**Scottish Hospitals Inquiry**

**Witness Statement of**

**Stewart McKechnie**

## Introduction

1. My name is Stewart McKechnie. My address for the purposes of this Inquiry is c/o BTO Solicitors LLP, 48 St Vincent Street, Glasgow G2 5HS.

2. This statement has been prepared for the Scottish Hospitals Inquiry to inform them of my involvement from the stage of the Full Business Case (FBC) being submitted though construction of the New Royal Hospital for Sick Children and Young People and Department of Clinical Neurosciences in Edinburgh (RHCYP/DCN).

## Professional Background

3. I have been qualified as an engineer now for over 40 years, working within mechanical and electrical engineering, however my specialism lies more towards the mechanical side. I have been a member of the Chartered Institute of Building Services Engineers (C.I.B.S.E.) for around the same length of time and a member of the Institute of Healthcare Engineering and Estate Management and Energy (IHEEM) for over 20 years. I am also registered as an Incorporated Engineer with the Council of Engineering (CEI).

4. I am employed at TÜV SÜD Ltd as a principal engineer. I previously had the title of “director” which is an engineering title within TÜV SÜD Wallace Whittle (TSWW). The term “director”, just to make clear, was used more as a seniority term, rather than inferring that I was a full director and registered as such in Companies House. The company Wallace Whittle, at the time of the RHCYP/DCN project, was owned by TÜV SÜD, but they have since had a management buyout. At the point where TÜV SÜD and Wallace Whittle parted company, I elected to remain with TÜV SÜD to assist them with various

legacy engineering issues that were ongoing at that time. Although TÜV SÜD are a huge company they do not have the same type of engineering expertise as Wallace Whittle, who were the only building services engineers that they had.

5. I worked in Wallace Whittle from 1975 until 1980 when I moved on to work with another company called Donald Smith before being invited to re-join Wallace Whittle in 1982 where I remained and progressed up the ladder to director

6. I have worked on a vast range of different types of projects, as Wallace Whittle covered quite a broad spectrum, from commercial buildings, offices, data centres, to more public sector and government work where I worked on schools and universities. I have also worked on a number of shopping/retail centres such as Buchanan Galleries and Princes Square, Glasgow and St. James Centre, Edinburgh. My work within healthcare settings has been varied as well, working on Balfour Hospital, Orkney; Craig Dunain Hospital, Inverness; Aberdeen Royal Infirmary; Queen Elizabeth University Hospital, Glasgow; Golden Jubilee Hospital, Clydebank, and Ailsa Hospital in Ayr. There will be others, but I cannot recollect them at this time. I have covered a wide range of projects, not specialising in any one area, so gaining a wide range of experience across numerous construction sectors.

## **Overview**

7. This section seeks to give a brief recap of my roles and responsibilities as lead of the Building Services Designs during the design and construction stage of the RHCYP/DCN. I will address the following themes:

    - My Role from Financial Close to Commissioning Building Services
    - The Design Process
    - The Reviewable Design Data (RDD) Process
    - The Environmental Matrix (EM) Review Process
    - Instructed Design Changes

- 4 Bed Ward Ventilation Review and Subsequent Alterations
- Site Installation Works
- Involvement in Commissioning
- Involvement with the Independent Advisor
- Rejection of the Critical Care Unit
- Opening of the RHCYP/DCN

**My Role from Financial Close to Commissioning Building Services**

8. I was the Building Services Design lead for the TSWW design team and as such was involved in core decisions affecting the Mechanical, Electrical and Public Health (MEP) services, timetables of information production and resource level requirements to achieve target dates for information issue, etc.

9. I am of a Mechanical Engineering background so whilst comfortable with Mechanical and Public Health Design matters, I was assisted by Senior Electrical Engineers on matters out with my specialist knowledge.

10. Following the successful achievement of Financial Close we embarked upon preparing the detailed design for all elements of the necessary Building Services designs comprising the MEP Installations and finalisation of the Environmental Matrix (EM).

11. It had been agreed by Integrated Health Solutions Ltd (IHSL) and Multiplex Construction (Europe) Limited (MPX) that all elements of the Building Services Detail Designs and EM were to be classified as Reviewable Design Data (RDD). I believe NHS Lothian (NHSL) was involved in that decision. We therefore engaged with the review team consisting of NHS Lothian (NHSL) and their advisors Mott McDonald Ltd (MML) in the RDD process managed and recorded by MPX. We engaged on the basis that our designs were to be subject to RDD and our designs always refer back to our drawings rather than the EM.)

**The Design Process**

12. Prior to FBC we had produced and submitted our outline design drawings which in the case of the ventilation systems confirmed the scope and strategy of the proposed ventilation systems. The ventilation drawings were outline only at this stage and still had to be fully developed. The drawings provided an indication of the areas to be mechanically ventilated which outlined the general scope of our proposals. The drawings themselves, at that time, required further development to show the finalised details of ductwork sizing, grille selection, plant selection. They would also require to be developed to show the detailed co-ordination (or interface) with other services to be installed.

13. A copy of Drawing Number WW-SZ-01-PL-524-001 **(A32479467 – WW-SZ-01-PL-524-001 - Bundle 13, Volume 6 – Page 6)** which shows a typical ventilation strategy is attached as illustrative of the outline nature of the design. A full set of strategy drawings were prepared and submitted at the time. Each one of the strategy drawings is compliant with the guidance in SHTM 03-01.

14. The RDD process is a relatively standard procedure where the designer presents their proposals for comment or approval (or both) from NHSL and their Technical Adviser. Design proposals are then revised in line with any comments before being signed off and then sent to the Contractor for preparation of their fabrication drawings.

15. At this point (financial close) we hadn't commenced our design calculations as we needed to have the Architects' BIM model. This is a 3-dimensional layout of the building which is then shared and developed with all of the designers. Upon receipt of the Architects' BIM Model we proceeded to:

    A. Calculate the airflows for each room utilising the Air Change rates as per the current Environmental Matrix (the version which formed part of the Project Agreement at financial close). We used those Air Change rates

as we understood they formed part of NHSL's brief and were therefore part of the Board's Contract Requirements (BCRs)

B. Map the routings of the necessary ductwork from the rooms back to the appropriate Plantroom.
C. Calculate the system total air volumes and system resistance to allow ductwork sizing and plant selection.
D. Prepare plant schedules for grilles, fans, Air Handling Units (AHUs) etc. (Sample copies are attached).

16. Schedules of the developed Ventilation Design Information are attached to this Statement. The actual drawings and documents are contained in the Aconex system which we understand the Inquiry has access to. I have appended an index of documents which are relevant to my evidence.

17. After Completion of our Detail Design proposals the developed information was then submitted to NHSL and their advisors within the Reviewable Design Data (RDD) Process. This Process was an ongoing series of submissions, written comments, and review meetings over a number of months.

18. A list of all the submitted ventilation drawings is as follows:

- Core 2 Sheet 1 Bed Lobby Smoke Extract Ventilation System Levels 00,01 & 02
    - WW-SZ-SL-PL-524-001 **(A47045054 - WW-SZ-SL-PL-524-001 – Bundle 13, Volume 6 – Page 7)**
- Core 2 Sheet 2 Bed Lobby Smoke Extract Ventilation System Levels 03 & 04
    - WW-SZ-SL-PL-524-002 **(A47043061 - WW-SZ-SL-PL-524-002 - Bundle 13, Volume 6 – Page 8)**
- Core 3 Sheet 1 Bed Lobby Smoke Extract Ventilation System Levels 00, 01 & 02
    - WW-SZ-SL-PL-524-003 **(A47042980 - WW-SZ-SL-PL-524-003 - Bundle 13, Volume 6 – Page 9)**

- Core 3 Sheet 2 Bed Lobby Smoke Extract Ventilation System Levels 03 & 04
    - WW-SZ-SL-PL-524-004 **(A47043082 - WW-SZ-SL-PL-524-004 - Bundle 13, Volume 6 – Page 10)**
- General Ward - Ventilation Amendments Proposal
    - WW-SZ-XX-DC-XXX-010 **(A39975868 – General Ward – Ventilation Amendments Proposal – 27 July 2018 – Bundle 2 – Page 1390)**
- Intra Operative MRI Room/ Theatre Ventilation
    - WW-SZ-SL-DC-500-005 **(A47044178 - WW-SZ-SL-DC-500-005 - Bundle 13, Volume 6 – Page 18)**
- Level 02 Isolation Room Ventilation Schematic
    - WW-XX-SL-SC-524-004 **(A38137476 – 4.1.4 WW-XX-SL-SC-524-004 - Bundle 13, Volume 6 – Page 19)**
- Level 03 Isolation Room Ventilation Schematic Sheet 1 of 2
    - WW-XX-SL-SC-524-005 **(A38137478 – 4.1.5 WW-XX-SL-SC-524-005 - Bundle 13, Volume 6 – Page 20)**
- Level 03 Isolation Room Ventilation Schematic Sheet 2 of 2
    - WW-XX-SL-SC-524-006 **(A38137487 – 4.1.6 WW-XX-SL-SC-524-006 - Bundle 13 – Page 21)**
- Level B1 Ventilation Distribution
    - WW-SZ-B1-PL-524-001 **(A36636510 – 32-WW-SZ-B1-PL-524-001-FT_(A1) - Bundle 13, Volume 6 – Page 22)**
- Magnetic Resonance Imaging & Computing Tomography Ventilation, Cooling and Quench Requirements
    - WW-SZ-SL-DC-500-001 **(A36069687 – WW-SZ-SL-DC-500-001 stamped B - Bundle 13, Volume 6 – Page 46)**
- Magnetic Resonance Imaging Ventilation Schematic AHU 02-22
    - WW-SZ-SL-SC-524-008 **(A47044067 - WW-SZ-SL-SC-524-008 - Bundle 13, Volume 6 – Page 47)**
- Typical Operating Theatre Ventilation Schematic
    - WW-SZ-SL-SC-524-007 **(A38138160 – 1.1.1 WW-SZ-SL-SC-524-007 - Bundle 13, Volume 6 – Page 48)**

- Zone Z2 Level 00 Ventilation Distribution
    - WW-Z2-00-PL-524-001 **(A38137955 – 7.1.2 ww-z2-00-PL-524-001 - Bundle 13, Volume 6 – Page 49)**
- Zone Z2 Level 01 Ventilation Distribution
    - WW-Z2-01-PL-524-001 **(A38137915 – 7.1.1 WW-Z2-01-PL-524-001 - Bundle 13, Volume 6 – Page 50)**
- Zone Z2 Level 02 Ventilation Distribution
    - WW-Z2-02-PL-524-001 **(A47044134 - WW-Z2-02-PL-524-001 - Bundle 13, Volume 6 – Page 51)**
- Zone Z2 Level 03 Ventilation Distribution
    - WW-Z2-03-PL-524-001 **(A47079880 - WW-Z2-03-PL-524-001 - Bundle 13, Volume 6 – Page 52)**
- Zone Z2 Level 04 Plantroom 1 & 2 Ventilation Schematic
    - WW-Z2-SL-SC-524-001 **(A47044085 - WW-Z2-SL-SC-524-001 - Bundle 13, Volume 6 – Page 53)**
- Zone Z2 Level 04 Ventilation Plantroom 1
    - WW-Z2-04-PL-520-001 **(A36636385 – 71-WW-Z2-04-PL-520-001 (1) – Bundle 13, Volume 6 – Page 54)**
- Zone Z2 Level 04 Ventilation Plantroom 2
    - WW-Z2-04-PL-520-002 **(A36636384 – 72-WWZ2-04-PL-520-002 (1) - Bundle 13, Volume 6 – Page 55)**
- Zone Z3 Level 00 Ventilation Distribution Sheet 1 of 2
    - WW-Z3-00-PL-524-001 **(A47040357 - WW-Z3-00-PL-524-001 Bundle 13, Volume 6 – Page 56)**
- Zone Z3 Level 00 Ventilation Distribution Sheet 2 of 2
    - WW-Z3-00-PL-524-002 **(A38137938 – 7.1.3 WW-Z3-00-PL-524-002 - Bundle 13, Volume 6 – Page 57)**
- Zone Z3 Level 01 Ventilation Distribution Sheet 1 of 2
    - WW-Z3-01-PL-524-001 **(A45046667 – WW-Z3-01-PL-524-001 REV G - Bundle 13, Volume 6 – Page 58)**
- Zone Z3 Level 01 Ventilation Distribution Sheet 2 of 2
    - WW-Z3-01-PL-524-002 **(A38138200 – 1.1.3 WW-Z3-01-PL-524-002 - Bundle 13, Volume 6 – Page 59)**

- Zone Z3 Level 02 Ventilation Distribution Sheet 1 of 1
    - WW-Z3-02-PL-524-004 **(A47044076 - WW-Z3-02-PL-524-004 - Bundle 13, Volume 6 – Page 60)**
- Zone Z3 Level 02 Ventilation Plantroom Layout Sheet 1
    - WW-Z3-02-PL-520-001 **(A38138052 – 7.1.11 WW-Z3-02-PL-520-001 - Bundle 13, Volume 6 – Page 61)**
- Zone Z3 Level 02 Ventilation Plantroom Layout Sheet 2
    - WW-Z3-02-PL-520-002 **(A38137968 – 7.1.12 WW-Z3-02-PL-520-002 - Bundle 13, Volume 6 – Page 62)**
- Zone Z3 Level 02 Ventilation Plantroom Layout Sheet 3
    - WW-Z3-02-PL-520-003 **(A38137491 – 4.1.16 WW-Z3-02-PL-520-003 - Bundle 13, Volume 7 – Page 1186)**
- Zone Z3 Level 02 Ventilation Plantroom Layout Sheet 4
    - WW-Z3-02-PL-520-004 **(A38137506 – 4.1.17 WW-Z3-02-PL-520-004 - Bundle 13, Volume 6 – Page 63)**
- Zone Z3 Level 03 Ventilation Distribution Sheet 1 of 2
    - WW-Z3-03-PL-524-001 **(A33656591 – WW-Z3-03-PL-524-001 - Bundle 13, Volume 6 - Page 64)**
- Zone Z3 Level 03 Ventilation Distribution Sheet 2 of 2
    - WW-Z3-03-PL-524-002 **(A45043666 – ww-z3-03-pl-524-002 REV G - Bundle 13, Volume 6 – Page 65)**
- Zone Z3 Level 04 Plantroom Ventilation Schematic
    - WW-Z3-SL-SC-524-001 **(A47041661 - WW-Z3-SL-SC-524-001 - Bundle 13, Volume 6 – Page 66)**
- Zone Z3 Level 04 Ventilation Distribution Sheet 1 of 2
    - WW-Z3-04-PL-524-001 **(A47044143 - WW-Z3-04-PL-524-001 - Bundle 13, Volume 6 – Page 67)**
- Zone Z3 Level 04 Ventilation Distribution Sheet 2 of 2
    - WW-Z3-04-PL-524-002 **(A47044163 - WW-Z3-04-PL-524-002 - Bundle 13, Volume 6 – Page 68)**
- Zone Z3 Level 04 Ventilation Plantroom Layout
    - WW-Z3-04-PL-520-001 **(A38137522 – 4.1.18 WW-Z3-04-PL-520-001 - Bundle 13, Volume 6 – Page 69)**

- Zone Z3 Level 2 Plantroom Ventilation Schematic Sheet 1
    - WW-SZ-SL-SC-524-001 **(A47039904 - WW-SZ-SL-SC-524-001 - Bundle 13, Volume 6 – Page 70)**
- Zone Z3 Level 2 Plantroom Ventilation Schematic Sheet 2
    - WW-SZ-SL-SC-524-002 **(A47042950 - WW-SZ-SL-SC-524-002 - Bundle 13, Volume 6 – Page 71)**
- Zone Z3 Level 2 Plantroom Ventilation Schematic Sheet 3
    - WW-SZ-SL-SC-524-003 **(A47042937 - WW-SZ-SL-SC-524-003 - Bundle 13, Volume 6 – Page 72)**
- Zone Z3 Level 2 Plantroom Ventilation Schematic Sheet 4
    - WW-SZ-SL-SC-524-004 **(A47042967 - WW-SZ-SL-SC-524-004 - Bundle 13, Volume 6 - Page 73)**
- Zone Z4 Level 00 Ventilation Distribution Sheet 2 of 2
    - WW-Z4-00-PL-524-002 **(A35910398 – WW-Z4-00-PL-524-002 - Bundle 13, Volume 6 – Page 74)**
- Zone Z4 Level 00 Ventilation Distribution Sheet 1 of 2
    - WW-Z4-00-PL-524-001 **(A38137532 – 4.1.15 WW-Z4-00-PL-524-001 - Bundle 13, Volume 6 – Page 75)**
- Zone Z4 Level 01 Ventilation Distribution Sheet 1 of 2
    - WW-Z4-01-PL-524-001 **(A33656602 – WW-Z4-01-PL-524-001 - Bundle 13, Volume 6 – Page 76)**
- Zone Z4 Level 01 Ventilation Distribution Sheet 2 of 2
    - WW-Z4-01-PL-524-002 **(A47042148 - WW-Z4-01-PL-524-002 - Bundle 13, Volume 6 – Page 77)**
- Zone Z4 Level 02 Ventilation Distribution Sheet 1 of 2
    - WW-Z4-02-PL-524-001 **(A38137490 – 4.1.11 WW-Z4-02-PL-524-001 - Bundle 13, Volume 6 – Page 78)**
- Zone Z4 Level 02 Ventilation Distribution Sheet 2 of 2
    - WW-Z4-02-PL-524-002 **(A38137517 – 4.1.12 ww-z4-02-pl-524-002 - Bundle 13, Volume 6 – Page 79)**
- Zone Z4 Level 03 Ventilation Distribution Sheet 1 of 2
    - WW-Z4-03-PL-524-001 **(A33656609 – WW-Z4-03-PL-524-001 (1) - Bundle 13, Volume 6 – Page 80)**

- Zone Z4 Level 03 Ventilation Distribution Sheet 2 of 2
    - WW-Z4-03-PL-524-002 **(A33656595 – WW-Z4-03-PL-524-002 (1) - Bundle 13, Volume 6 – Page 81)**
- Zone Z4 Level 04 Ventilation Distribution Sheet 1 of 2
    - WW-Z4-04-PL-524-001 **(A47042918 - WW-Z4-04-PL-524-001 - Bundle 13, Volume 6 – Page 82)**
- Zone Z4 Level 04 Ventilation Distribution Sheet 2 of 2
    - WW-Z4-04-PL-524-002 **(A47068812 - WW-Z4-04-PL-524 -002 - Bundle 13, Volume 6 – Page 83)**

19. Those drawings relevant to the ventilation serving the critical care and haematology/oncology departments are:

- Zone Z2 Level 00 Ventilation Distribution
    - WW-Z2-00-PL-524-001 **(A38137955 – 7.1.2 ww-z2-00-pl-524-001 - Bundle 13, Volume 6 – Page 49)**
- Zone Z3 Level 00 Ventilation Distribution Sheet 1 of 2
    - WW-SZ-SL-SC-524-004 **(A47042967 - WW-SZ-SL-SC-524-004 - Bundle 13, Volume 6 – Page 73)**
- Zone Z4 Level 00 Ventilation Distribution Sheet 2 of 2
    - WW-Z4-00-PL-524-002 **(A35910398 – WW-Z4-00-PL-002 - Bundle 13, Volume 6 – Page 74)**
- Zone Z4 Level 00 Ventilation Distribution Sheet 1 of 2
    - WW-Z4-00-PL-524-001 **(A35910617 – WW-Z4-00-PL-524-001 (1) - Bundle 13, Volume 6 – Page 84)**
    - WW-Z3-00-PL-524-001 **(A36051268 – Marked Up Vent Drawings, page 2 - Bundle 13, Volume 6 – Page 85)**

20. All sleeping accommodation not treated as Isolation Rooms was provided with 4A/C as set out in the EM. Had we been asked to adopt 10 A/c then the systems would have required a redesign. We were not involved in later changes so I have no detail of those.

**The Reviewable Design Data (RDD) Process**

21. We are very familiar with the RDD process in both healthcare and commercial projects. The basic format is that the designer, usually (but not always) acting on behalf of a Building Contractor, submits their design proposals to the client's technical adviser for review. The technical adviser then scrutinises the proposals for their compliance with the design brief or contractor's proposals. Any comments made by the technical adviser would require to be resolved to the client team's satisfaction prior to construction.

22. This is a standard process in the building industry and a process we have had experience of on both sides of the table, as presenter and as reviewer.

23. In the normal process we would expect to review of aspects of the proposals and after issuing commentary we would only expect to revisit the queried aspects of the proposals. This would be repeated until the party approving the design was satisfied and was able to give the designs the appropriate sign off and the agreed and recognised categorisation.

24. In this instance it did not appear to work in the same way with the various reclassifications and later comments on material which had previously been approved.

25. My understanding now is that the reason for this approach was that the submissions with the EM were subject to ad hoc reviews and were reviewed in full (rather than just the unacceptable elements being reviewed). We were not aware of that approach at the time. I did offer, on at least two occasions, to provide a line-by-line review to try to move past the stalemate we were in but this was not accepted by the client team. I accept it would have been a very time-consuming process and I believe the client team did not have the resources to commit to that.

26. The RDD process required us to prepare our detailed design drawings which were then submitted to MPX for them to review. If MPX were satisfied with the

content, the drawings were then forwarded to the NHSL Team for review and classification. This was done through the Common Data Environment (CDE) or Aconex.

27. This classification consisted of attributing a status to each drawing, being either:

    A. Accepted - No Comment.
    B. Accepted - Subject to noted comments being addressed.
    C. Rejected – Revise and resubmit.

    My understanding of the NHSL review was that they checked the designs submitted met their Operational Functionality requirements which covered performance, control and maintainability of the systems.

28. These classifications were recorded by physical stamps separately provided by both NHSL and MPX. The stamps recorded the classification and were dated, scanned, and distributed via Aconex.

29. Status A or B drawings documents were then issued to the Contractor classified as “Construction Issue” to allow them to prepare their own construction drawings.

30. To aid the RDD process, we attended regular (I think they were weekly) meetings with the NHSL review team where we answered any questions they may have had about the current information being commented upon. MPX managed and recorded the outcomes of these meetings and as far as I can recall they took notes of the proceedings. The review team’s comments were captured by either accompanying emails or “marked up” copies of the submitted drawings.

31. Management of these technical submittals was formalised by use of CDE (Aconex) managed by MPX but accessible to all involved parties, this recorded drawing issue dates, recipients, status, etc.

32. Following successful submittal and categorisation of our Ventilation Design Information, the documents were then issued by MPX via the Aconex system to their Building Services Partners, Messrs Mercury Engineering (Mercury Engineering). Upon receipt, Mercury Engineering would then have prepared their own Contractor's Installation details. Part of Mercury Engineering's Contract information issue was the preparation and submission of Technical Submissions which would have included proposed manufacturers details of Grillage, Fans, Filters and AHUs etc. This was a process managed by MPX and Mercury Engineering and the submitted information should be recorded and available via the contract Aconex account.

**The Environmental Matrix (EM) Review Process**

33. The review process for the EM was included within the RDD workshops with the same commenting and status stamping being applied. To my mind, the anomaly in the process was that instead of following the normal evolving designation of "A" or "B" status' and then moving to construction issues, the EM received reversals of previously agreed classifications. An example of this issue was that revision 7 of the EM was issued by us on the 19/09/2016; **(A34225612 – 2.7_0105_20161114 WW-XX-XX-DC-XXX-001 rev 07 v22 - Bundle 13, Volume 6 – Page 86)** the previously reviewed revision of this EM had received a status B. On the issue of revision 7 though, this version was now given a status C classification on the 27/10/2016 but was then given a status B on the same day despite not being updated in any way.

34. It was not entirely clear that the change in status was in respect only of additional comments made by NHSL although it seems that the "flip-flopping" on the status of the EM was to allow IHSL to both progress approved design elements whilst addressing non-compliant elements at the same time. None of the concerns raised by NHSL at this time related to non-compliance linked to air change rates or pressure regimes in critical care rooms.

35. Over the course of the project, the table below shows the summary of the status received on the EM:

| **date Modified** | **Document No** | **Revision** | **Status** |
|---|---|---|---|
| 11/02/2016 | WW-XX-XX-DC-XXX-001 **(A34225512 - WW-XX-XX-DC-XXX-001 rev 01 v8 – Bundle 13, Volume 7 – Page 1187)** | 01 | Status C |
| 21/04/2016 | WW-XX-XX-DC-XXX-001 **(A32793987 - WW-XX-XX-DC-XXX-001 (Rev 05) - Bundle 13, Volume 6 – Page 134)** | 05 | Status B |
| 27/10/2016 | WW-XX-XX-DC-XXX-001 **(A34225569 - WW-XX-XX-DC-XXX-001 rev 07 v20 – Bundle 13, Volume 6 – Page 180)** | 07 | Status C |
| 16/11/2016 | WW-XX-XX-DC-XXX-001 **(A34225569 – 2.7_0097_20161017 WW-XX-XX-DC-XXX-001 rev 07 v20 - Bundle 13, Volume 6 – Page 180)** | 07 | Status C |
| 16/11/2016 | WW-XX-XX-DC-XXX-001 **(A32793988 - WW-XX-XX-DC-XXX-001 (Rev 7) – Bundle 13, Volume 6 – Page 228)** | 07 | Status B |
| 20/07/2017 | WW-XX-XX-DC-XXX-001 **(A32623051 - WW-XX-XX-DC-XXX-001 (Rev 9) - Bundle 13, Volume 6 – Page 276)** | 09 | Status B |

| | | | |
|---|---|---|---|
| 23/11/2017 | WW-XX-XX-DC-XXX-001 **(A32623055 - WW-XX-XX-DC-XXX-001 (Rev 11) – Bundle 13, Volume 6 – Page 332)** | 11 | Status B |

36. All of this made the processing of this document, in my opinion, far more complicated than it could or should have been which led to a prolonged process which didn't align with our understanding of the purpose of the document or review process. My expectation, borne of my experience, was that the RDD would be a one shot process after Status B (or higher) was given with any further comments only being made by exception due to a change in client instructions for example in terms of room layout or use. In previous experience it was normal to have had the whole package reviewed and commented on at one time. On reflection, and in hindsight, it seems to me that things were being reviewed on an ongoing basis was due to the limited time being spent on the documents by the Technical Advisory team although that was not something I was aware of at the time. It may be that others were involved in the process but we dealt directly with NHSL and the Technical Advisors alone.

37. We would also point out that whilst we gave the document 11 revisions; these were notations to assist our internal processes. The records indicate that only five iterations were reviewed and classified by the Board. These iterations would have in some instances included alterations to suit instructed design changes.

38. Notwithstanding the apparent confusion regarding the management of the EM document there were no comments nor alterations to the core Design Figures and accordingly there were no changes made to the supply Air Change from the first to last version of the EM. The following table demonstrates this:

| | | | | Fresh Air Quantity Altered? | | | | |
|---|---|---|---|---|---|---|---|---|
| **Document No** | **Title** | **Revision** | **Date Modified** | **Single Bed Isolation Cubicle** | **Single Bed Cubicle** | **Open Plan Bay (4 Beds):** | **Open Plan Bay (3 Cots)** | **Single Cot Cubicle** |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 01 | 30/10/2014 | No | No | No | No | No |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 02 | 04/12/2015 | No | No | No | No | No |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 03 | 10/03/2016 | No | No | No | No | No |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 05 | 16/03/2016 | No | No | No | No | No |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 06 | 21/04/2016 | No | No | No | No | No |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 07 | 19/09/2016 | No | No | No | No | No |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 08 | 22/12/2016 | No | No | No | No | No |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 09 | 18/05/2017 | No | No | No | No | No |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 10 | 12/09/2017 | No | No | No | No | No |
| WW-XX-XX-DC-XXX-001 | Environmental Matrix | 11 | 25/10/2017 | No | No | No | No | No |

39. Generally, the comments made by NHSL related to Operational Functionality as evidenced by the 50 comments made by NHSL on revision 2 of the EM as set out in PPP8 (paragraph 3.3.5 to 3.4.2) on the Inquiry website, after financial close.

40. Some comments on the ventilation requirements were made with reference to the SHTM guidance and some in relation to critical care rooms. We reviewed and responded to each comment made, relevant to our design, and where appropriate we amended the EM. If no comment was made by NHSL on an entry in the EM this was taken as acceptance by NHSL of that entry.

41. The core Design Figures continued to adhere to the levels advised in the initial briefed EM. From v.2 of the EM, Guidance Note 15, **(A34225378 – Environmental Matrix version 2 - Bundle 4 – Page 17, Hearing Commencing 24 April 2023)** in the text about critical care areas, it is stated "Design Criteria - SHTM 03-01 Appendix 1 for air change rates - 10 ac/hr Supply for isolation cubicles." This was an alteration added purely for clarification to align with SHTM03-01 guidance as we felt the original text was vague. There were no comments made on this text clarification at the time. It was not a Technical Change which would have required to have been

highlighted. To my mind the design for the critical care ventilation system was complete by that point.

**Instructed Design Changes**

42. During the contract, we received a great many instructions from MPX to amend our designs due to what appeared to be, in the main, briefing changes from NHSL.

43. To perhaps help put this into perspective we received approximately a further 30% increase to our original predicted fee value for additional Design works during the Construction Stage, which in turn obviously generated a significant additional resource requirement for my Team.

44. One of these instructed and invoiced changes involved the redesign of the ventilation system of several of the 4 Bed Wards which had been the subject of lengthy and detailed review involving NHSL; this will be explained in more detail later in this statement but the wards included Critical Care.

45. However, I would suggest that the issue of such a change order and the acceptance of additional fees related to said change order demonstrate that those involved were well aware of this redesign.

**Critical Care Area Drawing Review**

46. During the design process, the proposed ventilation drawing for the Critical Care area (Drawing reference - WW-Z4-01-PL-524-001) **(A33656602 – 08 WW-Z4-01-PL-524-001 - Bundle 13, Volume 6 – Page 76)** was prepared and issued through the RDD process on 02/07/2015; it subsequently received a status B on the 28/08/2015. This drawing shows the ventilation schemes for Critical Care and haematology/oncology which were submitted and signed off by NHSL.

47. It was then updated on the 01/05/2018 to include additional ductwork within the 4 Bed Wards all in line with the 4 Bed Ward Review document (attached) **(A35271103 – 4 Bed Ward Review Document – IHS00002178 - Bundle 13, Volume 6 – Page 390)**. This revision was submitted for RDD review and received a Status B from NHSL on the 08/05/2018. The document details the potential installed ventilation systems to address late comments from NHSL. It formed the basis for them to instruct alterations.

**Critical Care Area Plant Reviews**

48. We produced amongst our RDD pack layout drawings for the various AHUs with the units for Critical Care being detailed on Drawing WW-Z4-01-PL-524-001 (attached in Appendix) **(A33656602 – 08 WW-Z4-01-PL-524-001 - Bundle 13, Volume 6 – Page 76)** which was submitted for RDD on the 02/07/2015 and received a Status B on the 28/08/2015. The relevance of this drawing is that it shows the extent of the ventilation schemes within the Critical Care Department.

49. These units were also included in our AHU Schedule reference 04-06 (WW-XX-04-SH-524-006) **(A46720245 - WW-XX-04-SH-524-006 – Paragraph 59 (b) - Bundle 13, Volume 6 – Page 409)** which was submitted for RDD on the 10/08/2015 and several times subsequently before being given a Status A on 21/03/2017. These units were then part of Mercury Engineering's Manufacturers Technical Submission submitted on the 03/03/2017 and receiving a Status B on the 21/03/2017 **(A47045109 – Mercury Engineerings Manufacturers Technical Submission MER-XX-SL-TS-127 - Bundle 13, Volume 6 - Page 414)**.

**4 Bed Ward Ventilation Review and Subsequent Alterations**

50. Prior to financial close, an issue had been raised about the pressure in single rooms. As a result, the financial close EM provided for balanced pressure in single rooms but one of the RDD issues (specified in the RDD schedule of the project agreement) relating to the EM was that a detailed proposal was

awaited on bedroom ventilation to achieve balanced/negative pressure relative to the corridor.

51. The EM included in the project agreement at financial close provided for multi-bedded wards to have a positive pressure relationship to adjoining spaces, including corridors. However it was not until much later, after the Construction phase had commenced, at an advanced point, during the installation phase, by which time some of the ductwork had already been physically installed, were we advised by MPX that NHSL wished to review an alternative strategy along with its potential implications within the 4 Bed Ward units. I believe the change resulted from internal discussions at NHSL which we were not party to. I understand (from the Inquiry) that NHSL wanted to “cohort” children with similar infections together in the same rooms and that to prevent the spread of infections from those rooms it was necessary for the rooms to have a negative pressure relationship to adjoining spaces. This reasoning was not provided to us at the time either at the original briefings nor as part of the RDD process.

52. NHSL wished to explore the potential consequences involved when changing from 4 air changes within bedrooms, as set out in the EM and accepted design drawings and designed 10 air changes from the adjacent bathrooms. We were advised that as part of our review we could consider reducing the 4 A/c supply rate to 120l/s which would align with the Building Standards Vent Rate for 12 occupants.

53. This could have resulted in potentially positive pressure in the wards to the corridors if the originally designed systems were used. The potential alternative was to have a solution which achieved balanced or negative pressure to the adjacent corridor. This setup was not as easy to accommodate as it was in the single bed ward and potentially involved significant additional or amended ductwork including alterations to installed installations. The magnitude of room volume between Ward and Bathroom meant that a much higher extract rate would generally be required than was the case with the Single bedrooms This could have air quantity drawbacks potentially causing

noise and user comfort issue. A more comprehensive solution involving additional extract systems was therefore required

54. I have now had sight of risk assessments carried out by NHSL to look at the risks arising if a negative/balanced pressure arrangement was not used. I was not aware of those at the time the changes were instructed.

55. We were therefore requested to prepare reviews which looked at each and every 4 Bed Ward, including those in the Critical Care area and haematology/oncology, and prepare summaries of the potential system changes and rate their complexity if adopted.

56. This exercise included the 4 Bed Wards in the Critical Care Dept namely 1-B1-009,1-B1-031 and 1-B1-063; all of which required alterations to their existing arrangements. A typical table entry was:

> *"Retain the supply ventilation at 4ac/hr. Introduce new general extract ductwork and grille into the room to provide 4ac/hr overall. The existing general extract ductwork currently serving the room has been increased in size and another grille added to it to serve the room. This will achieve a balanced room pressure. New branch duct to be connected locally into the existing general extract ductwork main. Supply & Extract Duty 312l/s. (Equates to 31 people)".*

57. This entry was for Ward 1-B1-031, which also recorded that the "severity" of the new works was classified as medium and that ductwork for the area was already fabricated as per the original design. The reference to 31 people was an indication of the possible maximum occupancy applying the SHTM 03-01 guidance of 10l/s per person; a quantification we were asked to include within the reviews.

58. The outcome of this exercise was the change order I have referred to which was only applied to a number of NHSL selected 4-bed wards.

**Site Installation Works**

59. During the construction stage, we regularly visited site to attend meetings and would at the request of MPX advise on any site related issues brought to our attention.

60. The day-to-day management of the Building Services Installation activities was overseen by MPX's own dedicated site management staff and thus only involved us when deemed necessary. Site Supervision was not part of our contractual duties.

61. I believe the installation quality was also monitored by NHSL using their own in house and presumably MML operatives, but I was not involved here so can't say to what extent.

62. I would also note that Technical Submissions, generally consisting of proposed manufacturers equipment data were produced by Mercury Engineering. These Technical Submissions went through the same scrutiny, classification, and acceptance criteria by MPX and NHSL prior to their adoption.

63. I am advised (by the Inquiry) that:

- on 25.1.19, the Scottish Government wrote to NHSL seeking assurance that all critical ventilation systems were to be inspected and maintained in line with SHTM 03-01 **(A36877101 – A. Letter from Paul Gray – plant rooms and ventilation systems – 25 January - Bundle 13, Volume 6 – Page 522)**
- on 31.1.19, Wallace Weir of IHSL wrote to Brian Currie of NHSL, referring to the letter of 25.1.19 **(A42980293 – Letter from W Weir to B Currie re Plant Rooms + Ventilation Systems dated 31 January 201 - Bundle 13, Volume 6 – Page 523)**, and said "All ventilation systems have been designed, installed and commissioned in line with SHTM 03-01 as required, systems are maintained such a manner which allows handover at actual completion to meet SHTM 03/01 standards"

- on 12.2.19, Brian Currie wrote to Wallace Weir **(A40988842 – Part A 4.25 – 20190212 – Letter from NHSL To IHSL Re Assurance – 12.09.19 - Bundle 13, Volume 7 – Page 427)** seeking written assurance of inter alia that engineering systems (including ventilation) had been designed and were being installed and commissioned to meet current guidance and statutory requirements
- on 13.3.19, Wallace Weir of IHSL wrote to Brian Currie of NHSL (see bundle) **(A40988855 – Letter from W Weir to B Currie re Assurance dated 13 March 2019 - Bundle 13, Volume 6 – Page 525)** stating that the engineering systems had been designed, installed, commissioned and validated to meet the relevant project agreement standards.

64. We were not party to any of that correspondence so I cannot interpret them beyond what is set out. We had been requested to confirm that our designs were compliant with guidance (SHTM 03-01) which we did, and I am clear they were compliant.

**Involvement in Commissioning**

65. MPX had their own commissioning management team who controlled the commissioning process involving Independent Commissioning (IC) experts where appropriate.

66. I think it would be fair to say that we had a good working relationship with the MPX commissioning team who sought our involvement if they felt, as designers, we might be able to assist with any particular issues which arose; from memory, these were relatively few though.

**Involvement with the Independent Advisor**

67. I recall having some conversations with the original Independent Advisor (IA) to clarify some general design issues. That was a firm called Arcadis. The design issues queried did not concern air change rates or pressure

arrangements for rooms in Critical Care or haematology/oncology. I cannot recall having direct contact with the final appointed IA.

68. Our involvement with the final IA (which was IOM) was in the form of responses to questions raised by them in a process managed by MPX. These queries were in the form of a tracker style document which we were asked to add our comments to where appropriate. I am referring here to those schedules to which we contributed via MPX. I don't recall any of these queries requiring major alterations. I do recall MPX adopting the line of least resistance solutions to a few low consequence items. On the face of it, I could see the logic of this approach at the time in the interest of getting the installations accepted by the TA representatives.

**Rejection of Critical Care Unit**

69. The first indication I had that there was a potential problem in relation to the Critical Care Ward ventilation was when I received a message from MPX containing a NHSL designed alternative design to the installed and approved ventilation systems. This was (if I remember correctly) described as a compromise solution and we were asked to comment on the implications. It took the form of sketches, descriptions and air change rates. My understanding was that it had been provided to MPX and had been developed internally by the NHSL team.

70. We were not party to the first meeting held on the potential problem when it arose. We were only involved at a point after the decision was taken not to open the hospital and that was in a meeting of all parties.

71. We duly carried out and reported on this solution (see the Review of Ventilation Provisions for (B1) PICU and HDU Departments (" July 2019 report") **(A42686243 - Review of Ventilation Provisions for (B1) PICU and HDU Departments – Tuv Sud – July 2019 - Bundle 13, Volume 6 – Page 527)** however my understanding was that it was rejected by others as not acceptable, but I can't confirm who these others were.

72. Thereafter, I was invited to what I believe was the second meeting of the various parties to discuss the best way forward. That meeting took place (as referred to above) after the decision not to open the hospital, and as far as I recollect it was in late June or July 2019. At that meeting, I explained as best I could the ramifications on what NHSL appeared to now be asking for. This meeting also included a visit to the area in question where again, I tried to get over the implications of converting the 4 Bed Ward areas to pressurised spaces. I have never been provided with the minutes of that meeting, if indeed any were taken.

73. The outcome of this meeting was that the July 2019 report I had prepared on our interpretation of the SHTM Guidance was to be submitted to HFS along with a similar explanation of NHSL's position to allow HFS to compare.

74. We duly did this but to date have never received a response. Incidentally, to hopefully assist the Inquiry we have prepared and submitted a complementary report reviewing every guidance document I could find available at that time and their guidance regarding ventilation in critical care departments. That report is dated April 2022 and is entitled "Critical Care Department Briefing Review" **(A42686242 - Critical Care Department Briefing Review – Tuv Sud – April 2022 - Bundle 13, Volume 6 – Page 542)**. In summary, we couldn't find anything which supported the comments made at that time to the effect that 10 A/c and 10 Pa positive pressure should have been provided throughout Critical care and not restricted to the Isolation Rooms . Both documents have previously been made available to the Inquiry. We also requested details of similar solutions applied to other Scottish Hospitals, again nothing has been forthcoming.

75. We are not aware of +10 A/c per hour and +10PA pressure being applied to critical care rooms in other Scottish Hospitals although as indicated we have asked for that information.

76. What has transpired is that the latest revision to SHTM 03-01 now gives specific guidance on this type of accommodation **(A32353809 – SHTM 03-01 Part A dated 1 February 2014 - Bundle 1 – Page 2490)**. This guidance did

not exist at the time of the RHCYP/DCN. In my opinion, this would support our view that the criticism of the Critical Care Department Ventilation stated as being non-compliant with the then current version of SHTM03-01 was unfounded and based on opinion rather than technical guidance. The current SHTM 03-01 does now include the specific guidance on 4 bed wards which demonstrates that at the time, this guidance was missing such that the criticisms made of the design were made with no technical background and thus could only be termed “opinion”.

**Eventual Opening of the hospital**

77. We were asked to redesign the ventilation within the Critical Care area to the new briefed criteria which we would have been keen to do as it would have allowed us to complete what was a significant landmark project for myself and my team. However, we couldn’t accept the proposed wording of the instruction as it required an admission that the initial accepted design had shortcomings which we didn’t agree with. The wording used stated that the design was to be in compliance with SHTM03-01. Our original design already complied with the then current version of SHTM03-01 and to accept the wording used in the instruction would have been a tacit acceptance that our solution was incorrect. We therefore suggested amendments along the line of “generally in compliance with the guidance of SHTM03-01” which were rejected by NHSL. who refused to amend their wording. We were keen to proceed in a less adversarial manner but this was not acceptable to NHSL.

78. I don’t have details of the eventual design solution however I do understand that significant air sealing of the building occurred, which I had previously brought to NHSL’s attention as being required to maintain the positive pressure arrangement, along with other significant works.

79. In my opinion, if the design had originally been to provide pressurised spaces then works other than simply ventilation installations would have been required, which I believe has now proven to be the case.

80. I would suggest it may assist the Inquiry if full details of the works subsequently undertaken by NHSL could be made available to all parties.

## Appendices

81. We have attached the following information which will hopefully assist the Inquiry when reviewing this statement:

- Sample Pre FBC Ventilation Strategy:
  - WW-SZ-01-PL-524-001 (First Floor Ventilation Strategy) **(A36636512 – 28 – WW-SZ-01-PL-524-001-FT_A0 - Bundle 13, Volume 6 – Page 564)**
- Sample RDD process Ventilation Drawing
  - WW-SZ-B1-PL-524-001 (Level B1 Ventilation Distribution) **(A36636510 – 32 – WW-SZ-B1-PL-524-001-FT_(A1) - Bundle 13, Volume 6 – Page 22)**
- Air Handling Schematic Drawing:
  - WW-SZ-SL-SC-524-001 (Zone Z3 Level 2 Plantroom Ventilation Schematic Sheet 1) **(A46720202 - WW-SZ-SL-SC-524-001 – Paragraph 59 (d) - Bundle 13, Volume 6 – Page 565)**
- Sample grille schedule:
  - WW-Z4-03-SH-524-005 (Zone 4-2 Level 03 Schedule of Extract Grilles) **(A46720322 - WW-Z4-03-SH-524-005 – Paragraph 59 (a) - Bundle 13, Volume 6 – Page 566)**
- Sample Air Handling Unit Schedule:
  - WW-XX-04-SH-524-006 (Schedule of Air Handling Unit 04-06) **(A46720245 - WW-XX-04-SH-524-006 – Paragraph 59 (b) - Bundle 13, Volume 6 – Page 409)**
- Typical Air handling Unit drawing for Critical Care department:
  - TBC **(A47045130 – Mercury Engineerings Manufacturers Technical Submission MER-XX-SL-TS-127 – AHU 04-07 and AHU 04-09 H8.1 - Bundle 13, Volume 6 – Page 569)**

## Declaration

82. I believe that the facts stated in this witness statement are true. I understand that this statement may form part of the evidence before the Inquiry and be published on the Inquiry's website.