identification of ‘unusual’ microorganisms, over a period of time (2016-2017).

There were then a further high incidence of Blood Stream Infections identified (BSIs) in early to mid-2018 (i.e. 23 No. – Ref HPS Report of October 2018 Page 3). Following this, further investigations, (noted in the IMT minutes) were carried out, including the increased incidence of sampling and testing from different locations with the range of testing of the samples to look for less common microorganisms. I believe colleagues from Microbiology, Infection Prevention & control and Estates could provide more detail. Assistance was sought from HPS and form other national leaders in the field of Water science, e.g. Susanne Lee, Tim Wafer, Tom Makin and also with input from the Board’s independent Authorising Engineer (Water) Dennis Kelly. There were various Risk Assessments and as the knowledge and understanding increased enabled by the more intensive focus and testing decisions were

taken and actions employed to mitigate the emerging risks that were being identified. Audits of nursing practice and cleaning audits were carried out by Infection Prevention & Control to identify any related issues.

Later on in mid-2019, although unconnected with the time when I was writing my report, Scottish Water undertook an audit in relation to the Scottish Water Bylaws. They produced a report with a number of recommendations to correct installations where backflow of water could have been an issue and where there were locations where different categories of water could possibly have become connected, (e.g. Potable water systems in showers could have potentially been mixed with Waste Water systems because the shower hose was of a sufficient length to reach to a WC, potentially causing contamination to the potable water system). I was involved with assisting the Estates team with the prioritisation, monitoring and management of the Estates' team's actions to quickly achieve solutions on all of the recommendations. Later on in 2020 there was an investigation by the Infection Prevention & Control and Governance Subgroup - NHS Greater Glasgow and Clyde/Queen Elizabeth University Hospital Oversight Group, which produced a report with recommendations. Although produced at a later time to the writing of my report, the issues which these investigations commented on were potentially present at handover and had possibly been current at handover. These investigations may therefore be of interest to the Inquiry.

b) What microorganisms were tested for?

A At and after the early part of 2018, in addition to the routine testing of water samples for Legionella, E. Coli, Pseudomonas and TVC / Total Count, I understand that the following microorganisms were typed at one time or another: Acinetobacter Ursingii, Chryseomonas Indologenes, Cupriavidus Pauculus, Enterobacter Cloacae, Klebsiella Oxytoca, Klebsiella Pneumonia, Pantoea sp, Serratia Marcescens, Stenotrophomonas Maltophilia and specific strains of Pseudomonas, i.e. Fuorescens, Pseudomonas Putida. The list is perhaps not exhaustive. I am aware that fungi was also considered problematic at certain points in time and also Aspergillus was considered,

perhaps more in relation to ventilation as a possible source. Again, I would suggest Microbiology colleagues would be better placed to give information and detail about how many samples were tested for these microorganisms, when these were taken and the results observed. I learned that there had been an earlier incidence of patient infection in 2016 on ward 2A that Microbiology had determined that it was caused by Cupriavidus Pauculus, which was considered ‘unusual’. I understand that concern was raised when a second patient’s infection in late 2017 / early 2018 was also identified by Microbiology as being from Cupriavidus Pauculus. I believe that the Microbiologist ‘drew the line between these two dots’ and began further investigation to find out if this was present in the water system and if so, was this localised (which I understand, due perhaps to the incidence of this organism being ‘unusual’, was the initial theory). The initial theory was, I believe, altered when the incidence of Blood Stream Infections sharply increased between early to late 2018.

c) What microorganisms where identified?

A Others would be better placed to provide this detail about what, when and where. See response to Q239 part b) above.

d) What evidence did you see that these were most likely the source of infection?

A I cannot recall seeing detailed evidence that specifically identified a specific source of infection other than discussion about one or two patient infections which were being considered as possible nosocomial infections. I recall that there was ‘hypothesising’, presumably because of the difficulty of being certain about source. Initial investigations about cleaning and nursing practice accompanied water testing and investigation into ventilation and fabric issues in order to seek to understand possible sources.

e) Do you have any comment/ observations regarding microorganisms not having been tested for and the potential impact this may have had?

A The routine testing process that had initially been carried out (looking for Legionella, Pseudomonas, E.coli and assessing TVC) was in line with the testing regime that would have normally been applied in any other hospital. The typing of other microorganisms, that emerged over time in NHSGGC, e.g. Cupriavidus etc, would not have been applied.

To the best of my knowledge this more extensive typing is still not routinely typed elsewhere in other hospitals in Scotland. One might consider that further guidance might be helpful to clarify whether more extensive testing should be applied either routinely, periodically, or when the circumstances prevail that would make such testing necessary. If any wider typing is thought appropriate, some guidance about what circumstances would prevail in order to trigger such an investigation, what to type for etc. Also, some guidance about applicable precautions to take to minimise the potential and also to minimise the circumstances that might cause the proliferation of these 'unusual' microorganisms, if these precautions might be different from those employed to manage the potential for Legionella and Pseudomonas, which are currently being routinely applied. E.g. are any of these microorganisms more resistant to biocides like Chlorine Dioxide etc? Some action on this may already be in progress as I understand, from memory, that the Montgomery et al report, recommended that HPS give some consideration of this issue, which I understand might include some thought being given to alterations to the scope of water testing protocols.

240 What is evidence was there that the water system was filled with water that bypassed the installed filtration system prior to commissioning? If so, why what mechanism would the system have been filled bypassing the filtration system?

A I learned that this had been done from several people that I interviewed as part of my investigation. In addition, the 2015 DMA Risk Assessment identified that a water main by-pass had been left in the open position from a

point prior to handover to the time their Assessors had undertaken their assessment. I learned that the operation of the main filtration unit was very problematic, with frequent failures being experienced. It may have also have been the case that the bypass facility was utilised to keep the hospital operational. From memory, I think there may have been an issue with the functionality of the valves in or around the bypass pipework which perhaps affected the time it took to correct this anomaly. Others may have a more detailed recollection of these circumstances.

241 Who filled the water system with water and bypassed filter system?

A I understand the water systems were charged with water several months before handover by staff from Brookfield/Mercury Engineering, which was witnessed by a few NHS GGC Estates staff.

242 What would have been the purpose of doing this?

A I have not seen this detailed but I speculated that the systems would be filled in order that testing and commissioning could be carried out. Given that the 0.5 micron filtration plant was presumably provided a mitigation against the introduction of contaminants to the water systems, it is unclear what the 'logic' was, about bypassing the filtration unit to charge the system. I understand that filtration at 0.5 micron will remove most, if not all, microorganisms. Bypassing the filtration units could have been done to save time and expense. The filtration unit would presumably present a challenge (resistance) to the volume of water that would be required to fill to whole system, potentially slowing down the fill rate.

Had filters been utilised for the filling of the systems there may have been a concern that the filter media might have needed to be replaced during or after the charging process, with implications for expensive maintenance to elements of the plant. There could have been a consideration that any potential contamination introduced from the filling of the system would be dealt with by flushing and then dosing the system with a biocide. I heard that there had been dosing of the water systems but also heard that there had

been concerns expressed about the concentration of the biocide and the dwell time of the dose; both being too low. I appreciate that a lot of this is speculative but, it explains the thought process I applied when considering these circumstances.

The questions that, in my opinion remain however, are that, irrespective of the reason *why* the system was filled by bypassing the filtration units, is, why would it be thought okay to design in this filtration unit, presumably as a safety precaution, and then not utilising it for filling the system? Also, was there, as one might expect, any risk assessment to cover this action? It might be an excusable action, in an emergency situation, to sustain the operation of the hospital, but it is hard to contemplate how this action might be justified during the initial fill of the system. Hopefully, further clarity can emerge from the other evidence that is provided to the Inquiry about the detail of what happened when, and by whom.

243 Provide detail on how this could have encouraged dead legs/ temperatures out with acceptable limits?

A The bypassing of the filtration units would not have encouraged dead legs in the system, but there is a possibility that dead legs could have been seeded with contaminates in the unfiltered fill-water. DMA had identified a number of dead legs and other weaknesses in the system, (e.g. expansion vessels not being the 'flow through' type, dissimilar metals in the system construction and even instances of malleable-iron pipework and Cast-steel components, (which, I understand was apparently surveyed for by the contractor, but there was concern expressed about how effective this survey could have been without having removed the insulation covering the pipes etc)), and suggested that these may have been flushing points that had been installed at installation and left in place at handover. If that was the case, these original flushing points would have become pipework dead legs and therefore have the potential to contain stagnant water and therefore, have an increased risk of microbiological contamination with the potential to introduce these contaminants to the rest of the system.

Arguably, contamination via dirt and dust could have been introduced into the systems during construction. The HFS report recorded incidences where pipe end caps were missing from pipe-lengths used for the construction of water systems on the site. So, potentially, the systems could have been contaminated at the time of construction and perhaps then compounded by the filling of the system through the bypass pipework. It is difficult to determine the extent to which systems may have been contaminated because of this poor construction practice and site management, but the possibility must logically exist, if this was the case. The bypassing of the filtration units would not, I believe, have any significant impact on the temperature of the water in the system.

The reason for my conclusion about this is that the water fed through the bypass pipework would be at the same (or at a similar) temperature of water being fed into the water system through the filtration unit. The more likely circumstances that I think might lead to temperatures being outside normal running parameters within the water systems, would possibly be increased temperature of cold water intake from the public supply, compounded by temperature ‘pick-up’ from ‘heat generating’ plant and equipment and sensible heat-gains from the internal service routes etc, or a lack of flow in the system, possibly caused by improper balancing of water tanks or the lack or turnover in all or part of the water systems, or a problem with temperature controls or settings, or a failure of central heating plant, calorifiers, pumps etc. possibly causing a temperature variations in the systems.

In relation to the temperature of the incoming water mains supply, there is a known discrepancy between the standards applied by the Supply Authority and the NHS. The supply authority’s action trigger for cold water temperature is (from memory 3^{o}C-5^{o}C) above the 20^{o}C upper limit for cold water temperature recommended within the NHS guidance. This routinely presents an increased risk to hospitals during particularly hot summer weather when water can sometime be at or above 20^{o}C as it enters hospitals.

244 How did this, if at all, potentially impact the integrity of the water supply?

A See the response to Q242 and Q243 above.

Completion of water findings report

245 During the preparation of your report, did you come to form a view regarding the size of the water system installed at QEUH/RHC?

A No

246 Would multiple smaller systems have been beneficial? If so, why?

A Yes, I believe so. Whilst it would possibly have increased construction cost implications, a number of smaller systems would offer improved flexibility and resilience. It would also offer the opportunity to provide dedicated water supplies to departments where patients' care may be particularly affected if biocides, used to disinfect water systems, is allowed to affect the safe functionality of equipment and systems used to provide their treatments, e.g. Renal. Having the Renal department, for example, served from the same water system as the rest of the hospital means that special arrangements need to be employed to ensure that disinfectants being used in the main hospital's water system do not affect the operation of the Renal service. Further, any issues needing action that arise in a separate (smaller) water system could be contained to that system and not have any effect on other parts of the hospital. It would be easier to turn over water in smaller water systems than it is in a larger system, where any issue with the large, single system effectively affects the whole hospital.

247 When you completed your report who did you deliver it to?

A Jane Grant

248 Are you aware of your report having been shared with infection control staff? If so, who?

A No

249 Were you aware of concern is being raised by members of staff, clinical and/ or non-clinical, at NHS GGC regarding the operation and safety of the ventilation system in ward 2a? If so what where these concerns, when did you become aware of these concerns, and who held these concerns?

A When I started with NHSGGC in May 2018, I became aware, through conversations with Ms Kane and Mr Powrie, that there had been historical concerns about the ventilation systems provided in Wards 2A&B were not fit for purpose. This, I understand had been expressed by Dr Brenda Gibson. Over time, and at different times, through conversations, (few of which I recall specifically in detail about who and when), and reading of documents and reports, I learned that concerns had been expressed almost immediately after handover and these concerns had persisted over time.

250 What work are you aware of having been carried out following the recommendations in your report?

A I don't necessarily believe that work that was carried out was as a direct response to my report in particular.

I do know that a concerted effort was applied to clearing all of the actions recommended in the DMA Risk Assessments, when it was recognised that the recommendations had not received an appropriate response. These 502 actions were all concluded apart from 3 at November 2018.

Water Safety Group

251 Please set out your understanding of the requirement to have a water safety group in place for governing the water system at QEUH.

A It is a statutory requirement and this is reflected in the various guidance documents.

252 Was such a water safety group existence when you were first instructed to prepare a review of the DMA risk assessments at QEUH?

A Yes

253 From when was it in place?

A I cannot answer this question. From the Inquiry Bundle provided to me it appears that minutes have been noted of a WSG since October 2014.

254 Did you participate in the water safety group? From when?

A Yes. I was 'in attendance' at one meeting of the WSG in July 2019.

255 How will did the group function? Did the group achieve appropriate engagement among necessary participants?

A It appeared to me to function well enough from the short time that I was there. There was a multidisciplinary attendance at the meetings and all of the sectors of the Board were represented, feeding in from their own Sector Water Safety Groups. The agenda items appeared to be appropriate. I learned however that Dr Susanne Lee, in her report of April 2018, commented that, "the WSG as described within the scheme of control does not comply with the latest best practice guidance (WHO, HSG 274 and HTM 04-01) and is still very much geared to *Legionella*." Dr Lee made some recommendations in her report, suggesting a wider focus on other microorganisms, so, whilst it seemed to be functioning well in respect of Legionella precautions etc, there was always room for development and improvement. I cannot really comment about the appropriateness, or otherwise, of the participant's relationships, as it was difficult to ascertain this from attending one meeting.

256 Were its activities properly recorded?

A Yes. The meetings were minuted and Mr Gallacher used a 'spreadsheet system' (Smart-Sheet) as a tracker on the actions that were assigned by the WSG to the various participants.

257 What contributions did you make? **Page 108 within the water safety group bundle.**

A I was at the meeting to speak about a Water Safety Policy that I was reviewing and updating.

258 How effective was the group as a whole and contributing to the proper operation over the water system at QEUH?

A The agenda looked to be appropriate and actions were being taken forward, e.g. training of APs etc, but the measure of its timing of initiating and delivering actions, etc, in the light of hindsight and comments made by Dr Lee, could have been more effective.

259 Did it meet your expectations?

A I didn't personally focus much detailed attention to the effectiveness of the group at the meeting I attended. It did appear to function reasonably well in my view, but Ms Kane, I recall did express some frustration about the time it was taking to get actions delivered. There wasn't really anything that I recall that struck me as being particularly dysfunctional.

260 Please make any other comments which you feel appropriate regarding your experience of the water safety group.

A I don't feel that my time involved with the WSG was sufficient for me to draw any wider opinion than that already provided in my evidence.

Conclusion

261 Looking back, how would you assess your reports in respect of the ventilation system in ward 2a and water system QEUH/RHC?

A I'm assuming that what is being asked here is, 'am I satisfied with the ventilation and water reports' I produced? I feel it is unfortunate that I got confused with the ward layout in ward 2 and the names of the different parts of the ward. This contributed to some of the inaccuracies in the ventilation paper. In general, however, I feel that much of the comment might have been useful and may have stimulated consideration by others. In respect to the water paper, the process of gathering and considering the information available to me at the time, I still believe arrived at reasonable conclusions. With both papers, I did try my best to provide comment on what was to the best of my understanding at the time.

262 Are you pleased you took the role?

A Yes.

263 Do you regret taking the role?

A No.

264 How effective would you assess your involvement to have been?

A For others to assess perhaps, but I believe my involvement to have been largely positive and helpful. People were kind enough to express their appreciation of my input from time to time.

265 How much improvement were you able to see in water matters at QEUH/RHC since preparing your report?

A A marked improvement. The team did well to turn it round from where it was. I'm sure the team will be focussed on sustaining this position and they will recognise that there will always be areas that can be improved.

266 How much improvement were you able to see in ventilation matters within the ward 2A following your report?

A I don't believe that the improvements were made as a result of the report I produced, but the Estates Team did make significant improvements to the ventilation and wider patient environment in ward 2.

267 Which aspects you assess to still have required improvement?

A All aspects! Generally, there needs to be an attitude of continual improvement to always seek to improve the systems and the facilities to deliver the safest and most effective patient clinical environment. Specifically, the correction of many of the deficiencies that are still present in the building's plant and systems, (e.g. the efficient functionality of the energy centre including the CHP and cooling systems, Ventilation systems, etc.), might never be fully achieved, in my opinion.

268 Which aspects were you able to contribute to the most?

A During my time with NHS GGC I gave contribution to a wide range of issues.

269 Please comment on any other matters which seem to you important.

A I think may of the weaknesses related to this and other major capital projects are significantly impacted from people in decision-making and leadership positions not having Hospital Engineering competence or expertise, particularly on the Client staff at Senior Level. An under-appreciation of the essential nature and need for statutory compliance of hospitals' engineering systems; the associated risk and the skills and resources that need to be deployed to liaise with contractors and then carry the associated statutory responsibilities and accountability for the safe operation and maintenance of the installations, inevitably contribute to poor decision making. This is particularly the case when their comprehension of the detail and subtleties of technical guidance is absent or sub-optimum. This can lead to derogations, without fully appreciating the possible impact of these actions. There is currently a particular shortage of experienced senior hospital engineering professionals. NHS Assure may increasingly help to plug the gaps on the Client team's expertise, but I think it would be a significant help if the Client was 'an informed client'. If thought important (or essential), it would help if there was a development of the skill sets of suitably qualified individuals in each of the Scottish Health Boards to take up these suggested leadership roles.

The level of operational preparedness, I believe, needs to vastly improve, with sound, safe operational arrangements and operational systems in place and tested end-to-end before any hospital reaches handover.

I think there needs to be a significant improvement in record keeping and in the detail contained in the records, such that a clear audit trail is provided, particularly of decisions taken, who took the decision and who is accountable for the decisions, the reason for the decision, e.g. what is the objective of the decision, what other options were considered and the reason why those were

rejected, what risks are considered to be associated with the decisions being taken, etc.

Technical systems that are relied upon to ensure safe and effective operation of the maintenance function need to be in place and populated with the necessary data prior to handover. These systems should be effectively commissioned and tested, end to end by the client's technical representatives to ensure appropriate functionality.
Ideally, some influence should be afforded to those who will maintain the hospital, in relation to the quality of the assets being procured to enhance the longevity of efficient and effective operation of assets and fabric.

The appointment of technical roles should happen at an early stage and the level of training and familiarisation provided should be sufficiently intensive to allow those appointed to satisfy the Authorising Engineer of their competence to take up the roles and responsibilities of their appointments at an early stage, before handover, in order that the handover does not inhibit effective patient and staff safety or maintenance activities.
Adequate resources (Human and Financial) need to be more accurately defined to determine the optimum levels that will be required to safely maintain systems and processes. This may perhaps require some relaxation of the Scottish Futures Trust's construction benchmarks.

Declaration

I believe that the facts stated in this witness statement are true. I understand that proceedings for contempt of court may be brought against anyone who makes, or causes to be made, a false statement in a document verified by a statement of truth without an honest belief in its truth.

The witness was provided with the following Scottish Hospital Inquiry documents for reference when they completed their questionnaire statement.

Appendix A

A43293438 – Bundle 6 - Miscellaneous Documents
A47390519 – Bundle 11 - Water Safety Group
A47069198 – Bundle 12 - Estates Communications
A43872137 - Discussion - Review of Issues Relating to Hospital Water Systems' Risk Assessment alias.
A41602105 - 2018-10-01 2A Ventilation Findings. - JL Comment Ver Final alias.