SCOTTISH HOSPITALS INQUIRY

Scottish Hospitals Inquiry Interim Report

The Royal Hospital for Children and Young People and Department of Clinical Neuroscience, Edinburgh

2025

Foreword

"Following recent concerns over safety and wellbeing, the Scottish Hospitals Inquiry will determine how vital issues relating to ventilation and other key building systems occurred, and what steps can be taken to prevent this being repeated in future projects"

Section 1 of the Inquiries Act 2005 gives a Scottish Minister the power to cause an inquiry to be held where particular events have caused public concern, or there is a public concern that particular events may have occurred.

On 17 September 2019 the then Cabinet Secretary for Health announced that a public inquiry would be held "to examine issues at the new Royal Hospital for Children and Young People (RHCYP) and the Queen Elizabeth University Hospital (QEUH) sites following recent concerns from affected parents over safety and wellbeing." The announcement continued, "The inquiry will determine how vital issues relating to ventilation and other key building systems occurred, and what steps can be taken to prevent this being repeated in future projects."

In implementation of the Cabinet Secretary's decision, I was appointed as chair of the Scottish Hospitals Inquiry, by letter of 29 June 2020 (but with effect from 28 November 2019). Following on a wide consultation process the Inquiry's Remit and Terms of Reference were published on 15 June 2020. The Inquiry's setting-up date was 3 August 2020.

The Remit and Terms of Reference are set out in full immediately after this foreword but, put short, the Remit explains that the overarching aim of the Inquiry is to consider the planning, design, construction, commissioning and, where appropriate, maintenance of both the Queen Elizabeth University Hospital Campus (QEUH), Glasgow and the Royal Hospital for Children and Young People and Department of Clinical Neuroscience (RHCYP and DCN), Edinburgh.

The Remit requires the Inquiry to determine:

- how issues relating to adequacy of ventilation, water contamination and other matters adversely impacting on patient safety and care occurred;
- if these issues could have been prevented;
- the impacts of these issues on patients and their families; and
- whether the buildings provide a suitable environment for the delivery of safe, effective person-centred care.

The Remit further requires the Inquiry to make recommendations to ensure that any past mistakes are not repeated in future NHS infrastructure projects.

The Remit explains that the Inquiry will carry it out by fulfilling the Terms of Reference. There are thirteen Terms of Reference of which number 13 is to report to the Scottish Ministers on the above matters, and to make recommendations identifying any lessons learnt to ensure that any past mistakes are not repeated in any future NHS infrastructure projects, as soon as reasonably practicable.

Provision for the delivery of a report by the chairman of the inquiry to Ministers is made by section 24 of the Inquiries Act 2005. Section 24(1) requires that the report will set out (a) the facts determined by the inquiry; and (b) its recommendations. Section 24(3) of the Act provides that the chairman may deliver to Ministers an interim report containing anything that a report under section 24(1) may contain.

This is an interim report as provided for in section 24(3) (hereinafter "the report"). It is intended to address, as far as is practicable, the Remit and Terms of Reference as they apply to the RHCYP and DCN, Edinburgh. I have yet to hear and consider all the evidence that I propose to hear in relation to the QEUH, Glasgow. Having done that, I propose to deliver a further and final report, this time in terms of section 24(1). The principal purpose of that further report will be to address the Remit and Terms of Reference as they apply to the QEUH, Glasgow. However, it may be that, having heard further evidence, I will require to revisit matters relating to, or raised in connection with, the Edinburgh hospital. In such an event they will be addressed in the further report.

The report which follows is set out in fifteen chapters. In large part, these chapters consist of a narrative of the material facts found by the Inquiry, but the principal facts determined by me as required by section 24(1)(a) of the 2005 Act, are those summarised, under reference to the relevant Term of Reference, in chapter 14 of the report. The recommendations which follow from the evidence heard thus far are set out in chapter 15.

In conducting its work, the Inquiry has relied upon witnesses, experts, core participants and their legal representatives who submitted evidence in the form of written statements, expert reports, and documents, as well as submissions and responses to queries. I am very grateful for their assistance and that of the legal teams and support teams behind them. I would like to express my thanks – my personal thanks and my thanks on behalf of the Inquiry – not simply for their contributions but for the considerable work that went behind their contributions. I would also like to acknowledge the considerable and extraordinarily high quality of the work of Mr MacGregor, Mr McClelland and the members of the Inquiry team, and give them my thanks for their hard work and commitment.

The Right Honourable Lord Brodie KC PC
Chair of the Scottish Hospitals Inquiry

REMIT AND TERMS OF REFERENCE

Scottish Hospitals Inquiry

Remit

The overarching aim of this Inquiry is to consider the planning, design, construction, commissioning and, where appropriate, maintenance of both the Queen Elizabeth University Hospital Campus (QEUH), Glasgow and the Royal Hospital for Children and Young People and Department of Clinical Neurosciences (RHCYP/DCN), Edinburgh. The Inquiry will determine how issues relating to adequacy of ventilation, water contamination and other matters adversely impacting on patient safety and care occurred; if these issues could have been prevented; the impacts of these issues on patients and their families; and whether the buildings provide a suitable environment for the delivery of safe, effective person-centred care. The Inquiry will make recommendations to ensure that any past mistakes are not repeated in future NHS infrastructure projects. The Inquiry will do this by fulfilling its Terms of Reference.

Terms of Reference

1. To examine the issues in relation to adequacy of ventilation, water contamination and other matters adversely impacting on patient safety and care which arose in the construction and delivery of the QEUH and RHCYP/DCN; and to identify whether and to what extent these issues were contributed to by key building systems which were defective in the sense of:
   A. Not achieving the outcomes or being capable of the function or purpose for which they were intended;
   B. Not conforming to relevant statutory regulation and other applicable recommendations, guidance, and good practice.

2. To examine the arrangements for strategic definition, preparation and brief, and concept design, including the procurement, supply chain and contractual structure adopted for the financing and construction of the buildings, to determine whether any aspect of these arrangements has contributed to such issues and defects.

3. To examine during the delivery of QEUH and RHCYP/DCN projects:
   A. Whether the Boards of NHS Greater Glasgow and Clyde and NHS Lothian put in place governance processes to oversee the projects and whether they were adequate and effectively implemented, particularly at significant project milestones;
   B. Whether operational management provided by the Boards of NHS Greater Glasgow and Clyde and NHS Lothian was adequate and effective for the scale of such infrastructure projects;
   C. The extent to which decision makers involved with the projects sought and facilitated the input and took account of the advice and information provided by, or available from, the clinical leadership team; infection control teams; estate teams; technical experts and other relevant parties to ensure that the built environment made proper provision for the delivery of clinical care;
   D. Whether the organisational culture within the Boards of NHS Greater Glasgow and Clyde and NHS Lothian encouraged staff to raise concerns and highlight issues in relation to the projects at appropriate times throughout the life cycles of the projects;

REMIT AND TERMS OF REFERENCE

E. Whether failures in the operation of systems were a result of failures on the part of individuals or organisations tasked with specific functions.

4. To consider whether any individual or body deliberately concealed or failed to disclose evidence of wrongdoing or failures in performance or inadequacies of systems whether during the life of the projects or following handover, including evidence relating to the impact of such matters on patient care and patient outcomes; and whether disclosures of such evidence was encouraged, including through implementation of whistleblowing policies, within the organisations involved.

5. To examine whether, based on the governance arrangements in place, national oversight and support of such large-scale infrastructure projects was adequate and effective and whether there was effective communication between the organisations involved.

6. To examine, during the life cycle of the QEUH and RHCYP/DCN projects, how the Boards of NHS Greater Glasgow and Clyde and NHS Lothian secured assurance and supporting evidence that:
   A. All necessary inspection and testing had taken place;
   B. All key building systems had been completed and functioned in accordance with contractual specifications and other applicable regulations, recommendations, guidance, and good practice and;
   C. Adequate information and training were provided to allow end-users effectively to operate and maintain key building systems.

7. To examine what actions have been taken to remedy defects and the extent to which they have been adequate and effective.

8. To examine the physical, emotional and other effects of the issues identified on patients and their families (in particular in respect of environmental organisms linked to infections at the QEUH) and to determine whether communication with patients and their families supported and respected their rights to be informed and to participate in respect of matters bearing on treatment.

9. To examine the processes and practices of reporting healthcare associated infections within the QEUH and determine what lessons have been or should be learned.

10. To examine whether the choice of sites was appropriate or gave rise to an increased risk to patients of environmental organisms causing infections.

11. To examine whether there are systematic knowledge transfer arrangements in place to learn lessons from healthcare construction projects and whether they are adequate and effective.

12. To examine whether NHS Lothian had an opportunity to learn lessons from the experience of issues relating to ventilation, water and drainage systems at the QEUH and to what extent they took advantage of that opportunity.

13. To report to the Scottish Ministers on the above matters, and to make recommendations identifying any lessons learnt to ensure that any past mistakes are not repeated in any future NHS infrastructure projects, as soon as reasonably practicable.

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Glossary

Terms marked "*" are defined in part 1 of the schedule to the Project Agreement or clause 1 of SA1, to which regard should be had for the contractual definitions in each case.

ac/h: Air changes per hour (air change rate for ventilation). Can also be expressed as ACH.

ACOP L8: Approved Code of Practice dealing with the risk of Legionnaires disease issued by the Health and Safety Executive, enforceable under the Health and Safety at Work Act 1974.

Actual Completion Date*: For the purposes of this paper, the Actual Completion Date is the date to be stated in the Certificate of Practical Completion as the date on which the buildings and other facilities to be provided under the Project Agreement by IHSL were completed according to the Completion Criteria.

ADS: Architecture + Design Scotland.

AE: Authorising Engineer.

AEDET: Achieving Excellence in Design Evaluation Toolkit.

Agreed Resolution*: Means the technical solution required to resolve the Dispute (other than the Post Completion Disputed Works) and the obligations on each Party to meet (or procure the meeting of) that agreed technical solution.

AHU: Air Handling Unit. A collection of components for purifying, conditioning (by adjusting the temperature and humidity for example) or renewing the air in a building or premises.

Approved RDD Item*: An item of Reviewable Design Data which has been returned or has been deemed to have been returned endorsed either "Level A – no comment" or "Level B – proceed subject to amendment as noted" by the Board's Representative pursuant to the provisions of clause 12 and schedule part 8 of the Project Agreement.

ARHAI: Antimicrobial Resistance and Healthcare Associated Infection Service, Scotland.

Assure: NHS Scotland Assure.

BCRs: Board's Construction Requirements. The requirements of the Board of NHSL set out in section 3 of schedule part 6 of the Project Agreement, as amended from time to time in accordance with the terms of that Agreement.

Board or NHSL Board: Unless the context indicates otherwise, the Board of NHS Lothian.

Board Change*: In terms of schedule part 16 (Change Protocol) means, as the case may be, a Low Value Change, a Medium Value Change or a High Value Change.

Board's Commissioning*: The pre-completion activities to be carried out by NHSL in accordance with clause 17 of the Project Agreement.

Board's Representative*: Brian Currie, or such other person appointed by NHSL as its representative under clause 8 of the Project Agreement.

Bouygues: Bouygues Energies & Services FM UK Limited, the facilities management contractor appointed by IHSL.

CAMHS: Child and Adult Mental Health Service.

Capital expenditure: Spending by a public authority from its own financial resources that produces or enhances an asset such as hospitals, schools or roads. Also referred to as "capital spending" or "spending from the capital budget".

Certificate of Practical Completion*: A certificate issued by the Independent Tester in the relevant form set out in schedule part 22 of the Project Agreement.

Change*: A Change means a change in the Works, the Facilities and/or Services or additional works and/or services or a change in the Board's Policies that may be made under clause 33 (Change Protocol) or schedule part 16 (Change Protocol).

CIG: Capital Investment Group. The Scottish Government Health and Social Care Directorate Capital Investment Group oversees the approval process for business cases across NHS Scotland where the value of the capital project is greater than the Board's delegated limit.

Completion Criteria*: The Completion Tests as defined in Appendix B of schedule part 10 of the Project Agreement.

DCN: Department of Clinical Neuroscience.

Defect or defective: The Inquiry's Term of Reference 1 defines "defective" as:

A. Not achieving the outcomes or being capable of the function or purpose for which they were intended;

B. Not conforming to relevant statutory regulation and other applicable recommendations, guidance and good practice.

It is in this sense that "defect", "defective" and like terms should be interpreted in this interim report, unless it is used explicitly in relation to the terms of the Project Agreement.

Defect*: When used in the context of the Project Agreement (and therefore capitalised, as per the Project Agreement), a Defect is any defect or fault in the Works and/or the Facilities which occurs due to a failure by Project Co to meet the Board's Construction Requirements and/or Project Co's Proposals or otherwise to comply with its obligations under this Agreement and is not a snagging matter.

Dispute*: In the context of the Project Agreement means:

i) all claims, disagreements and disputes between the Parties arising out of or in connection with the matters which are set out in the column entitled “Dispute” in Part 1 of the Schedule (Technical Schedule); and/or

ii) the Post Completion Disputed Works.

EM: Environmental Matrix. A spreadsheet used to capture environmental data for every room in the hospital as listed in the schedule of accommodation.

ESG: Executive Steering Group.

Facilities*: In the context of the Project Agreement means: The buildings and other facilities, together with all supporting infrastructure provided by IHSL under the Project Agreement.

FBC: Full Business Case. This builds on the approved Outline Business Case (OBC) and takes the chosen option through procurement, putting in place delivery plans and providing the final detailed costing.

Financial Close*: The date on which all of the documentation relevant to a project is signed and closed in financial terms (and, in particular, the finance documentation, including any interest rates etc are “locked in”). In the RHCYP/ DCN project, this occurred on 13 February 2015.

FM: Facilities Management.

GGC: Greater Glasgow and Clyde Health Board.

HAI or HCAI: Hospital Acquired Infection or Healthcare Associated Infection.

HAI-SCRIBE: Healthcare Associate Infection Systems for Controlling Risk in the Built Environment.

HCID: High consequence infectious diseases.

HDU: High dependency unit.

HEPA filter: High efficiency particulate air (or absorbing) filter.

HFS: Health Facilities Scotland (part of NHS National Services Scotland).

HSCMB: Health and Social Care Management Board.

HPS: Health Protection Scotland (part of NHS National Services Scotland).

HVC or High Value Change* Means:

a) a Change requested by the Board that, in the reasonable opinion of the Board, is likely either to Cost in excess of five hundred thousand pounds (£500,000) index linked or to require an adjustment to the Annual Service

Payment that on a full year basis is 2% or more of the Annual Service Payment in the relevant Contract Year provided that the parties may agree that such a Change should instead be processed as a Medium Value Change; or

b) any other Change that the parties agree is to be treated as a High Value Change.

IHSL: IHS Lothian Limited, the company or Special Purpose Vehicle with which NHS Lothian entered into the project agreement for the design, build, finance and maintenance of the RHCYP and DCN.

IMT: Incident Management Team.

IOM: Institute for Occupational Medicine, the Authorised Engineers for ventilation engaged by NHSL.

IPC: Infection Prevention and Control.

IPCD: Infection Prevention and Control Doctor.

IPCN: Infection Prevention and Control Nurse.

IPCT: Infection Prevention and Control team.

IT: Independent Tester.

KSR: Key Stage Reviews.

LVC or Low Value Change*: Means a Change which is either

a) of a type listed in the Catalogue of Small Works and Services; or

b) is not so listed, but has an individual Cost not exceeding twenty five thousand pounds (£25,000) index linked, or as otherwise agreed from time to time, except for any request that would (if implemented) increase the likelihood of Project Co failing to meet the Board's Construction Requirements and/or the Service Level Specifications or materially and adversely affect Project Co's ability to perform its obligations under the Agreement.

Mercury: Mercury Engineering, the subcontractor appointed by Multiplex to provide mechanical, electrical and public health (MEP) services.

MML: Mott MacDonald Limited, providing technical advisory services to NHSL.

Multiplex: Brookfield Multiplex Construction Europe Limited, the construction contractor appointed by IHSL to design and build the new RHCYP and DCN.

MVC or Medium Value Change*: Means a Change requested by the Board which is not a Low Value Change or a High Value Change.

NDAP: NHS Scotland Design Assessment Process.

NHSL: National Health Service Lothian/ Lothian Health Board. This is a reference to the health board formally called “Lothian Health Board”, not to its managing body.

NHS NSS or NSS: National Health Service National Services Scotland.

NIPCM: National Infection Prevention and Control Manual.

NNU: Neonatal unit.

NPD: Non-profit distributing. A model for procuring privately financed infrastructure projects.

OB: Oversight Board.

OBC: Outline Business Case. The OBC presents the preferred option for implementing a project, demonstrates that it provides value for money and identifies the supporting commercial and management arrangements to be put in place successfully to implement that option.

Outstanding Works*: The works set out in part 6 of the schedule of SA1, which the Parties have agreed will be completed after the Actual Completion Date, including those noted in part A of that part of the schedule labelled “Outstanding Works Exclusions”.

PA: Project Agreement – the agreement between NHSL and IHSL dated 12 and 13 February 2015 for the design, build, finance and maintenance of the new RHCYP and DCN building at Little France.

PCP’s*: Project Co’s Proposals. The document at section 4 of schedule part 6 of the Project Agreement, as amended from time to time in accordance with clause 33 of that Agreement.

PFI: Private Finance Initiative. A method of using private sector investment to deliver public sector infrastructure, constructed and managed by the private sector for a contractually defined period.

PICU: Paediatric intensive care unit, typically within the critical care department.

Post Completion Works*: The Drainage Works, Void Detection Works and Heater Battery Works all as described in part 5 of the schedule to SA1.

PPP: Provisional Position Paper (see Note to the Reader). PPP can also refer to “public private partnership” but this usage is avoided in this report.

Pre-Completion Commissioning*: The commissioning activities to be carried out by IHSL in accordance with clause 17 of the Project Agreement.

Project Agreement : The agreement between NHSL and IHSL dated 12 and 13 February 2015 for the design, build, finance and maintenance of the new RHCYP and DCN building at Little France.

Project Co or Project Company: The private sector signatory to the Project Agreement, IHSL.

PSCP: Principal Supply Chain Partners. Contractors appointed under Framework Scotland to undertake capital projects on behalf of health boards.

RAG: Red Amber Green risk rating.

RDD*: Reviewable Design Data. Parts of the design that were not approved at the date on which the Project Agreement was signed and were subject to further review by NHSL.

RDS: Room Data Sheets.

Revenue expenditure: Expenditure by a public authority on its day-to-day operations.

Review Procedure: The procedure specified in schedule part 8 to the Project Agreement to be used whenever anything is required to be reviewed or approved by NHSL.

RHCYP: Royal Hospital for Children and Young People (name given to the new children's hospital).

RHSC: Royal Hospital for Sick Children. The predecessor to the Royal Hospital for Children and Young People, located on Sciennes Road, Edinburgh and commonly referred to as "the Sick Kids". This title was used for the proposed new hospital up to the end of the construction period.

RIE: Royal Infirmary of Edinburgh.

SA1: Settlement and Supplemental Agreement between Lothian Health Board and IHS Lothian Limited dated 22 February 2019.

SA2: Project Agreement Supplementary Agreement No 2 between Lothian Health Board and IHS Lothian dated 5 August 2020.

SA6: Supplemental Agreement number 6 to the PFI contract between the former RIE NHS Trust and Consort Healthcare (ERI) Ltd. providing for the transfer of land required for the RHCYP and DCN project.

SA7: Supplemental Agreement number 7 to the PFI contract between the former RIE NHS Trust and Consort Healthcare (ERI) Ltd. facilitating required infrastructure for the RHCYP and DCN project including diversion of utilities and flood prevention works.

SBAR: Situation, Background, Analysis and Recommendation.

SCIM: Scottish Capital Investment Manual.

SFPA: Standard Form Project Agreement.

SFT: Scottish Futures Trust.

SG: Scottish Government.

SGHD: Scottish Government Health Directorate.

SGHSCD: Scottish Government Health and Social Care Directorate.

SHFN: Scottish Health Facility Notes.

SHTM: Scottish Health Technical Memorandum.

SHPN: Scottish Health Planning Note.

Site*: The land made available to IHSL for the Project by NHSL.

Snagging Matters*: Minor items of outstanding work which would not materially impair NHSL's use and enjoyment of the Facilities or it carrying out the clinical and other services provided by it or the performance of the Services by Bouygues.

SoPC4: Standardisation of PFI Contracts Version 4.

SPV: Special Purpose Vehicle. The project company set up specifically for the purpose of carrying out a project under the NPD model (and most other privately financed contract models). Sometimes referred to as the "Project Company" or "Project Co".

SRO: Senior Responsible Officer.

TSWW: TÜV SÜD / Wallace Whittle.

TÜV SÜD: TÜV SÜD Limited (trading as Wallace Whittle), the building services engineer appointed as a subcontractor by Multiplex.

Works*: The design (including the preparation of all Design Data), construction, testing, commissioning and completion of the Facilities and the Retained Estate Handback Infrastructure (including any temporary works) and the installation, testing, commissioning and completion of Equipment to be performed by Project Co in accordance with the Project Agreement (as varied, amended or supplemented from time to time in accordance with that Agreement).

WSG: Water Solutions Group.

QEUH: Queen Elizabeth University Hospital.

Executive Summary

Background

On 4 July 2019 the Cabinet Secretary for Health announced that the opening of the new Royal Hospital for Children and Young People (RHCYP) and Department of Clinical Neuroscience (DCN) in Edinburgh would be postponed due to the fact that it had been discovered that features of the ventilation system of the hospital did not comply with the authoritative guidance provided by Scottish Health Technical Memorandum 03-01 (SHTM 03-01), "Ventilation for Healthcare Premises". The hospital had been due to open fully on 9 July 2019 and the announcement came the day before equipment, staff and patients were to begin moving onto the site. The financial cost of the delay was reported to be £16.8 million. In addition to this there can be added the commencement of periodical payments to the contractor, notwithstanding the new hospital not being occupied, and the need to retain in operation the facilities which the new hospital was intended to replace.

Following remedial works the hospital was only fully opened on 23 March 2021.

Patients and their Families

The decision not to open the hospital as planned had a significant impact on patients and their families, who were shocked, scared and deeply disappointed that long-promised new facilities were not to be available for the treatment, in some cases, of children suffering from very serious conditions.

Approximately 2255 appointments required to be rescheduled immediately. Of these, 1586 related to paediatric patients and 669 to DCN patients. NHS Lothian (NHSL) informed all patients of the fact that appointments would not be taking place at the RHCYP and DCN as planned. A strategy was put in place to seek to ensure that patients and families knew where to attend for treatment. No evidence was led of any adverse issues surrounding that communication.

In relation to the population which it was intended should be accommodated in the RHCYP, patient care continued in the Royal Hospital for Sick Children, a Victorian building at Sciennes Road in Edinburgh ("the Sick Kids"). While these facilities were suboptimal, there is no indication of adverse clinical outcomes for patients arising from the built environment of the Sick Kids. The issues were more acute for the DCN. It had problems with the water system, including contamination with Pseudomonas bacteria. There was a reduction in capacity for operations. There were therefore risks associated with its continued use.

No formal complaints were received by NHSL or the Scottish Government (SG) in relation to the decision not to open the hospital. However, patients and their families were left in the dark as to the reasons the RHCYP and DCN did not open as planned. Neither SG nor NHSL engaged with the Family Council, whose role was to "represent the patients and families and engage with those running the hospital", on matters relating to the delay. Communication with patients and families was unsatisfactory in this regard.

Recommendation 1: an effective communication strategy must consider the lived experience of patients and their families and their need for information, transparency and support.

- There is a cohort of young patients who are very seriously ill and spend a significant portion of their time, sometimes much of their lives, in hospital. They are supported by family members or guardians. The hospital becomes, for these patients and their families or guardians alike, their second home.
- The impact of unclear or poor communication on the wellbeing of patients and their families during what may already be a very difficult, emotional, and uncertain period in their lives, is not to be underestimated.
- Health boards must ensure that in the event of any adverse situation that could affect the wellbeing of patients and their families, there is a communication strategy in place to liaise with this crucially important group.
- The Scottish Government should ensure that this liaison is supported in any overarching communication strategy it may wish to introduce.

The Inquiry has heard further evidence with respect to communication with patients and families in relation to incidents at the QEUH and will make further recommendations in its final report.

Deliberate concealment or failure to disclose wrongdoing

There is no evidence indicating any deliberate concealment or failure to disclose wrongdoing. There is no evidence indicating that there were issues with organisational culture that discouraged staff from raising concerns. NHSL had whistleblowing policies in place during the project and there were a variety of channels through which concerns could be raised.

Remedial Works

Significant remedial works were carried out to the ventilation system at the RHCYP and DCN to remedy the non-compliance with SHTM 03-01. This involved extensive works to replace the ventilation system for the relevant areas. The results of independent testing, and the expert evidence heard by the Inquiry, indicate that the remedial works have been successful. The ventilation system in the hospital now complies with published guidance, including SHTM 03-01. The hospital environment is suitable for the delivery of safe, effective, person-centred care. No evidence is available to the Inquiry indicating any contrary position.

The issue

The issue that led to the decision to delay related principally to the design of the ventilation system of the paediatric critical care department of the new hospital and, in particular, the pressure differentials and air change rates that the system was capable of achieving. It is generally accepted that specialised ventilation systems in hospitals have a role to play in protecting vulnerable patients from airborne sources of infection. This is reflected in the recommendations set out in SHTM 03-01. The ventilation system in the critical care department of the newly built RHCYP provided fewer than half the recommended air changes per hour in certain rooms. The level of pressure differentials did not conform to the guidance in SHTM 03-01, although this had been risk assessed and found to be preferable for some clinical functions.

The ventilation system in the critical care department was therefore defective in the sense set out in the Inquiry's Term of Reference 1B, that is, in the period from its installation until the remedial works were completed, it did not conform "to relevant statutory regulation and other applicable recommendations, guidance, and good practice." It was not adequate and had the potential adversely to impact on patient safety and care.

Patient safety and care and the need to follow guidance

The evidence before the Inquiry indicated that safety is not a binary issue. Rather, there is a sliding scale of risk from safe to unsafe, which can be influenced by many factors. SHTM 03-01 sets out recommended parameters for the outputs of ventilation systems which reflects a general consensus about what is required in order to create an acceptable level of patient safety. These are consistent with parameters set in other countries. A departure from such recommendations, taken in isolation, has the potential to increase risk. However, other control measures can be introduced to make a space that does not have ventilation compliant with SHTM 03-01 sufficiently safe for the patients being treated there. For example, the Sick Kids had no mechanical ventilation but nevertheless provided a safe environment in which to treat patients.

The available evidence indicates that achieving 4 air changes per hour when 10 are recommended, creates an unacceptable level of risk to the safety of patients unless other sufficient control measures are introduced.

Scientific basis for the guidance

The scientific basis for the current recommendations as to particular ventilation parameters is limited and to a significant extent depends on work published in the early 1970s when hospital environments and other aspects of medical care were very different from what would be expected today. It is however generally accepted that a ventilation system that maintains changes of air within spaces in a hospital and pressure differentials between certain adjacent spaces has an important contribution to make, together with other available measures, to reducing the risk of healthcare associated infections. This is particularly so in the case of patients who are especially vulnerable to infection by reason, for example, of their compromised immune systems. For the present, there is a strong consensus that the recommendations in current guidance are appropriate and that material deviations from these recommendations will be likely to increase the risk of infection, albeit that the increase is unquantifiable and will be dependent on what other control measures are in place.

There would be value in carrying out further research into the healthcare benefits of ventilation output parameters and systems. Interest in the role of ventilation in infection prevention and control has been stimulated by the experience of the COVID-19 pandemic and research is ongoing. There has been an increased focus on air change rates and the use of technologies, such as air scrubbers (also known as portable HEPA[1] filter devices), to support existing ventilation systems by reducing the concentration of contaminants in the air. The NHS Scotland Assure Research Service is currently reviewing a potential project which aims to understand, from an engineering perspective, the various factors which may influence the quality of air, in order to develop the evidence base which might inform future research topics and guidance.

Interpretation of guidance

A guidance document providing recommendations which are intended to be apposite in a variety of situations, such as SHTM 03-01, requires interpretation. A lack of clarity in guidance introduces the risk of misunderstanding.

In the RHCYP and DCN project the subcontractor that designed the mechanical and electrical building services interpreted the guidance in such a way that it understood itself to be designing and delivering a ventilation system that was compliant with SHTM 03-01, whereas the weight of the evidence available to the Inquiry indicated that it was not.

1 high-efficiency particulate air or absorbing

SHTM 03-01 Parts A and B have been updated since the new hospital was opened. An interim 2022 version is available, and it is anticipated this will shortly be superseded by the further versions of Parts A and B currently under preparation.

Among other developments, the revised guidance improves clarity around recommended parameters. Such changes should reduce the risk of misunderstandings on future projects.

However, notwithstanding the greater clarity of the current text of SHTM 03-01, engineers and contractors should not be expected, on their own, to have the necessary understanding of the clinical requirements of a hospital to be able to identify the appropriate output specifications for all areas without the risk of misunderstanding. The provision, introduced by the 2022 version of SHTM 03-01 of a multi-disciplinary Ventilation Safety Group (VSG) to oversee the management of the ventilation systems of a healthcare provider is therefore to be welcomed. As part of its remit to assess all aspects of ventilation safety and resilience, the VSG should inform the design process for the construction and refurbishment of new and existing premises. It is to be expected that it will bring to bear relevant clinical, infection prevention and control, and engineering perspectives on the interpretation and application of guidance.

Arrangements for funding the project

The project underwent a change in funding model a few years after it began. Initially intended to be procured as a capital-funded project through Framework Scotland, the project was instead procured through a revenue funded route, using the non-profit distributing (NPD) model developed by the Scottish Futures Trust. Following a procurement process Lothian Health Board (NHSL) entered into a Project Agreement with IHS Lothian Limited (IHSL) for the construction of the new hospital and its provision for a period of years in return for annual service payments.

The overall contractual structure adopted for the financing and construction of the building (the NPD contract) did not directly contribute to the relevant defects that arose but it did introduce complexity to the resolution of issues when they arose.

The RHCYP and DCN project does however demonstrate that risks can arise if design or specification-related material generated in the context of one funding model is used, without proper assessment of the risks of doing so, after the funding model has been materially changed. An environmental matrix capturing the output specifications for the ventilation system, which was developed during the capital funded phase of the project, was used after a change to a revenue funded model without any sufficient assessment of why this was being done and how doing so might impact on parties' understanding of its significance and on their contractual relationship. The lack of a suitable risk assessment was the genesis of many of the problems that arose on the project.

Recommendation 2: A risk assessment is required if there is a change in the arrangements for funding a project.

- In situations where the funding model or procurement route changes mid-project, a risk assessment should be conducted to assess whether work done on the project up to that point is suitable for the revised project. The rationale for decisions taken in this regard should be formally recorded.
- The party carrying out the risk assessment should be the party on whom the potential risk falls, and which is in a position to mitigate the risk, unless there are sound reasons why this should not be the case.

Arrangements for the strategic definition, preparation and brief, and concept design

The presentation of NHSL's requirements for the ventilation system lacked clarity. This brief was provided to tenderers and then the preferred bidder during the procurement exercise.

NHSL was subject to an instruction from the Scottish Government to prepare room data sheets (RDS) using Activity Database[2] (or an equivalent) in order, for example, to brief prospective tenderers as to the ventilation outputs required for the various rooms of the new hospital. Room data sheets are the commonly used briefing tool for hospital projects. NHSL initially intended to produce room data sheets for the project. However, a decision was made instead to require bidders and, later, the preferred bidder to produce their own room data sheets. As part of the procurement process an environmental matrix (EM) was provided to bidders to assist in the preparation of room data sheets. This was the same EM included with a draft of the Board's Construction Requirements (BCRs).

There was a lack of clarity in relation to whether tenderers required to fully comply with published guidance (including SHTM 03-01) or whether the EM was a derogation from published guidance. IHSL (Project Co) understood the EM, which was issued both with procurement documentation and the Project Agreement, to be a statement of the ventilation outputs required by NHSL for the rooms in the hospital.

2 A briefing and design software system mandated for use in a letter to the chief executives of health boards (Chief Executive Letter), CEL 19 (2010).

That EM contained an error in relation to the parameters for certain critical care rooms. The error arose from a mistake in the transcription of information into the relevant cells of the spreadsheet in which the ventilation requirements for each room in the hospital were set out. Had this error not been made, problems with the ventilation system are unlikely to have arisen.

The potential for the error in the EM to give rise to the issues and defects which occurred was exacerbated by the decision that the Reference Design Team (including the engineers who produced the original EM) would be ring-fenced from the procurement exercise. They had no involvement in the procurement exercise and did not know how the EM would be used during that exercise. Bidders had no opportunity to discuss matters with the engineers who produced the EM. Had they been able to do so, the engineers would have been available to explain that the environmental matrix was not a fixed client brief. There was no scope for prospective bidders to discuss with the engineers whether the values which were set out in the EM, and did not comply with SHTM 03-01, were deliberate or a mistake.

A further feature of the arrangements that contributed to the issues with the strategic definition and brief was the lack of input from clinicians into the EM. The engineers who produced the EM used a “Room Function Reference Sheet” to summarise the environmental parameters for repeatable room types in the hospital. Once a room function was ascribed to an area, the ventilation parameters for that room function were used regardless of the area’s intended use. This judgment as to room function was made by an engineer with no clinical input and no input from an infection prevention and control specialist or other clinician. Had clinician input been obtained through dialogue with the relevant engineer, it is unlikely that inappropriate room functions would have been ascribed to rooms in the critical care department.

NHSL concluded the Project Agreement without providing and agreeing a clear and robust ventilation brief. This led to a continuing lack of clarity as to what were NHSL’s requirements for the ventilation system.

It is critical that a health board formulates and then articulates its requirements for the key building systems in a proposed healthcare facility (its “brief”) in terms which are full, clear, and unambiguous, and that the brief is finalised before a contract is signed and Financial Close is achieved. While development of the design can be carried over to a later phase, clarification of the health board’s brief should not be.

In a project for the construction or refurbishment of a healthcare facility, the health board, in consultation with relevant stakeholders and its clinical and technical advisers, is best placed to identify which output parameters of key building systems are required for the particular clinical uses it intends for the facility (and how these may change and develop). These should be specified by the board as part of its brief and not left to the judgment of the project company and its subcontractors during the design phase.

Identification of environmental output parameters should not be regarded as a matter of design; design should address how previously determined environmental parameters are to be achieved, not what should be achieved.

Recommendation 3: A health board's brief for the construction or refurbishment of a healthcare facility must be clear and identify the output specifications to be met in accordance with guidance.

- The brief provided by a health board should include a clinical output based specification for departments or other areas having a clinical function, which sets out the patient cohorts and activities which these areas are intended to accommodate, together with a Schedule of Accommodation identifying how areas are to be laid out, but, in addition, there must be documentation identifying the environmental parameters of all spaces within such areas, including the ventilation parameters. There should be precisely specified references to air change rates, pressure differentials, levels of air filtration and temperature, the specifications being set out either in room data sheets or in an environmental matrix which comprehensively and exactly identifies every space within the proposed building.
- In determining what the specified environmental parameters should be, the board should follow the recommendations in Scottish Health Technical Memoranda, including SHTM 03-01, in their most recent versions (which can and should be regarded as statements of current good practice), subject to any derogations agreed in writing by, in respect of ventilation, the health board's Ventilation Safety Group (VSG).
- In the event of a derogation being proposed, the relevant recommendation should be specifically identified and the derogation should only be agreed where there is convincing evidence that the proposal will provide a degree of safety no less than if the recommendation had been followed. If a proposed derogation is agreed, the reasons for it and any limitations on its application should be recorded, all as is currently required by SHTM 03-01 Part A Interim Version (February 2022) paragraph 4.10.
- In formulating its brief, the health board may, separately, choose to include a general obligation on the contractor to comply with SHTMs, but it should never rely on such an obligation as a substitute for a full articulation of the brief as set out above.

The guidance now states that there should be a body of evidence showing that the proposal for a derogation will provide a degree of safety no less than if the guidance had been followed, and that this should be recorded. However, there is no method designated for how derogations are agreed, captured and recorded. A number of witnesses spoke of the potential advantages of a standard form for derogations from guidance.

Recommendation 4: Development of a standard form for derogations from guidance.

- A standard form for derogations, for use throughout the NHS, would be beneficial.
- This should ensure that derogations are captured and recorded in a uniform way, bring clarity to how a derogation is agreed, and ensure that the approval of all parties is recorded in an appropriate and familiar way.

While, as a matter of contract, design responsibility may lie with the project company, ensuring that the health board's requirements are met should be regarded as a joint objective of parties to be arrived at collaboratively. Accordingly, the procurement process should accommodate a gateway meeting prior to Financial Close at which a common understanding of the health board's brief is agreed and recorded.

Recommendation 5: The procurement process should accommodate a gateway meeting prior to Financial Close at which a common understanding of the health board's brief is agreed and recorded.

Governance and operational management

The governance, oversight and support provided by the Scottish Government, and the governance and management structures and processes adopted by NHSL, appear to be in line with what is to be expected with such an infrastructure project. No suggestion was made that they were not fit for purpose. However, these structures and their operation did not prevent or detect the issue with the ventilation system. The following key issues were identified:

The role of advisers

NHSL inadvertently agreed, in Settlement Agreement 1 signed in February 2019, that multi-bed rooms in the critical care department should be provided with an air change rate less than half of that recommended in national guidance. In agreeing to this solution

the Board of NHSL believed it could take assurance from its technical advisers, Mott MacDonald Limited (MML) that it complied with the Board's Construction Requirements (which included a requirement to comply with relevant guidance). MML had made clear to the project team that it was not providing this assurance. Therefore, there was a lack of clarity at Board level as to what assurance could be taken from the advice provided by its technical advisers. Furthermore, much of the advice provided by MML was ad hoc and informal, and it was often unclear when and if NHSL was instructing, and when and if MML was providing, formal advice on technical matters which NHSL was entitled to rely upon. This issue was highlighted in a report by Grant Thornton following its audit of internal control and governance in relation to the project. NHSL has taken steps to address this but it is not apparent from the available evidence that any such changes have taken place more widely within NHS Scotland.

Recommendation 6: Role specifications for technical advisers within health boards must be clearly defined.

- A uniform policy or procedure should be adopted for boards undertaking new build hospital projects in relation to obtaining, and recording, technical advice on key issues.
- There should be a clear record of the advice requested from technical advisers and the advice tendered by them which should generate a sufficient body of evidence to support and document relevant decisions. This is particularly important where technical advisers work closely day-to-day with the health board's project team and are engaged in commenting on design or construction proposals. Such arrangements can lead to informality and a lack of clarity about the scope and role of the advice, and the reliance which can be placed upon it.

Assurance and support with respect to technical matters

The former Cabinet Secretary identified gaps in how the Scottish Government obtains assurance and provides support to health boards on technical matters.

Significant and substantial steps have been taken to address the gaps with respect to assurance, and to improve support to health boards on technical matters through the establishment of NHS Scotland Assure (Assure).

Some developments occurred during the lifespan of the project, for example the NHS Scotland Design Assessment Process (NDAP) was made mandatory in 2011 but was not applicable to the project given the stage it had then reached.

A range of procedures now exists to help ensure health board projects meet appropriate standards. One is NDAP. There is also a Sustainable Design and Construction Procedure (SDAC). Assure now conducts Key Stage Assurance Reviews (KSARs) on projects to seek to ensure that similar problems to those that arose on the RHCYP and DCN do not arise in the future.

However, the number of new procedures can be time-consuming and demanding to complete. There is a risk they become unduly bureaucratic and focused on process rather than substance.

Recommendation 7: The duplication of procedures is to be avoided.

- It is important that new procedures be streamlined, and potentially merged, to ensure they are thorough and robust whilst avoiding duplication and unnecessary delay and cost.
- In developing new procedures consideration must be given to the commercial and other pressures likely to affect projects.

A partnership approach was not consistently applied

There was guidance in SHFN 30 that there should be a partnership approach to new-build hospital contracts, with all relevant disciplines involved.

Despite input being provided by clinicians, infection prevention and control (IPC) specialists, estates officers and technical experts, the issue which led to the postponement of opening the hospital was not identified. This was because not all relevant disciplines were involved at the correct times.

Significant and substantial steps have been taken which facilitate a partnership approach to healthcare projects. The recently revised SHTM 03-01 introduces a Ventilation Safety Group which provides a forum for all relevant disciplines to meet, consider and approve ventilation decisions. This should avoid the type of issues which arose on the RHCYP and DCN project, arising in the future.

There is not always clarity however within SHTM 03-01 and SHFN 30 about the specific tasks each discipline should undertake and the extent of their involvement at various stages of a hospital build project. This risks undermining the partnership model as there is scope for

different disciplines to consider that a specific issue or decision is not within their sphere of knowledge, and/or that it is not for them to be actively involved in that issue or decision.

There is also a risk that disciplines are required to be involved at some stages of a project where this is not necessary or beneficial. This risks wasting limited resources.

The demands placed on infection prevention and control practitioners to apply their expertise to construction and refurbishment projects, to which have recently been added the demands associated with the Assure KSAR process, cannot help but be at the cost of diverting them from their core clinical duties. The Inquiry also heard evidence that the precise nature of these demands can seem to practitioners to be unreasonable.

Several witnesses raised concern about there being insufficient IPC staff to implement the procedures introduced by Assure. As is obvious, if there are insufficient personnel to resource the system, it will not work effectively.

It is acknowledged that work, for example to clarify role specifications, is already underway. The Chief Nursing Officer advised that it is proposed to produce a role specification for IPC teams. NHS NSS is currently in the early stages of producing a replacement for Frameworks Scotland 3, the primary procurement vehicle for major capital projects. Roles and responsibilities will be further considered as part of this work in collaboration with stakeholders. The Inquiry also heard evidence that NHS National Education Scotland is working on a knowledge and skills framework for the built environment. At a project level, it is the responsibility of the senior responsible owner, project director and project board, committee or steering group to define the specific roles, responsibilities and project governance. This should be done when setting up procedures such as the Project Initiation Document and Project Execution Plan.

Recommendation 8: Role specifications for different disciplines involved in healthcare build projects in the NHS must be clearly defined.

- What is expected by way of consideration and advice from individual disciplines at various stages of a project should be made clear. Priority is to be given to protecting scarce IPC resources.
- Job and role specifications for various disciplines, particularly infection prevention and control, should be identified.
- Consideration should be given to whether there are sufficient infection prevention and control professionals to resource the current system. It is less than satisfactory to impose further duties on a service which is already over-stretched.

Healthcare engineering does not feature in the mandatory training for microbiologists or IPC professionals. There is the potential for individuals with little or no training, or practical experience of the key building systems in a hospital (e.g. water and ventilation), to be asked to undertake key roles on projects. There are similar gaps in training provided for clinicians and engineers.

Recommendation 9: Relevant training must be provided for disciplines involved in a healthcare build project.

- Infection prevention and control professionals should receive some basic training on the recommendations made by the NHS's own guidance for engineering systems, insofar as they are made in the interests of patient safety and care, before being recruited to work on large scale hospital projects.
- Similarly, engineers would benefit from basic training on infection control principles and clinical requirements before embarking on new build hospital projects.
- Clinicians involved in projects would also benefit from basic training in the recommended output parameters of building engineering systems which have a direct bearing on the safety and care of patients in their departments.

Knowledge transfer arrangements and the opportunity to learn from the experience of QEUH

There were no systematic knowledge transfer arrangements in place to learn lessons from healthcare construction projects in the period prior to the creation of Assure although NSS would share relevant learning with health boards when considered appropriate. Therefore, any board faced with a new build hospital project would not have been able readily to access learning from previous projects.

Opportunities to learn from the experiences at the Queen Elizabeth University Hospital (QEUH) and avoid similar issues at the RHCYP and DCN were limited. There was little concrete evidence available to NHSL about the problems with the QEUH ventilation system, because these were not yet fully understood at the time when the RHCYP and DCN were being constructed. The Inquiry has yet to hear detailed evidence about the issues relating to ventilation at the QEUH. This conclusion will, therefore, be kept under review until this evidence is heard.

The landscape has changed with the creation of Assure as a specialist body which is intended to gather knowledge and experience about the construction of healthcare facilities and make it available to health boards undertaking new projects. This should allow lessons to be learned on an ongoing basis.

NSS is conscious of the value of making information on common project errors generally and readily available to health boards. On 13 December 2022 NSS published a paper, "NHS Scotland Assure Lessons Learned: Overview for the Interim Review Service". The Inquiry was advised that work is underway both to update this publication and to refine the mechanisms for sharing lessons learned.

The current examples of lessons learned however are referred to in very brief terms. While brevity is desirable, a list of problems identified by short bullet points provides little by way of learning as to why it was that the problems came about, how they could have been avoided and whether and how they were resolved.

Recommendation 10: NHS Assure should consider, in consultation with relevant stakeholders, whether and how to provide health boards with more detailed information about common errors and issues experienced by other health boards than is currently provided.

- NHS Scotland Assure could develop its documentation on learning from common errors to include information on why it was that the problems came about, how they could have been avoided and whether and how they were resolved.
- This information should be updated as new, significant errors are identified.
- This should focus on material errors which, if repeated, would have a material impact, and for which there are identified solutions which are capable of being readily implemented.

Assurance and evidence regarding the inspection, testing and functioning of building systems

The Project Agreement contained provisions relating to quality control and commissioning, and made provision for an "Independent Tester" who would provide a certificate confirming the hospital was complete in accordance with completion criteria. These completion criteria included the provision of commissioning data demonstrating compliance with the Environmental Matrix. The Independent Tester signed a Certificate of Completion on 22 February 2019.

NHSL considered that the system had been designed to fully comply with SHTM 03-01 except for known derogations for the neutropenic ward, and from 6 to 4 air changes for certain bedrooms. Other than these known derogations, NHSL did not understand there to be any difference between the contractual requirements and the requirements set out in the published guidance.

SHTM 03-01 (2014) pointed to the requirements for commissioning and validation, albeit that it had little to say about the detail of validation of critical ventilation systems beyond that it should be carried out, on behalf of the health board, by a suitably qualified independent Authorised Person.

There was a degree of uncertainty on the part of NHSL as to how the ventilation system would be validated in the context of a revenue-funded project. NHSL had responsibility for providing healthcare at the hospital. However, it did not own the building. The building was owned by IHSL. Mr Henderson, NHSL's commissioning manager, was therefore unclear as to what reports should have been instructed or obtained by NHSL as opposed to IHSL.

NHSL ultimately instructed IOM to conduct an independent validation of the ventilation system in line with SHTM 03-01. The testing conducted by IOM identified that for certain spaces in the hospital the pressure regime and air changes did not conform to the guidance set out in SHTM 03-01.

The updated interim version of SHTM 03-01 issued in 2022 provides detail that was lacking in the 2014 version which it supersedes. It explains that commissioning and validation are distinct processes. Following a section on commissioning, it addresses how validation should be carried out and by whom, beginning with a clear recommendation at paragraph 12.1 that all new and refurbished ventilation systems should be independently validated prior to acceptance by the client. The purpose of validation is identified in the current version of SHTM 03-01 as proving prior to handover that the system in its entirety is fit for purpose and achieves the operating performance originally specified. What is not addressed is the possible disjunction between this purpose and the terms of the contract for the construction of the relevant facility.

Recommendation 11: There should be a contractual requirement for validation for revenue-funded projects.

- Whatever the funding method, contracts for the construction of new hospitals should permit validation, appropriately witnessed and with safeguards for all parties, to be undertaken on behalf of the health board in accordance with the guidance contained in SHTM 03-01 (2022) with a view to a report or reports being sent to the board's lead project manager.
- It is acknowledged that simply to permit a healthcare provider to carry out independent validation does not bring with it any contractual consequences in the event of failure to meet requisite standards; it is merely a way of providing the client with information. I see there to be merit in considering whether the standard form of contract for revenue-funded projects requires more radical revision, with a view to strengthening the healthcare provider's power to ensure that the completed facility is fit for purpose and constructed in accordance with the healthcare provider's requirements.

Summary of Recommendations

- **Recommendation 1:** An effective communication strategy must consider the lived experience of patients and their families and their need for information, transparency and support.
- **Recommendation 2:** A risk assessment is required if there is a change in the arrangements for funding a project.
- **Recommendation 3:** A health board's brief for the construction or refurbishment of a healthcare facility must be clear and identify the output specifications to be met, in accordance with guidance.
- **Recommendation 4:** Development of a standard form for derogations from guidance.
- **Recommendation 5:** The procurement process should accommodate a gateway meeting prior to Financial Close at which a common understanding of the health board's brief is agreed and recorded.
- **Recommendation 6:** Role specifications for technical advisers within health boards must be clearly defined.
- **Recommendation 7:** The duplication of procedures is to be avoided.
- **Recommendation 8:** Role specifications for different disciplines involved in healthcare build projects in the NHS must be clearly defined.
- **Recommendation 9:** Relevant training must be provided for disciplines involved in a healthcare build project.
- **Recommendation 10:** NHS Assure should consider, in consultation with relevant stakeholders, whether and how to provide health boards with more detailed information about common errors and issues experienced by other health boards than is currently provided.
- **Recommendation 11:** There should be a contractual requirement for validation for revenue-funded projects.

Note to Readers

This section provides some background information on the workings of the Inquiry, as an aid for readers.

Witnesses, Experts and Core Participants

There were a number of ways in which people were able to assist with and take part in the Inquiry. Anyone could submit evidence to the Inquiry in the form of a written statement and/or by providing documents. Individuals who did this or were otherwise identified as having potentially useful information were in some cases asked by the Inquiry to give oral evidence at a hearing. A list of witnesses who gave evidence at the Edinburgh hearings is provided in an appendix to this report.

Expert witnesses are specialists in their field who were asked to give evidence on matters relevant to specific Terms of Reference. The Inquiry appointed experts in engineering, ventilation systems and the role of these systems in infection prevention and control. Those who gave evidence in relation to ventilation and engineering were Andrew Poplett, Stephen Maddocks, and Dr Shaun Fitzgerald. Professor Hilary Humphreys, a professor of clinical microbiology gave evidence on ventilation as a means of infection prevention and control.

Core Participants (CPs) are those persons, whether individuals, groups, or other bodies, who had particularly relevant contributions to make, who wished to engage more closely with the Inquiry and consented to being so designated in terms of rule 4 of the Inquiries (Scotland) Rules 2007. The Core Participants in relation to the RHCYP and DCN were NHS Lothian, Scottish Ministers, Mott MacDonald Limited, IHS Lothian, Multiplex, TÜV SÜD Limited, Scottish Futures Trust, NHS National Services Scotland, IBI Group (UK) Ltd and the families of some of the patients affected by the delay to opening the hospital. Core Participants were represented by their legal representatives.

Provisional Position Papers and the responses to these

Provisional Position Papers (PPPs) were prepared by the Inquiry's investigative team to assist the Chair of the Inquiry in addressing the Terms of Reference. These PPPs represented the Inquiry team's understanding of certain topics at a point in time. It was open to any Core Participant, or indeed any other person holding relevant information, to seek to correct and/or contradict these by way of response to the paper.

Some of these PPPs contain detail that was not necessary to include in this report but which may be of interest to readers wishing to have full explanations of their respective topics. These PPPs, which were revised to take account of CP comments, have been made available on the Inquiry's website:

- PPP9: The Governance Structure within the project to construct the Royal Hospital for Children and Young People and Department for Clinical Neurosciences
- PPP10: The Contractual and Funding Structure relating to the Royal Hospital for Children and Young People and Department for Clinical Neurosciences

A revised version of a PPP and supplementary note relating to the issues with building systems other than those relating to the ventilation of the critical care department at the RHCYP and DCN and how these were remediated or otherwise resolved, is also available on the Inquiry's website.

- PPP7: Non-ventilation issues with the potential to adversely impact on patient safety and care at the Royal Hospital for Children and Young People and Department for Clinical Neurosciences; and remedial works to resolve them
- PPP7 – Supplementary: Note on issues with the ventilation system outside of Critical Care areas with the potential to adversely impact on patient safety and care at the RHCYP + DCN; and remedial works undertaken

The process of preparing and receiving responses to PPPs helped to confirm certain facts. They also revealed areas of disagreement between CPs. This was particularly the case for more controversial topics. In these cases the Provisional Position Papers have been retained in their original as sent to CPs for feedback. These include PPP1 on the Reference Design, PPP2 on the Environmental Matrix and PPP3 on Procurement Volume 1 and Volume 2. These topics were addressed at the second Edinburgh hearing held in April to May 2023. Responses to PPPs 1 to 3 were received from NHS Lothian, NHS National Services Scotland, Mott MacDonald Ltd, IHS Lothian Ltd, Scottish Futures Trust, IBI Group (UK) Ltd and TÜV SÜD and Multiplex.

PPP6 on the commissioning and validation process and PPP8 which provided a narrative concerning the construction phase of the project were prepared for the third Edinburgh hearing in February to March 2024. Responses were received from NHS Lothian, NHS National Services Scotland, Mott MacDonald Limited, Multiplex Construction Europe Ltd, TÜV SÜD, IHS Lothian Limited, and NHS Greater Glasgow and Clyde.

Footnotes and how to locate documents

Where a particular document is cited as a source of evidence, reference to it is contained in a footnote and, where possible, this is linked to the Inquiry's website where the reader can find that document. In many cases, this will be to a page containing a further link to a PDF of an "evidence bundle", which the reader can download.

An "evidence bundle" is a PDF which brings together the documents used as evidence at hearings held by the Inquiry. Therefore, evidence bundles will refer to the hearing they were prepared for ("Hearing Commencing 26 February 2024"), the bundle number, and in some cases a volume number. This has been abbreviated in the report. Thus, volume 7 of bundle number 13 from the hearing commencing 26 February 2024 will be abbreviated to HC2024.B13.V7.

Individual documents can be located within an evidence bundle by reference to the object ID and/or page number provided. An object ID (for example: A33146596) is a unique identifier that will accompany every document.

In a small number of cases a document has not been made available publicly due to a requirement for confidentiality.

The name of the hospital

The Royal Hospital for Children and Young People was given its name in 2017.[3] Up until that date, and occasionally thereafter, the new hospital was referred to as the Royal Hospital for Sick Children (RHSC), the name of the old hospital on Sciennes Road which the new hospital was to replace (sometimes referred to as "the Sick Kids"). The project to build the new hospital was referred to as the project to "reprovision the Royal Hospital for Sick Children". However, we have more generally referred to the project as the "RHCYP and DCN" project given that this is how it is named in the Inquiry's Terms of Reference.

3 The Scotsman (online), 1 May 2017, New Edinburgh's Sick Kids hospital changes 150-year-old name.

A hospital for children: historical note

The origins of the (then) Edinburgh Hospital for Sick Children are usually traced to a letter published in The Daily Scotsman on 24 February 1859 in which the correspondent, styling himself Sigma MD, posed the question "Why is it that among so many charitable institutions as abound here we have no hospital for the reception of children labouring under disease?…England can boast of one or two such establishments; but in Scotland there does not appear to exist anything of the kind".[4]

Less than a year later, the same newspaper reported the opening of that hospital. The hospital was in a "large self-contained and isolated house" at 7 Lauriston Lane, which had been rented by the directors of the charity for the purpose. The staff comprised a resident surgeon, a matron with two nurses, a porter and his wife. The general wards could accommodate twelve patients, and in addition there were "fever wards".[5]

Thirteen years later, in his remarks at the opening ceremony of the new premises at Meadowside House, the Lord Provost recorded it as a matter of "much satisfaction to us all to find that the resources of the hospital permit of a flitting to a more advantageous and more healthy building.…and so admirably do all the arrangements, both internally and externally, seem to have been contrived for the treatment and recovery of patients that I am quite sure it cannot fail to be most successful in its object."[6] It was at this time that the hospital acquired its "Royal" title through the patronage of Queen Victoria.

Following a brief relocation to Plewlands House, the Royal Hospital for Sick Children moved to a purpose-built location on Sciennes Road, Edinburgh, which was opened on 31 October 1895.[7] The opening, by Princess Beatrice, was reportedly attended by "an assemblage of several thousand people". In his remarks made on the occasion the chairman of the directors described the building about to be opened as "one of, if not the most perfect hospitals in the United Kingdom. Every appliance and device which modern science has suggested for the perfecting of such a building as this has been adopted…".[8]

4 The Daily Scotsman, 24 February 1859, page 4. The RHSC Edinburgh Virtual Archive & Time Capsule contains a visual record of the Sciennes building just prior to the transition to the new RHCYP.
5 The Daily Scotsman 15 February 1860, page 2. The Outline Business Case (2008) notes a total of 164 staffed beds in the hospital in 2008.
6 The Scotsman, May 19, 1863, page 2.
7 A full description of the then new building can be found on page 8 of The Scotsman, October 30th, 1895.
8 The Scotsman, 1 November 1895, page 5.

This expression of confidence may be seen to have been justified by the subsequent history of what was to become the much loved “Sick Kids” building at Sciennes (with occasional modifications and additions, including the construction of a new wing in 1995) where specialist paediatric care was provided for well over 100 years. At the beginning of the twenty-first century, it was one of the busiest hospitals in the United Kingdom, seeing almost 90,000 patients a year, the equivalent of nearly 250 children a day.[9] However, questions were raised about its continued fitness for purpose. Following a formal visit in 2006, the Scottish Child Health Support Group reported that it “would urge early consideration of the long-term future of RHSC. Continued reinvestment to maintain the fabric of this institution seemed at first sight to be unproductive in the long term and it is clearly no longer fit for the purpose originally designed, although continued viability of the institution is essential in the short term.”[10]

9 Scottish Parliament Members’ Business Debate, 25 January 2007, speech by Mike Pringle MSP (Edinburgh South).

10 A372952599 - The Reprovision of the Royal Hospital for Sick Children - NHS Lothian amended 9 May 2006 - HC2022.B3V1 - page 96.

Chapter 1

The need for a new children's hospital

Chapter 1

The need for a new children's hospital

Introduction

1.1. This chapter provides some background to the project. It looks at why NHS Lothian (NHSL) wanted to build new premises for the Royal Hospital for Sick Children (RHSC) and Department of Clinical Neuroscience (DCN), and considers certain decisions which lie within the Inquiry's remit because of their significance for infection prevention and control in the built environment. Specifically, Term of Reference 10 requires the Inquiry to examine whether the choice of site for the hospital was appropriate or gave rise to an increased risk to patients of environmental organisms causing infections. There was also the decision to derogate from a new national policy to provide only single rooms for patients. The new children's hospital was instead to have a number of multi-bedded rooms. A report by Grant Thornton, following an internal audit of the governance and internal controls for the RHCYP and DCN project, considered this decision to be a "determining factor in the project", because the guidelines set out in Scottish Health Technical Memorandum 03-01 "Ventilation for Healthcare Premises" (SHTM 03-01) do not recognise four-bedded rooms as a room type and there was accordingly a lack of clarity with respect to the ventilation requirements for these rooms.[11]

Issues with the Royal Hospital for Sick Children building

1.2. According to the NHSL Property and Infrastructure Strategy, published in November 2005:

- 56% of the buildings comprising the RHSC were non-compliant with fire standards;
- 56% of the buildings were non-compliant with other statutory and non-statutory standards;
- 69% of the property was not in an acceptable physical condition;

11 A32405341 - Grant Thornton Report - HC2022.B3.V1 - page 35.

- 18% was deemed unfit for its present purpose; and
- 7% of the hospital was overcrowded.[12]

1.3. The RHSC would therefore have required to be significantly modernised in order to provide an appropriate environment for the continued delivery of high-quality paediatric services. Physical building and site constraints, together with practical phasing difficulties, limited the ability to achieve such modernisation in a successful and cost-effective manner on the then current site.

1.4. In 2008, the cost of upgrading the building to ensure compliance with the then statutory requirements would have been in the order of £16.6 million.[13] But even with that investment, the age and fabric of the building and layout of patient facilities would have made it difficult to achieve the required infection control standards, adequate isolation facilities, and to maintain standards of cleanliness during refurbishment. Patients frequently required access to several services located in separate buildings on the hospital site.

1.5. The RHSC was closely surrounded on its east and west sides by residential properties and a primary school. Its southern elevation fronted on to Sciennes Road. In answer to a question as to why it would be difficult to redevelop the site, Jacqueline Sansbury (Project Sponsor and Director of Strategic Planning) explained it was:

> "Because of the physical constraints. It was an old building. Much of the services were being provided from what were actually old villas…outside the building, and it had a school next door to it so there was no expansion space left to expand."[14]

1.6. The age of the building and the physical layout involving departments in what had previously been houses was "less than ideal for the care of children and, particularly with children, the care of families who will want to be with their unwell child, really almost all the time."[15] Some of the accommodation for families of children being treated was off-site, and some of it was in the attics of old buildings. The NHSL Property and Infrastructure Strategy for 2011-15 recognised that while the RHSC required significant improvement, it would be uneconomic and highly disruptive to adapt the existing site. It concluded that the current buildings were no longer appropriate as healthcare facilities in the twenty-first century and that re-location of the RHSC to Little France, next to the Royal Infirmary of Edinburgh, would ensure that NHSL provided the safest possible hospital care for children.[16]

12 The Outline Business Case (2008) paragraph 4.5.2 (A37379697 - Outline Business Case 12 August 2008 - HC2022.B3V1 - page 293) records the same issues but with 47%, 56%, 48%, 13% and 6% respectively as the proportion figures. The Project Execution Plan of September 2011 uses the latter figures at paragraph 2.1. A33146596 - Project Execution Plan September 2011 - HC2022.B3.V2 - page 488.

13 Somewhere around £25.75 million in January 2024 using the Bank of England calculator.

14 Transcript - Jacqueline Sansbury - 13.04.2022 - column 25; See also Transcript - Tim Davison - 08.03.2024 - column 94 to 95.

15 Transcript - Tracey Gillies - 08.03.2024 - column 4.

16 A33431600 - Outline Business Case 2012 - HC2022.B3.V2 - page 672.

1.7. Similar issues arose in relation to the Department of Clinical Neuroscience (DCN), then located on the Western General Hospital site in the Craigleith area of Edinburgh.[17] Existing buildings there did not meet patient expectations of fitness for purpose. There was pressure on the existing DCN services and facilities to meet demand. NHSL had experienced a considerable increase in referrals to DCN outpatients, with a corresponding impact on radiology, theatre and inpatient services. Neurology referrals increased by 53% and neurosurgery by 84% over the period 2006-09. The different facilities which a patient might need to access were geographically distant from one another. The patient journey to and from intensive care beds in the Western General Hospital from other parts of the DCN could take more than 20 minutes and went through public areas of the hospital. Specialist staff urgently needed in one unit might be engaged at a distance in another.

1.8. The accommodation at DCN narrowly achieved a satisfactory rating in terms of health and safety criteria, but the physical condition and energy efficiency of the building was judged unsatisfactory. Upgrading the accommodation was costed at over £14 million in 2007.[18] Scottish Government directives on single rooms further supported the case for new accommodation. In 2012, approximately 20% of DCN beds were in single rooms, and all were in spaces less than the then recommended 19m^2 per patient bed.

1.9. NHSL wrote in the Outline Business Case (OBC), which explained the need for funding for a new hospital building: “In summary, while RHSC, CAMHS and DCN successfully provide safe and effective specialist clinical care, the ongoing delivery and development of these services is limited by the challenges posed by outdated accommodation that cannot be adapted to modern medicine.”[19]

The case for change

1.10. The condition of the existing buildings at Sciennes had reached a critical state from the point of view of both patients and staff. Other factors contributed to the case for change. The key documents that set out that case and with it the case for the construction of a new hospital (as opposed to refurbishment of existing facilities), are the Outline Business Cases (OBCs), the first created in 2008 for the original capital-financed project, and the second (proposing joint reprovision of the RHSC and DCN) in 2012 for the revenue-funded project which replaced it.[20]

1.11. The ambition demonstrated by the OBCs was to procure a hospital from which “high quality, modern services” could be provided to children and young people and which would facilitate “new, innovative ways of providing hospital and community services”. Construction of the new children’s hospital was seen as a part of NHSL’s proposals for sustaining clinical services in the face of changes in practice together with advances in medical technology and treatments, as well as maintaining

17 A33431600 - Outline Business Case 2012 - HC2022.B3.V2 - page 672.
18 Just over £22.5 million in January 2024.
19 A37379697 - Outline Business Case 2008 - HC2022.B3.V1 - page 272.
20 A37379697 - Outline Business Case 2008 - HC2022.B3.V1 - page 272; A33431600 - Outline Business Case 2012 - HC2022.B3.V2 - page 672.

the appropriate number of suitably qualified doctors which had "become more challenging over recent years due to the cost of living, housing and transport issues in Edinburgh".

1.12. Future business needs were considered in detail. The new hospital at the Little France site would have sufficient space for an increased age-range of patients, from 13 to 16, and to age 18 for those with some complex care needs. 58% of inpatient beds would be in single rooms with ensuite and facilities for a parent to stay with their child. Proximity to the RIE Emergency Department would assist in delivering integrated emergency services, including planning for incidents and decontamination. Projected activity was calculated using the latest activity data and population projections with a view to calculating the level of services in the new building. The new accommodation was to be capable of adaptation to meet changes in demand in the future, both for flexible management of unexpected peaks in activity and for long-term changes to clinical and service models.

1.13. Part of the planning for future business needs was to allow for technological advances and innovation. The intra-operative MRI within the joint theatre complex for RHSC and DCN would allow more effective operative treatment of brain tumours both in relation to paediatric and adult patients. The new facility would include a rooftop helipad for the transfer of patients to and from the Little France site by air. The existing helipad for the RIE, built before the latest guidance and Civil Aviation Authority regulations were in place for landing on hospital sites, did not meet current standards. Hotel accommodation would be provided for carers and relatives of children in hospital, and gardens or courtyards would be provided for an outside play and social space.

1.14. A systematic review of the number of beds required had been carried out in partnership with the Clinical Management Teams, with benchmarking against seven peer hospitals for both children's services and clinical neuroscience. The bed numbers likely to be required (166 for children's services, 80 for clinical neuroscience) informed the design and projected costs. The number of operating theatres would be increased to assist with meeting demand.

1.15. As NHSL put it: "A new 'fit for purpose' Children's Hospital is seen as a crucial element for the provision of 21st century services in Lothian for Children and Young People together with redesigned patient pathways that span primary, community, secondary and tertiary care."

Site selection

1.16. In the Initial Agreement for the new hospital project submitted to the Scottish Executive Health Department Capital Investment Group (CIG) in April 2006, six options were put forward for consideration – two involving some degree of refurbishment of the current site, or a new build on the site of Western General Hospital, the Royal Infirmary of Edinburgh (RIE), St. John's Livingston, or another NHS site. Building the new hospital on the site of the RIE emerged as the preferred option.

1.17. The choice of hospital was supported by a detailed analysis set out in the 2008 OBC.[21] That analysis carried out an appraisal of benefits, economic implications, financial analysis and risks. Three options were under consideration:

- Option 1: retain RHSC on its existing site upgrading where necessary to ensure that the buildings comply with statutory requirements.
- Option 2: reprovision the RHSC as a dedicated stand-alone facility on the RIE site at Little France.
- Option 3 reprovision the RHSC on the site of St. John's Hospital, Livingston.

1.18. The relative benefits of each of these options were assessed against clinical effectiveness and meeting national guidance, accessibility, and quality of physical environment. The criteria were scored at a workshop that included a wide variety of stakeholders. Option 1 was considered "unacceptable" following review of the scoring as it did not deliver any of the headline criteria to an acceptable standard. With respect to Option 3, "co-location with a significant number of major clinical services could not be achieved." Option 2 achieved co-location and scored best for the economic appraisal.

1.19. A risk analysis was undertaken to assess the relative level of risk associated with the options. The lowest risk option was option 2, which had no risks identified as being "Very High".

1.20. The option to construct a new hospital on the RIE site at Little France was ranked as the best option across benefits, financial and economic appraisals and risk assessment and was accordingly identified as the preferred option in the 2008 OBC. The identification of this as the preferred option also aligned with the recommendations of the Review of Tertiary Services for Children in Scotland (2004 – the Youngson Report), among the recommendations of which were:

> "Children's specialist acute services should be co-located with adult, maternity and neonatal services; however, the distinct nature of children's services as highlighted by the Bristol Inquiry (Kennedy Report) should be protected and preserved; and
>
> This should be progressed as a matter of urgency in Edinburgh and Glasgow where new, co-located C&YP's hospitals in Edinburgh and Glasgow are recommended."[22]

21 A37379697 - Outline Business Case 2008 - HC2022.B3.V1 - page 272.
22 A37379697 - Outline Business Case 2008 - HC2022.B3.V1 - page 295.

1.21. Achieving this co-location was described as meeting "the gold standard of triple co-location of children, maternity and adult services". This was clearly a critical factor in NHSL's thinking. When asked by Counsel to the Inquiry whether, notwithstanding constraints at the RIE site, the site was appropriate, Susan Goldsmith, then Finance Director of NHSL, responded:

> "Oh, absolutely. … the only way for the Board to deliver a major trauma centre, was to bring Children's Services on to the major acute site, along with Clinical Neuroscience …. So, it was definitely the best option for the Board."[23]

1.22. The 2008 OBC was approved by CIG in August 2008. As noted above, at the time of the 2008 OBC, reprovision of the DCN was a separate project. An OBC for the DCN had been approved by NHSL in November 2009. Following an appraisal the preferred option was construction of a new DCN on the RIE site at Little France. However, this OBC was not formally submitted to the Scottish Government for approval; rather, the funding and procurement routes were to be re-assessed by NHSL.

1.23. The Scottish Government Draft Budget for 2011 to 2012, published in November 2010, announced that both projects (reprovision of the RHCYP and reprovision of the DCN) would be delivered using the non-profit distributing (NPD) revenue funded model.[24]

1.24. The Business Case Addendum prepared following the Scottish Government's announcement identified opportunities for clinical integration and operational efficiencies that would result from a joint reprovision of RHSC and DCN. These included the ability to deliver paediatric and adult neurosurgery in the same theatre, maximising the utilisation of specialist equipment and expert staff, proximity of paediatric and adult neurology services for the large adolescent patient group transferring to age-appropriate care and the opportunity to improve emergency access to services. There would also be non-clinical benefits of integrating the two services into one building, including economies of scale, minimising disruption through the build and commissioning and maximising the benefit of development work undertaken to date.

1.25. The option of pursuing a joint build at the RIE site at Little France, through the NPD model, was considered the most financially advantageous and emerged as the preferred option in a new OBC. The OBC was approved by the NHSL Board on 25 January 2012 and by the Scottish Government on 18 September 2012.

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23 Transcript - Susan Goldsmith - 17.05.2022 - column 25; see also Transcript - Brian Currie - 18.05.2022 - column 25 and Transcript - Iain Graham - 17.05.2022 - column 56.

24 Scottish Government, Scotland's Spending Plans and Draft Budget 2011-12 Chapter 8 Health and Wellbeing, What the Budget Does section: "We will also ensure the delivery of a range of other health projects, including the Royal Sick Children's Hospital and Department of Clinical Neurosciences in Edinburgh through the NPD approach outlined in chapter 3.": The project is also mentioned in the "New investment financed through the Non-Profit Distributing model" table in Chapter 3.

1.26. There were clearly many benefits to the site at Little France. There were also some challenges. The Royal Infirmary of Edinburgh had been procured as a PFI contract between the former RIE NHS Trust and Consort Healthcare (ERI) Ltd. (Consort), with a contract period running until February 2028. The site had been leased to Consort for a term of 130 years, and therefore any site development required Consort's approval and changes to the relevant project agreement. The OBC noted that a Supplemental Agreement (SA6) to the project agreement providing a framework for the land transfer would be reached in December 2011, to be signed off by Consort funders in January 2012. The reliance on the timeous success of these negotiations was one of the possible disadvantages of the site.

1.27. The "enabling works" required for the hospital to be located at Little France would come to be resolved between NHSL and Consort in two supplementary agreements, SA6 and Supplemental Agreement 7 (SA7). Contrary to the suggestion in the 2012 OBC that SA6 would be signed in January 2012, SA6 was only signed in August 2012 and SA7 in December 2012.[25]

1.28. The choice of site also gave rise to challenges by having two different privately financed operators on the same campus. It was necessary to separate and clearly define services and utilities and the responsibility for them. The re-provision of RHCYP and DCN was to be as autonomous as possible from RIE albeit that there had to be physical and clinical connections between the buildings.[26]

1.29. The site also posed challenges arising from the topography and the consequent available physical space. The site was on a slope and within an active flood plain necessitating flood defence work.[27] The scale of the project was increased by the inclusion of DCN, which added more pressure on what was already a restricted site.

1.30. Despite these constraints, it was NHSL's view that the benefits offered by delivering a major trauma centre, with its safety and quality benefits, adjacencies and proximity to University teaching facilities, outweighed the disadvantages consequent upon the site's topography.[28] Brian Currie, the Project Director from August 2009, told the Inquiry:

> "…[I]t was very apparent to me, listening to colleagues and looking at the clinical justifications, that bringing paediatric services and neurosciences to an already acute hospital with the benefits of sharing emergency facilities, sharing critical care facilities, etc., particularly the synergy with neurosciences and the University of Edinburgh, who run the campus as a teaching hospital, it all made absolute sense to me, as a non-clinician I have to say, but just as a layperson. So, I was never other than convinced that it was the right site."[29]

25 Witness Statement - Brian Currie - 18.05.2022 - paragraph 18.
26 Witness Statement - Brian Currie - 18.05.2022 - paragraph 6; see also paragraph 8.
27 Transcript - Susan Goldsmith - 17.05.2022 - column 24; Transcript - Iain Graham - 17.05.2022 - column 31.
28 Witness Statement - Susan Goldsmith - 17.05.2022 - paragraph 14.
29 Transcript - Brian Currie - 18.05.2022 - column 25.

1.31. The Inquiry is required, under Term of Reference 10, to examine whether the choice of site for the hospital was appropriate or gave rise to an increased risk to patients of environmental organisms causing infections.

1.32. It is clear from the foregoing that careful attention was paid to the selection of the site on which the new building was located, and that a thorough appraisal process was carried out. No subsequent issues have been reported that arise purely from the site selection. The Inquiry is unaware of there ever having been any suggestion that the site itself gives rise to an increased risk to patients from environmental organisms causing infections. For the purposes of Term of Reference 10 it can be concluded that the choice of site was appropriate and that it did not give rise to an increased risk to patients of environmental organisms causing infections.

Decision to include multi-bed rooms

1.33. In planning the new hospital the decision was made to derogate from the new national policy to accommodate patients in single rooms. Interim guidance issued by the Scottish Government in December 2006 noted that in planning for the construction or major refurbishment of healthcare facilities, it is appropriate to provide an overall single occupancy room level of between 50 to 100%.[30] The appropriate level within that range was, at that stage, a matter for the relevant health board based on a number of broad criteria. In November 2008, a Chief Executive Letter was issued to all health boards providing that "For all new-build hospitals or other healthcare facilities which will provide inpatient accommodation there should be a presumption that all patients will be accommodated in single rooms, unless there are clinical reasons for multi-bedded rooms to be available."[31]

1.34. NHSL noted the likely benefits flowing from increased use of single rooms in the new hospital:

> "The quality of the clinical environment in a purpose-designed new build will reduce the risk of healthcare associated infection, particularly through the increased provision of single rooms in inpatient areas. 100% single rooms in DCN will also contribute to an improved patient experience, with greater protection of privacy and dignity, and improved clinical outcomes."[32]

1.35. The availability of single rooms designed for a parent to stay with their child addressed some of the issues highlighted with both the former RHSC and the former DCN. Equally, the policy in relation to single rooms supported the case for new accommodation for both RHSC and DCN.

30 A35838181 - Interim Guidance - HC2022.B3.V1 - page 152.
31 A35838178 - Provision of single room accommodation and bed spacing - CEL 48 (2008) - HC2022.B4 - page 5.
32 A33431600 - Outline Business Case 2012 - HC2022.B3.V2 - page 745.

1.36. However, the question of single rooms had been specifically explored as part of the consultation for the initial plans for the new hospital. This consultation revealed that children, young people and their families wanted a mixture of single and four-bedded bays. It was also considered that children, as part of their development, required social interaction and benefited from being cared for with other children. Nurse-to-patient ratios would also require to be higher with 100% single rooms due to the degree of dependence of babies and young children.[33]

1.37. The reasons why single rooms are not always appropriate for children were elaborated upon by Jacqueline Sansbury in evidence to the Inquiry:

> "Young children are unable to press buzzers to get assistance if … in a single room on their own. When winter is busy, it's sometimes helpful to be able to cohort children or babies with the same illness in a multi-bed bay, to allow for observation….It was felt that adolescents should have a single room rather than be in a multi-bed bay, but for younger children, it helps their socialisation to be in mixed rooms. Some patients need to be isolated for infection control purposes, others don't."[34]

1.38. Janice MacKenzie also gave evidence of the need to cohort patients, that is, to care for patients suffering from the same infection in the same area with the goal of preventing the spread of that infection:

> "…from a clinical and operational perspective, we needed to consider how we would be able to cohort children with the same infection, for example respiratory syncytial virus (RSV). RSV is also known as bronchiolitis and is a very common childhood respiratory illness, especially in young children. It was considered important to have the ability where appropriate to cohort children with the same infection because it allows for constant clinical observation when required. When children are cohorted together in a multi-bedded bay, there would be a minimum of one nurse in that room with the patients. If these children were in single rooms, close observation can be more challenging and if their condition was unstable then they may require one-to-one nursing care. With children, their condition can deteriorate very rapidly, so clinicians need to closely observe their patients.
>
> With younger children in particular, babies and toddlers, they are not able to communicate that they don't feel well so clinicians very much rely on monitoring and observation of the child's condition to determine their clinical status. So where clinically appropriate, for example if patients have the same infection, then cohorting those patients is the best utilisation of the available nursing resource and provides closer clinical observation and monitoring of the patients, which is ultimately safer for the patients."[35]

33 A37379697 - Outline Business Case 2008 - HC2022.B3.V1 - page 312.
34 Transcript - Jackie Sansbury - 13.05.2022 - column 35; see also Witness Statement - Janice Mac-Kenzie - 09.05.2022 - paragraph 9 and 21.
35 Witness Statement - Janice MacKenzie - 26.02.2024 - paragraph 12.

1.39. As noted, the Chief Executive Letter was issued in November 2008. The 2008 OBC had been approved by CIG in August 2008, and therefore strictly speaking the requirements of the letter did not apply. However, Ms. Sansbury explained:

> "I had both written and verbal discussions with… the then Chief Medical Office (CMO), explaining the NHS Lothian position and the rationale as set out in Appendix 6.3 of the OBC…for seeking a derogation from 100% single rooms. I understand that NHS Lothian has conducted various searches but been unable to locate an email or letter from me to [the CMO]…or a response from him approving the proposal for at least 50% single room accommodation, but I can confirm that I obtained CMO approval...had I not received the approval on behalf of NHS Lothian, the OBC… would have been rejected. It was my responsibility as Project Sponsor to obtain approval from the CMO. The approval was in writing although I cannot remember if this was in the form of email or formal letter."[36]

1.40. NHSL subsequently also sought a derogation from 100% single bedroom accommodation for the DCN. Ms Sansbury emailed the Scottish Government on 15 July 2013 to seek the CMO's position on the proposed derogation, explaining:

> "The clinicians wish to have 2 four beds wards in this are [sic] to allow for greater observations of agitated patients. This document gives details of the case mix and required observations. As you know this change was supported by [the Medical Director] and [Nurse Director].[37]

1.41. The document referred to is a short paper giving details of the case mix and required observations. The request was approved by the Scottish Government on 16 July 2013.

1.42. The decision to deviate from single bedroom policy has been described in an internal audit conducted by Grant Thornton as a "determining factor in the project", because: "SHTM 03-01 guidelines do not recognise four bedded rooms as a room type. The option, from a ventilation perspective, would be either single rooms or general wards."[38] The Grant Thornton Report notes that when NHSL sought approval for a variation from the single bedroom policy, and then throughout the project, "it was not identified by NHS Lothian and the other parties involved that the SHTM 03-01 guidelines on ventilation did not set out what the ventilation requirements would be for the twenty, four bedded rooms."[39] This had consequences for the project.

36 Witness Statement - Jacqueline Sansbury - 13.05.2022 - paragraph 16.
37 A36646211 - Email from Jackie Sansbury to Mike Baxter - HC2022.B4 - page 187.
38 A32405341 - Grant Thornton Report - HC2022.B3.V1 - page 42.
39 A32405341 - Grant Thornton Report - HC2022.B3.V1 - page 42.

1.43. The implications of the derogation from single bedroom policy is considered elsewhere in this report. Chapter 5 considers the issue of clarity of guidance. Chapter 9 of this report considers in some depth the arrangements that NHSL made for briefing the ventilation requirements for the hospital. Chapter 6 considers the development of the ventilation strategy for multi-bed (or four-bedded) rooms.

1.44. It is clear however that the decision to have multi-bedded rooms in the hospital was made following a consideration of clinical and patient needs, and was approved as appropriate.

Progress and setbacks

1.45. Following approval of the OBC in September 2012, work on the project progressed. It reached a key milestone in December 2012 with the publication of the contract notice inviting expressions of interest in the contract for the reprovision of RHCYP and DCN. That marked the formal start of the procurement process which would lead to the Project Agreement being signed in February 2015.

1.46. The Initial Agreement submitted to the Scottish Government in April 2006 contained an indicative timetable suggesting that construction would commence in May 2009 and be completed in May 2012. The 2008 OBC moved this slightly, anticipating construction to be complete by August 2012 and the commencement of service in the new facility by December 2012. Following the addition of DCN to the project and the change to the NPD model, these dates shifted significantly, with construction anticipated to be complete by September 2016 and the new facility being opened in November 2016. By the time that the Project Agreement was signed, the anticipated construction completion date was 3 July 2017 with the hospital due to open to patients that autumn.[40]

1.47. The start of construction on site was marked on 24 March 2015, with a ceremony to commemorate the cutting of the first turf by two young patients of RHSC.[41] Unfortunately, the construction phase thereafter was affected by a number of incidents that would lead to further delays prior to the hospital being ready. In August 2016 a six-month delay was anticipated when two subcontractors entered into administration and provisional liquidation respectively. Severe weather and technical issues caused further delays. A hot water pipe failure in June 2018 led to flooding of the site, and although it was reported that this was "unlikely to impact on the overall programme of works" by this stage the building was on course to be completed only in the autumn of 2018.[42] By March 2018, there were a significant number of disputes and outstanding technical issues between NHSL and IHSL in relation to the new facilities.[43] These were only resolved, after lengthy negotiation, in the terms of Settlement Agreement 1 (SA1), signed on 22 February 2019.

40 A35230283 - Full Business Case - HC2022.B3.V3 - page 729.
41 Work begins on £150m Edinburgh hospital; Young patients cut the first turf at new Edinburgh hospital for children.
42 Written question and answer: S5W-17221.
43 See for example A32512397 - KPMG Report 2019 - HC2024.B13.V3 - page 1153 - chapter 3.

Practical completion and proposed opening

1.48. As a result of SA1, the "Actual Completion Date" became 22 February 2019. On this date Arcadis, the Independent Tester for the project, issued a Certificate of Practical Completion which, in terms of the project agreement, provided "conclusive evidence" that the facilities were complete in accordance with the contractual completion criteria, with the exception of Outstanding Works[44] and Post-Completion Works[45], which had been introduced in the agreement, and Snagging Matters detailed in a "snagging notice" issued by the Independent Tester. Outstanding Works were to be completed by 27 May 2019, and all Post Completion Works by 13 June 2019.

1.49. With the signature of SA1 and handover of the building to NHSL, the new hospital was now scheduled to open in July 2019. Migration of services was planned to take place over ten days between 5 July and 15 July, with the emergency department first to open for patients on 9 July.[46] Patient support organisations[47] and the media helped publicise the forthcoming transition of services,[48] as did an advertising campaign that cost £62,000.[49] The proposed opening had featured in the NHSL staff magazine.[50]

1.50. There was, however, a five-month commissioning period to be undertaken during which the building was intended to be transformed into a fully functioning hospital. Janice Mackenzie, Clinical Director of the Project, was reported to have said: "The commissioning period is really important. Everything from furniture to sophisticated high-tech equipment needs to be delivered, installed, and tested. Staff orientation and training is also a vital part of this process and they are eager to get going. It's going to be an exciting time."[51]

1.51. It was during this period that issues with the ventilation system would be uncovered that would postpone the opening of the new hospital yet again, and that have been at the heart of the Inquiry's investigations. It is to those issues that this report now turns in more detail.

44 The works set out in Part 6 of the Schedule of SA1, which the Parties have agreed will be completed after the Actual Completion Date, including those noted in Part A of that Part of the Schedule labelled "Outstanding Works Exclusions".
45 The Drainage Works, Void Detection Works and Heater Battery Works all as described in Part 5 of the Schedule to SA1.
46 Sick Kids to open this month at Little France.
47 For example: What you need to know about the Sick Kids' move.
48 For example: Edinburgh's new hospital just days from opening.
49 Sick Kids: How much is 'hospital without any patients' costing NHS Lothian?
50 Connections-May-2019.
51 Keys to the Sick Kids handed over to NHS Lothian.

Chapter 2

Events of 2019 and the decision by the Cabinet Secretary

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Events of 2019 and the decision by the Cabinet Secretary

Introduction

2.1. This chapter provides the background to issues at the RHCYP and DCN that the SHI was set up to investigate. It considers the events of 2019 which culminated in a decision by the Cabinet Secretary, Jeane Freeman, to delay the opening of the RHCYP and DCN. It describes the requisitioning by NHSL of a report from the Institute of Occupational Medicine (IOM) on the performance of the ventilation system at the new hospital, including the system for the ventilation of the critical care department, what IOM reported, and the action NHSL took following IOM's report. It then considers the decision taken by the Cabinet Secretary to delay the opening of the hospital, and the basis for that decision.

2.2. This helps to address, in part, the Inquiry's Terms of Reference (TOR) 1, 3 and 5, albeit that these are given greater consideration in later chapters. The TOR are set out in full below:

> 1. To examine the issues in relation to adequacy of ventilation, water contamination and other matters adversely impacting on patient safety and care which arose in the construction and delivery of the QEUH and RHCYP/DCN; and to identify whether and to what extent these issues were contributed to by key building systems which were defective in the sense of:
>
> A. Not achieving the outcomes or being capable of the function or purpose for which they were intended;
> B. Not conforming to relevant statutory regulation and other applicable recommendations, guidance, and good practice.
>
> 3. To examine during the delivery of QEUH and RHCYP/DCN projects:
>
> A. Whether the Boards of NHS Greater Glasgow and Clyde and NHS Lothian put in place governance processes to oversee the projects and whether they were adequate and effectively implemented, particularly at significant project milestones;
> B. Whether operational management provided by the Boards of NHS Greater Glasgow and Clyde and NHS Lothian was adequate and effective for the scale of such infrastructure projects;

C. The extent to which decision makers involved with the projects sought and facilitated the input and took account of the advice and information provided by, or available from, the clinical leadership team; infection control teams; estate teams; technical experts and other relevant parties to ensure that the built environment made proper provision for the delivery of clinical care;
D. Whether the organisational culture within the Boards of NHS Greater Glasgow and Clyde and NHS Lothian encouraged staff to raise concerns and highlight issues in relation to the projects at appropriate times throughout the life cycles of the projects;
E. Whether failures in the operation of systems were a result of failures on the part of individuals or organisations tasked with specific functions.

5. To examine whether, based on the governance arrangements in place, national oversight and support of such large-scale infrastructure projects was adequate and effective and whether there was effective communication between the organisations involved.

The Instruction of IOM and why IOM were instructed

2.3. As will be discussed at length later in this report, Health Facilities Scotland (HFS) provides guidance on best practice in healthcare engineering through the issue, from time to time, of Scottish Health Technical Memoranda (SHTMs). One of these is SHTM 03-01 “Ventilation for Healthcare Premises” Part A and Part B, which relate to the design and validation, and operational management, of ventilation systems. In 2019 the then current version of Part A of SHTM 03-01 (design and validation) was that issued in February 2014. This is the part of SHTM 03-01 that is relevant to what follows.

2.4. SHTM 03-01 makes recommendations about the validation of completed ventilation systems prior to handover. Validation was defined as “A process of proving that the system is fit for purpose and achieves the operating performance originally specified”. The process is described in further detail in chapter 7 of this report. SHTM 03-01 also includes recommendations as to the air change rates and pressure differentials to be achieved by the ventilation systems in various parts of a hospital, including “Critical Care Areas”. It was these recommendations which NHSL expected the ventilation system to meet, except in relation to instances where NHSL had agreed to derogate from the recommended parameters.

2.5. Since at least August 2018 Dr Donald Inverarity, the Lead Infection Prevention and Control Doctor for NHSL, had communicated to the RHCYP and DCN Project Team that he wanted a formal validation summary report and evidence of compliance with SHTM 03-01, section 8, which deals with validation.[52] In his email to Jacqueline Sansbury, Head of Commissioning in the NHSL Project Team, he gave the following reasons: when validation or verification had been done at St John’s hospital “a number of snagging issues were identified that needed correction”, and “Glasgow have identified many issues since accepting their building that

52 A41295523 - Email from Dr Inverarity 24 August 2018 - HC2024.B13.V8 - page 460 to 461.

they are in the process of retrospectively addressing and we should avoid finding ourselves in that position." Dr Inverarity suggested that since Multiplex, as the builder, "is unlikely to be unbiased" NHSL should be asking for "independent verification and a clear validation summary report indicating that all aspects of these areas are functioning as intended which is supported by SHTM 03-01."[53]

2.6. One of the reasons for wanting the validation report was to assist with the HAI-SCRIBE Stage 4 process. HAI-SCRIBE is a procedure for the identification, management and mitigation of issues in the built environment giving rise to a risk of infection[54]. It is further discussed at chapter 7 and 8 of this report. In terms of how it related to Dr Inverarity's wish for a validation report, Dr Inverarity explained to the Inquiry:

> "It was and continues to be established best practice that commissioning of operating theatres involves a step to assess the microbiological air quality. As the consultant medical microbiologist with most experience of interpretation of this data in NHSL I was expecting to see such information to be able to assess this parameter of whether the theatres were providing a safe environment for surgery. Likewise, I was expecting to see data regarding air quality in the HEPA filtered isolation rooms in the building. In my role of [Infection Prevention and Control Doctor (IPCD)] and a senior member of the IPCT I was expecting to see a validation report (as per SHTM 03-01 section 8.64 and 8.65) for each operating theatre to be assured that they were meeting the parameters described in SHTM 03-01 Appendix 1 for air change rates and pressure cascades."[55]

> "In the later stages such as Stage 4 there will also be a dependence on … assessment of the ventilation system by the independent authorising engineer to fully assess if they are SHTM compliant and 'fit for purpose'."[56]

2.7. In early January, Multiplex provided Ms Sansbury with an example of a commissioning checklist indicating what they intended to provide by way of theatre validation. Ms Sansbury sent it on to Dr Inverarity and Sarah Jane Sutherland (lead HAI-SCRIBE advisor) by email on 9 January 2019 with a question as to whether this covered "all you need".[57] Ms Sutherland noted that the "contractor/project team" should refer to section 8 of SHTM 03-01, which outlines the validation and commissioning process, to be sure that all the requirements have been met. Dr Inverarity emphasised once again that "The company that performs the validation is expected by SHTM 03-01 (and us) to produce an easy-to-read succinct report that outlines which aspects have passed or failed, what snagging issues have been identified and how they have been corrected."

53 A41295523 - Email from Dr Inverarity 24 August 2018 - HC2024.B13.V8 - page 460 to 461.
54 The HAI-SCRIBE procedure is set out in SHFN 30 (A33662182- SHFN 30 Part 1 - HC2024.B13.V3) which was originally published in 2002. 2002 version was updated by a version published in 2007. Use of the 2007 version was mandated by CEL 18 (2007) of 13 December 2007.
55 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 40.
56 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 69.
57 A40988937- Email chain 11 January 2019 - HC2024.B4 - page 6.

2.8. NHSL's Commissioning Manager for Hard Facilities Management, Ronnie Henderson, assured Dr Inverarity that Multiplex would, by handover "have carried out all the tests and validation required in the SHTM" and that this information would be made available in the Operations and Maintenance manual. The information however "will not be in the form of a specific report". Mr Henderson noted that: "Should we wish to have the validation done independently this can be arranged after handover at a cost to NHSL, however it is worth noting that the company NHSL usually employs to do validation checks of this type is the company carrying out the commissioning on behalf of Multiplex."[58]

2.9. Dr Inverarity told the Inquiry that the Infection Prevention and Control team (IPCT) "took this at face value" and understood from the email that:

> "We were being advised that we would be provided with ventilation validation documents that complied with SHTM 03-01 prior to handover and so we understood we would be able to review such information prior to handover to assess HAI risk and complete the Stage 4 HAI-SCRIBE section about ventilation suitability."[59]

2.10. There was an expectation on the part of the project team and IPCT that the ventilation system would be validated at an appropriate time, although given that this was a revenue-funded project there was some confusion as to when that should be and by what means. It remains Dr Inverarity's opinion that, in terms of SHTM 03-01, independent validation should take place prior to the carrying out of Stage 4 of the HAI-SCRIBE process, which should itself take place before the handover of the building.[60]

2.11. However, HAI-SCRIBE Stage 4 did not take place, nor was any further information relating to validation provided to the IPCT, prior to handover. Members of the IPCT became aware that handover had taken place from an email sent to all NHSL staff on 27 February 2019. By this stage no member of the IPCT had been given sight of any validation data or documentation to allow it to understand what might be the infection risk. This caused concern among members of the IPCT that due process had not been followed, and that infection prevention and control risks were not known.[61]

2.12. After being asked to confirm the level of IPCT engagement in the project, the Head of Service of NHSL's Infection Prevention and Control Services, raised concerns about their lack of involvement at handover. These were escalated. On 13 March 2019, following discussion with Dr Inverarity, Professor Alexander McMahon, Executive Director for Nursing, Midwifery and Allied Health Professionals (NHSL) shared the concerns, set out in further detail by Dr Inverarity, by email with Jim Crombie, Deputy Chief Executive (NHSL), Susan Goldsmith, Director of Finance (NHSL) and Tracey Gillies, Medical Director (NHSL). He wrote that the content of

58 A40988937- Email chain 11 January 2019 - HC2024.B4 - page 6.
59 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 97.
60 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 130.
61 Witness Statement - Donald Inverarity - 05.03.2024 - paragraphs 98 and 105.

Dr Inverarity's email "gives me cause for concern" and that he would instruct an action for Dr Inverarity and members of the IPCT to do a walk around of the whole building with the appropriate personnel." He also asked for reports requested by Dr Inverarity to be made available to him.[62]

2.13. Ms Goldsmith communicated this to Brian Currie, the Project Director. In response Mr Currie wrote:

> "it is accepted that given the uncertainty of the actual completion date, to almost the day before it occurred, IPCT were not involved in the actual day of completion. It is worth emphasising that patients will not occupy the facility until 9th July, 2019. It is our intention to carry out a pre handover check when all construction activity by IHSL/[Multiplex] completes in June."[63]

2.14. At a walkaround arranged with IPCT and others, Mr Henderson explained that commissioning and validation had been carried out for isolation rooms and theatres but this would be done again once construction works had been completed.[64] Ms Sutherland told the Inquiry that when she came to realise that the handover was part of a commercial agreement and that patients would not be moving in "imminently", "we knew that there was some give in that there was time to complete that process."[65] Stage 4 HAI-SCRIBE reviews were carried out for two areas on 26 April and 2 May 2019. These were not signed off however.[66] An HAI-SCRIBE review of theatres and imaging was scheduled for 17 May 2019. Availability of, or access to, the required information to complete the HAI-SCRIBE reviews continued to be a problem.[67]

2.15. On 10 May 2019 Mr Henderson sent Dr Inverarity a "validation report" that Multiplex had provided for one of the theatres. Mr Henderson noted that it differed from an example validation report that Dr Inverarity had provided. Mr Henderson wrote:

> "I can confirm that these have been reviewed and signed off by the independent tester which provides us with reassurance of compliance. If however you have any doubts or concerns, happy to discuss with a view to appointing someone from outwith the project to give an additional layer of assurance if required."[68]

62 A47088787 - Email chain 18 March 2019 - HC2024.B13.V7 - pages 58 to 75.
63 A47088787 - Email chain 18 March 2019 - HC2024.B13.V7 - pages 58 to 75.
64 A40988853 - Email dated 20 March 2019 - HC2024.B13.V3 - pages 462 to 463.
65 Transcript - Sarah Jane Sutherland - 29.02.2024 - column 180.
66 A47088786- HAI-SCRIBE Stage 4 Reviews 3 May 2019 - HC2024.B13.V7 - page 97; Transcript - Lindsay Guthrie - 01.03.2024 - column 99.
67 Transcript - Lindsay Guthrie - 01.03.2024 - column 98.
68 A40980996 - Email chain 10 May 2019 - HC2024.B2 - page 1396.

2.16. Mr Henderson was of the view that the reports produced by Multiplex could have constituted an acceptable format for validation. [69] However, Dr Inverarity did not think the validation report was adequate.[70]

2.17. Dr Inverarity initially expected that independent validation was required only for theatres and isolation rooms. Following engagement with NHSL's Authorising Engineers[71], Mr Henderson instructed the Institute for Occupational Medicine (IOM) to undertake an independent validation of critical ventilation systems including theatres, isolation rooms, angiography procedures room, intra-operative MRI and units within critical care.[72] IOM were asked to check the performance of the system against SHTM 03-01, rather than Settlement Agreement 1 which contained certain derogations from SHTM 03-01 (discussed in chapter 6).[73] The request for validation was made on 30 May 2019, five weeks before the hospital was due to open.

What IOM reported - the respects in which the ventilation system was non-compliant with SHTM 03-01, or otherwise defective

2.18. On 17 June 2019 IOM began an independent validation of the hospital's ventilation system. Even at this stage the hospital was not the "fully clean" environment which was a pre-requisite for validation, and IOM reported some issues which were hampering its work.[74]

2.19. Between 17 June and 24 June IOM found that rooms in operating theatre suites, patient bedrooms in critical care and some isolation rooms did not meet the air change rates recommended in SHTM 03-01.[75] IOM did not produce written reports at this stage. However, based on the reports published by IOM in November 2019, it would appear that there were some 16 instances of failure to meet recommended air change rates in the above room-types surveyed between 17 and 24 June. Two of the rooms in the critical care department surveyed at this time also did not meet the recommended pressure differential.

2.20. On 19 June IOM's initial results, shared with NHSL's technical advisers Mott MacDonald Ltd (MML), showed that the air change rate in two of the four-bedded bays in the high dependency unit of the critical care department were achieving less that 4 ac/h. [76] On 20 June IOM found that air handling units (AHUs) were non-compliant with SHTM 03-01 due to the wiring connections within each section of each AHU.[77]

69 Witness Statement - Ronnie Henderson - 26.02.2024 - paragraphs 58 and 59.
70 A40988868 - Email dated 13 May 2019 - HC2024.B13.V8 - page 495.
71 A40981181 - Email chain - 20 May 2019 - HC2024.B2 - page 1401.
72 A32653431 - Email 3 June 2019 - HC2024.B6 - page 158; Witness Statement - Ronnie Henderson - 26.02.2024 - paragraph 75; see also Witness Statement - Donald Inverarity - 05.03.2024 - paragraphs 132 to 133.
73 A40982525 - Email 20 June 2019 - HC2024.B6 - page 178.
74 A40982525 - Email 20 June 2019 - HC2024.B6 - page 180.
75 A35231006 - IOM Services report 20 June 2019 - HC2024.B6 - page 203.
76 A34822744 - Email 19 June 2019 - HC2024.B6 - page 170.
77 A40982525 - Email 20 June 2019 - HC2024.B6 - page 174.

2.21. An interim reporting meeting was held between NHSL and IOM on 24 June 2019 during which a range of issues were raised. Mr Currie provided a summary of these issues to IHSL and Multiplex. On 25 June 2019 Paul Jameson of IOM sent an "issues log" to Mr Henderson, Colin Macrae (Senior Building Services Engineer, Mott MacDonald), Mr Currie, and Mr Greer.[78] The issues log recorded that some isolation rooms, some rooms within operating theatre suites and HDUs (high dependency units within critical care) were not achieving the required air change rate.

2.22. The issues log recorded a number of other issues with specific components of the system and its functioning. In total it contained 39 items, the majority relating to theatres and AHUs (15 items each). It also contained items relating to "general" (quality of commissioning and use of swirl diffusers), "preparation" (readiness for handover), "isolation rooms" (air change rates, and resilience issues), one item relating to "HDUs" and two items relating to "BMS" (the building management system).

Actions by NHSL and Scottish Government leading up to the decision to postpone opening

24 to 28 June 2019

2.23. The issues that IOM raised at an interim reporting meeting with NHSL on 24 June 2019 were discussed at the RHSC & DCN Steering Group meeting held later that day. The meeting was attended by Ms Goldsmith, Mr Currie, Matt Templeton (director of IHSL, contracted to deliver the hospital) and the Chief Operating Officer from Multiplex. Item 3 of the meeting was to "Review Progress of Post Completion Works and Outstanding Works". A list of issues "highlighted the Board's concerns with progress towards opening."[79] Independent validation of critical ventilation systems was the only issue marked as "critical to opening". It was recorded that "The verification process has highlighted some real concerns with certain areas not achieving the required air changes" and that a separate workstream would look at these questions.

2.24. Over the next few days, the IOM issues log was shared with and commented upon by relevant parties. A meeting was held on 28 June which Ms Goldsmith, Ms Gillies and Professor McMahon attended with members of the Project Team and others, but not the IPCT. The focus of the meeting – and many of the discussions at this stage – was theatre ventilation and water testing. Ms Gillies told the Inquiry: "we started focusing on making sure that for the move, which was then just under two weeks away, we had sufficient theatres to be able to deliver the expected activity."[80]

78 A40988873 - IOM issues log 25 June 2019 - HC2024.B6 - page 255.
79 A35827770 - Steering Group Meeting 24 June 2019 - HC2024.B6 - page 250.
80 Transcript - Tracey Gillies - 08.03.2024 - column 20.

2.25. At this point NHSL was still investigating the significance of the reported issue with critical care ventilation, including what the issues were and how they could be resolved. Mr Henderson, who had returned to work on 26 June 2019 following a period of annual leave, told the Inquiry:

> "Investigations included additional tests carried out by IOM (and separately by [Multiplex]) to verify the original results. In some areas [Multiplex] were reporting back different readings to IOM. To resolve that conflict, it was agreed that [Multiplex] and IOM testing would be carried out at the same time so readings could be verified by both parties on the spot. We were also checking the calibration of the measuring equipment itself to see if that was the problem. We were then triple checking calculations because the results were just so unexpected.
>
> While these investigations were underway it was unknown to NHSL if there was a fundamental fault with the system that could be rectified easily to provide the required 10 ach or if there were more significant underlying reason for the issue. The meetings with [Multiplex] turned into small, focused workshops."[81]

Monday 1 July 2019

2.26. On 1 July 2019 Ms Gillies emailed Timothy Davison, NHSL's Chief Executive, attaching a briefing on water and ventilation issues at RHCYP and DCN. The briefing began by noting:

> "The testing and quality assurance work prior to the move into RHCYP/DCN is not yet sufficiently complete and demonstrating adequate assurance to support the finalised move date. This will be subject to daily work and checks this week. A final decision about the move of patients will need to be made by Wed 3 July."[82]

2.27. Regarding ventilation, the briefing sets out that there were issues and faults with all 10 theatres but that no written report on isolation or critical care had yet been received. It contained an outline of the plan to address theatre ventilation and stated that twice daily calls would be put in place from Monday 1 July 2019 to monitor progress on issues.[83]

2.28. Mr Davison told the Inquiry:

> "The email on Monday followed what Susan had briefed me on the Friday evening. I knew that Tracey Gillies and Alex McMahon were going to be meeting with IOM and the project team that day and I would be briefed later in the day as to the outcome.
>
> At that point, I would still have been anticipating that we could resolve these issues although it was going to be very close to the wire."[84]

81 Witness Statement - Ronnie Henderson - 26.02.2024 - paragraph 78 to 80.
82 A41020535 - Email 1 July 2019 - HC2024.B13.V4 - page 15.
83 A36078221 - Document 1 July 2019- HC2024.B13.V3 - page 692.
84 Witness Statement - Tim Davison -08.03.2024 - paragraphs 51 to 52.

2.29. Later that day the IOM reported to Mr Currie that the ventilation system in critical care areas was not capable of delivering 10 air changes per hour. Mr Currie spoke to Ms Gillies before a meeting. Ms Gillies told the Inquiry:

> "I do not believe there is any ambiguity about when the critical care ventilation issue, namely the design that did not provide 10 air changes at the requisite pressure regime, was brought to my own attention. That was in a conversation between Brian Currie and myself immediately before the meeting at 4.30pm on the 1st July. Brian raised this with me in a side room prior to entering the main meeting discussing ventilation, which was primarily focussed on the snagging and rectification of the issues related to the theatre ventilation systems."[85]

2.30. After the meeting, Ms Gillies emailed Tim Davison, to brief him. She noted that if the hospital was occupied now, "there was risk to patients, visitors and staff of airborne virus transmission and difficulties in correcting." If not occupied now, the move would need to be postponed. The team was going to contact external experts for advice.[86]

Tuesday 2 July 2019

2.31. Mr Davison said that he read Ms Gillies's email the following morning, Tuesday 2 July. He told the Inquiry:

> "Within an hour or two of having seen Tracey's email…I convened and chaired an emergency meeting with the team.…
>
> It was important that I was appraised of just how serious this was, what could be done, whether the situation was retrievable and what options were available to us…
>
> …I wanted some clarity on whether what the IOM testing was showing us was complete and accurate and if there were permanent or interim solutions available…
>
> …One of the outcomes of the meeting was that those in attendance would engage with their appropriate counterparts to get answers to the questions discussed. For example, those within Infection Control would speak to HFS and HPS and those in the project team would speak to Multiplex and IHSL. We would reconvene later that afternoon and see where we had got to.
>
> It became clear…that we needed to make a decision by the following day… because the move…was going to start on Friday 5 July… We recognised that we might be having to make a decision with incomplete information, but we couldn't not make a decision.

85 Witness Statement - Tracey Gillies - 08.03.2024 - paragraph 9.
86 A41263213 - Email 1 July 2019 - HC2024.B13.V4 - page 13.

> My recollection was there was an interim conclusion that it was highly likely that we would have to postpone some or all of the move. We had not yet reached that decision but it was clear that this was not something that we were going to be happily resolving by the end of the day, hence my escalation of the issue."[87]

2.32. Mr Davison briefed the NHSL Chair, Brian Houston, in advance of a call that had been scheduled for the afternoon of 2 July with Scottish Government's Director General for Health and Social Care and NHS Scotland Chief Executive, Malcolm Wright, and NHS Scotland Chief Performance Officer, John Connaghan.

2.33. Mr Wright told the Inquiry:

> "I first became aware of the issue within the critical care unit at RHCYP when a message came through to my private office early that afternoon advising that the Chief Executive and Chair of NHSL wanted to have an urgent conversation with me. That does not happen very often. I made sure we had relevant officials in the room, who I believe were John Connaghan, Alan Morrison and a private secretary would have also been present. A conversation took place in the early afternoon of 2 July 2019, whereby the Chair and the Chief Executive were on the line, and they outlined that they had come across this issue, and they could not get the 10 air changes per hour within the critical care unit. They were both extremely concerned about it...The ability to resolve that by Friday was going to be very challenging but they were trying to identify a workaround to the problem."[88]

2.34. Mr Wright and Mr Connaghan stood up the Health Resilience Unit. According to Mr Wright, this is:

> "a standing capacity that we have within the DG Health...It's not a large unit but there are some very experienced colleagues who work there, and they report it through to John Connaghan as the chief performance officer. So, if there was a…critical emergency situation somewhere within the NHS in Scotland, they could give us capacity as to how to manage that, how to manage the flows of information, how to manage the communications around that, and making sure ministers got what they needed when they needed it."[89]

2.35. Mr Wright informed the Cabinet Secretary for Health and Social Care, Jeane Freeman, of the emerging issue and she was provided with a written brief later that day.[90] The briefing informed the Cabinet Secretary of the discovery that the rate of air change per hour in the critical care rooms did not meet recommended guidance of 10 ac/h. NHSL was "urgently exploring with our contractors what it will take to bring the air change rate in critical care up to standard and to understand what the implications are for migration to the new facility…" The briefing noted the issues in theatres. These were "being worked through and are not believed to pose risk to the migration programme".

87 Witness Statement - Tim Davison -08.03.2024 - paragraph 65.
88 Witness Statement - Malcolm Wright - 07.03.2024 - paragraph 27.
89 Transcript - Malcolm Wright - 15.03.2024 - paragraph 42.
90 A41020525 - Email from Alan Morrison attaching briefing 2 July 2019 - HC2024.B7.V1 - page 37.

2.36. It provided background to how it came to be that a derogation was agreed to reduce the air change rate from 6 to 4 times per hour in 14 out of 20 of the four-bedded rooms. Specifically, that a Settlement Agreement had been signed to that effect, and that the Settlement Agreement also included reference to the relevant guidance specifying 10 air changes per hour for critical care beds. NHSL noted "It is not yet clear if the Contractor, Multiplex, has interpreted the derogation as "overwriting" SHTM specifications."[91]

2.37. The briefing noted that the existing Royal Hospital for Sick Children had a zero rate of air change in critical care.

2.38. The note provided an assessment of the issue, beginning with a set of questions to which NHSL was seeking answers in order to reach an informed decision on continuing with migration as planned on 5 July:

- "What can be done with the existing ventilation plant to improve on an air change rate of 4 times per hour?
- Is there an interim fix which can improve upon 4 air changes per hour with a view to effecting a more permanent solution over time?
- Can a permanent solution be installed in the new building once it is occupied?
- What would be the level of disruption and what would be the loss of capacity?
- What loss of capacity could be tolerated within the bounds of acceptable clinical risk, given that paediatric critical care operates usually at high capacity and given that NHS Lothian runs a national service.
- How long would it take to acquire new ventilation kit and to complete works to achieve 10 air changes per hour?" [92]

2.39. The briefing included a summary of a meeting that had been held at midday between NHSL (including the IPCT) and contractors, where issues with theatres, PPV isolation rooms and critical care had been discussed. According to the brief, theatres were being tested and three were expected to be fully compliant by the end of the day. Plans were in place to test other theatres. A programme of work had been requested in respect of the isolation rooms which were not meeting the recommended air changes (this was not flagged as a significant issue in the brief). The briefing summarised options being put forward by Multiplex with a view to increasing air change rates in critical care. This included an interim option to keep some rooms closed in order to increase the air change rate to 5.2 ac/h in four-bedded rooms and 7.1 ac/h in single rooms. The indicative timescale for the interim solution was 3 days of work.

91 A41020525 - Email from Alan Morrison attaching briefing 2 July 2019 - HC2024.B7.V1 - page 37.
92 A41020525 - Email from Alan Morrison attaching briefing 2 July 2019 - HC2024.B7.V1 - page 37.

2.40. The briefing also included a short risk assessment from Dr Inverarity, according to whom: "all air exchange rates are currently better than what we have today, therefore will be in an improved position, but would wish external advice from HFS/HPS."

2.41. The conclusion of the briefing was:

> "We need to decide in the next 24 hours whether a permanent solution to get to 10 air changes per hour can be achieved after we have moved into the new building without undue disruption or loss of capacity. If this can be achieved our preference would be to continue with the move.
>
> However, if we cannot get a satisfactory answer to this question within the next 24 hours our preference would be to delay until such times as we do have a satisfactory answer." [93]

2.42. Over the following days the Cabinet Secretary was advised by the Director General and all of the relevant directors. The Chief Medical Officer (CMO) and Chief Nursing Officer (CNO) were both on leave, so their deputies stepped in to provide advice from those directorates.[94] Ms Freeman's first step was to seek further information. She explained:

> "After I had received this news on 2 July 2019, many meetings and telephone calls took place between 2 and 4 July 2019. I had various questions that I needed to have answered…This was a big bolt from the blue; it was going to be unsettling and destabilising; and both patients and staff would need to feel confident that somebody had taken a grip of the situation and that it was going to be fixed…
>
> …There were two categories of questions we needed to ask. One related to all the things we needed to know in order to put everything that would be required in place in the run up to making the announcement. That included everything from how to tell people (staff, patients, unions, the general public, the First Minister, and Parliament – which had just gone into recess), to re-arranging staff rotas and appointments. Then, running parallel to that, we needed to understand how this had happened; how could we be assured about the other areas; and what level of work would be needed and how much would that cost? Was the issue contained to the ventilation in critical care - was the ventilation everywhere else, okay? Were the water, drainage, and gases all right? We needed to quickly interrogate what had to be done in order to understand the full scale of the problem that required to be resolved, what would be required in order to resolve the problem and how much it was going to cost."[95]

93 A41020525 - Email from Alan Morrison attaching briefing 2 July 2019 - HC2024.B7.V1 - page 37.
94 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 50.
95 Witness Statement - Jeane Freeman - 12.03.2024 - paragraphs 44 and 51.

Wednesday 3 July 2019

2.43. On the morning of 3 July, Mr Morrison (Health Finance and Infrastructure, Scottish Government), met with HFS, HPS, and NHSL to consider the risks associated with delivering the proposed "permanent solution" with patients in situ. The consensus view was:

> "…with unknown risks associated with moving patients and then modifying the ventilation of the building, combined with the 'believed safe' environment of the current facility, the safety of patients might be better served by delaying the move and modifying the ventilation in the new building, before moving patients."[96]

2.44. At 13:00 NHSL held an internal meeting to consider the available options.[97] After detailed discussion, the option recommended was to rephase the timing of the move into the building and allow a phased occupation over the next few weeks and months.[98] At 14:00 the meeting was joined by Scottish Government representatives, including Mr Connaghan and Mr Morrison. Mr Connaghan asked that the communication strategy for the preferred solution be developed but emphasised that it was important that no communications were issued until he had briefed the Cabinet Secretary on the outcome of the meeting. Mr Connaghan said he would personally update Mr Davison on the outcome of his discussion with the Cabinet Secretary.

2.45. Following the meeting Mr Davison produced a note for Mr Wright and Mr Connaghan, sent by email, detailing the logic behind NHSL's preferred option, explaining the reasons why other options had been dismissed, and providing details around steps being taken to address the ventilation issues in collaboration with IHSL and its supply chain.[99] The option assessment was as follows:

> "1. Continue with the planned move of all services and attempt to deliver the permanent fix for the ventilation problem while the critical care unit remains occupied:
>
> This option was not supported because of the impact of noise and disruption during remedial works on patients, parents and staff; being unable to deliver the complete optimum solution of increasing the size of the ducting in an occupied clinical area; and the loss of capacity in critical care during the remedial works.
>
> 2. Continue with the planned move of all services and then decant critical care into a modular build unit to allow the optimum solution to be delivered in an empty environment:
>
> This option was not supported because of the lack of critical clinical adjacencies if critical care is remote from its ideal location; disruption and further works

96 A35827794 - Email from Ian Graham to Chief Executive 3 July 2019 - HC2024.B7.V1 - page 43.
97 A41292981 - Draft Minutes of Meeting 3 July 2019 - HC2024.B13.V4 - page 17.
98 A35827798 - Draft meeting note 3 July 2019 - HC2024.B7.V1 - page 57.
99 A41020529 - Email 3 July 2019 - HC2024.B13.V3 - page 1141.

involved in securing a secure connection to the new building; the significant likely time delay to deliver a modular building – estimated to be around 6 months; the risk associated with moving into a critical care unit that we know does not comply with the highest ventilation standards required.

3. Defer moving into the new building altogether:

This option was not supported because the rephrasing of the move of the critical care unit only really affects those services dealing with the sickest of paediatric patients including inpatient beds, the emergency department and theatres. It does not materially impact on DCN services and ambulatory paediatric services and therefore there is no need to defer these elements of the move;

4. Re-phase the timing of the move into the building to allow a phased occupation over the next few weeks and months:

This option was supported as the best option. It would allow the permanent optimum solution for the critical care ventilation issue to be implemented in an empty ward without clinical risk and with limited disruption to the other users of the building; it prevents the need for double moves including a decant; it would allow DCN services to move in as planned; and it would allow ambulatory paediatric services including outpatients, therapies, programmed investigations and day surgery to move in over the summer."[100]

2.46. The email also set out next steps for NHSL. This included developing the communications plan; commissioning the permanent solution; and carrying out a clinical assessment and plan for the rephased move. NHSL was also to investigate how the derogations for ventilation in the settlement agreement had come to include critical care beds "which was not consistent with the environmental matrix which included the requirement to comply with SHTM 03-01." NHSL also planned to undertake a post-project evaluation, as was standard practice for major estates developments.

2.47. Mr Connaghan told the Inquiry that:

"This email highlighted, in my mind, three areas of concern.
Firstly, communications to patients and staff needed to be clear and consistent to avoid confusion. Secondly, I worried that the concept of split site working may prove problematic given the scale of the moves. My third concern was whether or not the critical care ventilation issue was the only problem we had on the site."[101]

100 A41020529 - Email 3 July 2019 - HC2024.B13.V3 - page 1141.
101 Witness Statement - John Connaghan - 07.03.2024 - paragraph 36.

2.48. Mr Wright attended a meeting with Ms Freeman where he shared what NHSL's preferred option was. Ms Freeman told the Inquiry that she "did not believe it was their decision to make." She explained:

> "I took the view that I could not leave this decision in the hands of NHSL because they had not been aware of the problem until the last minute. Instructing IOM is standard and so was not an indicator at all that they were on top of the situation. In addition, given the criticality of ventilation, which was not identified to be sub-standard until mere days before 'go live,' I could not have confidence in the governance performance of NHSL and consequently that all other required standards in the build had been met…
>
> …I think it's probably fair to say that my level of concern at this situation grew over the days. You can't talk about putting patient safety first and then say you want to have a phased entry from the date originally planned without having supporting information to confirm that it will be safe in all hospital areas including theatres and that all required clinical and safety standards had been met to confidently allow patients and staff to enter and use the building. We did not have that level of confirmation and assurance because NHSL could not provide it; and any attempt to move patients and staff into some areas of the new hospital and then 'retrofit' the sub-standard areas carried clinical risk (for example, from airborne dust). And of course, at this point, we could not be sure the extent of any 'retrofit' required.[102]

The Cabinet Secretary's decision

2.49. On 4 July 2019 the Cabinet Secretary held a meeting with her advisers to help her make her decision with regard to opening the hospital. The position of NHSL, as explained to the Inquiry, is that the only issue precluding the occupation of the RHCYP by patients in July 2019 was the incorrect number of air changes in single and multi-bed rooms in critical care, albeit it accepts that there were other technical issues which could impact on patient care. The evidence heard by the Inquiry would indicate that while discovery of non-compliance with SHTM 03-01 was the occasion of the need to make a decision as to whether the hospital should open on 9 July 2019 and the central consideration, the Cabinet Secretary's decision-making process was somewhat more broadly based. Ms Freeman told the Inquiry:

> "The other element in my decision making was: if this had come to light barely a week before the intended move date and everything up until then had been assured to be 'on track', was everything else constructed properly? Now that this had happened, how could I be sure that the drainage, the gases, and everything else about this building was as it should be? The simple fact was that I couldn't be that sure and, in that moment, I felt that I had lost trust and confidence in the assurances that had been given about the readiness of the RHCYP/DCN to open and deliver safely to patients."[103]

102 Witness Statement - Jeane Freeman - 12.03.2024 - paragraphs 54 to 59.
103 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 45.

2.50. This was a particular concern in the context of the emergence of issues with patient safety at the Queen Elizabeth University Hospital in Glasgow. Mr Wright told the Inquiry:

> "…The experiences of and lessons being learned from the QEUH made us conscious that we had to be very careful about what action should be taken. We could not risk making the decision to open the hospital and then later discover that there were potential issues that we could have mitigated against by pausing, that harmed patients."[104]

2.51. Similarly, Mr Connaghan told the Inquiry that there were concerns that NHSL's preferred option would involve a partial move of services and that the Scottish Government "would need assurances that there were no patient safety issues associated with that – patient safety issues from the perspective of operational delivery and split-site working but also, more importantly, patient safety issues in terms of meeting the required technical standards."[105]

2.52. There was a sense that it was not possible to fully understand the problem, and the implications of resolving it, in the time available before the scheduled move. Mr Wright explained:

> "In terms of understanding the scale of the problem with the building, we were concerned that there might be further issues that were not yet known of, so we could not confidently, at that stage, identify the solution or the consequences (including cost) of such a solution. Similarly, we could not, at that point, properly understand the disruption that any solution would cause, including whether any solution could be implemented with patients in situ. There needed to be assurance that the new building would be fully compliant with relevant standards. More work also needed to be done in order that we could know what the knock-on impacts would be for other services, including whether there would be a loss of national capacity. There was also the contract structure, which might impact upon the cost and timeframes of potential solutions, to consider. You cannot properly consider all of these complex variables within 48 hours."[106]

2.53. Ms Freeman considered the practicalities of postponing the move, financial considerations, risks and consequences. According to Ms Freeman:

> "The principal risk considered was that if it was not currently safe to move patients into the new facility, how safe would it be to keep them where they were, and what could we do to make that safer….
>
> …I was aware that the conditions at the existing sites were far from ideal (hence them being replaced by the RHCYP/DCN). I was also aware that, despite those facilities being far from ideal, they were providing a safe environment for patients – something that on available information on 2 July 2019 and 4 July 2019 I had no assurance of in relation to the RHCYP/DCN.

104 Witness Statement - Malcolm Wright - 07.03.2024 - paragraph 53 to 56.
105 Witness Statement - John Connaghan - 07.03.2024 - paragraph 46 to 49.
106 Witness Statement - Malcolm Wright - 07.03.2024 - paragraph 53 to 56.

> The timescales concerned did not allow for a detailed risk analysis exercise, comparing and contrasting the pros and cons of remaining beyond 9 July 2019 at Sciennes/ WGH or moving on 9 July 2019 to RHCYP/DCN. There was no time to record a detailed risk assessment. As such, I had to make my decision based on all available advice from my advisers (including clinical advice from the offices of the Chief Medical Officer and Chief Nursing Officer, together with advice from HFS/HPS) and that decision, essentially, paused the move to allow time for more detailed consideration of all of these issues."[107]

2.54. The Cabinet Secretary was aware of issues with water safety at DCN which had led to a reduction in the capacity to treat patients there. In common with the RHSC at Sciennes, Ms Freeman noted, the building was in some disrepair.[108]

2.55. Ms Freeman did not seek any advice on whether the hospital was in fact "unsafe" with the specification of 4 ac/h as provided for by SA1, and the government did not consider the option of accepting the ventilation system as it had been built, even though it was better than what was provided at Sciennes. It was explained to the Inquiry that an assessment of risks and options in relation to a project would be within the remit of the health board or project team, not Scottish Ministers. Notwithstanding this, Ms Freeman's view was that:

> "Sciennes is a Victorian hospital…where it was not possible to insert mechanical ventilation…probably without decanting the whole hospital, but the effective mitigations that had been put in place and the quality of the clinical care all produced evidence that it was a safe environment. You've got a new build that has taken some time to build, has cost a great deal of money, and in one critical area does not meet the standard now required in this decade. Why would you move people into that from an environment which has proven itself, albeit without mechanical ventilation, but with high quality care, significant mitigation, and good infection prevention and control? Why would you move people from that into one that is not meeting the standards that are required now to assist effective and safe care?"[109]

2.56. Ms Freeman's view is that 10 ac/h was set out in the guidance, and that the guidance is the standard to be met:

> "… guidance is drafted by those who are expert in the area that the guidance addresses. I'm a Cabinet Secretary. I'm not an expert in infection prevention and control. I'm not an engineer. I'm not a construction expert. So it is important that I pay attention to the expertise in the relevant field and don't try and gainsay it."[110]

> "I cannot see the point of dancing on the head of a pin about whether or not it is 7.1 or 6.2, when 10 is what is required. 10 is what is required, so we will have 10."[111]

107 Witness Statement - Jeane Freeman - 12.03.2024 - paragraphs 63 to 74.
108 Transcript - Jeane Freeman - 12.03.2024 - column 61 to 62.
109 Transcript - Jeane Freeman - 12.03.2024 - column 51 to 52.
110 Transcript - Jeane Freeman - 12.03.2024 - column 18.
111 Transcript - Jeane Freeman - 12.03.2024 - column 55.

2.57. Mr Morrison told the Inquiry that investigating whether 4 ac/h could be safe:

> "… was not part of our consideration, but…thinking about this now, it would undermine our guidance… it would be presented as whenever it's inconvenient for us that we can just change our guidance…I don't think anyone or many people would have been happy with that. Even if we had gone to that effort to undertake a risk assessment and say, actually, you know, "We've got specialists that say this is fine," I just don't think that would have landed."[112]

2.58. Mr Wright told the Inquiry that the government wanted a hospital that complied with guidance and standards in order to "future proof" the hospital to ensure it would remain safe for patients throughout its life.[113] Dr Inverarity's view was that it was reasonable and appropriate to treat the guidance as a default standard in the absence of any risk-assessed, clinical choice for something lower.[114]

2.59. No risk assessment was subsequently undertaken in relation to the safety of the hospital as built under SA1.[115] The Scottish Government was not made aware of, and therefore did not consider, that there were alternative interpretations of SHTM 03-01, such as that offered by the contractor who designed the ventilation system for the RHCYP (and which is discussed further in chapter 5).

2.60. The Cabinet Secretary thus made her decision to "halt the planned move… for the time being…in the best interests of patient safety and to ensure that we provide sufficient time for the resolution of the ventilation issues".[116] Mr Davison was informed in writing. Shortly thereafter, at approximately 16:15 on 4 July 2019 the Scottish Government issued a media release. At approximately 16:30 NHSL issued a Staff Communication internally.

2.61. Following the delay to opening the hospital, NHS National Services Scotland undertook a review of the scientific literature on ventilation air changes and clinical outcomes and it was recognised that the evidence was sub-optimal. The Inquiry has heard that there are challenges in researching these matters. Nevertheless, as discussed in chapter 5, the air change and pressure parameters recommended in SHTM 03-01 reflect a broad consensus across the developed world, and a similar consensus supporting an approach in which critical care areas should be better ventilated than general wards and should afford protection of patients against air-borne pathogens by means of pressure differentials.

112 Transcript - Alan Morrison - 13.03.2024 - column 136.
113 Transcript - Malcolm Wright - 15.03.2024 - column 50 to 51.
114 Transcript - Donald Inverarity - 05.03.2024 - column 58.
115 See for example: Transcript - Ronnie Henderson - 26.02.2024 - column 171; Transcript - Alan Morrison - 13.03.2024 - columns 130 to 136.
116 A35827763 - Letter from Malcolm Wright - HC2024.B7.V1 - page 79.

Conclusion

2.62. The basis for the Cabinet Secretary's decision was the information she had received regarding the issue with critical care ventilation, from NHSL and her advisers. Some of the information was in writing but much of it was provided verbally. This was not inappropriate given the urgency of the situation. Witnesses' accounts of the timeline of key events and advice given to the Cabinet Secretary tell a coherent and consistent story to the extent that can be expected, given the urgency and fast pace of the events that occurred and decisions that were taken.

2.63. The issue with non-compliant ventilation in critical care was the technical issue that led to the Cabinet Secretary's decision to delay opening the hospital. The Cabinet Secretary felt there were too many unknowns around what work was required to resolve the problem with the ventilation system, and was aware of the risks to patients when ventilation works take place with patients on site, based on experiences at the QEUH. Moving patients did not appear to be a safe option.

2.64. While there were other issues being reported by IOM, for example with respect to theatres and AHUs, these were not the subject of briefings to the Cabinet Secretary.

2.65. In addition to the information the Cabinet Secretary had regarding the technical issue with critical care air change rates, Ms Freeman's decision was also informed by:

- her awareness of the risks to patients when there were issues with building services, based on experience at the QEUH;
- her concerns about the level of assurance NHSL was able to provide that building systems were safe, particularly in the context where NHSL had failed to detect a significant issue with ventilation until the last moment;
- a concern that there could be other issues with building systems beyond ventilation;
- a disinclination to accept a specification which was less than what was understood to be required by the standard guidance;
- an understanding of the difficulties involved in carrying out remedial construction work to a hospital when patients are in residence.

2.66. Given the short timeframe in which to make a decision, it was not possible to carry out a formal risk assessment. The Cabinet Secretary's assessment was that while there were issues with building services at the former RHSC and the DCN, these were being managed by staff who were familiar with the respective environments. Sciennes was considered to be safe. DCN had issues with water safety, but the these were being managed. This was in contrast to the many unknowns about the risks associated with the new hospital building and how to manage them.

2.67. The Cabinet Secretary's decision to insist on compliance with the guidance was, in respect of air changes, a defensible and rational one given that the guidance recommendation reflected a consensus agreed by experts and given that there was no risk assessment, or clinical need, justifying a departure from it. It had the consequence that a new and unused ventilation system was replaced at significant cost and disruption. Given the uncertainties of the underlying science, it is unlikely that any more detailed investigation would have generated comfort that 4 air changes was appropriate for the critical care department of a newly completed hospital. The decision to postpone migration of patients into the new hospital offered the practical advantage that remedial works could be carried out, and were carried out, in a building in which there were no staff or patients.

Chapter 3

Impact on patients and families and whether communications with patients and families supported and respected their rights to be informed

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Introduction

3.1. This chapter provides a conclusion on the Inquiry's Term of Reference 8, which is: "to examine the physical, emotional and other effects of the issues identified on patients and their families and to determine whether communication with patients and their families supported and respected their rights to be informed and to participate in respect of matters bearing on treatment."

3.2. Because of the decision of the Cabinet Secretary to delay opening the hospital, patients and families did not experience any direct effects in relation to their safety and care caused by, for example, an increased risk of infection due to a non-compliant ventilation system. Rather the effect of the issue with critical care ventilation in the case of the RHCYP and DCN was indirect. This chapter is concerned with the impact caused by the delayed move to the new facilities, and the extent to which patients and families were adequately informed about the delay and appropriately supported.

3.3. The Inquiry heard from a number of parents who gave evidence on the experience of patients and families affected by the delay to opening the RHCYP and DCN. In all of these cases it was the family member of a patient being treated at the former RHSC or DCN who gave evidence reflecting on their own experiences and that of their child. In all cases, the child had been treated for some time in the old facilities, and expected to receive treatment in, or be moved to, the new facilities in July 2019.

The state of the facilities at the RHSC and former DCN

3.4. Family members of young patients being treated at the former RHSC and DCN spoke to the poor condition of the facilities there. The overall situation at the Sick Kids was described as follows:

> ""Overall, I think that the old hospital just felt like a makeshift place, where they knew for years that a new hospital was being built and they just basically made do with what was in the old place for as long as was necessary. From a nonmedical point of view, I think it was very poor and the nursing staff did well just to keep it functioning."[117]

3.5. The lift often "wasn't working and, even when it was, it was the slowest lift you could imagine, to the extent that a lot of people just didn't use it."[118]

3.6. The size of the rooms for patients were described as "tiny".[119] One witness recalled for example:

> "during the ward rounds the consultant comes in, then the registrar comes in, then maybe two junior doctors are trying to look over their shoulder and see what they're doing. A pump then alarms because they need a new change of IV bag, and everyone has to shuffle around so that things can be done. Those rooms are only designed for the child, the parent, and one doctor. Another example was if an ultrasound was required and the child was too ill to be moved, a portable ultrasound machine would be brought in, and it is huge. To get it into the bedroom, almost all the furniture needed to be removed from the room. If the child is upset and scared, they want mum to hold their hand, but there's no room for mum. On some occasions, I had to sit on the windowsill to try and hold X's hand whilst the doctors/nurses were dealing with her. Those are the kind of things that let the staff down, I felt."[120]

3.7. There were issues with general maintenance. One witness said: "Most days there'd be something, either just off the ward, or in the ward, that needed a bit of fixing, and fiddling. Sometimes they'd be fixed immediately, sometimes they might be out of bounds for a little bit, until they managed to fix it."[121]

3.8. Wards were cold. When one witness's child was admitted to ward 2 from January to March 2019 they had to take their own blankets "because the rooms were freezing as it's an old building. Even with the heating on it was still a really cold ward."[122] Another witness said: "It was so cold, you could see your own breath

117 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 38.
118 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 36.
119 Witness Statement - Haley Winter - 3.11.2021 - paragraph 81.
120 Witness Statement - Lesley King - 04.11.2021 - paragraph 75. Name of child removed and substituted with "X" (in all following quotes also). See also Witness Statement - Mark Bisset - 03.11.2021 - paragraph 113.
121 Witness Statement - Lesley King - 04.11.2021 - paragraph 76.
122 Witness Statement - Mark Bisset - 03.11.2021 - paragraph 108.

in the room…It was winter the first time we were there, and I had to sit with my outdoor coat on."[123]

3.9. Internet facilities were poor. According to one witness they "rarely worked and there were kids who virtually lived in the hospital who struggled to do their school coursework because they struggled to get on their websites. That had been an issue for a long time at the hospital and people were looking forward to finally leaving that problem behind them at the old place."[124]

3.10. Facilities for disabled patients and families were poor or entirely lacking. One witness, who is a wheelchair user, told the Inquiry that the amenities in the old Sick Kids hospital "were no good to me". He explained that he couldn't go to the canteen because it was outside and up a flight of stairs, there was only one disabled toilet, he couldn't shower there as he couldn't get up the stairs, and "There was only one room that was suitable for me as it was the only wheelchair accessible one…"[125]

3.11. The toilet situation was described by one witness as "horrible".[126] Not every room had a toilet,[127] and there was no toilet on some wards for parents who had to use a public toilet in another part of the building.[128]

3.12. Getting drinking water was sometimes "a challenge", with no easy access to taps that would provide it.[129]

3.13. Similar issues were experienced by users of DCN:

> ""The DCN has never been an easy hospital to go to. In respect of the building itself, it was old, there weren't any waiting rooms and the treatment room was tiny. In the bedrooms there weren't en-suite bathrooms, and the beds weren't big enough…The beds didn't fit through the bedroom doors without having to apply some force and in general the building was not in a great state of repair. There were rusty hinges, the TVs didn't work, paint was peeling etc…We would then have to wait in a totally inappropriate waiting room. As the hospital was preparing to move to the new hospital there was stuff everywhere like boxes and chairs. It was not a great place to be.…The reality is that the building was not fit for purpose and these remedial works made no real difference to the hospital and it did not make anything better for the staff and patients"

3.14. Witnesses to the Inquiry acknowledged that some of these issues were inherent in the age and design of the building. It was simply inadequate properly to accommodate inpatients and the parents of often very young children, whose

123 Witness Statement - Haley Winter - 3.11.2021 - paragraphs 80, 81 and 84.
124 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 47.
125 Witness Statement - Mark Bisset - 03.11.2021 - paragraphs 111 to 113.
126 Witness Statement - Lesley King - 04.11.2021 - paragraph 74.
127 Witness Statement - Lesley King - 04.11.2021 - paragraph 13 and 15.
128 Ibid paragraph 16. See also Witness Statement - Haley Winter - 03.11.2021 - paragraph 86.
129 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 33. See also Witness Statement - Lesley King - 04.11.2021 - paragraph 78.

serious illnesses or congenital conditions meant that they were required to make repeated visits to and sometimes prolonged stays at the hospital. As one witness said: "The hospital was unpleasant for parents, but then it hadn't been designed to cope with parents; it had been designed for a time of life where you drop your child off at the door and pick them up in two weeks' time".[130] The state of the facilities was seen as making the job of the clinicians harder:

> "Overall, I think we tended to find that the building was letting the staff down. I think they were trying to do this tremendous job, and the building was limiting them sometimes. For example, they were trying to look after the infection control, but you'd see plaster coming off walls in places, and the maintenance guys would be around immediately that day, trying to patch things up. It was just a constant job of them trying to patch up things, to try and keep on top of the condition of the building, so that they could do the infection control. I mean, the cleaning staff were tremendous, but there's only so much you can do with the building as it was."

3.15. The impression was of buildings that, having given good service over the years, had reached their end of life and needed significant refurbishment or replacement. The "facilities were no longer fit for purpose by some margin".[131] One of the witnesses said:

> "I likened the situation to the hospital having limped along with one leg as it prepared for the big move to the shiny new facilities but that leg was effectively chopped off too at the point that the move was postponed, because we were just expected to make do with what was left until the move eventually happened. It was already a makeshift hospital that had seen better days, which was why the new hospital was needed in the first place, but people were expected to keep it going until the new place was available. I have to take my hat off to the staff who kept the place running. They were affected by the delay as well as the patients and families and they had to keep things running, making sure that patients were looked after despite the challenges of the environment."[132]

Ventilation at the RHSC and DCN

3.16. The provision of ventilation at RHSC did not meet the standards expected of a modern hospital (for example, that a general ward should have 6 air changes per hour, which may be mechanically or naturally supplied, and that critical care and isolation rooms should have 10 air changes per hour, which must be mechanically supplied).

130 Witness Statement - Lesley King - 04.11.2021 - paragraph 74.
131 Transcript - Susan Goldsmith - 17.05.2022 - column 40.
132 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 45 to 46.

3.17. It is clear that RHSC fell short of these requirements. When asked how many air changes there were in the critical care rooms at RHSC, Ronnie Henderson, Senior Programme Capital Manager at NHSL with previous experience as an estates officer in NHSL, responded:

> "To answer that in an honest way, zero measurable, but … "open all windows" were the means of ventilation in the old children's hospital. Two of the rooms that were separating patients from the body of the main ward had extract fans in the window, but that was really the sum total of mechanical ventilation in the ward."[133]

3.18. Dr Donald Inverarity, a consultant medical microbiologist at NHSL and the Board's Lead Infection Prevention and Control Doctor, provided further detail:

> "…My understanding of the conditions at Sciennes, as at July 2019, was that very little of the ward areas had mechanical supply ventilation. As it was opened in the 19th century, most areas only had natural ventilation from opening windows. There had been a Healthcare Environment Inspectorate inspection in October 2018 and window cleanliness had been discussed and it was established that some of the windows didn't open. The room hosting some bedspaces of the high dependency unit in the critical care area had once been a library and still had a mezzanine floor and stairs to it. The haematology/oncology ward was ward 2 and although it had some segregated bedspaces, they didn't all have lobbies and did not have supply ventilation. When we were undertaking preparation work ahead of the first wave of COVID in January 2020 we identified that ward 6 (Surgical Admissions Unit) had some mechanical supply ventilation and single rooms. ITU had 2 switchable pressure rooms for isolation and so did the HDU…Continued occupation of clinical spaces at RHSC, Sciennes was far from ideal architecturally and not aligned to the delivery of 21st century healthcare.…Preventing the transmission of respiratory viruses was difficult (although ward design and ventilation was only a component of that) …There were no isolation rooms that met any modern design or performance with regards to ventilation."[134]

3.19. This lack of ventilation notwithstanding, from an infection prevention and control perspective, RHSC was viewed as a safe hospital for children to occupy. Local and national systems were in place to monitor outcomes for patients in paediatric intensive care units. Sciennes was not an outlier nationally,[135] infection rates were considered "very low"[136] and outcomes were "not of any concern".[137]

133 Transcript - Ronnie Henderson - 26.02.2024 - column 171. Lindsay Guthrie indicated that "typically we would describe natural ventilation as achieving somewhere between zero and two air changes depending on prevalent conditions." Transcript - Lindsay Guthrie - 01.03.2024 - column 41. See also Transcript - Janice MacKenzie (Part 2) - 27.02.2025 - column 54 to 55.

134 Witness Statement - Donald Inverarity - 05.03.2024 - paragraphs 143 to 144.

135 Transcript - Donald Inverarity - 05.03.2024 - column 59.

136 Transcript - Janice MacKenzie - 26.02.2024 - column 54 to 55; Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 144.

137 Transcript - Donald Inverarity - 05.03.2024 - column 60.

3.20. It was noted that staff were very familiar with the issues of their wards and the hospital generally and were proficient at working around them such that patient outcomes were optimal.[138] It was however accepted that while an old hospital building with no air changes per hour and no mechanical ventilation could be safe, it would not be as safe as a modern hospital that complied with all of the relevant guidance.[139]

3.21. Ventilation at DCN was not identified as a matter of concern to the Inquiry.

Impact on patients and families at the Sick Kids of postponing the move to the new hospital

3.22. The material impact on patients was to do with the adverse consequences of having to stay in a space that had been prepared for closure and now had to be made operational again. This included the "big loss" of the cafeteria,[140] and the children's playroom.[141] Staff and patients also had to continue using old equipment.[142]

3.23. There is a risk of underestimating just how significant that impact was for the patients and their families who were involved. Among the children being treated at the Sick Kids were those suffering from very serious illnesses and congenital conditions which meant that their lives and the lives of their parents and carers were centred on the hospital. The hospital was effectively their home for perhaps weeks at a time or even longer. Witnesses were unanimous in their appreciation of the work done and the care provided by the staff, but the buildings at Sciennes Road were entirely inadequate, and the experience of using them was in sharp contrast to what had been promised at the new hospital. Thus, there was a significant emotional impact arising from the disappointment and fear of staying in inadequate facilities when the advantages of the new facilities – from a patient safety and care perspective – had been made clear to them.

3.24. For example, in the case of a patient needing to use the old MRI equipment at Sciennes, it is worth considering that parents had been told by staff "that the MRI equipment was newer and much more sophisticated at the new hospital and they said they would have preferred doing X's scan at the new place, because it would provide better imagery."[143] The patient involved had a neurological condition which, in their first year of life, had resulted in about 40 to 50 blue light ambulance trips to A&E. The condition causes seizures which can involve respiratory arrests requiring intubation and ventilation in intensive care. The witness told the Inquiry, "there's nothing that can prepare you for what this condition brings to your life and that of your child".[144] The significance of having an MRI scan, which aids in diagnosis and treatment, on outdated as opposed to new equipment has to be understood in this context.

138 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 144. See also Transcript - Tracey Gillies - 08.03.2024 - column 7: "…safety is a function not only of the built environment but the practice of the individuals who are providing and supporting care within the building."
139 Transcript - Donald Inverarity - 05.03.2024 - column 16 to 17.
140 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 41.
141 Witness Statement - Lesley King - 04.11.2021 - paragraph 54.
142 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 44.
143 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 44.
144 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 20.

3.25. The Inquiry also heard from a witness whose child was going to be accommodated in the new isolation facilities at the RHCYP. The child had a rare form of cancer and was due to undergo high risk treatment that involved rendering their immune system inoperative, before stem cell transplant. The witness told the Inquiry:

> "We were just flattened by this delay and very, very scared. We'd planned this whole treatment plan around being told these new facilities were going to help manage the risks surrounding the treatment. The medical staff now had to try and manage this treatment in the old hospital with just a few days' notice. The isolation room that would normally be used for this treatment needed to be prepared. There was another child in there, who had to be moved out, so the room could be deep cleaned. Then I think the room had to sit for 24 or 48 hours after this deep clean, because they'd cleaned vents, they'd cleaned windows, they'd cleaned every single surface they could in this room. But it's just a pair of doors off the ward, right next to the playroom. Every single person walks past this door to get in and out the playroom. It really threw us, this idea that, we were already on this train of treatment, we couldn't stop, had to keep going. And risks were now higher. It was a highly emotional period anyway. You know what you're doing to your child, you've been talked through at length, the risk this treatment gives her. But if we didn't do this treatment, then she's going to die. The thought that this new hospital would help to manage those risks was a great feeling. We felt lucky that we were the ones who were going to get to go to this new hospital, and the staff were going to be able to do all these additional things to manage the risks to her. Being told, when the train is already in motion, that those facilities were not for us after all and that we were going to have to stay at the old hospital was a blow."[145]

3.26. The young patient affected by the delay also suffered disappointment:

> "It greatly upset her at the time. She'd been promised a ride in an ambulance, and when you're a child on intensive treatment, you get a series of beads; a special bead for each bit of treatment you get. And she was very much looking forward to going in an ambulance and getting the beads that showed that she was getting it. She'd also been promised that this new hospital was going to give her an awful lot of freedoms and more fun than she was currently having. And so, she was really, really upset. She was crying a lot. It affected her emotionally at the time."

3.27. The child underwent a very difficult period of treatment, which was ultimately successful thanks to the care provided by medical staff:

> "They cured her, and that's down to them…They did absolutely everything they possibly could to support us during this, as much as they could, and if they were let down, it wasn't down to their fault, it was down to someone behind them. Medically, there were no flaws in what was done."[146]

145 Witness Statement - Lesley King - 04.11.2021 - paragraph 51.
146 Transcript - Lesley King - 20.09.2021 - column 104.

3.28. For the families of children whose treatment required prolonged stays in the hospital, the postponement of the opening of the new hospital represented a particular disappointment. The old Sick Kids offered only rudimentary accommodation for parents to stay overnight notwithstanding the need for them to be close at hand to help look after their children. Included in the RHCYP was the charity-funded "Ronald McDonald House", accommodation extending to 26 modern bedrooms with a lounge, kitchen and laundry. This very necessary facility was denied to parents until the opening of the new hospital.

3.29. Despite the negative impact, patient's families who gave evidence to the Inquiry ultimately agreed with the decision taken to delay the move. One witness noted:

> "It was good. The hospital's clean, it's fresh. X's more relaxed going there. She always was relaxed at Edinburgh, but feels more at ease visiting that hospital. You feel safer and I know that it took a long time for it to open. I think the fact that it took that bit longer to open makes me and my wife feel a bit more safe about taking there, because you know …maybe they have learned from their mistakes at Glasgow and not done it at Edinburgh as well."[147]

Impact on patients and families at the former DCN

3.30. The former DCN was not considered to be safe. Earlier that year the water system was found to be "quite heavily" contaminated with Pseudomonas aeruginosa which could lead to post-operative brain infection in the patient group treated at the Western General Hospital site.[148] The water contamination was found to have affected different parts of the building, including wards and the high dependency unit. The risk was managed by putting filters on water outlets and replacing some of the plumbing. Showers and toilets were put out of use, and the number of surgeries that could be undertaken per day was reduced. [149] Substantial building work was going on. There were, in summary, serious issues with the built environment which had an operational and patient-safety impact. There was a pressing need to move to the new hospital.

3.31. In one instance described to the Inquiry, a witness described how their child had caught a stomach infection following surgery to replace a shunt (a tube going from the patient's brain to their stomach) intended to relieve intercranial pressure. Medical staff were concerned that the infection could spread into the shunt and back up to the patient's brain. To prevent this, the patient underwent a procedure to "externalise" the shunt, so that it came out of their chest. The patient's parent suspects the stomach infection could have been caused by water in the hospital but said that no one has ever explained where the infection came from, "so we still don't know".

147 Transcript - Mark Bisset - 03.11.2021 - columns 132-133.
148 Transcript - Donald Inverarity - 05.03.2024 - column 61 to 62.
149 Transcript - Donald Inverarity - 05.03.2024 - column 61 to 62.

3.32. The witness described a generally challenging situation at the DCN. Maintenance work caused disruption and noise which was "not that conducive to getting better and relaxing". Showers and toilets were closed for 3 days which caused upset and loss of dignity to patients and an additional workload for nurses to provide bed baths for patients. Some of the equipment was old and "not fit for purpose", and there was a shortage of some equipment. There seemed to be a staff shortage, and more temporary staff than usual. Staff were also very time-pressed and morale seemed to be low.

3.33. The witness expressed concern that this may have impacted on the ability of staff to provide the careful attention required for the effective management of their child's complex condition. This meant that the patient's parents felt the need to provide a lot of the care themselves. The witness told the Inquiry that: "The level of care received…during 2019 and 2020 within the DCN was far below the standard that we would have expected and the facilities and accommodation within the hospital were also substandard and not fit for purpose."

Evidence from NHSL and the Scottish Government

3.34. Tim Davison, Chief Executive of NHSL, said that he "can't deny" the experiences that patients had as a result of the delay and that these were "unacceptable". Mr Davison did not consider the impact on patients to have been "catastrophic" by which he meant "a patient dying, or a significant material outcome of harm to a patient", but he told the Inquiry, "I would have hoped that we would have been able to have done better than that and I can only, all these years later, apologise."[150]

3.35. Jeane Freeman, the Cabinet Secretary, was not aware of any adverse clinical outcomes for patients associated with the hospital not opening.[151] She told the Inquiry that the Chief Medical Officer was in conversation with clinical teams at both Sciennes and the former DCN, and would have raised any issues in this regard with the Cabinet Secretary.

3.36. With respect to the emotional impact she observed that it would have been "at best disconcerting for the wider public, but absolutely upsetting, worrying for patients and staff and their relatives" to be told that the new hospital is not going to open "because, at least in one area, it is not considered safe." This guided her approach to the communications strategy. She said:

> "The reason for that decision was because I wanted all communications to be aligned, because it was really important that what we said publicly, the support that we put in place, the helpline that was put in place, what the Board was doing in terms of rebooking patients for procedures, including outpatient appointments, ensuring that there were staff at the new build to assist anyone who went there instead of where they needed to go now, that all of that was streamlined, smooth and in place."[152]

150 Transcript - Timothy Davison - 08.03.2024 - column 116 and 121.
151 Transcript - Jeane Freeman - 12.03.2024 - column 86.
152 Transcript - Jeane Freeman - 12.03.2024 - column 65.

Communications

3.37. The Cabinet Secretary's decision, on 4 July 2019, to "halt the planned move… for the time being" was relayed in a letter to Mr Davison, which explained that the delay was "in the best interests of patient safety and to ensure that we provide sufficient time for the resolution of the ventilation issues".[153]

3.38. The letter also set out next steps for NHSL, which included:

- to immediately send a Communications Plan for the public, patients and staff to the Scottish Government for approval before enactment later that day.
- to produce a plan for providing appropriate support for patients and carers, including transport, a telephone helpline and direct communication to each of the patients impacted by the change.[154]

3.39. Thus, the Scottish Government took overall responsibility for communication to ensure that conflicting messages were not given to patients, staff and the public. This involved approving "lines for communication" that is, what NHSL proposed to say in public statements and correspondence.

3.40. Tim Davison told the Inquiry that SG control over communications:

> "meant that our ability to communicate was significantly diminished, and that was a huge frustration for us. It got to the situation where…my communications director had to actually have intended communications from NHS Lothian to the broader patient population, or to the media, approved in advance by Scottish Government before we could issue them. Frustratingly, that approval often didn't come quickly enough; it didn't come for hours, or sometimes it didn't come for a day or two, by which time the communication was actually out of date and things had moved on or there were other things to say. So, while I wouldn't want to use that entirely as an excuse for poor communication, that significantly hindered our ability to tell people what was happening."[155]

3.41. In the immediate aftermath of the delay, NHSL's focus was on ensuring patients knew where to attend appointments and take patients in an emergency. Tim Davison told the Inquiry:

> "For emergency patients, we'd been running a big publicity campaign, reminding people that emergency paediatric cases should go to the new hospital from a certain date…and so we had to reverse all of that...We had a significant number of outpatients whose appointments had been booked for patients and families to attend the new hospital in the later weeks of July and into August and we had to reappoint all of those patients. I think every patient was seen, but they all had to be communicated with and advised to go to their outpatient appointment or their diagnostic appointment in the old hospital rather than the new hospital."[156]

153 A35827763 - Letter from Malcolm Wright - HC2024.B7.V1 - page 79.
154 A35827763 - Letter from Malcolm Wright - HC2024.B7.V1 - page 80.
155 Transcript - Timothy Davison - 08.03.2024 - column 118.
156 Transcript - Tim Davison - 08.03.2024 - column 100.

3.42. Approximately 2255 appointments required to be rescheduled immediately from July 2019 alone. Of these, 1586 were paediatric appointments and 669 were for DCN patients.[157] NHSL informed all patients of the fact that appointments would not be taking place at the RHCYP and DCN as planned. A strategy was put in place to seek to ensure that patients and families knew where to attend for treatment.

3.43. No evidence was led of any adverse consequences arising from the way in which the rescheduling of appointments was communicated, although some witnesses noted that they were not informed personally of changes to appointments or where to take a child in an emergency but found out via news channels or social media even though they would be personally affected.[158] No formal complaints were received by NHSL or the Scottish Government in relation to the rescheduling of appointments to take place in other hospitals.[159]

3.44. It was, however, a clear theme which emerged from the evidence of patients' family members that the witnesses had not felt well informed about the delayed move when it was announced. There is a distinction to be drawn between those who were present in the RHSC and DCN on the date of the announcement and those who were not. Evidence was heard that families within the RHSC were informed that the move was not happening as planned, in person by nurses. There was no evidence of direct communication with those not present in the hospital buildings on that particular day.

3.45. Ms Freeman attended the former Sick Kids and DCN in August and October 2019 to seek to explain to staff and patients the reasons for the decisions that had been taken, and to understand what steps could be taken to facilitate treatment being provided at the old facilities in the period until the new hospital could open.

3.46. Patients and families were not provided with a written explanation for the reasons for the RHCYP and DCN not opening as planned, by either NHSL or the Scottish Government. Two letters were sent to staff by the Cabinet Secretary providing an explanation of the situation. However, no similar letters were sent to patients and families.

3.47. One witness, whose child was being cared for at the Sick Kids received a letter that "basically said that any appointments planned at the new hospital should continue at the old one. There was no information about the cause of the delay or how long it would be for, nothing really."[160] He spoke of his disappointment that the Family Council, whose role was to "represent the patients and families and engage with those running the hospital" never received any official communication about the delay despite having had regular contact with NHSL senior management.[161] The witness told the Inquiry:

157 A41440939 - Email 10 July 2019 - HC2026.B7.V1 - page 303.
158 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 57.
159 A41232311 - Update 19 July 2019 - HC2024.B7.V2 - page 113, and A41232309 - Update 25 July 2019 - HC2024.B7.V2 - page 117.
160 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 56.
161 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 57.

> "…there was a serious failure of communication in letting those who would be most affected – the patients, families and staff – know what was going on. Though the new hospital is now up and running, I still don't think it has been communicated why there was such a delay. I can only guess it was a safety thing. There may have been good reasons and people might have actually understood and agreed with the reasons, but I can only stress again that there was no communication, either with parents directly or with the Family Council, so people were just left to get on with it and deal with the uncertainty…[162]
>
> …I think management at the Health Board need to understand that some families have kids who spend literally 100-150 days per year in the Sick Kids hospital. For these families, it's not enough to just tell them what's happening, although any communication at all would be better than what we have been used to. But they should engage with these parents and ask them what they think about plans before making definite decisions about things. Who is better placed to comment on the proposals than families who spend such a large part of their lives at the hospitals?"[163]

3.48. Families who had close links to the hospital were not kept up to date on the remedial works and some felt forgotten about in the construction dispute which took place.

3.49. Another witness remarked on the lack of formal communication, particularly from senior management:

> "There was never any communication from the Chief Executive of the hospital, or anyone in management to us acknowledging the delay or the effects it had on the patients and families. Yes, the Chief Executive had been on the ward at the time of the delay but we were focussed on [a child's] treatment and too upset to speak with the Chief Exec at that point. It was a similar situation when the Health Secretary visited the ward."[164]

3.50. Another witness noted the lack of up-to-date and accurate information on the DCN website in the period following the delay. The website had for a long time contained an announcement that the DCN would move in 2015. By 2019 this had not been updated, and was still not updated after the further delay.

3.51. Asked whether communication with patients and families was good enough at this time, Mr Davison answered:

> "I would probably imagine not. I think we were moving at an enormous pace, and…I think it was handled well in the context of being able to contact so many… within a few days to be able to redirect them to the appropriate place of their appointment, but I'm sure we could have done better as well."[165]

162 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 59.
163 Witness Statement - Abishek Behl - 05.11.2021 - paragraph 62.
164 Witness Statement - Lesley King - 04.11.2021 - paragraph 80.
165 Transcript - Timothy Davison - 08.03.2024 - column 117.

3.52. Ms Freeman said with respect to evidence given by a witness on the adequacy of communication, "I completely appreciate what your witness has said and I'm sorry that they feel that they were ignored by the Board, but also I would take it as ignored also by me, and that is remiss because I think it is really important that patients and families know what is happening and why it's happening, including what we don't know at any particular time but what we're doing about it."[166] Ms Freeman defended her decision for the government to approve all communications because of the need for communications to be aligned in order to provide assurance to the wider public as well as patients, staff and relatives.[167] She acknowledged that if a similar problem was to arise in the future, a letter should be sent to patients and families.

Conclusion

3.53. The decision to delay the opening of the new facilities on 4 July 2019 was sudden and came only days before the transfer between facilities was due to take place on 9 July. This was not the first time that the date projected for the opening of the RHCYP had been delayed.

3.54. Patients and families were shocked and extremely concerned by the decision to postpone the opening of the hospital. The evidence clearly shows increased anxiety about the ability of the old hospital facilities to support the healthcare needs of patients. However, the Inquiry has not heard or seen evidence to suggest a direct link between the delay and any significant detrimental impact on medical treatment, at least not to the knowledge of the witnesses from whom evidence was heard.

3.55. In relation to the Sick Kids, as a result of the postponed opening children continued to be treated in a suboptimal Victorian building which had been allowed to further run down in expectation of its closure in July 2019. In relation to the DCN, again the building was suboptimal but in addition there was a known risk of harm associated with the state of the water system which required to be managed.

3.56. Families of patients who had close ties to the hospitals did not feel that they had been properly informed about the delayed move; the reasons for it; or the progress made towards moving to the new facilities.

3.57. The Cabinet Secretary's requirement that communications be approved by the Scottish Government inhibited NHSL's ability to communicate effectively. Mr Davison indicated that this prevented NHSL being open and transparent with patients. Ms Freeman's position was that this decision was taken to ensure that there was clear and consistent messaging and to avoid confusing the public.

166 Transcript - Timothy Davison - 08.03.2024 - column 71.
167 Transcript - Jeane Freeman - 12.03.2024 - column 65.

3.58. The result was that patients and families were not provided with a direct explanation for the reasons for the RHCYP and DCN not opening as planned, by either NHSL or the Scottish Government. Two letters were sent to staff by the Cabinet Secretary providing an explanation of the situation, but no similar letters were sent to patients and families. Mr Davison and Ms Freeman agreed that the communication to patients and families was suboptimal in this regard. Ms Freeman acknowledged that if a similar problem was to arise in the future, all patients and families should be contacted directly.

Chapter 4

Remedial works and the decision to open

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Remedial works and the decision to open

Introduction

4.1. This chapter addresses in part Term of Reference 1, which is

> "To examine the issues in relation to adequacy of ventilation, water contamination and other matters adversely impacting on patient safety and care which arose in the construction and delivery of the QEUH and RHCYP/DCN; and to identify whether and to what extent these issues were contributed to by key building systems which were defective in the sense of:
> A. Not achieving the outcomes or being capable of the function or purpose for which they were intended;
> B. Not conforming to relevant statutory regulation and other applicable recommendations, guidance, and good practice."

It also addresses Term of Reference 7, which is "to examine what actions have been taken to remedy defects and the extent to which they have been adequate and effective."

4.2. In doing so, the approach adopted is intended to be proportionate. It was apparent from the evidence available to the Inquiry that as of July 2019 there were a number of issues relating to the adequacy, or at least the state of readiness, of the hospital's key building systems. However, they were not all of equal significance and they did not all have the potential to impact on patient safety and care or to justify postponing the opening. I have accordingly not thought it appropriate to discuss each of these issues in detail. Nevertheless, it is necessary at least to mention them with a view to identifying the nature and variety of concerns, confirming that they were addressed, and providing a context for understanding the complexity of the remedial works that were undertaken.

4.3. I will begin this chapter by setting out the actions taken following the decision to postpone the opening of the hospital, specifically with respect to governance arrangements. This provides the necessary background to what follows.

4.4. I will continue with a consideration of what, in the opinion of NHSL and the Scottish Government, was deficient or lacking in the building systems. There follows discussion of the issues under the headings: the ventilation works under High

Value Change 107[168], other ventilation issues, and non-ventilation issues, followed by a consideration of the decision to open the hospital and a note of the financial costs associated with the decision to postpone opening the hospital and to carry out the works.

4.5. I then turn to address Term of Reference 7, with an evaluation of whether the remedial works have been "adequate and effective".

Following up on the decision to postpone the opening of the hospital - responsibility for overseeing remedial works

4.6. Immediately following the Cabinet Secretary's decision to delay opening the hospital, Timothy Davison, the Chief Executive of NHSL, was sent a letter from the Scottish Government setting out the next steps for NHSL.[169] This included actions to be taken to address the immediate needs of patients and staff (discussed in chapter 3), as well as what needed to be done to make the new hospital operational, including:

- to provide assurance to the Scottish Government "that there are no other material deficiencies that are known to you at this stage"
- to provide a revised migration plan for Clinical Neuroscience and for the Edinburgh Children's Hospital, with the involvement of HPS and HFS in the scrutiny of the plan, and approval by the Scottish Government
- a description and timetable of the works to resolve the ventilation issues, and an "assurance that such work will comply with all technical standards"

4.7. The letter referred to an external audit by HFS and HPS that the Scottish Government would put in place, and noted:

> "in respect of the external scrutiny of the adherence to technical standards and the Governance process surrounding these we will wish to ensure that any planned re-sequencing of moves will only occur once we have **received clearance that all facilities meet the required technical standards** (including those applying to infection control and lessons learned from the commissioning of the new Queen Elizabeth building)."[170] [their emphasis]

4.8. The Scottish Government subsequently commissioned NHS National Services Scotland to undertake "an external series of checks, led by Health Facilities Scotland (HFS) and Health Protection Scotland (HPS), to ensure that the relevant

168 High Value Change (HVC) means a) a Change requested by the Board that, in the reasonable opinion of the Board, is likely either to Cost in excess of five hundred thousand pounds (£500,000) index linked or to require an adjustment to the Annual Service Payment that on a full year basis is 2% or more of the Annual Service Payment in the relevant Contract Year provided that the parties may agree that such a Change should instead be processed as a Medium Value Change; or b) any other Change that the parties agree is to be treated as a High Value Change.

169 A35827763 - Letter Malcolm Wright to Tim Davison - HC2024.B7.V1 - page 79.

170 A35827763 - Letter Malcolm Wright to Tim Davison - HC2024.B7.V1 - page 79.

technical specifications and guidance applicable to the new hospital have been followed and are being implemented."[171] HFS, at the time a division of NSS, provided guidance and advice on best practice in healthcare engineering through the issue, from time to time, of Scottish Health Technical Memoranda (SHTMs). Accordingly, the objectives of the NSS review were:

- To provide a report by September 2019 to the Scottish Government on whether the relevant technical specifications and guidance applicable to the RHCYP and DCN are being followed and implemented.
- Where relevant technical specifications and guidance have not been followed, identify necessary remedial actions.

4.9. On 8 July 2019 NHSL convened an Incident Management Team (IMT), chaired by Susan Goldsmith, NHSL's Director of Finance. This was renamed the Executive Steering Group (ESG) on 26 August 2019, chaired by Professor Alexander McMahon, Executive Director for Nursing, Midwifery and Allied Health Professionals, NHSL. The ESG's remit was to "provide a forum for NHS Lothian executive management to consider all business relating to responding to and addressing the delay to the Royal Hospital for Children & Young People and Department of Clinical Neurosciences." It was the ESG which put in place and managed a programme of remedial work following the recommendations in the NSS phase 1 and phase 2 reports of September and October 2019.[172]

4.10. While operational responsibility for remediation of what were considered to be deficiencies in the hospital's building systems remained with NHSL, the Scottish Government assumed a direct role in the project. On 12 July 2019 the Health and Social Care Management Board (HSCMB) placed NHSL at Stage 3 of the NHS Board Performance Escalation Framework. This allowed the SG to provide NHSL with a tailored package of support with a view to improving performance.

4.11. An Oversight Board and Oversight Group were established. The Oversight Group focused on improving performance across a number of different healthcare deliverables across NHSL.[173] The Oversight Board related specifically to the delivery of the RHCYP and DCN project and was put in place to oversee and provide advice regarding the work being carried out by NHSL. The Oversight Board would: "seek assurance from NHS Lothian that according to its due diligence and governance, the facility is ready to open; and from NHS NSS that its agreed diligence has been successfully completed."[174]

171 A41213257 - NHS NSS Phase 1 Report: review of water, ventilation, drainage and plumbing systems, September 2019 - HC2024.B7.V3 - page 373.
172 For an overview of governance during the period of remedial works see Provisional Position Paper 7 (Revised)- Non-ventilation issues with the potential to adversely impact on patient safety and care at the Royal Hospital for Children and Young People and Department for Clinical Neurosciences; and remedial works to resolve them.
173 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 103.
174 A44284514 - Oversight Board ToR - HC2024.B13.V3 - page 1149.

4.12. Membership of the Oversight Board included:

- Chief Finance Officer, Scottish Government (until 19 December 2019)
- Chief Medical Officer, Scottish Government (until 5 April 2020)
- Chief Nursing Officer, Scottish Government (until 14 January 2021)
- Director of Finance, NHSL
- Executive Medical Director, NHSL
- Nurse Director, NHSL
- Chief Executive, Scottish Futures Trust
- Chief Executive, NHS National Services Scotland
- NHSL Joint Staff Side representative
- Capital Accounting and Policy Manager, Scottish Government February 2021

4.13. Christine McLaughlin, Chief Finance Officer in the Scottish Government, was the Chair of the Oversight Board until 3 October 2019. Fiona McQueen, Chief Nursing Officer, took over as Chair from 7 October 2019. The Board was to sit until 8 April 2021. Alan Morrison, Capital Accounting and Policy Manager in the Scottish Government, chaired its final two meetings.

4.14. A number of others attended meetings to provide advice and assurance. Those that attended during the entire lifespan of the Oversight Board included

- Senior Programme Director
- Project Director, NHSL
- Healthcare Associated Infection executive lead for NHS National Services Scotland and Senior Responsible Officer for the centre of excellence
- Assistant Director, Engineering, Environment and Decontamination, HFS Scotland
- Director of Capital Planning and Projects, NHSL
- Director of Procurement, Commissioning and Facilities, NSS

4.15. Malcolm Wright, the Director General for Health and Social Care and NHS Scotland Chief Executive, told the Inquiry that "this was serious heft going into the Health Board to work with them to work through these issues." Mr Wright said the thinking behind putting such a senior team of officials together was that "this was such a pivotal project for the National Health Service in Scotland, and it was so important that we got this building finished and opened and safe."[175]

4.16. In September 2019 NHSL was escalated to Stage 4 within the Scottish Government's Performance Escalation Framework due to concerns about its ability to deliver the RHCYP and DCN project without additional support.[176] This allowed the Scottish Government to appoint a Senior Programme Director (SPD), Mary Morgan, whose role was, in her words: "to provide support; to work within NHSL and its governance structures; to facilitate the completion of remediation works at RHCYP and DCN and to provide assurance that the building would open safely and was fit for occupation."[177] She explained:

> "I acted as the interface between NHSL, the Project Team, Scottish Government (either Christine McLaughlin or Fiona McQueen via the Oversight Board), NHS NSS (my own organisation), including Health Facilities Scotland and Antimicrobial Resistance & Healthcare Associated Infection (ARHAI) Scotland: a clinical service providing national expertise for infection, prevention and control (IPC), antimicrobial resistance (AMR) and healthcare associated infection (HAI) for Scotland. As part of my "interface role", I brokered and improved communication between NHSL and the NPD provider, IHSL. The commercial relationship and negotiations between these parties were challenging and I feel that I made a positive difference to these…
>
> …In very simple terms, I was making sure everyone was doing what they were supposed to be doing, when they said they were going to do it by and ensuring that all parties were accountable for their own actions. The purpose of this was to keep the project and required actions on track and to ensure that any proposed delays were properly interrogated."[178]

4.17. Ms Morgan submitted regular "Senior Programme Director's Reports" to the Oversight Board, and attended meetings where she gave input.

4.18. As Project Director, Brian Currie led a number of workstreams set up to resolve the issues identified with ventilation, water, electrical installation, fire safety and management and assurance. The issues and the actions to address them were recorded in separate action logs for the six technical review areas: ventilation, water, drainage, fire safety, electrical and medical gasses.[179] It was updated at weekly meetings when new issues were identified and as others were closed.

175 Transcript - Malcolm Wright - 15.03.2024 - column 87.
176 A46527599 - Letter 23 September 2019 - HC2024.B13.V3 - page 704.
177 Witness Statement - Mary Morgan - 07.03.2024 - paragraph 12.
178 Witness Statement - Mary Morgan - 07.03.2024 - paragraph 20 and 22.
179 Witness Statement - Mary Morgan - 07.03.2024 - paragraph 28.

The methodology for closing items was agreed with Health Facilities Scotland (HFS) representing National Services Scotland (NSS). The closing of items was approved at either the Executive Steering Group (ESG) or Oversight Board (OSB), with agreement from HFS after submission of appropriate evidence. Ronnie Henderson (Commissioning Manager for Hard FM) managed these. IHSL/Multiplex contributed responses and NSS HFS had sight of them. Mott MacDonald provided advice and project management support.

4.19. The Oversight Board reported to the Cabinet Secretary, Jeane Freeman, and advised her on the readiness of the facilities to open, the plan for phased migration and other key decisions that the Cabinet Secretary would take. Ms Freeman told the Inquiry that the Oversight Board*:*

> "understood very well what the big drive for me was. That was to ensure that everything that needed to be fixed was fixed. I didn't want a hospital opened where major infrastructure had to be retrofitted. I wanted the facility to be fixed to the appropriate standards so we could be confident it was safe and then get the people in there. If you do not open a hospital because it is not safe, you can't compromise on getting it to a point where it is safe…"[180]

4.20. Ms Freeman took responsibility for ensuring the successful delivery of the hospital. Although she recognised that there was room for different views on the matter, she told the Inquiry:

> "I do not think you can have major healthcare infrastructure designed and built at a cost to the public purse without a clear line of accountability and, in my view, that can only come through a Minister of Government. In some instances, it is the force and nature of your personality that inserts yourself in a project. I think, to an extent, this was the case with the RHCYP/DCN project. There was no question in my mind that I, rather than NHSL, was now responsible for the successful delivery of the RHCYP/DCN project. Other Cabinet Secretaries might have taken a different view, and they could reasonably argue that they would have been legitimate to do so, because of the way in which contractual arrangements and responsibilities work."[181]

What, in the opinion of NHSL and the Scottish Government, was deficient or lacking in the building systems: the extent of the remedial works

4.21. In the opinion of NHSL and the Scottish Government, the air change rate for single and multi-bed rooms in the critical care department were not compliant with the recommendations set out in Scottish Health Technical Memorandum 03-01 "Ventilation for Healthcare Premises" (SHTM 03-01). This view has been contested on the basis of an interpretation of SHTM 03-01, which is discussed in greater detail in chapter 5. For present purposes it is simply necessary to note that NHSL,

180 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 144.
181 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 153.

the Scottish Government and NHS NSS gave no substantial consideration to an alternative interpretation of SHTM 03-01.

4.22. The position of NHSL is that it was solely the issue with air change rates in critical care that led to, and merited a delay to, opening the hospital. Mr Davison told the Inquiry:

> "There were lots of issues, and HFS and HPS came up with a raft of issues but, none of them in our view were sufficient to have merited on their own a delay to the move, unlike the issues in critical care.
>
> These were all issues that we believed could have been remedied while we were occupying the building and during the course of normal maintenance. We have a massive real estate in NHS Lothian, including some very modern buildings and some very old buildings, and doing major capital works within our buildings while continuing to provide services was not unusual for us. We were of the view that critical care was the only 'show stopper' issue that caused the delay, and it remains my view."[182]

4.23. The key technical issue which the Cabinet Secretary was briefed on was the non-compliant air change rates in the critical care department. However, as they explained in their evidence to the Inquiry, the Cabinet Secretary and her advisers were concerned about the potential for there to be other issues, and were not satisfied with the level of assurance on the safety of building systems that NHSL was able to provide. On the basis of what the Inquiry has heard, these concerns look to have been warranted. The results of the NSS reports, which were issued on 9 September 2019 (phase 1) and October 2019 (phase 2), as well as further associated investigations, identified a number of areas where NHSL was required to undertake remedial works or risk assessments in order to secure compliance with guidance and/or the effective and safe performance of systems.[183]

4.24. The phase 1 report on a review of water, ventilation, drainage, and plumbing systems in the RHCYP, noted that NHSL had informed the reviewers at the start of the process that "elements of the critical care ventilation system required redesign and modification to ensure compliance with guidance" and also that the haematology and oncology ward was being reviewed "as a result of changing clinical needs, and specific risks were identified." NSS noted that it had already provided advice relating to the critical care ventilation system and would be providing advice on haematology and oncology.

4.25. The phase 1 report found issues with management and assurance, noting that: "For both IHSL and NHS Lothian, there appeared to be omissions in the identification, appointment and definition of key roles in an effective management structure. Additionally, some records which are necessary to demonstrate compliance with appropriate specifications and guidance remain outstanding."

182 Witness Statement - Tim Davison -08.03.2024 - paragraph 113 to 114.
183 A41213257 - NHS NSS Phase 1 Report: review of water, ventilation, drainage and plumbing systems, September 2019 - HC2024.B7.V3 - page 373; A33448006 -NHS NSS Phase 2 report on fire stystems, electrical systems and medical gas installations - October 2019.

4.26. In addition to the issue with critical care ventilation systems, the phase 1 report noted there were “major deviations” from guidance with respect to ventilation systems in relation to air handling units and ductwork, evidence of resilience of the ventilation system in the event of maintenance or plant failure, single and multi-bed ventilation design, access to fire dampers, location of the helipad and an external plant room door gap which created a risk of contamination. There were “elements of non-compliance” with guidance in respect of theatres and isolation rooms. There was no widespread contamination of the water system but there were issues with specific components of the system, and the water management system.

4.27. Remedial action was required. NSS provided recommendations for actions to be taken in respect of each issue identified. These included undertaking remedial works to modify building systems, and decontaminating the water system including replacing contaminated components; as well as taking a wider set of actions including adopting management and reporting processes described in SHTM 00 - Best Practice Guidance for Healthcare Engineering and the SHTMs for each critical engineering service, undertaking risk assessments and further inspections, and providing additional assurance.

4.28. The NSS phase 2 report on a review of fire systems, electrical systems and medical gas installation was published in October 2019.[184] It found further issues with management and assurance, electrical installations and fire safety that required remedial actions. It recommended enhancements in respect of fire safety measures.

Ventilation works under HVC 107

4.29. The technical issue that led to the decision to delay opening the hospital was that the air change rate achieved by the ventilation system serving single and multi-bed rooms in critical care fell short of the performance recommended in SHTM 03-01. The ventilation system did not conform to guidance in two ways: it could only achieve 4 ac/h when 10 ac/h was recommended, and it provided for a balanced pressure regime when a positive pressure regime at 10 pascals (Pa) was recommended.

4.30. The provision of a balanced pressure regime in multi-bed rooms[185] in critical care had been a deliberate decision based on a risk assessment undertaken in 2017.[186] According to Dr Inverarity, the initial solution was based on an agreed design for paediatric critical care ventilation that predated SHTM 03-01. The previous ventilation guidance SHTM 2025, was not explicit regarding ventilation parameters for critical care units.[187] Clinicians wanted to address the risks of a very common scenario, which was the need to accommodate children with respiratory viruses in the same room or ward together. There was a general understanding that a negative or balanced pressure regime would prevent the spread of pathogens

184 A33448006 -NHS NSS Phase 2 report on fire stystems, electrical systems and medical gas installations - October 2019.
185 Specifically, three 4-bed bays and one 3-cot bay.
186 A45497403 - Response by NHS Lothian to Provisional Position Paper 8 - HC2024.B12.V1 - page 148 - paragraph 2.7.4.
187 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 90.

from an area accommodating infectious patients to other parts of the hospital. Thus, in respect of the pressure regime, requiring a negative or balanced rather than positive pressure regime may have been a reasonable approach to take at the time.

4.31. However, Dr Inverarity explained that there is a misconception that pathogens will flow out of a room which has positive pressure in relation to the corridor. A better view is that having a closeable door and a mechanical ventilation system that provides for the extract of air from within a room, mitigates against the spread of infection in a situation where infectious patients are accommodated in a room with positive pressure.[188]

4.32. The solution for a negative or balanced pressure regime in multi-bed rooms did not take into account some of the ways that critical care differs from other departments. Dr Inverarity told the Inquiry that in his opinion positive pressure and high air changes are needed in the critical care department because:

> "The types of clinical activities in critical care are very different to general wards. For example, invasive procedures such as chest drain insertion can be needed in emergencies and, on rare occasions, a room in critical care needs to be on par with, or at least closer to, the parameters for an operating theatre rather than a general ward. That is because occasionally an ITU bed space can of necessity function as an operating theatre if a patient requires immediate surgical intervention and it is not feasible to transfer them to an operating theatre until they are more stable. In my view, that's why you need conditions with air changes and positive pressure, which effectively replicate operating theatre conditions or treatment room conditions"[189]

4.33. In the period after the IOM reports were available there were discussions about whether it would be safe to change the ventilation system from balanced/negative pressure to positive pressure. Following discussions between clinical staff, the IPCT and Ronnie Henderson, the consensus view was that positive pressure for bedrooms in critical care would provide a safe environment. This view was endorsed informally by Peter Hoffman (Public Health England) and Malcolm Thomas (one of the authors of the equivalent English guidance, HTM 03-01).[190]

4.34. With respect to the provision of 4 ac/h rather than 10 ac/h as recommended in SHTM 03-01, Dr Inverarity explained the risks:

> "The air changes per hour…was lower than what would be optimal for performing many of the invasive procedures involved on a daily basis in an intensive care unit and could have compromised patients undergoing the procedures and increased their risk of infection e.g. device infections, blood stream infections, nosocomial pneumonia all of which could have fatal consequences for children already critically ill for other reasons.

188 Transcript - Donald Inverarity - 05.03.2024 - column 162.
189 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 92.
190 Transcript - Lindsay Guthrie - 01.03.2024 - column 126.

> Likewise, the low air change rates would have hampered dilution and removal of airborne pathogens such as respiratory viruses which are a predictable microbiological hazard in ITU and would risk staff and other patients catching infections like influenza from ill patients."[191]

4.35. Dr Inverarity also considered that the heightened risk of occupational exposure to pathogens and the failure to "engineer this out" did not align with Health and Safety Executive controls.

4.36. TSWW advised in a "Review of Ventilation Provisions for (B1) PICU and HDU Departments" that for the ventilation system to achieve 10 ac/h, extensive alterations would be necessary to both the ventilation installation and the building fabric, fittings and layouts. For example, additional Air Handling Units (AHU), new ductwork and grillage was required, which would impact on electrical, heating, and cooling distribution systems. [192]

4.37. The ductwork had been sized to provide 4 ac/h. Steven Maddocks, a chartered building services engineer with Cundall, a multi-disciplinary engineering consultancy, and expert instructed by the Inquiry, explained that there is a sequential process to designing a ventilation system. Calculating duct sizes comes near the end of the process, and is dependent on the criteria for air requirements in a space (for example air change rates), the room volume, the height of the ceiling and the size of ceiling voids, among other things. According to Mr Maddocks:

> "it is not common practice to oversize ducts for future increase in air to be delivered through a ventilation duct network, unless specifically advised in a client brief. Maximum allowances would be typically 5-10% which is chosen to cover future duct leakage due to failing joint gaskets."[193]

4.38. Mr Maddocks told the Inquiry that based on a design for 4 ac/h, the original air duct serving critical care "is correctly sized and could accommodate up to 6 ac/h but 10 ac/h would not meet acceptable air velocity criteria and would likely result in noise generation within the duct"[194]

4.39. Changing the performance of the ventilation system would require new air ducts and would have knock-on effects to other elements of the bedroom environment. The ceiling, some windows and light fittings would need to be replaced. Ceiling track and pendants would need to be reviewed to consider if they were appropriate, and some form of pressure protection would be required, which could involve an airlock or interlocking doors.[195]

191 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 188 to 189.
192 A43542997- TÜV SÜD Review July 2019 - HC2024.B2 - page 1583.
193 Stephen Maddocks - RHCYP/DCN Critical Care Ventilation Systems Review - page 27.
194 Stephen Maddocks - RHCYP/DCN Critical Care Ventilation Systems Review - page 29.
195 A43542997- TÜV SÜD Review July 2019 - HC2024.B2 - page 1583.

4.40. Thus, to achieve an output of 10 ac/h required a significant alteration of the ventilation design and extensive works to implement that design. A proposed Board Change[196], as provided for in the Project Agreement, was produced for the Oversight Board meeting on 8 August 2019.[197]

4.41. By this point in time, NHSL was struggling to reach an agreement with Multiplex to undertake the remedial works. Multiplex wanted a waiver of rights to the effect that there would be no recourse against Multiplex should there be any future problems with the ventilation system. NHSL would not agree to this.[198] In about October 2019 Matt Templeton from Dalmore Capital (IHSL) contacted Imtech Engineering Services Central Limited, since renamed Dalkia Engineering Limited ("Imtech"), to see if Imtech could provide "enhancements to the system".[199] Imtech engaged Hoare Lea to help with this work. Due to the complexity of the contractual arrangements, it was only on 5 December 2019 that the works required to bring the ventilation system to the standards recommended in SHTM 03-01 were instructed under High Value Change (HVC) 107. [200]

4.42. Hoare Lea began work on the initial briefing of the project and the initial concept design. This involved a number of workshops with NHSL and other stakeholders, including:

- Authorising Engineer (Turner Professional Engineering Services)
- Board's Technical Adviser (Mott MacDonald Limited)
- Principal Engineer (Health Facilities Scotland)
- Nurse Consultant, IPCT (Health Protection Scotland)
- Health and Safety Adviser (NHSL Health and Safety Services)
- Lead IPCT Nurse (NHSL)
- Consultant Microbiologist (NHSL)
- Hard FM Commissioning Manager RHCYP/DCN (NHSL)
- RHCYP Commissioning Manager (NHSL)
- Theatres and Critical Care Commissioning Manager (NHSL)
- Project Director RHCYP/DCN (NHSL)
- Clinical input

196 In terms of Schedule Part 16 *(Change Protocol)* Board Change means, as the case may be, a Low Value Change, a Medium Value Change or a High Value Change. See Glossary for a definition of these Changes.
197 A40988931 - Proposed technical specification 8 August 2019 - HC2024.B7.V2 - page 362.
198 Transcript - Susan Goldsmith - 06.03.2024 - column 111.
199 Witness Statement - Darren Forbes - paragraph 6.
200 A34957602 - HVC 107 - 5 December 2019 - HC2024.B3 - page 1146.

4.43. IHSL issued a "Concept Design Report" in March 2020. Commentary was received from Turner Professional Engineering Services (Authorising Engineer), Mott MacDonald Limited, and the Principal Engineer from HFS.[201] MML confirmed that they had identified no "red flags" in relation to the proposed solution although they did not provide design assurance.[202] (MML maintained throughout the remedial works process that they could not confirm that any design solution was appropriate without undertaking design responsibility.) This was shared with the Oversight Board along with a report from Brian Currie.

4.44. On 5 August 2020, Supplemental Agreement 2 (SA2) was signed. This supplemented the Project Agreement with the agreed solution to the issues with the ventilation system. Recital B to SA2 provides that "The Board wishes to amend the ventilation system within the Facilities from 4 air changes to 10 air changes per hour with an associated change to the pressure regime…".[203] Consequential changes were made to the financial relations between the parties applicable under the Project Agreement.

4.45. The works instructed under HVC 107 went beyond those required to increase the air change rate in critical care.

4.46. After the decision to delay opening the hospital, NHSL decided to review the existing ventilation provision for the haematology and oncology ward (named the Lochranza ward). NHSL had first become concerned in 2017 that the ventilation design for 12 single rooms in the haematology and oncology ward was not suitable for the neutropenic patients who would be accommodated there.[204]

4.47. Neutropenia describes a period (usually transitory but which may persist in terms of days, weeks or months) when the neutrophil count in peripheral blood drops below 0.5×10^9 cells per litre, most often as a consequence of receiving chemotherapy drugs to destroy cancer cells in the body but particularly cancer cells in bone marrow. Patients who are neutropenic and therefore immunosuppressed, are particularly susceptible to infection, including infections caused by exposure to opportunistic air-borne fungal pathogens.[205]

4.48. Dr Inverarity explained that because of this susceptibility to infection, neutropenic patients have traditionally been placed in "protective isolation", that is, in a room of their own, and in an environment that is as clean as possible, with attention paid to water and air quality. The focus on air quality is "primarily to avoid exposure to fungal spores which are ubiquitous in the air that everyone breathes."

201 A40933361 - Oversight Board Papers 12 March 2020 - HC2024.B3 - page 775.
202 A40933361 - Oversight Board Papers 21 May 2020 - HC2024.B3 - page 972.
203 A32469196 - Supplemental Agreement 2 - 5 August 2020 - HC2024.B3 - page 1204.
204 A34225618 - Email 7 February 2017; A45497403 - NHSL response to PPP8 - HC2024.B12.V1 - page 85.
205 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 84.

4.49. SHTM 03-01 recommends that neutropenic patient wards are provided with 10 ac/h at 10 Pa (positive pressure). What was provided for the Lochranza ward (other than in the 5 isolation rooms) was 4 ac/h and balanced pressure, in line with TSWW's standard design for bedrooms. Neutropenic patient wards also require HEPA filtration, which was not included in TSWW's standard design for single bedrooms.

4.50. When this had come to light in 2017 NHSL decided to progress with the existing design for single bedrooms of 4 ac/h and balanced pressure, for reasons discussed in chapter 6 of this report. This was considered a compromise solution, but NHSL determined that any risks could be managed operationally.

4.51. However, as Donald Inverarity told the Inquiry: "Once the critical care ventilation issue came to light in the Summer of 2019 and it was clear that remedial works would be required there, IPCT took the opportunity to suggest a review and improvement of the ventilation system in the Lochranza ward so that it fully complied with SHTM 03-01."[206]

4.52. Tracey Gillies prepared a briefing on the "Haematology Oncology provision in RHCYP" for the ESG dated 3 September 2019.[207] The briefing provided some background to the issue and NHSL's decision, but noted that the situation had changed as of mid-2019 with the following developments:

- "The building has not been occupied as planned, so there will be a time window of opportunity prior to occupation in which to undertake rectifications and bring the 12 single rooms up to the required standard.
- The risk appetite across NHS Scotland has changed with regard to the care in hospital of neutropaenic [sic] patients with an increasing recognition of the potential impact of the environment. For example, the refurbishment of the adult haematology ward at WGH [Western General Hospital] will deliver this standard for all rooms, and it would be hard to explain why this is not also delivered for children requiring inpatient care in a state of the art new facility.
- The current chemotherapy regimes in use are more effective but in doing so induce more neutropaenia [sic], and are used in clinical situations where previously there was no therapeutic option.
- Increasing numbers of children from the East Coast are managed for inpatient care in Edinburgh where they might previously have received care in Grampian or Tayside
- The helipad is by the courtyard and there is a risk of downdraughts blowing particles into the air inlets and windows."[208]

206 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 87.
207 A42980429 - Briefing 3 September 2019 - HC2024.B13.V8 - page 256.
208 A42980429 - Briefing 3 September 2019 - HC2024.B13.V8 - page 256.

4.53. The briefing recommended that:

> "A board change should be developed and progressed to bring the 12 single rooms up to the required specification for the care of neutropaenic [sic] patients. This will involve:
>
> • Increase the air changes from 6 to 10 per hour
>
> • Increase the positive pressure to 10pa
>
> • Fit HEPA filters to the air inlets for the rooms (H12 grade)
>
> • Seal windows and trickle vents"[209]

4.54. Dr Inverarity told the Inquiry:

> "When Lindsay Guthrie and I were consulted by other members of the RHCYP DCN Executive Steering Group regarding our views of the ventilation strategy in Lochranza ward in August and September 2019…my view was that as long as the demand for protective isolation by neutropenic patients did not exceed 5 patients at one time (who could be managed safely in the PPVL isolation rooms) then there may not be an adverse impact. The majority of children receiving inpatient haematology or oncology management in Edinburgh are not neutropenic and therefore would not need the specialist environment for care of neutropenic patients. Edinburgh is not a paediatric bone marrow transplant centre for instance whereas the children's hospital in Glasgow is and provides inpatient management for more immunocompromised children."[210]

4.55. The issue, according to Dr Inverarity, was not that there were no suitable rooms available, but that "changing demands and availability of paediatric cancer beds was changing (some of which as a consequence of events in NHS Greater Glasgow and Clyde) and there was a real concern that the future need would outstrip what had been installed in the building."[211] Dr Inverarity told the Inquiry that the non-compliant ventilation system in haematology and oncology "didn't in my view merit delaying occupation overall as it was an improvement to what was being provided for cancer patients at RHSC, Sciennes… the decision to delay occupation provided a window of opportunity to resolve these issues."[212]

4.56. On 3 October 2019 the Oversight Board approved in principle the development of a Board Change to bring the 12 single rooms in the Lochranza ward up to the required specification for the care of neutropenic patients.[213]

209 A42980429 - Briefing 3 September 2019 - HC2024.B13.V8 - page 256.
210 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 83.
211 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 194.
212 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 196.
213 A40933361 - Oversight Board Papers 10 October 2019 - HC2024.B3 - page, 285 - paragraph 4.1.

4.57. In addition to problems with air change rates, a further issue identified in both critical care and the haematology and oncology ward was that the isolation rooms were served by a common Air Handling Unit, which created resilience risks. Guidance on "Isolation Facilities in Acute Settings", SHPN4 supplement 1, recommends that each isolation room should ideally have its own air handling unit, so that if an AHU fails, or is offline for maintenance, only one isolation room is out of commission. This was not provided at the RHCYP. Rather, there were instances where a number of isolation rooms were served by a single AHU, meaning that "up to five out of 19 isolation rooms may be not performing as intended in the event of an air handling unit failure."[214] The implication of this was that there would be no appropriate facilities in the haematology and oncology ward for the most vulnerable paediatric cancer patients in the event that the single AHU broke down or required maintenance. This issue was raised in the NHS NSS phase 1 report of September 2019.

4.58. A guidance note regarding this particular configuration for Air Handling Units was contained in the environmental matrix shared with bidders during the procurement period and which was understood by the successful bidder to set out NHSL's requirements for the ventilation system (although this is controversial and is discussed in detail in later chapters). The environmental matrix states at guidance note 21:

> "Note that Isolation Suite ventilation solutions for this project shall follow HBN 4 Supplement 1 Section 4 Item 4.8 Guidance i.e. A common departmental AHU shall be employed to provide supply air ventilation (and shall therefore employ duty & standby motors)…"[215]

4.59. Section 4 item 4.8 of HBN 4 Supplement 1 states:

> "In a high-rise building a common supply and extract system may be the only feasible solution. In this case, run and standby fans would be required for the extract and a duplicate supply unit may be considered necessary. The supply and extract branches to each isolation suite should be fitted with spring-close gas-tight dampers. This will permit individual suites to be shut down for cleaning and maintenance. The common supply and extract systems will need to be controlled to ensure a constant volume in each isolation suite branch regardless of the number in use. The overall design should ensure that short-circuiting could not occur between isolation suites."[216]

214 A41213257 - NHS NSS Phase 1 Report: review of water, ventilation, drainage and plumbing systems, September 2019 - HC2024.B7.V3 - page 373 - paragraph 4.2.8.
215 A34691184 - Reference Design Environmental Matrix 19 September 2012 - HC2023.B4 - page 132.
216 This is the same as in SHPN 04 Supplement 1 A36372665 - SHPN 4 Supplement 1 - HC2024.B13.V3 - page 442.

4.60. In his expert report to the Inquiry Mr Maddocks noted that combining rooms into common systems "is allowed with standby provision (which it is understood were provided) but it is ultimately a commercial/risk management issue that should be agreed with the operational and clinical staff."[217]

4.61. Members of the Infection Prevention and Control team had raised concerns about this air handling unit configuration in 2016 and in Dr Inverarity's view the ventilation strategy for isolation rooms was non-compliant with HBN 04-01 Supplement 1 during periods of maintenance, and lacked resilience.[218] Ms Morgan told the Inquiry that she considered the works to resolve the resilience issue in the Lochranza ward "essential".[219]

4.62. Works to provide each isolation room in critical care and the haematology and oncology ward with a dedicated air handling unit were instructed in the same Board Change as the works to provide for compliant air change rates.

4.63. Thus, Imtech and Hoare Lee were instructed to design, manufacture, supply, construct, test, commission and complete amendments to the ventilation systems to deliver 10 ac/h at 10 Pa positive pressure as per SHTM 03-01 Appendix 1 Table A1 to the following single and multi-bed rooms in Paediatric Critical Care: 1-B1-065, 1-B1-075, 1-B1-063, 1-B1-037, 1-B1-031, 1-B1-021, 1-B1-020, 1-B1-019, 1-B1-009.

4.64. In addition, HVC 107 instructed the following changes to provide compliance with SHTM 03-01 and SHPN 4 supplement 1, "Isolation Facilities in Acute Settings":

- Isolation rooms in critical care: changes to provide PPVL, HEPA with dedicated Air Handling Units for the ventilation system serving isolation rooms 1-B1-016, 017, 026 and 1-B1-036;
- Single and Multi-bedrooms in haematology and oncology: changes to the ventilation systems to deliver 10 ac/h at 10 Pa positive pressure and provide HEPA filters to rooms 3-C1.4-059, 057, 055, 046, 032, 018, 016, 013, 010, 074, 076, 078, 084 and 061;
- Isolation rooms in haematology and oncology: changes to provide PPVL, HEPA with dedicated Air Handling Units for rooms 3-C1.4-040, 043, 049, 052. 072.[220]

217 Stephen Maddocks - RHCYP/DCN Critical Care Ventilation Systems Review - page 33 - paragraph 4.7.3.
218 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 195 to 196.
219 Transcript - Mary Morgan - 7.03.2024 - column 256 to 257.
220 Stephen Maddocks - RHCYP/DCN Critical Care Ventilation Systems Review - page 35 - paragraph 5.1.2.

4.65. It was difficult to deliver this within the existing footprint of the building, even re-using elements of the existing ventilation system. This contributed to the timescale for the remedial works. Paul Winning, a Chartered Engineer from Hoare Lee explained that:

> "We made the decision, after looking at the plant space, ceiling void space, and coordination, that re-using what was there would be beneficial. We therefore tried to use the existing air handling units to supply some of the non-critical care rooms, and designed new air handling units that were eventually located outside the building, dedicated to serve the isolation rooms requiring 10 air changes per hour.
>
> From a co-ordination point of view, the ductwork was the first thing that we installed in the ceiling voids; below that was the electrical containment, then the pipe work, including the medical gases. This was a huge additional piece of work because to work on the ventilation system meant completely overhauling or tinkering with other MEP systems."[221]

Other ventilation issues

4.66. Following the delay to opening the hospital in July 2019, HFS commissioned ventilation experts to report on the ventilation system as installed. These reports informed the NSS review of the ventilation system.

4.67. The issues identified in the expert reports were added to a "ventilation action log" along with all other issues identified by relevant parties over the course of July and August 2019. Ultimately, 81 issues were recorded on the log.[222]

4.68. Although I have not seen it as proportionate to discuss these 81 issues in detail, the Inquiry considered them in order to determine their nature and how they were remedied. This is more fully set out in the supplementary note to PPP7.[223] Some items on the action log were demonstrated not to be an issue. Many were minor or snagging issues that were relatively straightforward to resolve, or could be corrected through rebalancing of the ventilation system, which is a normal part of a commissioning process. By mid-October 2019, soon after the first consolidated ventilation action log had been created, 59.3% of the items on the action log were closed.[224] Most ventilation actions were closed by 1 May 2020.

4.69. This included issues with the operating theatres. As noted in the previous chapter, when IOM undertook independent validation of the ventilation system it found issues with theatres, including with the air change rate and air pressure in some areas. This occupied the project team in late June and early July as they tried

221 Witness Statement - Paul Winning - paragraph 15 to 16.
222 A35055315 - Ventilation Action Log - HC2024.B1 - page 2983.
223 Provisional Position Paper 7 Supplementary (revised) - Note on issues with the ventilation system outside of Critical Care areas with the potential to adversely impact on patient safety and care at the RHCYP + DCN; and remedial works undertaken. Relevant documentary evidence can also be found in The Works Under Supplementary Agreement 2 (SA2) - HC2024.B3.
224 A40933361 - Oversight Board Papers 17 October 2019 - HC2024.B3 - page 333.

to find a workaround. A consensus view was arrived at that if 4 theatres could be rebalanced by the expected opening date then "it might be possible to safely run emergency surgical services from RHCYP/DCN". Dr Inverarity said in his recollection that by 5 July 2019 four theatres had been made operational.[225]

4.70. Following the delay, theatres were rebalanced, which is a process that involves "fine-tuning" the ventilation system and ensuring the correct air flow and pressure cascades are being met. Dr Inverarity told the Inquiry that rebalancing of theatres could be done with patients in situ, although this would not have been his preference, or it could have warranted a short delay. [226]

4.71. By the time NHS NSS published the report on ventilation in September 2019 only a small number of issues with theatres remained.[227] These were considered "moderate" (as opposed to "significant" or "major") in terms of the priority ranking used by NSS and described below:

1. Significant – Concerns requiring immediate attention, no adherence with guidance
2. Major – Absence of key controls, major deviations from guidance
3. Moderate – Not all control procedures working effectively, elements of noncompliance with guidance
4. Minor – Minor control procedures lacking or improvement identified based on emerging practice
5. Observation and improvement activity.

4.72. NSS found no significant priority issues with ventilation. However, a number of issues under the heading "general ventilation systems" were categorised as a "major priority" issue. These included:

- External doors to plant rooms
- Fire dampers
- The impact of downdraft from the helipad
- Provision for maintenance or plant failure
- Air handling units and ductwork which contained numerous deviations from SHTM 03-01
- Single and multi-bed ventilation design.

225 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 176.
226 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 175.
227 A41213257 - NHS NSS Phase 1 Report: review of water, ventilation, drainage and plumbing systems, September 2019 - HC2024.B7.V3 - page 373.

4.73. The issues with external doors to plant rooms and fire dampers are not considered further here as the Inquiry has seen no evidence to suggest that they were not relatively straightforward issues to resolve, or were a cause of major concern on their own.

4.74. With respect to the third bullet point above, Malcolm Thomas, one of the ventilation experts consulted by HFS, had raised concerns about the location of air intakes below the helipad, that is, that downdraughts from the helicopter landing or taking off could impact on the ventilation system.[228] On 18 March 2020 helicopter test flights, including take-off and landing manoeuvres, were carried out. The building management system (BMS) was monitored during these tests and the results showed no adverse effect on the ventilation system pressures. The location of the helipad was found not to be an issue.

4.75. "Provision for maintenance and plant failure", in the fourth bullet point above, relates to: a) the ability of the ventilation system to serve areas affected by plant failure or undergoing maintenance, and b) the ability to manage the effects and risks of ventilation plant failure or maintenance on the provision of services to patients. Ventilation bypass arrangements also require to be shown to comply with fire safety requirements. This was not a technical issue, rather, what was required was for NHSL and other relevant parties to demonstrate that the arrangements they had put in place in the event of maintenance or plant failure were effective and safe. At the Oversight Board meeting 9 April 2020 it was noted that maintenance bypass "has now been demonstrated on all Air Handling Units being retained and the documentation was being awaited for the 2 units being removed under HVC 107 works."[229] NHSL has confirmed that this is no longer an issue.

4.76. The "major deviations" NSS reported with air handling units and ductwork included "loose internal cabling in the airflow, cable routes allowing air to bypass filters, air leakage at penetrations and possible fan replacement difficulties which need to be corrected."[230] Filters were also poorly fitted. Some of these issues had been identified during the IOM's independent validation in June 2019, including cabling inside air ducts which IOM considered not to be compliant with SHTM 03-01. Further issues with ductwork were found during subsequent investigations of the AHUs over July and August.[231] The result was a list of 23 separate issues to be checked and remediated for every AHU in the hospital.[232]

228 A41213185 - Malcolm Thomas Report 27 July 2019 - HC2024.B2 - page 73.
229 A40933361 - Oversight Board Papers 23 April 2020 - HC2024.B3 - page 909.
230 A41213257 - NHS NSS Phase 1 Report: review of water, ventilation, drainage and plumbing systems, September 2019 - HC2024.B7.V3 - page 373.
231 A40933361 - Oversight Board Papers 17 October 2019 - HC2024.B3 - page 337.
232 A41334383 - AHU Remedials Sign-off Sheet 6 May 2020 - HC2024.B1 - page 3233.

4.77. Multiplex completed a benchmark air handling unit to demonstrate the extent of remedial works they would undertake across all units to achieve compliance.[233] Following a multidisciplinary assessment by relevant stakeholders, which found the proposed solution to be "acceptable" with some caveats, the Oversight Board agreed to proceed with the AHU refurbishment works subject to:

- written confirmation of acceptance from HFS, IOM and the Board's Authorising Engineer (AE)
- all IPCT recommendations being implemented
- IHSL/Multiplex providing outstanding confirmation and information required regarding the cleaning methodology, details of anti-bacterial sealant and other specific IPCT queries.[234]

4.78. Refurbishment works were undertaken on all AHUs in the hospital outside of critical care and the haematology and oncology ward, to rectify the cabling issue, and to check for and rectify the other 22 items on the list of AHU issues. The "AHU refurbishment works" did not require a Board Change. These were signed off by Mr Henderson (NHSL Commissioning Manager for Hard Facilities Management), John Rayner, (authorising engineer for NHSL) and P.W Jameson, (Authorising Engineer for Independent Validation, IOM) on 6 May 2020.[235]

4.79. The final ventilation issue that NHSL was required to address which is of interest to the Inquiry was the design for single and multi-bed rooms outside of critical care and the haematology and oncology ward. Single and multi-bed rooms across the hospital had been designed with 4 ac/h mechanical ventilation, whereas SHTM 03-01 recommends 6 ac/h for bedrooms and "general wards". TSWW's design allowed for a natural ventilation component, but did not specify that natural ventilation would contribute to meeting a particular air change rate. There was however an assumption among NHSL staff that 4 ac/h would be supplemented by a natural ventilation component providing 2 ac/h, thus meeting the 6 ac/hr required. That is consistent with the rationale offered to the Inquiry by Michael O'Donnell of Hulley & Kirkwood (H&K), the electrical and mechanical engineers who were part of the team engaged by NHSL to develop a reference design preparatory to the procurement process. When asked by Counsel about the discrepancy between the 4 ac/h specified by H&K and the recommendation of 6 ac/h set out in SHTM 03-01, Mr O'Donnell explained that his motivation was "to come up with the most energy-efficient solution for a hospital… and so we adopted an approach which was aligned to a mixed mode – mechanical plus natural – approach which we think is a valid approach".[236]

233 A40933361 - Oversight Board Papers 17 October 2019 - HC2024.B3 - page 337.
234 A34957602 - Oversight Board Papers 24 October 2019 - HC2024.B3 - page 349.
235 A41334383 - AHU Remedials Sign-off Sheet 6 May 2020 - HC2024.B1 - page 3233.
236 Transcript - Michael O'Donnell - 25.04.2023 - column 71.

4.80. Following the decision to delay opening the hospital, NSS identified two difficulties with this aspect of the design. Firstly, while in most cases the provision of 4 ac/h through mechanical ventilation had been validated by IOM, the natural ventilation component had not been proven. For example, it was not clear whether natural ventilation could increase the air change rate for bedrooms to the 6 ac/h required in SHTM 03-01.[237] Secondly, opening windows would affect the pressure regime, which meant that the pressure differential and direction of airflow described in the environmental matrix "cannot be relied upon when windows are open".[238]
NSS accordingly recommended in its report that NHSL:

> "Confirm that all areas serviced by this arrangement are suitable for categorisation as listed in SHTM 03-01 Part A, Appendix 1.
>
> Undertake an IPCT risk assessment ward by ward/ speciality specific in relation to the guidance.
>
> A full assessment of the services and patient population should be carried out and mechanisms for monitoring established."[239]

4.81. Clinical leads from the project team (including amongst others, the Clinical Director, Janice Mackenzie), the Lead Infection Prevention and Control Nurse (Lindsay Guthrie) and Lead Infection Prevention and Control Doctor and consultant microbiologist (Dr Donald Inverarity) conducted a review of all clinical departments. The review was discussed with key clinical colleagues in paediatrics and neuroscience for comment and input.

4.82. Given that the provision of a full 6 ac/h through a combination of mechanical and natural ventilation had not been proven, the review focused on demonstrating "that the Board is assured that the provision of 4 air changes per hour on mechanical supply, rather than 6 air changes per hour on mechanical supply does not compromise patient safety by introducing either an increased risk of transmission of infection or acquisition of healthcare associated infection."[240]

4.83. The findings of the review were reported in an SBAR paper titled "Risk Assessment regarding Impact of Design Ventilation on managing HAI risk in RHCYP & DCN clinical areas (not including Paediatric Critical Care)" on 27 September 2019.[241] The paper noted that haematology and oncology was being considered separately.

4.84. For all other areas considered in the SBAR, the key risk of the existing ventilation design was that "there will be competition for single rooms and isolation rooms and the possible permutations of the need for isolation, taking into account transmission routes, are vast." The mitigation for this was a pre-existing "NHS Lothian Isolation

237 A34012657 - Email 27 August 2019 - HC2024.B7.V3 - page 168.
238 A41213257 - NHS NSS Phase 1 Report: review of water, ventilation, drainage and plumbing systems, September 2019 - HC2024.B7.V3 - page 373.
239 A41213257 - NHS NSS Phase 1 Report: review of water, ventilation, drainage and plumbing systems, September 2019 - HC2024.B7.V3 - page 384.
240 A34821534 - SBAR Risk Assessment Impact of Design Ventilation - 27 September 2019.
241 A34821534 - SBAR Risk Assessment Impact of Design Ventilation - 27 September 2019.

Prioritisation Risk Assessment Guidance". The SBAR recommended that staff should refer to and implement this guidance, and continue to follow other relevant standard operating procedures in line with national policy.

4.85. The SBAR also considered the resilience issue created by having multiple isolation rooms served by a single AHU and outlined "the actions required if one or more air handling unit fails resulting in the loss of isolation room supply ventilation." The report noted that:

> "in the absence of an infectious disease of high consequence, and providing all other standard and transmission based precautions required by HPS NIPCM [National Infection Prevention and Control Manual] are in place, the risk of infection to patients, staff or visitors is likely to be low...
>
> Depending on the nature and duration of the AHU failure, and in line with NHS Lothian Prioritisation of Isolation Guidance, a clinical risk assessment would be required in conjunction with the IPCT to determine any further actions required on a case by case basis…."[242]

4.86. The second issue noted by the SBAR is that the hospital had been provided with Positive Pressure Ventilated Lobby (PPVL) isolation rooms rather than conventional negative pressure lobbied isolation rooms which may not be suitable for the care of patients with Infectious Diseases of High Consequence, such as viral haemorrhagic fever (VHF) or MERS. The SBAR noted the mitigations in place, and that patients suspected of having VHF would be "transferred directly to the nearest high level isolation facility" which was the Freeman Hospital in Newcastle.

4.87. Ms Guthrie, Dr Inverarity and a clinical lead from NHSL, with the support of MML, conducted a separate review of the ventilation provisions for outpatient and therapy areas. The review contained a number of recommendations but found "no significant concerns or issues identified in relation to any impact on factors that would compromise delivery of infection prevention and control procedures and ventilation delivered based on the stated intended clinical use of the space and patient population."[243] No further action was required in respect of the ventilation design for patient accommodation outside of the haematology and oncology ward and critical care. The Oversight Board noted the risk assessments on 3 October 2019.[244]

4.88. Thus, while some single and multi-bed rooms in the hospital outside of critical care and the haematology and oncology ward retained the ventilation design solution which had been a source of concern by reason of its non-compliance with guidance, infection control measures were put in place to mitigate the risks of infection for the types of patients likely to stay in those rooms.

242 A34821534 - SBAR Risk Assessment Impact of Design Ventilation - 27 September 2019 - paragraph 3.15.
243 A47172292 - SBAR Assessment 12 November 2019 -HC2024.B13.V8 - page 721.
244 A40933361 - Oversight Board Papers 10 October 2019 - HC2024.B3 - page 283 to 284.

4.89. After the COVID-19 outbreak, guidance relating to Infection Prevention and Control for acute care settings was updated. This impacted on the requirements for isolation of "high consequence infectious diseases" (HCID) in the Emergency Department. Following engagement between NHSL and NSS on how to meet these new requirements, the Oversight Board noted the recommended solution on 4 June 2020.[245] Works to make alterations to the Emergency Department took place under Medium Value Change (MVC) 157.

Non-ventilation issues

4.90. As previously noted, in addition to reviewing the ventilation system at the RHCYP and DCN, NSS reviewed water, drainage, fire systems, electrical systems and medical gas installations.

4.91. The Inquiry did not see evidence to suggest that there were any other issues raised in the NSS review of fire systems, electrical systems, and medical gas installations which required further investigation. The works done to improve fire safety were described as "enhancements" or "improvements", and an opportunity to make the hospital as safe as possible.[246]

4.92. With respect to water systems, NSS categorised only one issue (non-compliant shower hose lengths) as "major" meaning that there was deviation from guidance. Other issues were categorised as moderate and minor.[247] Given the significance of water systems for patient safety and care, particularly in relation to infection risks, it is nevertheless important to consider these concerns here and what was done about them.

4.93. Concerns about water safety existed prior to July 2019.

4.94. In February 2019 Bouygues commissioned Clira to undertake a Legionella Risk Assessment. Clira reported that the overall risk rating of the hospital was high in relation to certain risk parameters including formation of water droplets (whether aerosol spray is created), water condition (how clean or contaminated it is), water temperature, water turnover, susceptibility of exposed population and population density of exposed population.[248]

4.95. In May 2019, the findings of the Clira report were reflected in a Compliance Audit undertaken by Callidus.[249]

245 A40933361 - Oversight Board Papers 18 June 2020 - HC2024.B3 - page 1006.
246 Transcript - Mary Morgan - 7.03.2024 - column 255.
247 A41213257 - NHS NSS Phase 1 Report: review of water, ventilation, drainage and plumbing systems, September 2019 - HC2024.B7.V3 - page 373.
248 A32653968 - Clira Report - February 2019.
249 A34053106 - Callidus Compliance Audit May 2019 - HC2024.B13.V8 - page 979.

4.96. NHSL commissioned Westfield Caledonian to carry out an assessment of water safety at the RHCYP and DCN. The assessment took place between 1 and 12 July and found evidence of contamination.[250]

4.97. Following the decision to delay opening the hospital, Water Solutions Group (WSG), which had experience at the QEUH, was commissioned to provide specialist technical and analytical support to HFS and HPS.[251] When checking the results of microbiological testing against guidance parameters WSG found there was "no indication…to suggest that the water system is not fit for use." On widening the scope of water testing beyond what was required by guidance, WSG found evidence of some gram negative micro-organisms and mould.

4.98. Following its review of water systems, which took into account the previous mentioned reports, NSS reported evidence of water contamination (limited to specific components of the water system), non-compliant shower hose lengths and use of retaining rings, and concerns about water management, including water temperature control, which increased the risk of contamination of the system and healthcare associated infection. NSS recommended a number of remedial actions.

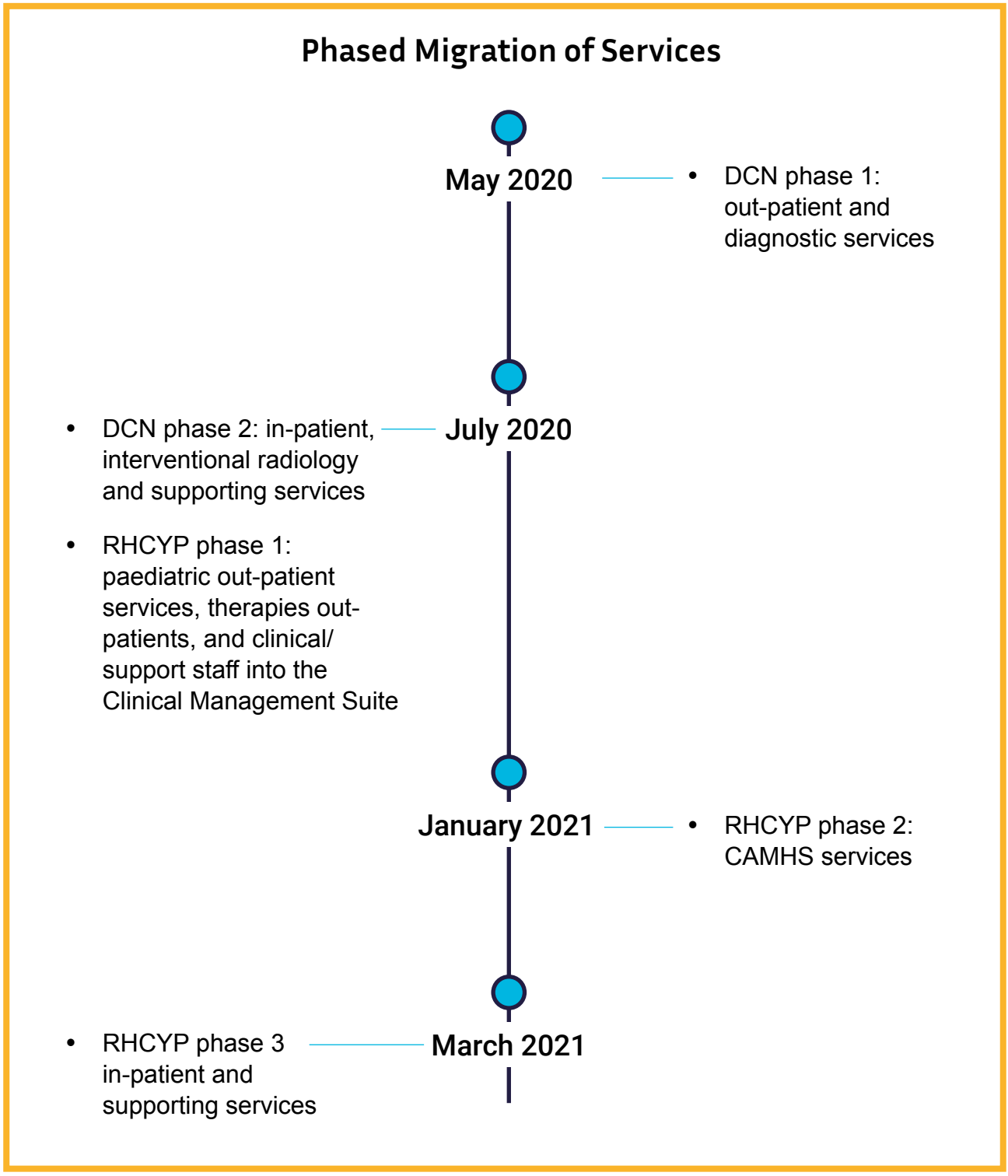
4.99. Lindsay Guthrie and Dr Inverarity prepared a Water Safety Report for the Oversight Board to provide an assessment of the remedial actions recommended by NSS and to outline the risk-based approach NHSL would take to demonstrate that water quality and delivery systems were safe, and conformed with legislation and technical guidance.[252] NHSL's approach was supported by the Oversight Board.

4.100. Action was taken before the hospital was occupied to address non-compliant shower hose lengths, replace contaminated components such as taps and improve water management, including a planned preventative maintenance regime. A low value change was issued to cover whole system disinfection prior to occupation of the building by patients.[253]

250 A47172495 - Water Condition Assessment July 2019 - HC2024.B13.V8 - page 939.
251 A34053098 - Water Solutions Group Report July 2019 - HC2024.B13.V8 - page 884.
252 A40933361 - Oversight Board Papers 16 January 2020 - HC2024.B3 - pages 558 to 586.
253 A40933361 - Oversight Board Papers 20 February 2020 - HC2024.B3 - page 707.

The decision to open

4.101. The hospital was opened in phases with different services migrating between May 2020 and March 2021 .



4.102. The decision for phased migration was influenced by a number of factors. The DCN and CAMHS were ready for occupation before the RHCYP, partly due to the complexity involved in the remedial work to the ventilation system in critical care and the haematology and oncology ward. There were concerns about water safety at the former DCN, which had resulted in reduction of services and patient accommodation there. There were also the commercial implications of paying for an unused facility. These factors had to be balanced against the concerns that some clinicians had about a phased migration. What swung the balance towards a phased migration was the impact of the COVID-19 pandemic. Mary Morgan explained to the Inquiry:

> "I was keen that there was a phased opening to the building. The public purse was paying for the building that wasn't being used, and I always felt that it was important to get it occupied as soon as it was safe to do so. Further, the facilities at the RHSC at Sciennes Road and the DCN at the Western General Hospital were suboptimal for the delivery of modern healthcare. Phased migration was not, however, straightforward and particular regard had to be had to NHSL's ability to clinically resource any part of the building that was opened.
>
> Initially, I sensed reluctance to consider a phased opening of the hospital. I don't think anyone was ever overtly against the possibility and there was a willingness to have exploratory conversations.
>
> There was resistance from clinical teams about dividing their places of work and existing clinical adjacencies. For example, the Child and Adolescent Mental Health Service (CAMHS) is essentially a stand-alone service within the hospital. However, when they need help, they need it from the rest of the Children's Hospital. So, if there is a clinical emergency or an incident that takes place, then they needed to have other staff who would come in to support them in their area. Whilst CAMHS is independent, they could not be isolated from other mechanisms of support and that, for them, was a no-go position.
>
> The "game changer" for phased use of the building was COVID-19. Additional space was required across the NHS estate to allow for continuity of services while maintaining and accommodating the need for social distancing.
>
> As the project progressed there were areas of the hospital that were or became fit to occupy ahead of other areas. Outpatient and diagnostic services of the DCN were the first to migrate, which was within a year of the decision to delay the opening of the hospital…
>
> Another factor for me was that the new facility is far superior to what people were already working in and where patients were receiving treatment, at the RHSC at Sciennes Road and at the DCN at the Western General Hospital."[254]

254 Witness Statement - Mary Morgan - 07.03.2024 - paragraph 61 to 69.

4.103. Fiona McQueen, who was Chief Nursing Officer in the Scottish Government and a member of the Oversight Board, echoed this view.[255]

4.104. The Cabinet Secretary signed off every phase of the migration. Ms Freeman told the Inquiry that her role was to be sure that the clinicians and healthcare team at DCN were consulted and that she "needed to be assured that plans for taking matters forward were fit for purpose." In addition to advice from the OB, Ms Freeman was communicating with unions: "That provided me with, if you like, an additional assurance. I would hear where things were not correct and whether the clinicians and healthcare staff were content."[256]

4.105. Ms Morgan told the Inquiry that in addition to the Oversight Board, which included membership from HFS and NSS more broadly,

> "one of the things that we did make sure that we had, and had improved upon, was authorising engineers throughout the duration of the project. The project had already had authorising engineers, but I believe they were much more heavily engaged throughout the remedial works than they had been previously. So they were more a part of the ongoing advice rather than stepping in to do checks at various times."[257]

4.106. The phased moves did not take place until the facilities were considered fit for purpose. NHSL provided the Inquiry with a body of evidence showing how decisions were reached, actions taken, concerns raised, and evidence provided, in order to close out the issues with building systems that were identified in the summer of 2019.[258] This included:

- The papers and minutes of the IMT/ESG from its inception in 2019 to the final meeting on 8 March 2021. In addition to minutes of meetings this included:
    - A regular Senior Programme Director's Report with updated action logs, dashboard and programme risks.
    - Regular updates on NHSL's response to the NHS NSS review, showing progress to close out actions recommended by NHS NSS.
    - Papers by the Infection Prevention and Control team, including risk assessments of proposals to resolve issues.
    - Reports from consultants providing assessments, advice, technical assurance and third party validation.
    - Change Notices for works to be undertaken.

255 Transcript - Fiona McQueen - 07.03.2024 - column 207 to 210.
256 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 146 to 148.
257 Transcript - Mary Morgan - 7.03.2024 - column 258.
258 Some of this evidence can be accessed in The Works Under Supplementary Agreement 2 (SA2) - HC2024.B3.

- Designs and proposals, and documents relating to design assurance.
- Other evidence used to close out issues, obtained from Multiplex, Bouygues and others.

- The papers and minutes of the Oversight Board from its inception in 2019 to its closure in April 2021, similar to the above but with less consideration of operational issues.
- Separate action logs showing the progress of ventilation, water safety, fire safety, electrical and other workstreams.
- Minutes of workstream meetings.
- Correspondence of Ronnie Henderson (Commissioning Manager - Hard FM, NHSL) Brian Currie (Project Director, NHSL), Iain Graham (Director of Capital Planning and Projects) and others with members of the Infection Prevention and Control team, Mott MacDonald Limited, NHS NSS, Multiplex, Bouygues and others showing discussion and debate on key issues, agreements and disagreements on actions to take, confirmation of actions taken and evidence of issue closure.

4.107. NSS also provided the Inquiry with documents, including correspondence, meeting minutes and consultation with experts, that showed a high level of engagement in ensuring hospital building systems at the RHCYP and DCN were compliant and fit for purpose.

4.108. Scottish Ministers provided the Inquiry with relevant briefings to the Cabinet Secretary and letters, in draft or final copy, from the Cabinet Secretary to the Convener of the Health and Sport Committee updating Parliament on the migration to the new hospital.

4.109. The following timeline shows the key events which led to the completion of remedial works, and which contributed to the body of evidence that the building systems at the RHCYP and DCN were fit for purpose, and the hospital ready to open.[259]

259 The table is based on the findings contained in Provisional Position Paper 7 (Revised)- Non-ventilation issues with the potential to adversely impact on patient safety and care at the RHCYP and DCN; and remedial works to resolve them and Provisional Position Paper 7 Supplementary (revised) - Note on issues with the ventilation system outside of Critical Care areas with the potential to adversely impact on patient safety and care and remedial works undertaken read together with Core Participants Responses to PPP7 and supplementary note in HC2024.B12.V2. Supporting documentary evidence can be found in the following evidence bundles: Documents referred to in the expert report of Mr. Stephen Maddocks- HC2024.B1; and The Works Under Supplementary Agreement 2 (SA2) - HC2024.B3.

Date	Timeline of the completion of works, and the evidence of readiness to open the RHCYP/DCN
27 September 2019	The Infection Prevention and Control Team (IPCT) completed risk assessments on the impact of ventilation design and managing HAI risk in clinical areas (not including critical care).
3 October 2019	The Oversight Board noted the IPCT risk assessments and approved in principle the development of a board change to bring the 12 single rooms in the haematology and oncology ward up to the required specification for the care of neutropenic patients.
4 October 2019	A number of issues on the ventilation action log were closed after the IOM provided a 'witnessing of theatre re-balancing and validation summary report'.
November 2019	An 'Interim RHCYP and DCN Water Safety Group' was set up.
8 November 2019	A number of issues were closed on the ventilation action log after IOM provided theatre validation reports.
5 December 2019	The works required to bring the ventilation system to the standards recommended in SHTM 03-01 were instructed under High Value Change (HVC) 107.
16 December 2019	The IPCT produced a risk assessment: "SBAR assessment: Outpatient and therapy areas: Ventilation Room Review RHCYP DCN".
February 2020	A Water Safety Group was set up.
13 February 2020	TAD Facilities Management 'High and Low Voltage System Audit Report' found that "the site demonstrated that its procedures and processes were in accordance with the current legislation and relevant Safe Systems of Work."
20 February 2020	The Oversight Board received an 'IPCT Water Quality Update Report', "took assurance from the detail provided" in the report and "accepted the recommendation to close the outstanding aspects of the actions pertaining to water quality."
12 March 2020	The Oversight Board agreed that the electrical workstream can be closed off upon receipt and appropriate certification of evidence statements by the Multiplex authorising engineer. The Oversight Board also "approved the mechanisms in place in terms of water" and "agreed to closing off the water safety workstream action tracker once the shower hose compliance was confirmed."
18 March 2020	Helicopter test flights showed no adverse effect on the ventilation system pressures.
20 March 2020	Scottish Water formally approved the solution for shower hoses.

Date	Timeline of the completion of works, and the evidence of readiness to open the RHCYP/DCN
9 April 2020	The Oversight Board supported the phase 1 move of the DCN to commence on 11 May 2020 and noted that ventilation maintenance bypass "has now been demonstrated on all Air Handling Units being retained".
1 May 2020	NHSL produced a response to the actions identified in the NHS NSS Reports. The response indicated that most ventilation issues had been closed.
5 May 2020	Following a site visit on 20 and 21 April, Oakleaf issued a Site Observations Report for wards in the Department of Clinical Neuroscience (DCN). This provided validation of fire safety enhancements.
5 May 2020	The Cabinet Secretary was sent a paper for the NHSL Board, for clearance. The paper provided assurance to the Board that the facilities and services at the new hospital were ready for the DCN migration to commence on 11 May 2020.
6 May 2020	NHSL's Commissioning Manager for Hard Facilities Management, NHSL's Authorising Engineer for ventilation, and the IOM's Authorising Engineer for validation signed off the Air Handling Unit (AHU) Refurbishment Inspections for all AHUs outside of the critical care department and haematology and oncology ward. The sign-off sheets confirmed that the AHUs were 'fit for purpose'.
May 2020	The Phase 1 move of the Department of Clinical Neuroscience took place.
5 June 2020	The Chief Nursing Officer Directorate briefed the Cabinet Secretary on the target completion date of 25 January 2021, and Oversight Board support for plans for the DCN Phase 2 and RHCYP Phase 1 moves to the new site.
18 June 2020	The Oversight Board supported the Phase 2 move of the DCN and Phase 1 move of RHCYP services.
6 July 2020	Oakleaf visited the RHCYP and DCN to provide validation of fire safety enhancement for wards Dirleton, Tantallon, Dunvegan, Dalhousie, Borthwick, Castle Mey and Children's A+E . Oakleaf issued the 'Site Observations Report – Phase 2' on 16 July.
July 2020	The Phase 1 move of RHCYP services and Phase 2 move of DCN services took place.
20 July 2020	The Authorising Engineer (ventilation) from the IOM, confirmed the quality of the new Air Handling Units following a visit to the AHU factory.

Date	Timeline of the completion of works, and the evidence of readiness to open the RHCYP/DCN
5 August 2020	NHSL and IHSL entered into a Supplemental Agreement (SA2) in respect of the ventilation works described in High Value Change No 107.
21 October 2020	Oakleaf issued its "Site Observations Report – Phase 3", providing third party validation for fire safety enhancement in the Child and Adult Mental Health Service (CAMHS).
14 January 2021	The Oversight Board supported the Phase 2 move of the RHCYP (CAMHS) to commence on 15 January 2021.
14 January 2021	The Chief Nursing Officer Directorate briefed the Cabinet Secretary on the migration of CAMHS, the new expected completion date of 8 February 2018, and Oversight Board support for the final migration of RHCYP inpatient services on 22 and 23 March 2021.
January 2021	The migration of CAMHS to the new site took place.
January – February 2021	IOM's final validation survey took place.
4 February 2021	NHSL's Authorising Engineer provided a Design Assurance Statement confirming that AHUs for the critical care department and haematology and oncology ward met the full requirements of SHTM 03-01 and were fit for purpose.
10 February 2021	Oakleaf issued the final "Site Observations Report – Phase 4", providing third party validation for fire safety enhancement in areas of RHCYP affected by ventilation works to the critical care department and haematology and oncology ward.
11 February 2021	NHSL's Authorising Engineer (water), produced a final audit of BYES water management. The audit concluded: "the hospital operates well run water systems and is generally able to evidence that with the onsite water safety plan that is in use."
25 February 2021	The Oversight Board supported the phase 3 move of the RHCYP to commence in March 2021. The Senior Programme Director (RHCYP and DCN), stated that the RHCYP is "now one of the safest and best buildings in the whole of Scotland."
2 March 2021	IOM issued the results of its validation audit. The ventilation systems serving the critical care department (paediatric intensive care unit and high dependency unit), haematology and oncology ward, and emergency department were confirmed to be 'fit for purpose'.

Date	Timeline of the completion of works, and the evidence of readiness to open the RHCYP/DCN
8 March 2021	The Senior Programme Director wrote to the Chief Nursing Officer to confirm that final validation reports had been reviewed by the lead infection prevention and control doctor, the Stage 4 HAI-SCRIBE was completed by the lead infection prevention and control nurse and HFS had reported nil outstanding. NHSL had decided to progress with move of inpatient services on 22 March on this basis.
9 March 2021	The Senior Programme Director briefed the Cabinet Secretary on the readiness for migration of RHCYP inpatient services.
22 March 2021	The Phase 3 move of RHCYP – inpatient services began.
8 April 2021	The Oversight Board met for the final time. All ventilation actions were closed following discussion with the Head of Engineering, HFS.

4.110. In summary, the air changes and pressure in critical care was a standing item on the agenda of the Oversight Board. By 8 March 2021, Ms Morgan, the Senior Programme Director, was satisfied that the hospital was safe to open. By this time, the IOM reports had been obtained showing that the hospital complied with SHTM 03-01, IOM confirmed that the ventilation system was fit for purpose and would only require routine maintenance to remain so. HFS reported no outstanding issues. HAI-SCRIBE Stage 4 had been completed by Ms Guthrie.[260] The Cabinet Secretary was only prepared to agree to allow the hospital to open when she was satisfied that the ventilation system complied with published guidance. She received assurances to this effect.[261]

Financial impacts

4.111. The cost of the delay was reported to be £16.8 million. This consisted of £10.3 million relating to remedial work at the new facilities; £2.8 million for maintaining the existing sites; and £3.7 million for project and professional costs relating to ongoing project management and required specialist review.[262] In addition to these costs, periodical payments to IHSL commenced, notwithstanding the hospital not being occupied.

260 A41584294 - Emails 8 March 2021 - HC2024.B8 - page 240.
261 Transcript - Jeane Freeman - 12.03.2024 - column 112 to 113.
262 Written question and answer: s6w-00623; A40933361 - Oversight Board Papers 25 February 2021 - HC2024.B3 - page 1085.

Evaluation as to whether the works post-July 2019 have been adequate and effective

4.112. The remedial works have been adequate and effective. The ventilation system in critical care is designed, and commissioned, in compliance with published guidance and best practice. This is evidenced by the testing carried out by IOM.[263]

4.113. In addition, following the completion of ventilation works, the Infection Prevention and Control team produced a "Review of Suitability of the Performance of Redesigned Ventilation Systems in RHCYP DCN". Version 1 was dated March 2021.[264] Dr Inverarity explained:

> "A final report was produced by IPCT in early March 2021 for the project team and ESG that outlined all the risk assessments that IPCT had undertaken on aspects of the ventilation system and that IPCT were satisfied all the HAI risks had been addressed to our satisfaction and at that point we signed the HAI-SCRIBE Stage 4 documents. This report was informed by reports produced by IOM and the NHSL Authorising Engineer for RHCYP DCN (John Rayner) regarding the performance of the ventilation systems in February and March 2021."[265]

4.114. Version 2 of the abovementioned report was dated December 2021. Dr Inverarity and Ms Guthrie confirmed that following these reviews, along with all other reviews undertaken by the IPCT and others of the ventilation system, they are of the view that the RHCYP provides a safe environment for patient care.[266]

4.115. In his expert report for the Inquiry Mr Maddocks concluded:

> "The ventilation system in Critical Care and Isolation Rooms at the RHCYP/DCN has been designed, tested, commissioned and validated in compliance with published guidance (SHTM03-01) and best practice. The ventilation system has therefore been checked and demonstrated to be in accordance with the design requirements detailed in SHTM03-01. From an engineering perspective, the ventilation system in the Critical Care and Isolation Rooms in the RHCYP/DCN is adequate for its intended purpose. The Critical Care and Isolation Rooms provide a suitable environment for the delivery of safe, effective person-centred care."[267]

263 A35231147 - IOM Ventilation Validation Report - HC2024.B1 - page 2995.
264 A47091309 - IPCT Review 3 December 2021 - HC2024.B13.V7 - page 152.
265 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 204.
266 Transcript - Donald Inverarity - 05.03.2024 - column 170; Transcript - Lindsay Guthrie - 01.03.2024 - column 134.
267 Stephen Maddocks - RHCYP/DCN Critical Care Ventilation Systems Review - page 37 - paragraph 5.2.4.

4.116. Witnesses, including senior leaders from NHSL and the SG healthcare directorate, who were questioned on this matter during hearings held by the Inquiry in 2024 unanimously agreed that the hospital was safe to open when it did:

> "Given the process that we had gone through and the rigour and scrutiny, and indeed the number of important players…we were content that the building was as safe as any could be and, therefore, we were safe to move people into it."[268]

> "We had been thorough. The hospital had been inspected many times. We had specified… up to the level of the guidance, and therefore we believed that it was one of the safest and best buildings in the whole of Scotland, given its newness and its completeness.[269]

> "the Oversight Board had overseen both the rectifications required to bring critical care up to a level of compliance with the air changes, but [also] a number of what would be regarded as enhancements to the building to absolutely optimise that built environment. So, the safety from the built environment… was absolutely as good as it could be."[270]

> "I think the involvement, in particular of the assurance processes around HPS and HFS…gave everyone a great deal of assurance…it had been described by colleagues as probably the most inspected and tested hospital… in the world."[271]

4.117. The Inquiry has not identified anything to challenge these assessments or otherwise to express concern over the adequacy and effectiveness of the works undertaken from July 2019 to March 2021 to remedy defects that might adversely impact on the safety of patients. In the light of the whole evidence, I have accordingly no hesitation in determining, in terms of the Inquiry's remit, that the RHCYP and DCN buildings, as opened on 23 March 2021, provide a suitable environment for the delivery of safe, effective person-centred care.

268 Transcript - Alex McMahon - 07.03.2024 - column 57.
269 Transcript - Fiona McQueen - 07.03.2024 - column 216.
270 Transcript - Tracey Gillies - 08.03.2024 - column 66 to 67.
271 Transcript - Timothy Davison - 08.03.2024 - column 88 to 89.

Chapter 5

Ventilation in healthcare premises

Chapter 5

Ventilation in healthcare premises

Introduction

5.1. Underpinning the Cabinet Secretary's decision to postpone opening the RHCYP and DCN was an understanding that if the critical care department of the hospital was not ventilated in accordance with the recommendations of SHTM 03-01, then she could not be assured that it was safe for the patients who were to be treated there. Once that proposition is accepted, it is a short step to concluding, on the basis of the findings of IOM at the end of June 2019, that features of the ventilation system of the new hospital were "defective" as that term is defined in the Inquiry's Term of Reference 1:

> "A. Not achieving the outcomes or being capable of the function or purpose for which they were intended;
>
> "B. Not conforming to relevant statutory regulation and other applicable recommendations, guidance, and good practice."[272]

5.2. The soundness of the foregoing proposition, at least when presented in unqualified terms, did not go unchallenged during the proceedings of the Inquiry. It is therefore necessary to say something, on the basis of the evidence heard, about the function of ventilation in healthcare, its role in infection prevention and control, how that is explained in the available guidance and what status that guidance has and should have.

The function of ventilation in a healthcare built environment

5.3. In his report to the Inquiry, Dr Shaun Fitzgerald defined ventilation as the provision of air to a room, which at least for some of the time, is fresh air. Ventilation's "primary purpose … is generally to help provide a space which is pleasant and

272 It is in this sense that "defect", "defective" and like terms should be interpreted in this interim report, unless it is used explicitly in relation to the terms of the Project Agreement. The report is concerned with whether systems were "defective" in the sense used in the Terms of Reference and it offers no view on whether the systems suffered from any Defects, as that term is used in, and for the purposes of, the Project Agreement.

safe in terms of air quality."[273] In a hospital, this can be expressed in terms of three main functions: (1) the removal of odours or noxious smells, (2) the maintenance of comfortable temperatures for patients and staff, and (3) assisting in the prevention and control of infection.

5.4. Ventilation can be provided naturally by the effects of wind pressure and/or the buoyancy of warmer air (for example, through the mechanism of opening a window). Natural ventilation offers advantages, particularly in relation to simplicity and cost, and in many areas where it is practicable to have a sufficient number of openable windows, it will be the preferred solution. Where, however, it is necessary to maintain constant air flow rates and controlled pressure regimes, mechanical ventilation will be required to ensure that the system performs consistently regardless of the prevailing weather conditions. A mechanical ventilation system is usually automated. It will include, among other components, supply fans, extract fans, distribution ductwork and filters.[274] It may have the ability of cooling or heating the air passing through. Dr Fitzgerald noted the possibility of hybrid systems combining natural and mechanical means of ventilation, but, again, if a space is used to house a patient where a given air flow rate and/or given pressure is required at all times whilst the patient is present, then it is normal for a wholly mechanical system to be used.

5.5. A ventilated space will usually have provision for the supply and the exhaust of air. The relative positions of the respective supply and exhaust points will determine the pattern of the air flow within the space. Where the rate of air supply exceeds the rate of exhaust this will generate a positive pressure relative to adjoining spaces which are not subject to such an excess of supply over exhaust. Conversely, if the rate of exhaust exceeds the rate of supply, a negative pressure will be generated. The efficiency of these processes depends on the permeability of the space. Accordingly the ability to achieve and maintain a positive pressure in a bedroom, for example, depends on the extent to which the bedroom has leaks through its walls and ceiling and the extent to which the door is left open.

Ventilation and infection prevention and control

5.6. The evidence available to the Inquiry repeatedly emphasised the importance of minimising infections contracted by patients while within a healthcare setting. These infections were variously referred to as nosocomial, hospital acquired (HAIs) and healthcare associated (HCAI).

273 A37277147 - Report on Ventilation Principles by Dr Shaun Fitzgerald - HC2022.6 - page 29.

274 For a general discussion on modes of ventilation see SHTM 03-01 Part A v.2 2014 - chapter 5. See also Transcript - Shaun Fitzgerald - 09.05.2022 - column 17 onwards; A37277147 - Report by Dr Shaun Fitzgerald - HC2022.B6 - page 38; A37331867 - Expert Report of Professor Hilary Humphreys - HC2022.B6 - page 12.

5.7. Professor Humphreys, Emeritus Professor of Clinical Microbiology and an expert instructed by the Inquiry, explained that, in recent decades, all patients seen either in the community or in hospitals are considered to be at risk of infection. In introducing the section of his report on the consequent importance of infection prevention and control in the healthcare setting, Professor Humphreys had this to say:

> "Amongst the adverse events or safety issues that can arise after a patient is admitted to [a] hospital or healthcare facility, HCAI are amongst the most important. While side-effects to drugs were the commonest, HCAI were amongst the top three in a recent Irish study, and the greatest recent decrease in preventable adverse events occurred with HCAI, which fell by 22%. Similar findings might be expected in Scotland, given many similarities such as healthcare provision and demography. It is generally considered that many HCAI are preventable, especially those arising from the insertion of medical devices such as intravascular catheters ('drips') and some outbreaks. Furthermore, prevention strategies can enhance patient safety and improve the quality of patient care."[275]

5.8. Professor Humphreys emphasised that an effective programme of infection prevention and control required to be multi-modal; a suite of measures was required rather than only one measure for a particular infection. These measures should include ensuring hand hygiene, disposing of waste, environmental decontamination, the administration of prophylactic antibiotics, and the appropriate isolation of patients.[276] However, an important infection prevention strategy was the effective control of the ventilation of spaces within hospitals, and in particular of those areas where the more vulnerable patients are accommodated and treated. When designed, installed and operated correctly, ventilation systems can help reduce the risk of infection. When not designed, installed or operated correctly then ventilation systems can not only fail to protect people but can also increase the risk of infection.[277]

5.9. The role of ventilation in infection prevention and control can be understood by reference to the fact that among the vectors of transmission of infection within a hospital, as elsewhere, is the air-borne route, whereby bacterial, viral and fungal pathogens are carried, within droplets as droplet nuclei, on particles of shed skin, or as spores, from a human or environmental source, to a potentially vulnerable

275 A37331867 - Report of Professor Hilary Humphreys - HC2022.B6 - page 9. Professor Humphreys did not offer a figure, but a paper by Schreiber et al, *The preventable proportion of healthcare-associated infections 2005-2016: Systematic review and meta-analysis* Infect Control Hosp Epidemiology. 2018 Nov; 39(11):1277-1295 suggests that between 35% and 55% of HCAIs may be preventable.

276 Professor Humphreys' evidence on the central importance of infection, prevention and control in a healthcare setting was consistent with the other clinical evidence heard by the Inquiry and the learning and policy expressed, for example, in NHS Scotland's National Infection Prevention and Control Manual.

277 Transcript - Hilary Humphreys - 12.05.2022 - column 21 to 22.

patient.[278] Patients vary in their susceptibility to infection, whether as a result of air-borne transmission or otherwise. Neonates and the elderly are generally vulnerable. However, as Professor Humphreys explained, modern medical care has resulted in an increasing number of patients who are particularly susceptible to opportunistic pathogens (micro-organisms that would not be a risk in a normal individual but would be in somebody who is more vulnerable). Patients with such therapeutically induced susceptibility include those who are immunocompromised by reason of their undergoing treatment for blood cancers. Professor Humphreys cited as examples of opportunistic pathogens presenting a risk to these more susceptible patients, the fungus *Aspergillus* and skin bacteria such as *Staphylococcus epidermis*.

5.10. Professor Humphreys explained that controlled mechanical ventilation is specifically required in the operating theatre to prevent bacteria shed from the operative team falling on the wound, leading to surgical site infection. This is achieved by trying to ensure that the cleanest air is that closest to the wound and that bacteria from the surgical teams are carried away from the wound.

5.11. Properly designed ventilation is also relevant to the prevention of infection outside the operating theatre. Isolation rooms maintained at negative pressure to the rest of the ward can be used to accommodate a patient with a transmissible infection when the intention is to prevent the air surrounding that patient spreading to other patients in the ward (source isolation). Patients presenting this sort of risk would include those with COVID-19 infection. In contrast, positive pressure ventilation is used to protect very vulnerable patients such as those receiving chemotherapy for cancer or who have had organ transplantation, where air from their room moves to other areas because the room pressure is maintained at a level which is higher than that in the surrounding area (protective isolation). This prevents the ingress of air from other parts of the ward where there may be pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA), and therefore protects the vulnerable patient from the air-borne spread of harmful organisms. The effectiveness of this strategy of isolation by maintaining a pressure differential is of course a function of the extent to which the room containing the patient is completely sealed off from adjacent spaces, including the ceiling space, and free from leaks.

5.12. Ventilation systems can also contribute to infection prevention and control by maintaining and improving the quality of the air (by reducing the level of pathogenic contaminants) in, for example, a unit with neutropenic patients. This can be achieved by providing High Efficiency Particulate Air (HEPA)[279] filtration to the air supplied to the unit and applying a higher rate of changes of the air within the unit, as compared with the rate of changes that would be applied to a normally ventilated room.

278 The February 2022 version of SHTM 03-01 notes, at paragraph 2.2, that up to 25% of infections that occur because of a surgical intervention are thought to be caused by the airborne route, predominantly as a result of airborne microorganisms.

279 For a filter to meet the HEPA standard it requires to remove from the air at least 99.95% of particles whose diameter is equal to 0.3 microns.

5.13. Needless to say, an inevitable limitation on what can be achieved by the installation of specialised ventilation systems in relation to particular spaces such as bedrooms, is that the patient may have to leave these spaces from time to time in order to receive treatment in another part of the hospital or for other reasons.

Impact of rate of air changes on effectiveness of infection prevention and control

5.14. As has been seen, it was concern over the air change rate achievable by the ventilation system supplying the critical care department in the new hospital, and in particular the fact that it did not meet the specification in the then current version of SHTM 03-01, which was the key issue leading to the Cabinet Secretary deciding not to open the hospital in July 2019.

5.15. At the risk of oversimplification, air change rates are used to describe the volume of air that goes into a room or is extracted from a room over time. They are usually expressed as a number of times that the volume of air within that space is changed per hour.[280] The figure is derived by dividing the volume of air introduced into the space by the volume of the space. Changing the air in a room dilutes and reduces the contamination in the air.[281] The more that contaminated air is diluted the better. The more air changes that are delivered, the more rapid the dilution of the contamination, provided of course that the supply air is uncontaminated or at least less contaminated than the air being replaced. Therefore, the more air changes, the safer is the air.[282] As Andrew Poplett, the healthcare engineering expert instructed by the Inquiry, put it in his statement, "the solution to pollution is dilution".[283]

5.16. In the course of his evidence, Professor Humphreys referred to research conducted by Dr Owen Lidwell in 1972.[284] His work is significant as one of the earliest sources of guidance regarding ventilation in healthcare facilities,[285] and his research is the basis for the minimum ventilation rates that are used today.[286] Applying the principles developed by Dr Lidwell, assuming that contamination is not continuing to be introduced into or generated within a closed space, after four air changes approximately 98 per cent of contaminants originally in that space will be removed.[287] The research indicates that each successive air change will remove a smaller and smaller number of contaminants: "…you're getting closer and closer, but never quite mathematically reaching 100 per cent removal of the existing contaminants." [288]

280 A37521582 - Statement of Andrew Poplett - HC2022.B6 - page 108 - paragraph 27.
281 A37521582 - Statement of Andrew Poplett - HC2022.B6 - page 103 - paragraphs 11, 13 to 20.
282 Transcript - Hilary Humphreys - 12.05.2022 - 47 and 49.
283 A37521582 - Statement of Andrew Poplett - HC2022.B6 - page 106 - paragraph 20.
284 A37475379 - The Report Of A Joint Working Party On Ventilation in Operation Suites chaired by Dr O.M. Lidwell of the Medical Research Council.
285 A37521582 - Statement of Andrew Poplett - HC2022.B6 - page 102 - paragraph 10.
286 Transcript - Andrew Poplett - 10.05.2022 - column 34.
287 Transcript - Hilary Humphreys - 12.05.2022 - column 55.
288 Transcript - Hilary Humphreys - 12.05.2022; see also Transcript - Andrew Poplett - 10.05.2022 - columns 28 to 29 and A37521582 - Statement of Andrew Poplett - HC2022.B6 - page 109 to paragraph 28.

5.17. Thus, the higher the rate of air changes in a given area, the more quickly the level of contamination of the air in that area will be reduced. That does not, however, mean that high air change rates are required uniformly throughout a healthcare facility. Regard has to be had to the level of risk which is sought to be mitigated which in turn will depend on the relevant patient population to be protected, and the practicalities associated with the provision of a system capable of delivering higher air change rates. As Professor Humphreys explained in his oral evidence to the Inquiry:

> "So, for example, obviously the more air changes you have in a facility, in theory, the greater the dilution of any contamination in the air, but you may not require huge air changes where the risk is relatively low. So, that sort of balance between making sure we have preventative measures in place, but that they are, I suppose, balanced by other aspects such as expense, space and so on."[289]

5.18. Professor Humphreys was asked to evaluate the consequential risk to vulnerable patients where the contamination in question is a potential source of infection and a lower, rather than a higher rate of air change has been adopted. His response indicated the difficulties in addressing this question. First, it is an over-simplification of matters to state that if a lower rate (lower, for example, than that recommended in SHTM 03-01) has been adopted there will always be a risk, or an increased risk, of infection to patients. With a number of factors in play, that will depend on circumstances.[290] Second, Professor Humphreys explained that there is no precise cut-off point at which a particular air change rate will become dangerous to a patient. For example, as a matter of generality, he could not say that 5 air changes per hour is significantly worse than 6: "…if you're asking me 'Is there strong evidence that, for example, six air changes per hour is better than five or not as good as seven?' I don't think you can be as precise as that."[291] Similarly, "If, for example…you talk about 25 air changes for a general operating theatre and you go down to 15/16, then I think you're into territory where there may be a significant risk. On the other hand, if you're going from 25 to 20, the risk may not be so great."[292]

5.19. When discussing the potential impact of air change rates, Professor Humphreys addressed the issue in terms of an increase in risk of infection as opposed to a causative link to a specific adverse outcome. He explained: "There is no precise science that I am aware of that sets the ACH for a critical care unit at 10 and whether this is significantly better than 12 or even 15 ACH…".[293] The same view was expressed by others giving evidence to the Inquiry.[294] However, in relation

289 Transcript - Hilary Humphreys - 12.05.2022 - columns 13 to 14; Transcript - Andrew Poplett - 10.05.2022 - columns 16 to 17.
290 Transcript - Hilary Humphreys - 12.05.2022 - column 56; see also discussion at columns 15 to 20.
291 Transcript - Hilary Humphreys - 12.05.2022 - column 14.
292 Transcript - Hilary Humphreys - 12.05.2022 - column 47.
293 Transcript - Hilary Humphreys - 12.05.2022 - column 47.
294 For example Transcript - Stephen Maddocks - 12.05.2022 - column 110; Transcript - Shaun Fitzgerald - 09.05.2022 - column 62; Transcript - Andrew Poplett - 10.05.2022 - column 25. One core participant stated: "There is no evidence to support why SHTM proposed minimum ventilation requirements are as they are, and there is nothing to suggest that particular rates of air changes themselves have any direct impact upon rates of infection." (Closing Submission on behalf of Greater Glasgow Health Board - paragraph 8).

to the contrast between the number of air changes per hour actually achieved in critical care areas at the RHCYP and DCN when tested by IOM (not better than 4.2 ac/h)[295] and the number recommended in SHTM 03-01 (10 ac/h), Professor Humphreys concluded:

> "Hence, while it is difficult to be definitive, ACH of 7, 8, and 9 might still give significant protection, but those at 5 or less would probably not, as they would be similar to what you would see in a non-mechanically ventilated area. Nonetheless, failing to implement guidelines is likely to increase the risk of adverse events occurring, such as infection, even if quantifying this increased risk would be challenging generally and especially in the case of an individual patient."[296]

5.20. When Andrew Poplett was pressed by Counsel as to the significance of the recommended 10 ac/h as opposed to 12 or 8, he responded:

> "I don't have the specific scientific evidence base, but [10 ac/h] is intended to represent a good rate of dilution to minimise potential infection transmission and risk"[297]

5.21. Dr Inverarity's evidence was to similar effect.[298] A downward departure from the 10 ac/h recommended by SHTM 03-01 can be taken as increasing the risk of infection transmission, albeit that it was not possible to quantify the increase. In his witness statement to the Inquiry, he explained:

> "It is hard to advise on the risks and impacts that not providing an environment of 10 Pa positive pressure and 10 air changes per hour would have as the infection risk is now very individual to particular patients and their degree of immunosuppression and an assessment of the clinical risk of acquisition of infection is often best done by the clinical team looking after the patient who understand which cancer they are treating and which chemotherapy regimen is being used. Many neutropenic patients (paediatric and adult) are now managed at home with no protective isolation and until 2022, the adult haematology and oncology wards at the Western General Hospital had no such isolation facilities and did not experience excess mortality among their patients over several decades of using those facilities. Neither did RHSC at Sciennes have such facilities. I am not an expert in this area and not fully versed in the evidence base for the ventilation parameters stipulated in SHTM 03-01 for wards

295 A32653506 - IOM, Witnessing of Theatre Re-Balancing and Validation Summary Report - HC2024.B1 - page 2934 .

296 A37331867 - Expert Report of Professor Hilary Humphreys - HC2022.B6 - page 15 - paragraph 4.4.3. See also paragraph 4.7.3: "It can be difficult to assess the possible impact of failure to comply fully with ventilation guidance if the deviation is small. For example, if it is recommended that a conventional operating theatre should have 25 ACH when built, and if monitoring suggests that it is 18-22, that…may not result in an increase in infection, in contrast to the risk if the ACH were as low as 8 - 12".

297 Transcript - Andrew Poplett - 10.05.2022 - column 119.

298 Transcript - Donald Inverarity - 05.03.2024 - column 115 onwards.

managing neutropenic[299] patients but I am aware of guidance issued by the Centre for Disease Control (CDC) in the USA which has advised use of greater than 12 air changes per hour for such areas which references papers from the late 20th century and early 21st century to support this."[300]

5.22. Dr Inverarity confirmed in evidence that the air change parameters recommended in SHTM 03-01 reflect a broad consensus across the developed world[301] and an approach in which critical care areas are better ventilated than general wards.[302]

5.23. Peter Hoffman is a consultant clinical scientist with Public Health England. He has an expertise in healthcare specialist ventilation. He gave evidence in the third hearing in relation to the Queen Elizabeth University Hospital and Royal Hospital for Children in Glasgow. For Mr Hoffman what was most relevant to the protection of an immuno-compromised patient from air-borne fungal spores and microbial pathogens was the filtration of the air supply to the patient's room by means of tightly fitted HEPA filters, together with the minimisation of the leaks through the inevitable gaps in the fabric. Positive pressure within the room should ensure that air will leak outwards but positive pressure without HEPA filtration is pointless. In Mr Hoffman's view, regulation of the air-change rate in a positive pressure room where the air supply was HEPA filtered was merely for purposes of the comfort of persons within the space being ventilated.[303]

5.24. A number of conclusions can be drawn from the evidence of Professor Humphreys, taken with that of Dr Inverarity, Dr Fitzgerald, Mr Poplett and Mr Hoffman.

5.25. The air within a healthcare facility (as is the case with the air within other public and private buildings) is likely to contain (and therefore can be considered to be contaminated with) air-borne bacterial, viral and fungal pathogens which have the potential to give rise to infections in patients.

5.26. A particular source of pathogens within a healthcare facility is other patients with infectious diseases, but other sources include the general hospital environment and everyone coming within that environment, whether patients, visitors or members of staff.

5.27. Notwithstanding their description as "pathogens", many if not most of these micro-organisms are not likely to harm persons in normal health with effective immune systems.

299 A patient with an abnormally low concentration of neutrophils, the type of white blood cells which serve as a primary defence against infection, may be described as suffering from neutropenia, or neutropenic. Neutropenia may be the result of chemotherapy.

300 Witness statement - Donald Inverarity - 05.03.2024 - paragraph 85. See also paragraph 122: "The risk of HAI is not uniform nor solely determined by the room ventilation parameters. Knowledge of what patient groups (and their susceptibility to infection) would be in which areas and which procedures would be being performed was not information that was comprehensively available to IPCT…"

301 Transcript - Donald Inverarity - 05.03.2024 - column 45 onwards.

302 Transcript - Donald Inverarity - 05.03.2024 - columns 146 to 148.

303 Transcript - Peter Hoffman - 26.09.2024 - column 32.

5.28. These micro-organisms do, however, present a risk of infection to the very young, the very old, those undergoing operations, and those in ill-health, particularly those who are immuno-compromised, whether as a result of their medical treatment or otherwise.

5.29. A combination of factors operating in relation to a hospital population mean that patients are at significant risk of contracting infections during their treatment. These HAIs or HCAIs are considered to be important and preventable adverse events, the prevention of which is to be prioritised through the implementation of a wide range of infection prevention and control (IPC) measures.

5.30. Among the recognised available IPC measures is reducing the level of contamination of the air within the hospital, and particularly the air within the areas of the hospital accommodating the most vulnerable patients.

5.31. One method of doing that is to secure the change of the air within areas of the hospital at a rate which is commensurate with the activities carried out in these areas and the characteristics of the patients accommodated there.

5.32. It is difficult to correlate a particular air change rate with a particular level of risk, but a high air change rate within a particular space is a means of minimising the contact of patients with pathogens by increasing the rate at which the concentration of air-borne contaminants is diluted and therefore reducing the risk of infection. It therefore follows that a numerically significant reduction of air change rate (4 ac/h rather than 10 ac/h, for example) will bring with it an increase in the risk of infection to relevant patients.

5.33. When considering the utility of an enhanced air-change rate as a means of infection prevention and control, regard must be had to how the quality of air within a particular space comes to be as it is. If the object is to protect vulnerable patients from opportunistic air-borne pathogens present in the external environment, a means of doing so is to accommodate such patients within spaces that are, as far as is practicable, sealed off from that external environment (protective isolation). Exclusion of pathogens from the air within these spaces can be achieved by HEPA filtration of the mechanical supply together with maintaining a positive pressure to the outside in order that air will leak out rather than in. Where, by these means, potentially harmful micro-organisms are excluded from, for example, a bedroom, an enhanced air-change rate may have nothing further to contribute to preventing the infection of the patient accommodated in that bedroom from micro-organisms carried into the bedroom by the mechanical air supply. However, even where provision for the protective isolation of a space has been made by a combination of HEPA filtration and a positive pressure differential to the outside, an enhanced air change rate within the space will have a role in increasing the rate of dilution of potentially harmful micro-organisms which have been introduced into the protected space by means other than the mechanical air supply, for example by the entry and presence of members of staff or visitors.

A need for research

5.34. A qualification of the evidence that I have summarised above is that the consensus position it disclosed has a rather elderly research basis. Witnesses identified that much had changed since Dr Lidwell had done his work, some 50 years ago. There had been changes in the nature of patient populations, the nature of the treatment administered to these patients and the nature of the locations where that treatment is administered. There had been changes in the appreciation and assessment of risk, by reason, for example, of the increase in antibiotic resistance and the experience of dealing with the highly transmissible coronavirus during the COVID-19 pandemic. Colin Macrae of Mott MacDonald Ltd, a building services engineer with particular experience in hospital design and construction, drew attention to the adoption, by the Scottish Government, in November 2008, of the policy whereby all patients in new-build hospitals would be accommodated in single rooms.[304] He explained:

> "In the past, that critical care area was like a Nightingale Ward, where it was an open plan area, and to prevent infection, 10 air changes would be appropriate. When you come down to the modern critical care where there are individual bedrooms, it may be relevant to reduce the air flow because you don't have the infection control risk because you have the boundaries of the room."[305]

5.35. While accommodating patients in single rooms may have reduced the risk of patients succumbing to air-borne infections, other developments have shifted the balance of risk in the other direction. Professor Humphreys saw a need for investigation and possibly the provision of additional specially ventilated spaces:

> "There is a need for a review of ventilation quality in healthcare facilities, particularly for vulnerable patients even if risks are complex and there are a number of factors, which affect the development of infection. …I think that over the last 10 or 15 years, the complexity of care has increased in hospitals and particularly in critical care areas, and we're now seeing a much greater, I think, number of vulnerable patients who are immunocompromised and a more heterogeneous group of patients, some of which may not be recognised as vulnerable…in the context of the COVID-19 pandemic, we have realised that…our hospitals were under huge pressure because of the transmissibility of COVID and because we had very, very defined and, in many instances, very limited facilities in which to care for these patients because most of our areas within hospital were naturally ventilated and we had no control over where the airflows were going. So we often had to come up with innovative ideas in terms of, for example, putting fans on windows to extract the air from a core area where there might be COVID patients to make sure the air from those COVID patients was not going back into the rest of the ward…we need to review and I think probably either increase the number of air control ventilated facilities or avail of alternative technologies such as portable HEPA filtration

304 A35838178 - CEL 48 (2008) - HC2022.B4 - page 5.
305 Transcript - Colin Macrae - 02.05.2023 - column 47.

> systems, or there are various air purification systems that are marketed out there commercially that may be worth looking at. …I think we need to look at the categories of patients we now have in hospital compared to 10 or 15 years ago because most of the facilities that many of us work in are not only 10 or 15 years old, but would be older, much older than that, and we need to look at the proportion of those patients that are low risk, medium risk, high risk, and maybe very high risk, such as our neutropenic patients. We need to look at what current facilities we have for those patients and whether we believe that those are adequate or not. Then I think we need to incorporate into that some sort of future planning not only for increased numbers of some of those patients that I talked about, but perhaps a bit more flexibility such that if we have another pandemic, we can perhaps react better. So those would be, in very broad general terms, the kind of things I'm talking about…[the review] would need to…involve, obviously, management and healthcare planners, it would need to involve infection prevention and control and infection specialists, it would need to involve clinicians looking after these patients, engineers, architects and probably health economists as well amongst others…"[306]

5.36. The Inquiry requested NHS Scotland Assure (Assure) to advise the Inquiry as to its knowledge of ongoing research into the contribution specialised ventilation systems can make to infection prevention and control in healthcare facilities. In responding, Assure pointed to the difficulty of carrying out trials investigating the relationship between air change rates and infection risks in particular healthcare settings. Typically, research tends to be based on laboratory mock-ups or computer modelling, using Computational Fluid Dynamics software to simulate and analyse air flow scenarios.

5.37. Assure advised, however, that as a result of the COVID-19 pandemic, there has been an increased focus on air change rates and the use of technologies, such as air scrubbers (also known as portable HEPA (high-efficiency particulate absorbing) filter devices), to support existing ventilation systems by reducing the concentration of contaminants in the air. Assure has been part of a working group, established by NHS England in September 2021, to review research in relation to air scrubbing technology and to develop guidance on its application within the healthcare-built environment. In May 2023 NHS England published guidance on the use of lamps emitting short wavelength ultraviolet-C light in the spectrum 200-280nm (known as UVC) which may be installed within the ductwork of the mechanical ventilation systems and standalone units in order to inactivate air-borne microorganisms. The Assure Research Service is currently reviewing a potential project which aims to understand, from an engineering perspective, the various factors which may influence the quality of air, in order to develop the evidence base which might inform future research topics and guidance.[307]

306 Transcript - Hilary Humphreys - 12.05.2022 - columns 67 to 71, quoting Expert Report by Prof. Hilary Humphreys - 12.05.2022 - paragraph 5.2.

307 A47362797 - NHSScotland Assure Ventilation Guidance Paper - 12 February 2024 - HC2024.B13.V10 - page 297 - paragraphs 2 to 6.

Legislation

5.38. I turn to consider how the understanding of the role of ventilation systems in promoting patient safety is reflected in current legislation and (in the next section) guidance.

5.39. Legislation relating to ventilation in buildings is listed in SHTM 03-01.[308] The more important provisions were identified by Counsel to the Inquiry in his closing statement after the hearing in April 2023.[309]

5.40. The Health and Safety at Work etc Act 1974 is relevant to hospital ventilation given that the ventilation system was intended to prevent contamination, closely control the environment, dilute contaminants and contain hazards.

5.41. The Building (Scotland) Regulations 2004 set standards for buildings in Scotland. Building Standard 3.14 concerns Ventilation. It states that: "Every building must be designed and constructed in a way that ventilation is provided so that the air quality inside the building is not a threat to the building or the health of the occupants". In Scotland, section 3.14.5 of the Mechanical Ventilation, Environment (Non-domestic buildings) Technical Handbook 2017 provides that at least 8 litres/second of fresh air per occupant should be provided. There is no further specification as to the air quality for a building such as a hospital. The Buildings Standards Technical Handbook does not contain any references to published guidance or associated standards. That contrasts with the regime in England. There, the Building Regulations 2010 introduce the concept of "Approved Documents". These set out what, in ordinary circumstances, may be accepted as one way to comply with the Building Regulations. Approved Document Part F "Ventilation requirements vol 2" contains specific reference to published guidance such as Health Technical Memorandums as a method of complying with the building regulations.

5.42. It has not been suggested that the ventilation system at the RHCYP and DCN was designed or installed in such a way as to breach such legislative requirements as apply, and the Inquiry has not identified any such breach during its investigations. The focus rather was on the guidance provided by the Scottish Health Technical Memoranda and, in particular SHTM 03-01.

308 A33662259 - SHTM 03-01 Part A (v.2 February 2014) -HC2022.B1 - Pages 343 to 345; A37301626 - SHTM 03-01 Part A (February 2022) - HC2022.B1 - Pages 821 to 825.

309 Closing Submission - Counsel to the Inquiry - paragraphs 43 to 45.

Guidance – the Scottish Health Technical Memoranda and SHTM 03-1

5.43. Susan Grant, Principal Architect, Health Facilities Scotland (HFS), explained in her statement that NHS guidance documents setting national healthcare built environment quality standards for a general hospital have a history almost as old as the NHS itself. Currently, the principal examples of such documents are, for Scotland, the Scottish Health Technical Memoranda (SHTMs), a suite of publications issued and from time to time revised and reissued by HFS.[310]

5.44. There is a series of engineering-specific SHTMs. The series is introduced by SHTM 00: Best practice guidance for healthcare engineering (February 2013). In the preface to SHTM 00 it is explained that:

> "Scottish Health Technical Memoranda…give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare. The focus of SHTM guidance remains on healthcare-specific elements of standards, policies and up-to-date established best practice. They are applicable to new and existing sites and are for use at various stages during the whole building life cycle. The focus of SHTM guidance remains on healthcare-specific elements of standards, policies and up-to-date established best practice. Healthcare providers have a duty of care to ensure that appropriate engineering governance arrangements are in place and are managed effectively. The Scottish (Engineering) Health Technical Memoranda [series] provides best practice engineering standards and policy to enable management of this duty of care … Healthcare-specific technical engineering guidance is a vital tool in the safe and efficient operation of healthcare facilities. Scottish Health Technical Memoranda guidance is the main source of specific healthcare-related guidance for estates and facilities professionals" [311]

5.45. SHTM 00 continues:

> "Only by having a knowledge of these requirements can the healthcare organisation's Board and senior managers understand their duty of care to provide safe, efficient, effective and reliable systems which are critical in supporting direct patient care. When this understanding is achieved, it is expected that (in line with integrated governance proposals) appropriate

310 See Witness Statement - Susan Grant - 09.05.2023 - paragraphs 12 to 20. Other examples are: Scottish Health Facilities Notes (SHFN) which give guidance on the operation of healthcare facilities including matters relating to infection prevention and control, cleaning services, security and health and safety; Scottish Health Planning Notes (SHPN) which address how facilities should be planned; and Scottish Health Technical Notes (SHTN) which provide guidance on healthcare specific standards, policies and best practice. In addition, (English) Health Building Notes (HBN) which are intended to be read in conjunction with the relevant parts of the (English) Health Technical Memoranda series and give guidance on the design and planning of new healthcare facilities, may be approved by HFS for use in Scotland.

311 A33662233 - SHTM 00 (February 2013) - HC2022.B1 - page 333.

governance arrangements would be put in place, supported by access to suitably qualified staff to provide this 'informed client' role, which reflect these responsibilities."[312]

5.46. Edward McLaughlan is the former Assistant Director of HFS. He gave evidence as to how SHTMs are developed. The process involves cooperation between HFS and the equivalent bodies in England, Wales and Northern Ireland. Most frequently the relevant guidance originates with Health Technical Memoranda produced on behalf of the Department of Health in England but in other instances HFS may take the lead. In order to produce guidance, the best expertise is recruited. Drafting tends to be in the hands of authorising engineers, but other relevant disciplines are involved both in drafting and carrying out the underlying research. Approval of guidance is through stakeholder groups, representing the best expertise available to NHS Scotland on each topic. There are currently four stakeholder groups: one each for Heating and Ventilation, Water, Electrical, and Medical Gases. Members of the groups are nominated by the engineering leads for each territorial health board, through the Scottish Engineering Technology Advisory Group. In addition, the groups are at liberty to recruit anyone else whom they see fit. Once a draft has been approved by the relevant stakeholder group, with or without modification, it is put out for a wider consultation, following which a final version is put to the stakeholder group for final agreement.[313]

5.47. SHTM 03-01 is the technical memorandum which deals with the design, installation, testing and validation of ventilation systems. In the overview of engineering services guidance provided in chapter 2 of SHTM 00, it is described as: "best practice guidance on the design and installation of ventilation systems and the close-control (mechanical cooling or air conditioning) of general and 'specialised' healthcare environments."[314]

5.48. SHTM 2025, originally published in 1994 and updated as version 2.0 in June 2001, was the first Scottish guidance relating to ventilation in a healthcare setting.[315] While containing detailed information concerning operating theatres, it also provided more general guidance in relation to hospital ventilation systems. SHTM 2025 was superseded by SHTM 03-01 in version 1.0 of October 2011, which was in its turn superseded by version 1.2 of February 2013 and then by version 2.0 of February 2014.[316] It was the 2014 version that was extant during the RHCYP and DCN project (albeit that in the critical matter of recommended air change rates, the recommendations in the 2014 version did not materially differ from those in the

312 A33662233 - SHTM 00 (February 2013) - HC2022.B1 - page 8.
313 Witness Statement - Edward McLaughlan - 09.05.2022 - paragraphs 17 to 26. Further detail on the process of developing SHTMs is provided in NHSScotland Assure Response 12 February 2024 - HC2024.B13.V10 - page 299.
314 A33662233 - SHTM 00 (February 2013) - HC2022.B1 - page 346 - paragraph 2.9.
315 For a history of healthcare specific guidance relating to ventilation, see A37465696 - Stephen Maddocks - Healthcare Ventilation Principles and Practice - HC2022.B6 - page 72; A37521582 - Statement of Andrew Poplett - HC2022.B6 - page 101 - paragraph 9.
316 A33103351 - SHTM 2025 - HC2022.B1 - pages 4 to 251 and A33662259 - SHTM 03-01 Part A (v.2 February 2014) - HC2022.B1 - page 618.

2013 version). The 2014 version has since been superseded by an interim version of February 2022.

5.49. SHTM 03-01 was (and is) published in two parts. Design parameters for new installations of ventilation systems (whether in new hospitals or existing buildings) are set out in Part A. Part B deals with the operational management of systems. For present purposes, therefore, the 2014 version of Part A is the most relevant. The intent, however, is that Parts A and B together give "comprehensive advice and guidance to healthcare management, design engineers, estate managers and operations managers on the legal requirements, design implications, maintenance and operation of general and specialised ventilation in all types of healthcare premises."[317]

5.50. Part A deals with design and validation of ventilation systems both generally and in relation to "specialised ventilation", where certain activities require the provision of equipment with features that enable the achievement and maintenance of specific conditions. This may be required, for example, to remove, contain or dilute specific contaminants or to control the cleanliness of a space. Among the departments listed as requiring specialised ventilation are critical areas and high-dependency units of any type, and isolation facilities.[318]

5.51. The design information for specialised ventilation systems is contained in Chapter 7. As that chapter notes, the section on operating theatres is the most extensive (containing some 8 pages of guidance) although it notes that "It is not possible within this existing document to give definitive guidance for every healthcare specific ventilation application."[319]

5.52. Chapter 7 also directs readers to Appendix 1, Table A1, for design information relating to many of the areas in which specialist ventilation is required. The memorandum explains that the air change rates given in Table A1 have been found to give sufficient dilution of airborne contaminants, providing the mixing of room air is reasonably uniform.[320] It is this Table which was at the centre of the issue that arose in relation to the RHCYP and DCN project, and in particular the entry relating to critical care areas.[321] The relevant part of Table A1, showing the entry for critical care areas is reproduced below. In the column in the table indicating type of ventilation, the letter S indicates supply, the letter N indicates natural ventilation, and the letter E indicates extract.

317 A33662259 - SHTM 03-01 Part A (v.2 February 2014) - HC2022.B1 - page 627.
318 At page 14 (paragraphs 1.25 - 1.26) the reference is to "intensive treatment units" . At page 82 (paragraph 7.2), the reference is to "critical areas and high-dependency units of any type" and, then, "isolation facilities" .
319 A33662259 - SHTM 03-01 Part A (v.2 February 2014) - HC2022.B1 - page 699 - paragraph 7.4.
320 A33662259 - SHTM 03-01 Part A (v.2 February 2014) - HC2022.B1 - page 699 - paragraph 7.2.
321 While not specifically defined in SHTM 03-01, "Critical Care Areas" can be taken to include intensive care and high dependency units - see A33662186 - SHFN 30 Part A v4.0 Oct 2014 - paragraph 4.54.

Application	Ventilation	ac/Hour	Pressure (Pascals)	Supply Filter	Noise (NR)	Temp (°C)	Comments For further information see Section 6
General ward	S/N	6	–	G4	30	18–28	
Communal ward toilet	E	10	–ve	–	40	–	
Single room	S / E / N	6	0 or –ve	G4	30	18–28	
Single room WC	E	3	–ve	–	40	–	
Clean utility	S	6	+ve	G4	40	18–28	
Dirty utility	E	6	–ve	–	40	–	
Ward Isolation room	–	–	–	–	–	–	See SHPN 4: Supplement 1
Infectious disease Iso room	E	10	–5	G4	30	18–28	Extract filtration may be required
Neutropenic patient ward	S	10	+10	H12	30	18–28	
Critical Care Areas	S	10	+10	F7	30	18–25	Isolation room may be –ve press
Birthing Room	S & E	15	–ve	G4	40	18–25	Provide clean air-flow path
SCBU	S	6	+ve	F7	30	18–25	Isolation room may be -ve press
Preparation room (Lay-up)	S	>25	35	F7*	40	18–25	*H12 if a lay-up for a UCV Theatre
Preparation room/ bay sterile pack store	S	10	25	F7	40	18–25	*50NR if a bay in a UCV Theatre
Operating theatre	S	25	25	F7	40	18–25	
UCV Operating theatre	S	25*	25	H12	40	18–25	Fresh air rate: excludes re-circulation
Anaesthetic room	S & E	15	>10	F7	40	18–25	Provide clean air-flow path
Theatre Sluice/ dirty utility	E	>20	–5	–	40	–	
Recovery room	S & E	15	0	F7	35	18–25	Provide clean air-flow path

5.53. As can be seen, Table A1 is in the form of a grid. Twenty-nine possible applications (of which nineteen appear in the above extract from the table) for spaces within a hospital are listed vertically. Against each application there are set out six design parameters and (in relation to some of the applications) comments. The design parameters are: ventilation (in the sense of being one or other of supply ("S"), extract ("E"), natural ("N") or a combination of these); air changes per hour; pressure (in the sense of differential from an adjacent space); type of filter on the supply; noise rating; and temperature. The ventilation for a "General ward" is supply and extract, the air-change rate being stated as 6 ac/h with no pressure differential. For a "Single room", ventilation is supply, extract and natural with an air change rate of 6 ac/h and a balanced or negative pressure differential. Among the other applications, "Ward isolation room" has no figures for air-change rate or pressure differential set against it in the respective parameters but a reference in the comments section "see SHPN 4: Supplement 1"; "Infection disease iso room" has extract ventilation, 10 ac/h and 5 pascals of negative pressure; "Neutropenic patient ward" has supply ventilation 10 ac/h and 10 pascals of positive pressure; and "Critical Care Areas" have supply ventilation, 10 ac/h and 10 pascals of positive pressure.

5.54. "SHPN 4" is a reference to Scottish Health Planning Note 04 Inpatient Accommodation: Options for Choice Supplement 1: Isolation Facilities in Acute Settings, issued by HFS in September 2008. It gives guidance as to the provision of single rooms within general wards in order to allow the isolation of patients for reasons which include both where the patient is susceptible to infection from other sources and where a patient presents an infection risk to others. It recommends 10 ac/h and (in respect of new build) for a lobby between the bedroom and the ward corridor which is at 10 pascals of positive pressure to both the bedroom and corridor.[322]

5.55. The inclusion of specific air change rates was an innovation in SHTM 03-01 version 1.0. The table reproduced above did not appear in SHTM 2025.[323] It was only when SHTM 03-01 was introduced in October 2011 that specific air changes rates for particular spaces in a hospital were set out in Scottish guidance intended for a variety of applications. In that sense, the concept of air change rates may be thought to have been relatively new in the Scottish context at the time of the RHCYP and DCN project. However, this should be set within the wider UK context. HTM 03-01 (the equivalent of SHTM 03-01 issued by the (English) Department of Health),[324] which incorporated at Appendix 2 a table almost identical to that contained in SHTM 03-01 had been published in 2007. The table and specification of air change rates set out in version 1.0 of SHTM 03-01 could not, therefore, have come as a surprise to those working in the industry.

322 Such an arrangement is described as a Positive Pressure Ventilated Lobby (PPVL) Room.

323 While occasionally air changes per hour were referred to in previous guidance, more conventionally reference was made to "flow rates" in m^3/s or $litres/s/m^3$. SHTM 2025 pointed readers to Activity Data Base A-Sheets for specific requirements for individual spaces - A33103375 - SHTM 2025 Part 2 (v.2 June 2001) - HC2022.B1 - page 46 - paragraph 2.52. SHTM 03-01 (A35610757 - SHTM 03-01 - HC2022.B1 - page 462) repeated this pointer at paragraph 2.60.

324 A37344356 - HTM 03-01 Part A (2007) - HC2022.B2 - page 698.

5.56. Part B of SHTM 03-01 provides for annual inspection and verification of ventilation systems. As part of the criteria for that, it refers back to Table A1 in Part A and states that, on periodic inspection and verification, critical ventilation systems (which include those in critical care departments) should achieve not less than 75% of the design air change rate given in Table A1, or its original design parameters. Pressure must be similarly maintained.[325]

Interpretation of SHTM 03-01 and its application to the critical care department within the RHYCP

5.57. Department B1 of the new hospital had been designated "Critical Care" in NHSL's Clinical Output Based Specification (COBS), the version of which dated September 2014, formed part of the documentation which constituted the Board's Construction Requirements.[326] Paragraph 1.1.1 of the COBS explained the objective of the department as the provision of excellence in medical, nursing and paramedical care to patients who require intensive care and high dependency care. It was to contain a Paediatric Intensive Care Unit (PICU), a High Dependency Unit (HDU) and a Neonatal Surgical High Dependency Unit (NNU). As set out in paragraph 1.4.1 of the COBS, facilities were required to accommodate: 8 PICU patients split into one four-bedded bay, two single isolation cubicles with gowning lobby and two single cubicles; 12 HDU patients within a High Acuity area and a Low Acuity area, with each area requiring one four-bedded bay, one single isolation cubicle with gowning lobby and one single cubicle; and 4 NNU patients split into one three bedded bay and a single cubicle. At paragraph 1.8 of the COBS, in a section headed up "Environmental and Services Requirements", it is noted: "Flexibility in the use of Critical Care beds for both High Dependency and Intensive Care is key to maintaining efficient use of high specification beds. All three Critical Care Areas must be co-located". It is further noted: "Lobbied single bed isolation cubicles are required for both source and protective isolation of patients, and they all require to have identical design of pressure control with positive pressure lobbies with filtered air and negative extraction cubicles. It is required that contaminated air must not flow back into any of the open Critical Care areas." The section also noted that: "All PICU and HDU bed spaces are required to be of the same specification to allow greatest flexibility of use".

5.58. As has been narrated in chapter 2 of this report, the advice given to NHSL by IOM following the tests carried out in June 2019 was that, as installed, the ventilation system of all single rooms and four-bedded (and three cot) areas in Department B1 of the new hospital was non-compliant with SHTM 03-01 in that it did not achieve the recommended 10 ac/h and 10 pascals of positive pressure differential set out in the application "Critical Care Areas" in Table A1.

325 A33662241 - SHTM 03-01 Part B (v.1 Oct 2011) - HC2022.B1 - page 313 - paragraphs 4.16 and 4.17.

326 A33405670 - Schedule Part 6, section 3 - HC2023.B5 - page 376 to 390.

5.59. Among the witnesses who accepted that, on a proper construction of SHTM 03-01, at least all the single cubicles, four-bedded and three cot areas in Department B1, required to be ventilated at 10 ac/h with 10 pascals of positive pressure differential to the external space, was Michael O'Donnell of Hulley & Kirkwood, the services engineers appointed by NHSL as part of its Reference Design Team.[327]

5.60. However, an alternative construction of SHTM 03-01 was put forward by another witness who gave evidence to the Inquiry, Stewart McKechnie of TÜV SÜD / Wallace Whittle (TSWW), the building services engineer appointed as a subcontractor by Multiplex.[328] In his opinion, in critical care departments, 10 ac/h was needed only for isolation rooms.

5.61. In giving his evidence, Mr McKechnie was emphatic. After a lengthy exchange between him and Counsel, Mr McKechnie explained:

> "if you are suggesting that, again, that 10 air changes and +10 pascals is intended to be applied in every single room that constitutes a critical care ward, I don't see that as being a practical solution, and it's certainly not the solution that's applied to the majority of critical care wards that I have reviewed.… the critical care department of its very nature includes other standards of rooms such as: nurse spaces, interview rooms, clinicians' rooms, the whole host of different forms of accommodation.… I don't believe these areas are designed as pressurised areas, which is what we're speaking about."[329]

5.62. In summarising what he understood to be his evidence, Counsel (Q) put to Mr McKechnie (A) the following propositions:

> "**Q** So, the parts of the critical care department where patients are to be housed and looked after, your view is that 10 air changes per hour and 10 pascals of positive pressure are not always needed for those patient areas. Is that a correct understanding of what you are saying?
>
> **A** That's correct, yes.
>
> **Q** Again, I am going to say what I have understood you to mean. The area that you would say has to have these air change and pressure arrangements is specifically only isolation rooms within the critical care department?
>
> **A** Yes."[330]

327 Transcript - Michael O'Donnell - 25.04.2023 - columns 76 to 77. The matter is dealt with throughout his evidence and his witness statement - Witness Statement - Michael O Donnell - 25.04.2023.
328 Wallace Whittle were acquired by TÜV SÜD Limited.
329 Transcript - Stewart McKechnie - 04.05.2023 - columns 31 and 33.
330 Transcript - Stewart McKechnie - 04.05.2023 - column 34. See also Witness statement - Stewart McKechnie - 04.05.2023 - paragraph 15 - "As best I can recall, the guidance specified in 10 air changes and 10 PA pressure for the isolation rooms in the Critical Care area…".

5.63. At the third Edinburgh hearing in February 2024, Mr McKechnie maintained his position. In his witness statement for that hearing, referring to a report that he had prepared for the Inquiry, he stated:

> "we couldn't find anything which supported the comments made at that time to the effect that 10 ac/h and 10 Pa positive pressure should have been provided throughout critical care and not restricted to the Isolation Rooms…We also requested details of similar solutions applied to other Scottish Hospitals, again nothing has been forthcoming. We are not aware of +10 ac/h and +10 Pa pressure being applied to critical care rooms in other Scottish Hospitals…".[331]

5.64. Under questioning by Counsel, Mr McKechnie similarly maintained the position that "other than the isolation rooms, there wasn't any reference in SHTM 03-01 to 10 air changes within critical care bedrooms."[332] That others disagreed with his interpretation of the guidance was specifically put to him and the suggestion made that the guidance was to be read in such a way that the recommendation for 10 air changes applied generally throughout the critical care area. Mr McKechnie responded:

> "**A** I didn't feel that way, I still don't feel that way, that that was what was inferred by the original terminology. I just felt it was badly phrased.
>
> **Q** Yes. So it did not occur to you at the time that there was another possible way of reading both the guidance note and the guidance applying 10 air changes ----
>
> **A** Not at the time, no ----
>
> **Q** ----beyond isolation rooms?
>
> **A** – not at all, no."[333]

5.65. Thus, while in his evidence Mr O'Donnell considered that all areas in critical care required 10 ac/h in order to comply with SHTM 03-01, Mr McKechnie considered that 10 ac/h was only required in isolation rooms.

5.66. In his evidence to the third Edinburgh hearing, Mr Maddocks gave his view on the interpretation of SHTM 03-01 by reference to paragraphs in a report which he had prepared for the Inquiry:

> "2.3.2 In my opinion the reference to Critical Care Areas would generally be interpreted by an engineer as referring to the spaces within any space within a complete Critical Care Department including single and multi-bed ward bedrooms, with the exception of specific rooms such as listed in Appendix 1 of SHTM 03-01 which are typically encountered across many other departments in a hospital which are in a Critical Care Unit. Common spaces such as Toilets,

331 Witness statement - Stewart McKechnie - 04.05.2023 - paragraphs 74 to 5.
332 Transcript - Stewart McKechnie - 29.02.2024 - column 30.
333 Transcript - Stewart McKechnie - 29.02.2024 - column 31.

> Bathrooms, Staff Base, Dirty Utility, Clean Utility, Offices, Linen Bays, Waiting Areas and Seminar rooms, where the environment, particularly ac/h, is different to the bed areas where Critical Care nursing is administered.…
>
> 2.3.4 It is worth noting that HTM 2025 was revised to become the first edition of HTM03-01-Part A in 2007 and the table that lists recommended air changes didn't change from 2007 to the SHTM 03-01 2014 requirements, … hence this had been an established design criteria for a number of years.…
>
> 2.4.1 In my opinion, a requirement to comply with SHTM 03-01 would communicate to an engineer that 10 air changes per hour and +10 pascals of pressure would be required for all critical care spaces. However, these requirements were not reflected in the room-specific entries in the [environmental matrix] (either the version issued to tenderers, or the version included in the Project Agreement as RDD). The EM provided an ambiguous lower figure. The fact that the [environmental matrix] was included as [Reviewable Design Data] left that issue unresolved at Financial Close, holding it over for resolution within the contractual RDD procedures. In my opinion, the specific parameters for the ventilation system should have been clarified and confirmed much earlier in the project and certainly before Financial Close."[334]

5.67. Mr McKechnie's position was put to Mr Maddocks by Counsel in the following exchange:

> "**Q** Mr McKechnie, in his evidence, stated a very similar position, that if you are talking about a requirement for 10 pascals of positive pressure and 10 air changes per hour, that is really just for isolation rooms and critical care in terms of SHTM 03- 01, the 2014 version. Do you agree with that view?
>
> **A** I don't.
>
> **Q** Okay, and why not?
>
> **A** In my opinion, the table within SHTM 03-01, which lists all the departments, it lists critical care areas with supply ventilation and 10 air changes an hour at 10 pascals. There's a small note at the side about the potential for isolation rooms being at negative pressure, but I see that as an all-encompassing requirement for the critical care area."[335]

334 Stephen Maddocks - RHCYP/DCN Critical Care Ventilation Systems Review - paragraphs 2.3.2 to 2.4.1.

335 Transcript - Stephen Maddocks - 13.03.2024 - column 39; see also columns 43 to 44 where Mr McLaughlin's view that he does not agree with TÜV SÜD's interpretation of SHTM 03-01 is put to Mr Maddocks, who responds "I agree with that statement".

5.68. Mr McKechnie's position: that he was not aware of any other hospitals where 10 ac/h had been specified generally for all parts of critical care areas, was also put to Mr Maddocks. He was asked if he was aware of any such hospitals:

> "**A** The ones that I've been involved with have been done at-- With the critical care or ITU, as it's called – intensive therapy unit, as it's called – they've been done at 10 air changes.
>
> **Q** Right. That is okay.
>
> **A** 10 pascals.
>
> **Q** For the whole area?
>
> **A** For the whole area, yes…
>
> **[Q] :** Wherever we are talking about projects you have worked on, are we talking about one project, more than one?
>
> **A** …Bishop Auckland Hospital. There were spaces within Hexham Hospital that had smaller critical care areas at 10 air changes. Those two immediately spring to mind. Ulster Hospital, which is one we completed a few years ago, that was 10 air changes."[336]

5.69. Mr O'Donnell, Mr McKechnie and Mr Maddocks are all well-qualified engineers with extensive experience in healthcare projects over lengthy careers.

5.70. However, useful as the evidence of the three engineers was as to their understanding of the meaning of SHTM 03-01, it cannot be determinative. It will always be valuable to learn how a document is interpreted by those whose job it is to interpret that document and to apply their interpretation in the practice of their profession, technical terms may have to be explained and the relevant factual matrix understood, but in the end arriving at the proper construction of any document is a matter of textual analysis.

5.71. In carrying out such an analysis of the 2014 version of SHTM 03-01 the following appears to me to be relevant. SHTM 03-01, at paragraph 1.25, explains that in healthcare premises certain activities will necessitate the provision of ventilation equipment with additional special features. Among the reasons for providing specialised ventilation is the more rigorous removal, containment or dilution of contaminants; and the isolation of one space from another. At paragraph 1.26 it is further explained that among the departments which will usually have specialised ventilation requirements, either for a single room or throughout a suite of rooms, are the intensive treatment unit and the infectious diseases isolation unit.

336 Transcript - Stephen Maddocks - 13.03.2024 - column 41 to 42.

5.72. Paragraph 2.17 explains that the types of specialised ventilation system which are generally required in individual departments and typical arrangements are given in section 7 of the memorandum. Paragraph 7.2 of section 7 identifies among the departments which will require a degree of specialised ventilation: critical areas and high dependency units of any type; and isolation facilities, these being infectious diseases units, bone marrow and other transplant units and chemotherapy and oncology units. Paragraph 7.3 states that design information for many of these particular applications is given in Appendix 1 Table A1.

5.73. Paragraph 7.6 reiterates, in the context of specialised ventilation, that among the main functions of the supply of air is to dilute airborne contamination and to control air movement within premises such that the transfer of airborne contaminants from less clean to cleaner areas is minimised. Paragraph 7.8 identifies four routes whereby airborne contaminants may appear in a room: through the supply air; shed directly by the room occupants; arising as result of the work activities; and transferred from adjacent spaces. Paragraph 7.39 appears in a part of SHTM 03-01 which is primarily concerned with operating rooms. It explains: "Supply flow rates for the main rooms of the operating suite are given in Appendix 3. For the other areas where room sizes and activities vary from site to site, air-change rates are given in Table A1. These figures have been found to give sufficient dilution of airborne bacterial contaminants, providing the mixing of air is reasonably uniform."

5.74. Table A1 maintains the distinction which is drawn in the text of SHTM 03-01 as between, on the one hand, isolation facilities where the principal objectives are to dilute the contaminants produced by the patients within these facilities and also to protect those outside the facility from these contaminants; and, on the other hand, wards where the patients may be neutropenic and other critical care areas where the principal objectives are to dilute any contaminants within the facility but also to protect those within the facility from the ingress of contaminants from outside the facility. It also makes a distinction between the situation of an isolation room within a larger facility with less rigorous parameters, and the situation where the whole facility is subject to more rigorous parameters.

5.75. When considering, by reference to the proper interpretation of Table A1, which application (and therefore which guidance) relates to the patient accommodation in Department B1 PICU/ HDU/ Neonatal Surgery at the RHCYP, it will be recollected that paragraph 7.2 of SHTM 03-01 listed among the "departments" requiring specialist ventilation, "critical areas and high-dependency units of any type". The expression "any type" spreads the net quite wide. At least at first blush, the whole of Department B1 in the Schedule of Accommodation for the RHCYP would therefore look to be an example of the "Critical Care Areas" application in Table A1 and therefore to require 10 ac/h and 10 pascals of positive pressure. That it has a higher rate of air changes per hour than a general ward or single room and positive pressure to the outside, is consistent with an intention to protect a patient population, which is susceptible to infection but not necessarily neutropenic, from contaminants including infective pathogens.

5.76. Table A1 designates ward isolation rooms as a separate application from critical care areas without indicating (as Mr McKechnie would have it) that the latter is only intended to refer to isolation rooms. Rather, the comment against critical care areas is "isolation room may be -ve press". That is a provision to address the situation of there being one or more isolation rooms within a critical care area. With such a room, the pressure should be negative in relation to the immediately adjacent space in order to protect the rest of the patients within the critical care area from the risk presented by the patient in the isolation room but that is without prejudice to the pressure in the critical care area which contains isolation rooms being positive in relation to the exterior corridor. Nothing is said in the comment section of the table about the air change rate. That is consistent with the air change rate being the same as in the rest of the critical care area (and indeed the same as is recommended in SHPN 04: Supplement 1, for a ward isolation room) and that is 10 ac/h.

5.77. According to Mr McKechnie, to require 10 ac/h and 10 pascals of positive pressure in every single room that constitutes a critical care ward was not a practical solution and certainly not a solution that had been applied to the majority of critical care wards that he had reviewed. The critical care department of its very nature, he explained, includes a variety of rooms such as: nurse spaces, interview rooms, clinicians' rooms; a whole host of different forms of accommodation for which different standards were appropriate. Within the critical care area of the RHCYP, there were designated isolation rooms; these were the only references to pressured rooms and it was only to these rooms, so Mr McKechnie argued, that the 10 ac/h requirement applied.[337]

5.78. I have acknowledged Mr McKechnie's extensive experience but his reading of SHTM 03-01 goes against the grain of the text, whereas Mr O'Donnell's interpretation, and that put forward by Mr Maddocks, would appear to be consistent with the whole terms of the document. Mr McKechnie did not see the choice of air change rate as being to do with the dilution of contaminants and sources of infection. For him it was to do with achieving the specified pressure differentials.[338] That is not consistent with the repeated references in SHTM 03-01 to one of the purposes of enhanced air changes as being to dilute contaminants in the air. If it be the case that it would clearly be impractical, or perhaps unnecessary, to provide 10 ac/h in all the various rooms which might be included in the space within a hospital designated as a critical care ward, or a synonym of that (and this proposition was not tested during Mr McKechnie's evidence) then one might consider precisely what was intended by the descriptor "Critical Care Areas". As was put to Mr McKechnie during his oral evidence, an obvious meaning of "Critical Care Areas" would be those areas where critical care is actually administered or may potentially be administered; the patient accommodation and any other treatment rooms (the construction adopted by Mr Maddocks). If, on the other hand, Mr McKechnie were correct in his understanding of what is meant by Table A1, it is difficult to see

337 Transcript - Stewart McKechnie - 29.02.2024 - columns 31 to 33.
338 Transcript - Stewart McKechnie - 29.02.2024 - column 27.

why a separate Critical Care Areas application is included; on Mr McKechnie's interpretation, the only area for which specialised ventilation is required would be covered by the descriptor "Ward isolation room". Now, Mr McKechnie asserted that "Ward isolation room" does not include isolation wards in critical cares areas, but he did not explain why, other than impliedly in that it cannot do so if his interpretation is correct. On Mr O'Donnell's interpretation, on the other hand, the application "Ward isolation room" fits into the structure of Table A1 as referring to isolation rooms in a general ward, whereas isolation rooms in critical care areas are provided for in the relevant comment section, as explained above.

5.79. As noted by NHSL in its closing statement following the hearing commencing on 25 April 2023 I did not understand any of the core participants to argue for Mr McKechnie's interpretation of the scope of the recommendation in Table A1. Mr Maddocks agreed with Counsel to the Inquiry's description of Mr McKechnie's interpretation as an "outlier".[339] Looking to the text and having regard to the opinions expressed, I would accept that characterisation.

5.80. That the recommendation for 10 ac/h is intended to relate to all areas where critical care is administered, and not simply to isolation rooms, is made even clearer in the current version of SHTM 03-01 issued in 2022. It introduces the concept of levels of care, ranging from Level 0 (normal ward care in an acute hospital) to Level 3 (patients requiring advanced respiratory support or monitoring and support for two or more organ systems). While the table (now in Appendix 2, and headed "Summary of design conditions") refers to "Critical Care Areas (Level 2 and 3 care)" and provides for 10 ac/h, the tables of "Other application-specific design guidance", in referring to Level 2 and 3 critical care areas, specifically refers to "Level 2 or 3 critical care individual rooms" and "Level 2 or 3 critical care open bays" in providing for greater than or equal to 10 ac/h.[340]

The status of SHTM 03-01

5.81. Immediately following the table of contents of the 2014 version of SHTM 03-01, the following text appears in red:

> "Disclaimer
>
> The contents of this document are provided by way of general guidance only at the time of its publication. Any party making any use thereof or placing any reliance thereon shall do so only upon exercise of that party's own judgement as to the adequacy of the contents in the particular circumstances of its use and application. No warranty is given as to the accuracy, relevance or completeness of the contents of this document and Health Facilities Scotland, a Division of NHS National Services Scotland, shall have no responsibility for any errors in or omissions therefrom, or any use made of, or reliance placed upon, any of the contents of this document."[341]

339 Transcript - Stephen Maddocks - 13.03.2024 - column 45.
340 A37301626 - SHTM 03-01 Part A (February 2022) - HC2022.B1 - Page 880.
341 This wording does not appear in the 2022 edition, nor is there wording to similar effect.

5.82. The word "guidance" is repeated several times: "The focus of Scottish Health Technical Memorandum guidance…"; "Healthcare-specific technical engineering guidance is a vital tool…"; SHTM 03-01 gives "comprehensive advice and guidance…".[342] Table A1 is headed "Recommended air-change rates". This is not the language of something intended to be mandatory. In his statement to the Inquiry, Edward McLaughlan of NHS NSS explained in relation to Scottish Health Technical Memoranda:

> "They are issued to the health boards as guidance, but if they are specified in a contract then they become contractual requirements. It appears to me from early interactions relating to the Inquiry, that those not close to the issue might assume they are an instruction manual handed out by government. This is not the case; they are the Health Service's interpretation of the responsibilities it has under the applicable legislation, regulations, codes of practice and government policy. These obligations include those enabled under the Health and Safety at Work Act and other instruments such as the Building (Scotland) regulations."[343]

5.83. The point was impressed upon the Inquiry by some core participants:

> "SHTM 03-01 is guidance. …SHTM 03-01 does not have the force of law. Compliance with it is not mandatory in that sense."[344]

5.84. In her statement to the Inquiry, Susan Grant of NHS NSS also sounded a cautionary note, explaining that Table A1:

> "provides users with an aide-memoire but should not be considered as a sole source of data for briefing or design…Table A1 should be read in conjunction, not only with that whole SHTM 03-01, but also with the rest of the NHS Guidance relevant to each project. Unfortunately in my experience…Table A1 is often seen as the easy go-to place to find information; with elements taken out of context…patient safety and care is not guaranteed by a number on a table, any more so than any single element of e.g. architectural image, contained in any of our 170 NHS Guidance documents. NHS Briefing, Design and Delivery is a whole process, with a series of documents that requires multi-disciplinary clinical and HBE [Healthcare Built Environment] experts to support.…In my experience, NHS Guidance could be taken out of context or alternative interpretations put on a specific clause, table, parameter or value. For specific projects, the appropriate application requires each element of Guidance to be read as part of the key aims of the whole Guidance…".[345]

342 A33662259 - SHTM 03-01 Part A (v.2 February 2014) - HC2022.B1 - pages 624 and 627 - paragraph 1.2.
343 Witness Statement - Edward McLaughlan - 09.05.2022 - paragraph 5.
344 Interim Written Submissions on behalf of Multiplex Construction (Europe) Limited - paragraph 4.1. That compliance with SHTM 03-01 may be imposed contractually is acknowledged at paragraph 4.3.
345 Witness Statement - Susan Grant - 09.05.2023 - paragraphs 67, 70 to 71.

5.85. The legal representative for IHS Lothian Ltd (IHSL) relied on Ms Grant's evidence when making his closing statement following the hearing commencing on 25 April 2023.[346] It was his submission that the recommendations in Table A1 of SHTM 03-01 require to be approached and handled with some caution. The recommendations are nuanced (not to be applied blindly) and require to be considered in light of the clinical activity taking place in the space and in consultation with the relevant stakeholders. Accordingly, the proposition which was contained in the closing statement by Counsel to the Inquiry that where the recommendations set out in SHTM 03-01 are to be departed from this should be based on a risk assessment, and that therefore a ventilation system which did not comply with the published guidance for which there has been no individualised risk assessment is "defective" for the purposes of the Inquiry's Terms of Reference, was unsound.

5.86. Submissions to similar effect to that put forward on behalf of IHSL were advanced on behalf of TSWW[347] and Greater Glasgow and Clyde Health Board (GGC).[348] The submission on behalf of GGC went further. Acknowledging that SHTMs had been described as a "best practice framework", it nevertheless submitted that:

> "given the relative antiquity of the research which underpins what is reflected in SHTM 03-01, there must be a question arising as to whether these standards can, some 50 years later, properly be considered as best practice guidance, particularly given the significant impact of single bedroom accommodation that has become a feature in modern hospitals. Professor Humphreys had highlighted in his evidence that there was now a need for a review of ventilation quality requirements in healthcare facilities in light of various developments in recent years, including in the type of hospital accommodation now provided, and the availability and prescription of prophylaxis."[349]

5.87. I considered these submissions in the light of the evidence that I heard, including the evidence as to the need for further scientific research. The focus of these submissions and that evidence was on the version of SHTM 03-01 dated February 2014, the version applicable during the RHCYP and DCN project. The 2014 version has since been superseded by the interim version of February 2022. I shall touch on the 2022 version later, but what I immediately have to say relates to the 2014 version.

5.88. Clearly, the Scottish Health Technical Memoranda in general, and SHTM 03-01, whether in its current or earlier versions, in particular, are not mandatory in the sense of imposing a legal obligation on healthcare organisations or their contractors to follow its recommendations, in the absence of contractual provision requiring them to do so. Where the matter is given full consideration by those qualified to do so, these recommendations may be departed from when designing and constructing hospital buildings. However, on the evidence heard by the

346 Closing Submission - IHS Lothian - Edinburgh Hospital - paragraphs 3.4 to 3.9.
347 Closing Submission - TÜV SÜD - Edinburgh Hospital.
348 Closing Submission - Greater Glasgow Health Board - Edinburgh Hospital.
349 Closing Submission - Greater Glasgow Health Board - Edinburgh Hospital - paragraph 11.

Inquiry, in the absence of such consideration (for example in the course of a risk assessment as contemplated by Counsel to the Inquiry in his closing statement), SHTM 03-01 (2014) should have been regarded as setting out the standards to be achieved by the ventilation system of a modern hospital at the beginning of its life.[350] For all that he cautioned against regarding the technical memorandum as a rulebook, Edward McLaughlan said that he was not aware of better guidance.[351] I heard nothing to suggest that he was wrong about that. That was the approach taken by the Cabinet Secretary's advisers in 2019. They were right to do so. Contrary to the suggestion of GGC, pending the sort of research envisaged by Professor Humphreys pointing in a different direction, it appears to me that SHTM 03-01 must be taken, as it describes itself, as representing "comprehensive advice and guidance" as to "established best practice".[352]

5.89. SHTM 03-01 was and is built on established guidance dating from at least 1955.[353] It is the product of a collaborative effort involving many practitioners from a range of relevant disciplines.[354] As Mr Maddocks explained in his report to the Inquiry: "In my view the requirements of the SHTMS and SHBN's are the fundamental starting block for any hospital design. They are often used by private healthcare providers in the UK and overseas as the most appropriate standards based on years of development and operational experience of hospitals."[355] They "should be considered as the starting point for any new design" and "provide the benchmark and design principles" for new hospitals.[356]

5.90. Andrew Poplett reinforced this point. In his statement to the Inquiry, Mr. Poplett stated:

> "In all practical sense my belief and interpretation is that the HTMs should be viewed as an approved code of practice and as such should be deemed in elements as minimum standards…I believe that organisations who choose to derogate from the HTMs have an increased risk of potentially compromising patient outcomes, staff/visitor safety in addition to increased risk of legal, civil and reputational damage/harm."[357]

350 Andrew Poplett explained that as a facility or system gets older it is expected that its performance will become degraded with use. The recommended air change rates in ventilation technical memoranda therefore include a tolerance so that notwithstanding the anticipated degradation in performance over time, systems would remain compliant and safe - page 119.
351 Transcript - Edward McLaughlan - 09.05.2022 - column 22 to 23.
352 A33662259 - SHTM 03-01 Part A (v.2 February 2014) - HC2022.B1 - page 624.
353 A37521582 - Statement of Andrew Poplett - HC2022.B6 - page 101 - paragraph 9. See also A37465696 - Stephen Maddocks - Healthcare Ventilation Principles and Practice - HC2022.B6 - page 72 - section 5.2.
354 Transcript - Andrew Poplett - 10.05.2022 - column 80; also columns 133 to 134. See for a similar explanation in relation to ventilation for education buildings: Transcript - Shaun Fitzgerald - 09.05.2022 - column 62 to 63. The list of the contributors is set out at page 9 to 10 of the 2022 edition of SHTM 03-01; A37301626 - SHTM 03-01 - HC2022.B1 - page 1039.
355 A37465696 - Stephen Maddocks - Healthcare Ventilation Principles and Practice - HC2022.B6 - page 68.
356 A37465696 - Stephen Maddocks - Healthcare Ventilation Principles and Practice - HC2022.B6 - page 70.
357 A37521582 - Statement of Andrew Poplett - HC2022.B6 - page 130 - paragraph 74; Transcript - Andrew Poplett - 10.05.2022- columns 92 to 93 and 121.

5.91. Further, SHTM 03-01 and the standards enshrined in it, have widespread acceptance within the industry. I reproduce the following exchange between Counsel to the Inquiry (Q) and Stephen Maddocks (A):

> "**Q** Have these rates [specified in SHTM 03-01] become standard within the industry?
>
> **A** Yes, they have.
>
> **Q** Have you discussed those over the years with architects, engineers, infection prevention and control officers?
>
> **A** I have discussed them with engineers as to say, "Why is that?" and they've just gone, "I don't know, just design it to that figure."
>
> **Q** Having worked within the industry for over 40 years, are you aware of anybody suggesting that these rates are far too high?
>
> **A** No.
>
> **Q** Or anybody suggesting that they are far too low?
>
> **A** No, they've worked. They're proven. Again, as I said earlier, the HTMs have been developed with working practice and procedures and found to be satisfactory."[358]

5.92. Dr Fitzgerald concluded his report as follows:

> "The provision of a ventilation system which operates in accordance with the HTMs and SHTMs is important as part of a strategy to provide an environment which reduces risk of infection and transmission to an acceptable level. Ventilation in a healthcare setting is to help control the environment and air movement in a space in order to contain, control and reduce hazards to patients, staff and visitors from airborne contaminants, dust and harmful micro-organisms.
>
> It is not possible to eliminate risks completely, but the design principles which are laid out in the guides and the values of the parameters which have been used will have been chosen because they are deliverable. Design guides are typically written in collaboration with not just academic scientific and engineering experts in the field, but practicing design engineers, manufacturers, installers/ contractors, and facilities management teams."[359]

5.93. Given that evidence, I would accept, as Counsel to the Inquiry submitted[360], that it is only rational that if specific recommendations set out in SHTM 03-01 (2014) were to be departed from this should have been only on the basis of a risk assessment.

358 Transcript - Stephen Maddocks - 12.05.2022 - column 110 to 111.
359 A37277147 - Report on Ventilation Principles by Dr Shaun Fitzgerald - page 44.
360 Closing Submission - Counsel to the Inquiry - Edinburgh Hospital - June 2023 - paragraph 60.

5.94. I would, however, add this qualification. The evidence heard by the Inquiry in relation to the meaning and status of SHTM 03-01 (2014), and the debate which followed, largely focused on air change rates and pressure differentials. I would see these parameters, as set out in Table A1, as specific and precise recommendations. There are many other examples of such recommendations to be found in the memorandum, but the tone of the language of what is a 184-page document is not uniformly specific and hard-edged. Much is more general, and couched in terms of providing information or giving advice. This has obvious consequences for what is meant by "compliance" with a particular recommendation which is to be found in the SHTM. Where a recommendation is precise, as is the case with air change rates and pressure differentials, I would see compliance to mean following the recommendation exactly, but where a recommendation is very broadly stated, then there may be "room for interpretation" in the sense of scope for the exercise of a judgement as to what is required and in respect of which more than one solution may be appropriate.

5.95. I would add that there are expressions or formulations used in SHTM 03-01 which need to be interpreted in the light of clinical expertise and knowledge of the precise purpose for which a particular space within a healthcare facility is to be used. An example would be "critical care areas". Textual analysis only takes one a certain distance. The guidance may be principally directed at those designing and building ventilation systems but in order to understand what are the "critical care areas" in a particular facility requires input from the relevant clinicians and infection prevention and control practitioners. Engineering input will also be necessary but where there is room for interpretation in this sense the task of interpretation cannot be left solely to engineers.

5.96. Matters are made clearer in the 2022 revision of SHTM 03-01. At page 5 of Part B, under the heading "Language usage in technical guidance", there is the following explanatory text:

> "In SHTMs, SHPNs and HBNs, modal verbs such as "must", "should" and "may" are used to convey notions of obligation, recommendation or permission. The choice of modal verb will reflect the level of obligation needed to be compliant.
>
> The following describes the implications and use of these modal verbs in SHTMs/SHPNs/HBNs (readers should note that these meanings may differ from those of industry standards and legal documents):
>
> - 'Must' is used when indicating compliance with the law;
> - 'Should' is used to indicate a recommendation (not mandatory/ obligatory), i.e. among several possibilities or methods, one is recommended as being particularly suitable – without excluding other possibilities or methods;
> - 'May' is used for permission, i.e. to indicate a course of action permissible within the limits of the HBN, SHPN or SHTM."[361]

361 A37301626 - SHTM 03-01 Part B (2022) Interim - HC2022.B1 - page 1033.

5.97. There is then a section on Project derogations from the Technical Guidance in the following terms:

> "Healthcare facilities built for the NHS are expected to support the provision of high-quality healthcare and ensure the NHS Constitution right to a clean, safe and secure environment. It is therefore critical that they are designed and constructed to the highest and most appropriate technical standards and guidance. This applies when organisations, providers or commissioners invest in healthcare accommodation (irrespective of status, for example Foundation and non-Foundation trusts).
>
> The need to demonstrate a robust process for agreeing any derogation from Technical Guidance is a core component of the business case assurance process.
>
> The starting point for all NHS healthcare projects at Project Initiation Document (PID) and/or Strategic Outline Case (SOC) stage is one of full compliance.
>
> Derogations to standards will potentially jeopardise business case approval and will only be considered in exceptional circumstances. A schedule of derogations will be required for any project requiring external business case approval and may be requested for those that have gone through an internal approvals process. While it is recognised that derogation is required in some cases, this must be risk-assessed and documented in order that it may be considered within the appraisal and approval process.
>
> Derogations must be properly authorised by the project's senior responsible owner and informed and supported by appropriate technical advice (irrespective of a project's internal or external approval processes)" [362]

5.98. I see the current version of the guidance making explicit what was already implicit in the 2014 version. SHTM 03-01 (2022) Part A recommends that the management of a healthcare provider's ventilation systems should be overseen by a Ventilation Safety Group (VSG). Paragraphs 4.10 and 4.11 of Part A provide as follows:

> "4.10 Any derogations or alternative design strategies from this guidance should be subject to the scrutiny and agreement in writing by the VSG. The reason for the derogation or alternative design strategy and limits to its application should be recorded.
>
> 4.11 Designers proposing a derogation or alternative design strategy should be able to supply a body of evidence that their proposal will provide a degree of safety no less than if the guidance in this document had been followed." [363]

362 A37301626 - SHTM 03-01 Part B (2022) Interim - HC2022.B1 - page 1034.
363 A37301626 - SHTM 03-01 Part A (February 2022) - HC2022.B1 - page 827.

Non-compliance with SHTM 03-01 (2014) as a "defect"

5.99. Counsel to the Inquiry followed his submission that if there were to be departure from the recommendations in SHTM 03-01 (2014) in respect of air change rates and pressure differentials, then there required to be a risk assessment, with a submission that a ventilation system which did not comply with these recommendations and which had not been subject to a risk assessment, was "defective" for the purposes of the Inquiry's Terms of Reference. I accept that submission. As Counsel recognised, it would be an over-simplification to say that if the air change rates set out in SHTM 03-01 are not followed there will always be a material risk to patients' safety as a matter of fact. Other circumstances bearing on risk come into play. However, in the absence of a risk assessment a decision-maker simply does not know what is the impact of his decision not to implement the recommended measures.

5.100. The closing statement on behalf of IHSL following the hearing which began in April 2023 criticised Counsel to the Inquiry's definition of "defective" as "technical" and as making no reference to the Project Agreement or the contractual position thereunder. If by "technical" is meant following the definition of "defective" in the Inquiry's Term of Reference 1, then IHSL's points are correct. While I would understand it to have been the original intention of the representatives of NHSL to secure the implementation of all the recommendations of SHTM 03-01, particularly in relation to the critical care area of the hospital, it is another question as to whether, on a proper interpretation of the documents, that is what was contracted for in the Project Agreement, and there is a further question as to whether NHSL's actions have always been entirely consistent with such an original intention. For that and other reasons, there may be room for discussion as to whether the systems serving critical care which IOM found to be not capable of achieving 10 ac/h were "Not capable of the function or purpose for which they were intended" in terms of Term of Reference 1 A. However, there having been no relevant risk assessment, I would see there to be no question but, on the basis of the IOM findings, that the systems did not conform to "applicable recommendations, guidance and good practice" in terms of Term of Reference 1 B. Accordingly, I consider that as at the beginning of July 2019, the ventilation system serving critical care was "defective" in the sense envisaged by the Inquiry's Terms of Reference.

5.101. A question which I do not require to answer, for reasons already touched on, is just how extensive the critical care area in the RHCYP is to which the SHTM 03-01 requirement of 10 ac/h and 10 pascals of positive pressure extended. The schedule of accommodation dated 27 November 2014 identifies 88 spaces within Department B, of which only 13 are bays or cubicles accommodating beds or cots. Looking to the descriptions attached to the remaining 75 spaces in Department B, it is clear that they are all ancillary to the needs of a unit delivering high levels of care to vulnerable patients, but only very few of them are spaces where it would be expected that treatment might be administered. I accept the logic of Mr Maddocks' evidence that what he described as the "common spaces" (in the sense of spaces

of the sort that will be found in many other parts of the hospital) in a critical care area are “excepted” from the 10 ac/h and 10 pascals requirement, but I would see there to be a question remaining as to whether that logic necessarily means that the guidance should be understood as limiting the 10 ac/h and 10 pascals requirement to bed and cot spaces. Much might depend on details of layout and the precise use to which spaces are put.

Chapter 6

How the issues as to non-compliant ventilation occurred

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How the issues as to non-compliant ventilation occurred

Introduction

6.1. The purpose of this chapter is to address that part of its remit that requires the Inquiry "to consider the planning, design and construction of the RHCYP and DCN in order to determine how issues relating to adequacy of ventilation occurred; and if these issues could have been prevented". The particular issue under consideration is that at the date of the planned opening of the hospital the ventilation system serving critical care was not capable of providing 10 ac/h with a positive pressure differential of 10 Pa to bed and cot spaces other than isolation rooms. This meant that, for the reasons discussed in previous chapters, the ventilation system was "defective" in the sense envisaged by the Inquiry's Terms of Reference, that is, the system did not conform to "applicable recommendations, guidance and good practice" in terms of Term of Reference 1B.

6.2. Thus, the focus of this chapter is to consider how it was that the ventilation system serving critical care bed and cot areas came to be designed to achieve less than the 10 ac/h recommended in Scottish Health Technical Memorandum 03-01 "Ventilation in Healthcare Premises" (SHTM 03-01), and how it came to be installed, and the hospital handed over to NHSL, without this issue being identified.

Appointment of the first design team under Frameworks Scotland and the creation of the environmental matrix

6.3. When the project to reprovision the Royal Hospital for Sick Children (RHSC) was initially approved, the intention was to use the "Frameworks Scotland" procurement route. This was a construction framework managed by Health Facilities Scotland (HFS) for use by NHS Scotland bodies in the delivery of capital projects. The objective was for "one stop shop" Principal Supply Chain Partners (PSCPs) to be responsible for delivering both design and construction projects via an integrated supply chain.[364]

364 A42420902 - NSS Response to Provisional Position Papers 1-3 - HC2023.B12.V1 - page 470 - paragraph 6.

6.4. On 10 July 2009 NHSL appointed BAM Construction Limited (BAM) to design and build a new hospital to replace the old Royal Hospital for Sick Children (RHSC). Mott MacDonald Limited (MML) were appointed as "NEC3 supervisor" (in reference to the form of contract used at this stage of the project).[365] Davis Langdon were appointed as the Project Managers. In terms of its agreement with NHSL, BAM undertook responsibility for initial design development, assistance in preparing the Full Business Case and the completion of the design, construction and handover of the new hospital.[366] BAM had in its design team Hulley and Kirkwood (H&K) as mechanical and engineering consultants. H&K became responsible for the design of building services including ventilation.

6.5. H&K was tasked with inputting building services information into "Room Data Sheets" or "C Sheets".[367] This would involve setting out the performance and other parameters to be achieved by the hospital's ventilation system for each room in the hospital. The ventilation parameters appear on a sheet for a particular room along with other environmental data, such as lighting and noise parameters. These parameters - which include air change rates and pressure differentials between adjacent spaces - determine the elements of the detailed design of the ventilation system such as the location of grilles and the size and distribution of air ducts and air handling units. They also feed into a range of architectural considerations on which the more detailed design of a ventilation system is dependent, such as the height and type of ceilings and the height of the ceiling cavity.

The environmental matrix as a summary of design information

6.6. Room data sheets (RDS) are the commonly used briefing tool for hospital projects. It has been the policy of the Scottish Government since 2006 that NHS bodies in Scotland, when procuring new healthcare facilities, should use the Activity Database (ADB) in the preparation of room data sheets, as the appropriate digital tool for briefing, designing and commissioning these facilities.[368] The ADB is a digital database of healthcare design information which contains the details of the environmental requirements for clinical spaces in hospitals. It is the latest in a line of standardised hospital design tools used by the NHS in the UK.[369] It is based on the guidance relevant to the design of hospitals in England, including Health Building Notes (HBNs) and Health Technical Memoranda (HTMs). Accordingly, when the ADB is used to populate the RDS for a particular project, the data recorded in that RDS, including the environmental data, should, in theory, automatically comply with that guidance. The policy however states that "extreme care should be taken" to ensure that such data generated by ADB are consistent

365 Frameworks Scotland used the New Engineering and Construction Contract 3 (NEC3), an iteration of a type of build contract introduced by the UK Institute of Civil Engineers in 1993, which was commonly used for public sector projects.
366 A36878634 - BAM Contract - HC2022.B3.V1 - page 860.
367 A36308450 - BAM, RHSC and DCN Stage 3 Programme - 14 December 2009.
368 A37215538 - HDL (2006) 58 - HC2022.B3.V1 - page 125; A37215536 - CEL 19 (2010) -HV2022.B4 - page 113.
369 A37465696 - Healthcare Ventilation Principles and Practice - Expert Report of Stephen Maddocks - HC2022.B6 - page 66 - paragraph 3.3.2.

and compliant with Scottish-specific guidance such as is found in Scottish Health Planning Notes, Scottish Health Facilities Notes (SHFNs) and Scottish Health Technical Memoranda (SHTMs) as published by Health Facilities Scotland. The policy permits alternatives to be used, but only if the ADB is deemed inappropriate for the particular project. In these circumstances, the relevant NHS body is responsible for demonstrating that the alternative is of equal quality and value to the ADB.

6.7. The Inquiry was told that there is a disadvantage in relying on RDS as the only means of communicating the parameters of a ventilation system. A typical hospital will contain hundreds of rooms. A RDS typically runs to four or five pages. For a hospital of any size, a full set of room data sheets may therefore run to several thousand pages. An alternative which has been devised by engineers is to summarise environmental information in one spreadsheet which gathers together the parameters of the mechanical and electrical (M&E) engineering systems for all rooms in a building. Such a document, conventionally referred to as an "environmental matrix" (EM), can then be used to establish the client's brief for a ventilation system.[370]

6.8. H&K were asked at a design team meeting on 14 December 2009 to develop a bespoke environmental matrix which could be used to summarise the environmental information for the different rooms in the hospital listed in the schedule of accommodation produced by Tribal, the healthcare planners appointed to BAM's design team. On 15 February 2010, Michael O'Donnell, (building services engineer, H&K) wrote to BAM: "With regards to environmental issues, rather than employ ADB M&E sheets, HK will produce Environmental Matrix spreadsheet for each room type for easy reference as a user sign off tool."[371] H&K proceeded to produce an EM which it was to develop over a number of iterations.

6.9. NHSL had arranged for the production of a set of "Activity Database Room Data Sheets" (ADB RDS) for the project, which H&K received in April 2010. NHSL's ADB RDS were dated September 2009 and marked as drafts. NHSL, in a note to the Inquiry, described them as having been developed following "significant consultation with the clinical user groups".[372] H&K did not, however, use the environmental data from the ADB RDS provided by NHSL. Mr O'Donnell's evidence was that these did not appear to have undergone a detailed technical review. The environmental data that they contained were, in his view, neither complete nor consistent with the latest technical ventilation guidance in place at the time (the English HTM 03-01 from 2007).[373] Thus, when H&K prepared the EM in 2010 the relevant data had to be entered manually into a spreadsheet.[374] The first version was issued in September 2010.[375]

370 Witness Statement - Michael O'Donnell - 25.04.2023 - paragraph 11.
371 A34691195 - Email 15 February 2010 - HC2023.B4 - page 278.
372 A42408446 - NHSL Narrative on ADB and RDS - HC2023.B12.V1 - page 72.
373 Transcript - Michael O'Donnell - 25.04.2023 - column 14 onwards.
374 Witness Statement - Michael O'Donnell - 25.04.2023 - paragraph 11; Transcript - Michael O'Donnell - 25.04.2023 - column 54.
375 A34691163 - H&K Environmental Matrix September 2010 - HC2023.B4 - page 42.

6.10. A page at the beginning of the EM contained guidance notes. The reason for including these, according to Mr O Donnell, was to pull together and summarise what was important to note from a vast suite of healthcare guidance at various stages of currency, and to "have it out there and up front as important watch points".[376] It was Mr O'Donnell's understanding that the guidance notes should take precedence over the values in the matrix.[377] The body of the EM, which contained the environmental data for each room set out in a spreadsheet, included a column in which it was stated with respect to each room, "See Guidance Notes".

6.11. The guidance notes included with this first version of the EM drew attention to (the English) HTM 03-01 and its recommended air change rate of 10 ac/h for the high dependency units (HDU) and critical care areas (guidance note 13).[378] The comparable Scottish guidance at the time (SHTM 2025) did not feature recommended air change rates albeit it did make reference to the ADB.[379]

6.12. In the section of the EM setting parameters for particular rooms, an air change rate of 4 ac/h was provided for single bed cubicles in the department designated "B1 Critical Care/ HDU / Neonatal Surgery". Mr O'Donnell regarded this as a mistake and said that the air change rate for those rooms should have been 10 ac/h.[380] This was a transcription error. That mistake was corrected in H&K's second version of the matrix, dated 22 December 2010, in which the air change parameter for single bed cubicles in critical care is stated as 10 ac/h.[381]

6.13. The development of an environmental matrix for use in a capital-funded project under Frameworks Scotland went no further.

Change in the funding model

6.14. On 17 November 2010, the Scottish Government published the Draft Budget for 2011 to 2012 and announced that the projects for the RHCYP and DCN would be delivered using the non-profit distributing (NPD) revenue funded model.[382] This meant that the project would not be funded from the capital budget of NHSL but rather would be funded through revenue expenditure.

6.15. For present purposes, capital expenditure may be defined as expenditure from a public authority's own resources that results in the creation or enhancement of an asset. In the public sector this might, for example, be a hospital, a school, a prison or a road. Revenue expenditure is expenditure from the authority's own resources for the purposes of the day-to-day operations of that authority that

376 Transcript - Michael O'Donnell - 25.04.2023 - column 32 and 33.
377 Transcript - Michael O'Donnell - 25.04.2023 - column 88.
378 A34691163 - H&K Environmental Matrix September 2010 - HC2023.B4 - page 43.
379 A33103370 - SHTM 2025 part 2 - HC2022.B1 - page 68
380 Transcript - Michael O'Donnell - 25.04.2023 - column 42.
381 A34691173 - Environmental Matrix September 2010 - HC2023.B4 - page 64.
382 Scottish Government, Scotland's Spending Plans and Draft Budget 2011-12 Chapter 8 Health and Wellbeing, What the Budget Does section: "We will also ensure the delivery of a range of other health projects, including the Royal Sick Children's Hospital and Department of Clinical Neurosciences in Edinburgh through the NPD approach outlined in chapter 3.": The project is also mentioned in the "New investment financed through the Non-Profit Distributing model" table in Chapter 3.

does not normally result in the creation of an asset. A simple example of revenue expenditure is the wages and salaries of staff.

6.16. Traditionally, construction of a new hospital would be an item of capital expenditure. However, using private finance to meet the costs of construction enabled the costs of construction to be met from revenue expenditure. Several models of private finance funding of construction costs have been used in the past, such as the Private Finance Initiative (PFI). All such projects essentially require investment by lenders to fund the construction of an asset which is then operated and maintained for the benefit of the relevant public authority by a project company, sometimes referred to as "Project Co" or "the SPV" (Special Purpose Vehicle). The project company is usually set up solely for the purpose of delivering the particular project and carries out no other business activities.[383] This arrangement lasts for a set period (in the case of the RHCYP and DCN project, initially 25 years) during which the public authority pays for the use of the building usually in the form of a monthly "service payment", effectively repaying the capital costs over that period. This enables classification of the expenditure as revenue payments for a "service" rather than for the construction of a building. The construction costs are not charged against the Scottish Government's capital budget nor met from capital borrowing.[384]

6.17. The relevance of this is that the decision to switch to an NPD model was taken against a background of lack of availability of capital funding to meet the cost of these (and other) projects. The Inquiry heard that using revenue funding was the only option available at the time to take forward the project.[385] Had a revenue funded model not been adopted the hospital simply could not have been built.

6.18. The development of the NPD model was closely linked to the establishment and work of the Scottish Futures Trust (SFT).[386] The SFT is a non-departmental "arm's length" public body, established in 2008 as a private limited company wholly owned by Scottish Ministers. One of the SFT's objectives is to "innovate and bring fresh approaches and models for infrastructure investment". SFT is concerned with the promotion of "Government policy and priorities for infrastructure investment and related topics".[387] This included the use of the NPD model as a revenue-finance option.

6.19. The NPD model developed by SFT shared many characteristics of other variants of private finance of public infrastructure, with some innovations. For example, with the NPD model, private sector profits were capped at an agreed level at the outset

383 The structure of IHSL is explained in Provisional Position Paper 10 - The Contractual and Funding Structure Relating To The Royal Hospital for Children and Young Persons/ Department of Clinical Neurosciences Project - section 6.4.
384 A33586569 - Audit Scotland - Privately Financed Infrastructure Investment - page 13 The accounting treatment of privately financed projects changed in 2014.
385 Witness Statement - Peter Reekie - 19.05.2022 - paragraph 71 to 84.
386 A33586569 - Audit Scotland - Privately Financed Infrastructure Investment - page 12.
387 A33727451 - SFT Management Statement and Financial Memorandum - paragraphs 2.2.1(iii) and 2.3.1(ii).

of the project. In addition, with the NPD model, the project company had a public interest director with voting rights and, in early NPD projects, effective veto on some actions of the company.[388]

6.20. Notwithstanding the perceived advantages of doing so, switching to a new funding model while the project was already underway added further challenges to what was already a complex project.

6.21. The Gateway Review carried out in early 2010 in relation to experience with Framework Scotland noted that as that procurement route only became available in late 2008, knowledge and experience around its operation had been limited. The Review Team noted that:

> "There is quite a steep learning curve for all parties involved in this new form of contract and while there appears to have been a good partnering ethos developed to date, it is recognised that this may be severely tested in the later stages. It will be important for all concerned, particularly at the decision-making levels in NHSL, to take some time to fully understand the NEC3 approach and to support the ethos as the project progresses through the later stages."[389]

6.22. The change in funding route represented a fundamental amendment to the procurement method for the project. As described in the quotation above, the use of the NEC 3 contract form had meant that those responsible were required to master procedures which had been unfamiliar to them. This revision represented further change, and a further learning curve. NHSL had no advance warning of the announcement, and until it was made, NHSL was under the impression that capital funding had been secured for at least the RHCYP project.[390] Accordingly, this change gave rise to some concerns on the part of NHSL.[391] There was a need for a degree of regrouping and working out how to take matters forward under the new approach.

6.23. Significant changes to the contractual structure were required. Iain Graham, who was Director of Capital Planning and Projects (NHSL) at the time of this change in funding route, noted that:

> "The Framework Scotland was not designed to deliver revenue-funded projects and the collaborative risk sharing approach of the National Engineering Contract has not generally been acceptable to the commercial funders in Public Private Partnership contracts who seek a fixed price and fixed risk construction contract."[392]

388 The veto rights were removed because of changes to the rules under which public - private partnership projects had to be accounted for. The public interest director in the RHCYP/ DCN project did not have veto rights on the actions of IHSL.

389 A34872870 - Gateway Review 2 - HC2022.B3.V1 - page 803.

390 Transcript - Jackie Sansbury - 13.05.2022 - columns 49 to 50; see also Witness Statement - Brian Currie - 18.05.2022 - paragraph 16; Witness Statement - Susan Goldsmith - 17.05.2022 - paragraph 8.

391 Witness Statement - Susan Goldsmith - 17.05.2022 - paragraph 11; Transcript - Susan Goldsmith - 17.05.2022 - column 26 onwards.

392 Witness Statement - Iain Graham - 18.05.2022 - paragraph 18.

6.24. Furthermore, by late 2010, a significant amount of work had already been done.[393] The project had progressed to the Works Information stage, where the design outputs developing the specifications and requirements prepared earlier would be completed. The Works Information stage had, in fact, nearly been completed - work packages had been prepared and were out for pricing, and planning consent was to be applied for shortly.[394] According to Brian Currie, the project director,

> "We had to prepare a revised business case, prepare for a new procurement model and consider how best to utilise the design work already done. This involved liaising with internal and external stakeholders and independent advisers. We had numerous meetings with lawyers and technical advisers which were costly and time consuming."[395]

6.25. The pre-existing design work would later be used for a "reference design" and included among the information provided to bidders. The significance of this in the context of a change in contractual structure will become apparent and is discussed further in chapter 9.

The Standard Form Project Agreement

6.26. There is only one available type of contract for an NPD project, and that is the Standard Form Project Agreement (SFPA), which follows HM Treasury Standardisation of PFI Contracts Version 4 Guidance (SoPC4)[396] and its adaptations.[397] The SFPA is mandatory for NPD projects, and is intended to simplify documents and minimize transaction costs for contractors, investors and funders as well as procuring authorities.[398]

6.27. The SFPA's basic features are:

- The private sector will provide the Authority with serviced accommodation.
- Payment will only commence once the accommodation is complete and ready for use.
- The Authority will pay for available facilities and deductions will be made from the annual service payment if the facilities are not available or the services are otherwise not provided in accordance with the Authority's requirements.

393 Transcript - Brian Currie - 18.05.2022 - columns 22 and 85.
394 Witness Statement - Iain Graham - 18.05.2022 - paragraphs 17 to 18. See also Transcript - Iain Graham - 17.05.2022 - columns 18 to 27; also Witness Statement - Brian Currie - 18.05.2022 - paragraph 16.
395 Witness Statement - Brian Currie - 18.05.2022 - paragraph 19; see also Transcript - Brian Currie - 18.05.2022 - columns 22 to 24.
396 A32925574 - Scottish Futures Trust, NPD Model Explanatory Note - paragraph 2.6.
397 A32925575 - Standard Project Agreements (hub DBFM & NPD Model) Users Guide Version 2 - June 2012 - page 1.
398 A32925575 - Standard Project Agreements (hub DBFM & NPD Model) Users Guide Version 2 - June 2012 - page 2.

6.28. However, SFT notes that each project agreement needs to be tailored to the specific project. The SFPA needs to be carefully assessed and reviewed in the light of any further project and sector specific guidance and advice received. It should also "be used in conjunction with any further guidance issued/adopted by the Scottish Government and/or the SFT from time to time."[399]

6.29. Any changes to the SFPA made in the context of a specific project need to be approved by SFT. Changes to the Project Agreement are referred to as derogations. Even making allowance for sector specific derogations, the SFPA is not capable of use "as is". In particular (and importantly), the SFPA does not contain a brief or specification of the facilities to be provided or the works to be carried out. For example, clause 12.1.1 of the SFPA provides that "Project Co shall carry out the Works …so as to procure satisfaction of the Authority's Construction Requirements" but it does not specify what those "Construction Requirements" are – that is a matter to be defined by the Authority in each individual case.[400] It follows from this that the SFPA does not specify what the particular building standards or performance standards are for mechanical and electrical engineering systems which have to be met. Where the authority using the SFPA is subject to certain mandatory requirements, it is up to that authority to ensure that they are properly reflected in the form of the contract ultimately adopted.

6.30. The SFPA (which includes the standard Service Level Specifications, NPD articles of association and the User's Guide) was published in 2011 and amended in 2012, 2014 and 2015. Use of the second (2012) version was mandatory for projects still in the procurement phase before the close of competitive dialogue (and is therefore the relevant version for the RHCYP and DCN project).

Procurement process in overview

6.31. With the change in contract structure, given the value of the contracts for the reprovision of the children's hospital, NHSL was required to conduct a fresh procurement exercise in accordance with the Public Contracts (Scotland) Regulations 2012 (the Regulations).[401]

399 A32925575 - Standard Project Agreements (hub DBFM & NPD Model) Users Guide (Version 2 - June 2012), page 5.

400 A32925599 - Standard Form Project Agreement (NPDModel) - page 22. The Project Agreement substituted "Board's Construction Requirements" but is otherwise in identical terms. See A33405351 - Main body of contract - HC2023.B5 - page 4.

401 Now superseded by the Public Contracts (S) Regulations 2015. The procurement process to which parties became subject has its origin in EU law, in particular Directive 2004/18/EC of the European Parliament and Council of 31st March 2004 on the co-ordination of procedures for the award of public works contracts, public supply contracts and public services contracts. The Directive was implemented for Scotland by the Public Contracts (S) Regulations 2006. The 2006 Regulations were revoked and replaced by the Public Contracts (S) Regulations 2012, which were revoked and replaced in their turn by the Public Contracts (S) Regulations 2015, in order to reflect developments in the relevant EU law, including repeal of the 2004 Directive by Directive 2014/24/EU. The 2012 Regulations came into force on 1 May 2012 and therefore given that the relevant contract notice appeared in the Official Journal of the EU on 4 December 2012, it is the 2012 Regulations which apply to the procurement process for the provision of the RHCYP. Important among the guidance available to NHSL in carrying out the procurement process was *The Scottish Capital Investment Manual PPP Guide: Section 2 From OJEU to Contract Award* of 17 Dec 2009

6.32. The object of the Regulations was to ensure open and fair competition for public contracts on terms which the contracting authority considered economically advantageous. Regulation 4(3) of the 2012 Regulations required a contracting authority, at all stages of the procurement exercise, to: (a) treat economic operators wishing to contract with the contracting authority equally and without discrimination; and (b) act in a transparent and proportionate manner. An aspect of the requirement of transparency is that documents issued to prospective tenderers should be drafted in a manner that would allow for uniform interpretation by reference to the objective understanding of "reasonably well informed and normally diligent tenderer" (the RWIND Tenderer).[402]

6.33. The Regulations contained a range of options in terms of the procurement procedure which a contracting authority might choose to follow. These included the "open procedure" and the "restricted procedure". However, where a contracting authority wished to award a particularly complex contract and considered that the use of open or restricted procedure would not allow that, it might use the "competitive dialogue procedure" as provided for by regulation 18. A "particularly complex contract" was defined in regulation 18(1) as meaning a contract: "…where a contracting authority is not objectively able to – (a) define the technical means… capable of satisfying its needs or objectives; or (b) specify either the legal or financial make-up of a project or both".

6.34. NHSL opted for the competitive dialogue procedure. In the event of a contracting authority using the competitive dialogue procedure it must comply with the provisions of regulation 18. Regulation 18, read with regulations 23 to 26, provided for a competitive dialogue procedure which was required to be carried out in a number of stages. These were:

i. The publication of the contract notice in the Official Journal of the European Union inviting requests to participate;
ii. Specification of the contracting authority's needs and the evaluation of economic operators;
iii. The Invitation to Participate in Dialogue;
iv. The competitive dialogue process;
v. Invitation to Submit Final Tenders;
vi. The assessment of tenders and identification of a Preferred Bidder;
vii. Conclusion of Contract and Financial Close; and
viii. Publication of Contract Award.

402 *Healthcare at Home Ltd v Common Services Agency* 2014 SC (UKSC) 247.

6.35. Regulation 18(22) provided that during the competitive dialogue procedure, a contracting authority:

> "(a) may discuss all aspects of the contract with the participants selected; (b) must ensure equality of treatment among all participants and, in particular, must not provide information in a discriminatory manner which may give some participants an advantage over others; and (c) must not reveal to the other participants solutions proposed or any confidential information communicated by a participant without that participant's agreement".

6.36. The contracting authority was entitled to conduct dialogue in successive stages. The contracting authority was also entitled to continue the competitive dialogue procedure until it could identify one or more solutions, if necessary, after comparing them, capable of meeting its needs (Regulation 18(25)).

6.37. In terms of regulation 18(26) of the 2012 Regulations, the contracting authority then required to: (a) inform each participant that the dialogue had concluded; (b) request each participant to submit a final tender containing all the elements required and necessary for the performance of the project on the basis of any solution presented and specified during the dialogue; and (c) specify in the "invitation to submit a tender" the final date for the receipt of tenders.

6.38. The Regulations permitted NHSL, as contracting authority, to make a request for a participant to clarify, specify or fine-tune a Regulation 18(26)(b) tender. However, such clarification, specification, fine-tuning or additional information could not involve changes to the basic features of the tender if those variations were likely to distort competition or have a discriminatory effect (Regulation 18(27)).

6.39. The contracting authority was required to assess the tenders received on the basis of the award criteria specified in the contract notice or descriptive document, and to award the contract to the participant that submitted the most economically advantageous tender (Regulation 18(28)). The contracting authority was entitled to request the participant identified as having submitted the most economically advantageous tender to clarify aspects of that tender, or confirm commitments contained in the tender, provided that any such request did not have the effect of modifying substantial aspects of the tender and did not risk distorting competition or causing discrimination (Regulation 18(29)).

A Reference Design for the NPD procurement process

6.40. As has been noted, when the Scottish Government announced its proposal to change the funding model, a significant amount of work had already been done on the design of the new children's hospital. The design was complex given the need to "interface" with an existing hospital (the Royal Infirmary of Edinburgh) on a site presently owned and used by the contractor that had built, and was responsible for maintaining, the RIE.

6.41. Clinicians and user groups had already been engaged, and the project team was concerned about taking up more of their time. Brian Currie, the Project Director, explained:

> "We did not want to throw out what had been hard-won clinical input, for example discussions around clinical models and pathways. To repeat the process would eat into precious clinical time for the clinicians and medics."[403]

6.42. Following a meeting with representatives of the Scottish Government and Scottish Futures Trust on 23 December 2010, NHSL identified that the potential for delay, abortive effort and cost consequent on the change in funding route would be mitigated were BAM's existing design team retained with a view to it completing a "reference design".[404] In its Advisory Paper, "Reference Design Development", MML defined a reference design as "a design developed [by] the procuring authority that represents a specific solution to the output specification, the key features (and potentially other areas) of which the procuring authority wish to see in the final design".[405] It contrasted a reference design with an exemplar design: "Both an Exemplar Design and a Reference Design represent a springboard for the bidders to develop their own designs, however the level of prescription and fixity in the case of a Reference Design is greater." The reference design would be included in the information provided to prospective bidders during the procurement process.[406]

6.43. On 12 January 2011 Susan Goldsmith (Director of Finance, NHSL) and Jacqueline Sansbury (COO, NHSL) invited the Finance and Resources committee to approve progressing with a detailed reference design. Such approval was given at the F&R Committee meetings on 12 January and 9 February 2011. At this point in time the level at which the reference design was to be developed had not yet been determined.

6.44. NHSL was to receive advice on the reference design from MML, which had been appointed Technical Adviser for the revised project on 22 March 2011 in consideration of its previous experience with the project.[407] According to the "Technical Adviser Scope" included in the contract between NHSL and MML, MML would, among other things, manage and co-ordinate the review of any design proposals against the scheme brief during the preparation of the Business Cases, lead on the preparation of reference design documentation, and check the reference design for compliance with all appropriate NHS and legislative guidelines and requirements, and identify any derogations.[408] MML prepared the technical

403 Witness Statement - Brian Currie - 18.05.2022 - paragraph 26.
404 A35362520 - Lothian NHS Board, Finance and Performance Review Committee - 12 January 2011 - HC2023.B2 - page 4 to 11.
405 A32824312 - Mott MacDonald Limited, "Advisory paper 02: Reference Design Development", February 2011 - HC2023.B2 - page 15.
406 Witness Statement - Susan Goldsmith - 09.05.2023 - paragraph 14.
407 A32618292, Contract between Lothian Health Board and Mott MacDonald 22 March 2011 - HC2023.B2 - page 28.
408 A32618292, Contract between Lothian Health Board and Mott MacDonald 22 March 2011 - HC2023.B2 - page 28.

schedules and developed the technical components of the invitation to participate in dialogue (ITPD) which would provide information to bidders at the start of the competitive dialogue process. MacRoberts and Ernst & Young, NHSL's legal and commercial and financial advisers respectively, also provided input to the ITPD. MML was required to assist with the evaluation of tenders. MML became an integral part of NHSL's Project Team, sharing offices and providing advice, sometimes on a formal basis and sometimes on an *ad-hoc* and informal basis.

6.45. In a paper with the first issue date of 16 June 2011 titled "NHS Lothian RHSC + DCN Little France Procurement Options" MML presented four options as to the form of reference design which NHSL might adopt.[409] Following discussion at a Project Working Group meeting on 2 June 2011, NHSL adopted "Option A - Mandate Clinical Functionality" which was described as follows:

> "… developing the design to the extent required in order to fix aspects of the design as they relate to clinical functionality, as defined under the Project e.g.
>
> - Access
> - Relationships between buildings
> - Adjacencies between clinical departments and between rooms
> - Schedule of accommodation areas
> - Room layouts (loaded).
>
> The clinical functionality elements will then be mandated within the invitation to participate in dialogue (IPTD). Only associated elements of the design that are required to prove the robustness of the clinical functionality solutions will be developed and these will be released for information to bidders."[410]

6.46. The reference design option adopted by NHSL allocated some, albeit limited, design responsibility to the procuring authority. This was for the elements of the design which were referred to in MML's paper as "clinical functionality" and later as "Operational Functionality". These are the elements related to the layout of a room or department and their adjacency to other areas, and to the equipment to be accommodated within these spaces. In the reference design option adopted by NHSL, these are the elements which are mandatory in the sense that they are determined by the procuring authority and require to be incorporated into the design developed by the successful bidder.

409 A36878620 - Procurement Options Paper June 2011 - HC2023.B10.V2 - page 2874.
410 A36878620 - Procurement Options Paper June 2011 - HC2023.B10.V2 - page 2880.

6.47. MML produced a paper titled "Approach to Reference Design" which went through a number of iterations.[411] The aims of this paper included setting out the reasons for preparing a reference design; outlining the level of detail required; outlining the distinctions between mandatory and non-mandatory elements of the reference design; outlining the application of the reference design during competitive dialogue; and outlining the development of the reference design.

6.48. According to this paper, the perceived benefits of the reference design were: (1) a reduction in the timescale for the procurement exercise, (2) a reduction in clinical user consultation, and (3) greater certainty as to the final solution.[412] Richard Cantlay (Lead Technical Adviser, MML) told the Inquiry that the main driving factor behind the decision to adopt a reference design approach was to shorten the procurement process and reduce the amount of money spent on having three bidders developing a different design.[413] NHSL's F&R committee was also told that the use of the reference design would "ensure that quality was built into the selection of parties shortlisted."[414]

The Reference Design Environmental Matrix and the introduction of an error

6.49. MML entered into a sub-contract with Davis Langdon (DL) which was appointed Project Manager, and DL appointed the Reference Design Team, consisting of the members of BAM's former design team, on 11 July 2011.[415] H&K was appointed as Services Engineer, its responsibilities included:

- Developing the environmental information to use for Room Data Sheets.
- Input to the "Building Research Establishment Environment Assessment" (BREEAM) pre-assessment workshops and provision of preliminary 'evidence' as necessary, relating to the requirement for a BREEAM 'excellent' rating.
- Support BREEAM pre-assessment with M&E Strategy Drawings and Statements, Energy strategy and schedules of power, heating and cooling loads, Engineering design philosophy.
- Review and advise the client on the engineering services requirement elements contained within the ADB room data sheets.

411 A32824397 - MML Approach to Reference Design August 2012 - HC2023.B2 - page 603.
412 A32824397 - MML Approach to Reference Design August 2012 - HC2023.B2 - page 603.
413 Transcript - Richard Cantlay - 20.05.2022 - column 48 to 49.
414 A33887882, Minutes of the F&R Committee, 18 April 2012 - HC2023.B2 - page 591 - paragraph 2.3.
415 A34606908 - Contract Control Order 11 July 2011 - HC2022.B3.V2 - page 439.

- Review architect's proposals for compliance with section 6 (energy) of the Scottish Building Regulations and SHTM 07-02: Encode – making energy work in healthcare.

- Determine the mechanical services system philosophies, including on natural ventilation and mixed mode ventilation.[416]

6.50. The scope of services outlined above illustrates that there is a link between building services, the energy strategy, and sustainability considerations and it is worth reflecting briefly on this. Ventilation in a hospital consumes a significant amount of electricity and it was a requirement in this project that the ventilation strategy would need to minimise energy consumption and support the public sector duty to meet sustainability-related targets.[417] Mr O'Donnell remarked that "all healthcare bodies, healthcare trusts right across the UK, are focused on trying to have the most efficient and least energy burden and lowest carbon profile healthcare estate that they can have." He explained that providing a higher air change rate of 10 ac/h rather than 4 ac/h for bedrooms in critical care would have had an impact on the energy consumption of the hospital, but this impact would have been small.[418] The Inquiry has heard no evidence to suggest that the issue with non-compliant air change rates in the critical care department is rooted in energy strategy or sustainability requirements. It was, however, a factor that influenced a "mixed mode approach" to ventilation which used "passive design strategies" encouraged by BREEAM.[419] This involved using openable windows and reducing the use of mechanical ventilation.

6.51. In the course of its work as part of the Reference Design Team, H&K produced a further three versions of the environmental matrix (EM), each titled "Reference Design Envisaged Solution Environmental Matrix" (the Reference Design EM) and dated, respectively 3 February 2012, 13 March 2012 and 19 September 2012.[420]

6.52. Mr O'Donnell explained that the intention was, as with the two earlier versions of the EM, that the Reference Design EM in its several iterations should reflect the then available authoritative technical guidance in relation to, among other things, the specification of the outputs of the ventilation system appropriate to particular room types (as would be the case with room data sheets generated by the Activity Database). By the time of the production of the Reference Design EM such guidance included Scottish Health Technical Memorandum: Part A - Design and Validation 03-01 (SHTM 03-01).[421]

416 A34606908 - Contract Control Order 11 July 2011 - HC2022.B3.V2 - page 439.
417 A34225364 - ITPD Volume 3 - HC2024.B2 - pages 853 to 855, 890.
418 Transcript - Michael O'Donnell - 25.04.2023 - column 93 to 94.
419 A34225364 - ITPD Volume 3 - HC2023.B2 - page 854.
420 See Environmental matrices in HC2023.B4 - pages 77 to 158.
421 Following its publication in October 2011.

6.53. I have discussed SHTM 03-01 in chapter 5 of this report and set out there an extract of "Table A1: Recommended air-change rates" which appears in the appendix to the memorandum. It will be recollected that the table includes entries for "Critical Care Areas" and the "Neutropenic Patient Ward" which differ from the entries for "Single Room" and "General Ward". In respect of critical care areas and the neutropenic patient ward the air change rate per hour is stated as 10 and the pressure as +10 Pa.

6.54. Each of the versions of the Reference Design EM included a "Room Function Reference Sheet" (RFRS).[422] This was an innovation by H&K. It was a list of the repeatable room types which were used throughout the matrix, together with the environmental parameters for those room types. The room functions in the RFRS correlated with, and were derived from, the schedule of accommodation for the hospital (the document produced by architects or healthcare planners to list the rooms which the hospital was to contain). These were not the same as the room descriptions used in SHTM 03-01 as the basis for its recommended ventilation parameters.[423] The table below shows the ventilation parameters outlined in the RFRS by room function.

6.55. As can be seen in the table, the room function reference sheet included listings for "bedroom" and "multi-bed ward" both of which had been given an air change parameter of 4 ac/h mechanical ventilation. It also contained a listing for "HDU" which was given the air change rate parameter of 10 ac/h.[424] H&K used the term "HDU" because it was the term used in the schedule of accommodation, and they understood it as a synonym for a critical care area.[425]

Room Function	Type	Supply ac/hr	Extract ac/hr	Relative Pressure	Min Filtration
Bedroom	Central Supply Air	4	0	Positive	G4
Changing Facilities	Central Supply and Extract	5	4	Positive	G4
HDU[426]	Central Supply Air	10	0	Positive	F7
Multi-bed Wards	Central Supply Air	4	0	Positive	G4
Isolation lobby	HBN4 Dependent	HBN4 Dependent	HBN4 Dependent		F7

422 See for example A32623039 - Environmental Matrix 4 September 2014 - HC2024.B4 - page 6.
423 Transcript - Michael O'Donnell - 25.04.2023 - column 72.
424 See Environmental matrices in HC2023.B4 - pages 79, 105 and 133.
425 Transcript - Michael O'Donnell - 25.04.2023 - column 77.
426 HDU stands for High Dependency Unit, which is a unit within the Critical Care Department.

Room Function	Type	Supply ac/hr	Extract ac/hr	Relative Pressure	Min Filtration
Isolation bedroom	HBN4 Dependent	HBN4 Dependent	HBN4 Dependent	Balanced	F7
Operating Theatre Recovery	In line with SHTM 03-01	In line with SHTM 03-01	In line with SHTM 03-01	Balanced	F7
Recovery Bay/ Recovery Room	Central Supply and extract	4	0	Positive	G4

6.56. H&K's intention in creating the RFRS was, by summarising the room types into a shorter list, to make the process of reviewing the EM easier and more streamlined. Mr O'Donnell explained that it was hoped this would encourage feedback on the EM, very little of which had been received on the version of the EM produced during the phase of the project when it was planned to be capital funded.[427]

6.57. However, according to Mr O'Donnell, the inclusion of a Room Function Reference Sheet inadvertently introduced an error in the ventilation specification for the rooms in what the schedule of accommodation designated as "Department B PICU/ HDU/ Neonatal Surgery". The error was to be repeated in the second (13 March 2012) and third (19 September 2012) versions of the Reference Design EM.

6.58. Specifically, the room functions from the reference sheet, and their associated parameters, were used to populate the EM. In the section for department B1 (Critical Care/HDU/Neonatal Surgery), each of the bedded areas, except those for isolation facilities, is given a room function of either "Bedroom" or "Multi-bed wards" with the associated air change rate of 4 ac/h.[428] The "HDU" room function was unused in the main body of the spreadsheet.

6.59. When asked specifically about the use of the "multi-bed wards" room function and its associated parameter of 4 ac/h in the critical care department, Mr O'Donnell confirmed that this was an error.[429] It was inconsistent with both the guidance note and with Table A1 in SHTM 03-01, which referred to 10 ac/h for critical care areas. It was not an intended derogation from the guidance and, if H&K had been aware of it, they would have corrected it rather than sought a derogation. Single bedrooms in critical care should likewise have been given the room function "HDU" and corresponding air change rate of 10 per hour.

427 Transcript - Michael O'Donnell - 25.04.2023 - column 72.
428 See Environmental matrices in HC2023.B4 - pages 81, 107 and 135.
429 Transcript - Michael O'Donnell - 25.04.2023 - page 78.

6.60. Support for the conclusion that the selection of 4 ac/h for patient rooms in critical care was the result of an error as opposed to a conscious decision may be drawn from the guidance notes at the top page of each iteration of the Reference Design EM. Guidance note 15 included under both the heading “HDU bed areas” and that of “Critical Care Areas” the information: “Design Criteria: SHTM 03-01 esp Appendix 1 for air change rates – 10 ac/hr supply …”.

6.61. Further support for this conclusion may be drawn from a Thermal Comfort Analysis report prepared by H&K on 17 February 2012.[430] This was produced to demonstrate that NHSL’s preferred upper temperature limit of 25°C could be achieved with a mixed-mode ventilation approach. The analysis was confined to rooms with lower intended air change rates: as the report states, “critical care and high dependency type wards rooms which receive air change rates in the region of 10 ACH, have not been analysed in this study”.[431] That may be taken to confirm that the critical care and high dependency wards were intended to have 10 ac/h.

6.62. As previously discussed, Stewart McKechnie (Design Team Lead, TÜV SÜD / Wallace Whittle) put forward the view that the data contained in the EM for single bedrooms and multi-bed rooms in critical care was compliant with SHTM 03-01. For the reasons given in chapter 5, I do not consider Mr McKechnie’s reading of the guidance to represent a proper interpretation.

6.63. My finding accordingly is that the issue with the air change rates for certain critical care rooms in the environmental matrix arose through human error, specifically an error of transcription, as spoken to by Mr O’Donnell. This was the genesis of the problem with the ventilation system.

6.64. The error in the Reference Design EM of 3 February 2012 was similar to one which had existed in the first version of the Reference Design EM of September 2010, but which H&K had detected and corrected in the earlier iterations of the matrix. When asked if he could explain why the error was detected previously but not on the subsequent occasion, Mr O’Donnell thought perhaps the room function reference sheet had “blinded” him and others to the error. For that reason, he thought room function reference sheets should not be used. [432]

6.65. Mr O’Donnell understood however that the Reference Design EM was being prepared only for information and was not intended to be prescriptive.[433] Along with the rest of the Reference Design Team he was not involved in preparing the procurement documents which would be given to bidders, such as the Invitation to Participate in Dialogue.

430 A34225373 - Thermal Comfort Analysis Report - HC2023.B4 - page 283.
431 A34225373 - Thermal Comfort Analysis Report - HC2023.B4 - page 293; Transcript - Michael O’Donnell - 25.04.2023 - column 89 onwards.
432 Transcript - Michael O’Donnell - 25.04.2023 - column 79 to 80
433 Transcript - Michael O’Donnell - 25.04.2023 - column 75 and 81.

6.66. It may also be noted that the air change parameter that was provided for bedrooms and multi-bed wards also differed from the recommendation in SHTM 03-01 for general wards and single rooms. That is, the EM specified 4 ac/h while SHTM 03-01 recommended 6 ac/h.[434] This however was a deliberate choice which H&K considered to provide the most energy-efficient solution while complying with the overall tenor of the guidance, which permitted a mixture of mechanical and natural ventilation for general ward areas.[435] Bedrooms and multi-bed wards would accordingly be provided with natural ventilation along with mechanical ventilation at 4 ac/h.

Review of the Reference Design EM prior to the beginning of the procurement process

6.67. The Reference Design EM was viewed by NHSL and the second version (13 March 2012) "Revised to suit NHSL comments".[436] The error with air change rates specified for bedrooms in critical care was not picked up.

6.68. On 28 February, by email, MML required each member of the Reference Design Team to confirm that the Reference Design conformed with NHS guidance and key legislation.[437] On 16 March 2012, H&K contributed to a statement by the Reference Design Team that the reference design complied with SHTMs and HTMs.[438] In light of the error in the air change rates specified in the Reference Design EM for critical care bedded areas, Mr O'Donnell accepted that that statement was incorrect, albeit that the guidance note and room function reference sheet correctly reflected the guidance.[439]

6.69. The third version of H&K's Reference Design EM (19 September 2012) was revised to reflect an updated schedule of accommodation. The error, however, remained. H&K was not asked to update its compliance statement. It is not clear that doing so would have made any difference. H&K believed the EM accurately reproduced the recommendations in SHTM 03-01. The guidance notes indicated that "HDU'" and critical care bed areas were to have 10 ac/h in compliance with SHTM 03-01, and this was reflected in the entry in the room function reference sheet for HDU.

6.70. In its "Narrative on ADB and RDS" submitted to the Inquiry, NHSL explained that in addition to the statement of compliance, NHSL took comfort from MML's assurance that the requirement to comply with NHS Scotland design guidance was contained in the Board's Construction Requirements, a document that would be provided to bidders and that would eventually form part of the Project Agreement. In addition, the Clinical Output-based Specification (COBS), which contained the clinical activities for each department and which were also included with the ITPD,

434 A36962493 - SHTM 03-01 Part A - 2011 - page 141.
435 Transcript - Michael O'Donnell - 25.04.2023 - column 70 and 91.
436 A34691183 - Reference Design Environmental Matrix 13 March 2012 - HC2023.B4 - page 103.
437 A37318840 - Email from MML 28 February 2012 - HC2023.B4 - page 322.
438 A37318849 - Joint Statement 16 March 2012 - HC2023.B4 - page 324.
439 Transcript - Michael O'Donnell - 25.04.2023 - column 86.

contained reference to the relevant design guidance at the time.[440] The COBS had been reviewed by MML and Capita.[441] The design risk for the ventilation system would also, under the NPD contract, fall on the project company.

Date	Timeline of the Environmental Matrix
10 July 2009	BAM Construction Limited was appointed by NHSL. BAM's design team included H&K as mechanical and electrical engineering consultants.
15 February 2010	H&K were tasked with preparing an environmental matrix ("EM").
April 2010	H&K received a set of 'Activity Database Room Data Sheets' from NHSL.
September 2010	H&K produced the first version of the EM. This contained an error in relation to air change rates for single bed cubicles in the critical care department.
November 2010	The Scottish Government announced that the new buildings for the RHCYP and DCN would be delivered using the non-profit distributing (NPD) revenue funded model. In this model 'design risk' is transferred to the private sector partner.
December 2010	H&K produced a second version of the EM. The error with respect to air change rates for single bed cubicles in the critical care department was corrected.
January – February 2011	The decision was made to use a 'Reference Design'. This was a design that "represents a specific solution to the output specification, the key features (and potentially other areas) of which the procuring authority wish to see in the final design."
October 2011	Scottish Health Technical Memorandum: Part A - Design and Validation 03-01 (SHTM 03-01) was published. SHTM 03-01 Part A contained a table called 'Table A1: Recommended air-change rates'.
3 February 2012	H&K produced a third version of the EM, which was named "Reference Design Envisaged Solution Environmental Matrix". This version contained a 'room function reference sheet' which is a list of the repeatable room types used throughout the hospital. The room function 'bedroom' and 'multi-bed ward', which had a corresponding air change rate of 4 ac/hr, was used for single bed cubicles and open plan bays in the critical care department. This was the origin of the error in the EM which resulted in a delay to opening the RHCYP and DCN.

440 The guidance referred to in the Clinical Output-based Specification for Critical Care was SHTM 2025, current at the time the COBS was produced. This was not updated when SHTM 03-01 became the relevant guidance but it may be assumed that relevant parties would be aware of that guidance had been updated.

441 A42408446 - NHS Lothian's Narrative on ADB and RDS - HC2023.B12.V1 - page 77.

Date	Timeline of the Environmental Matrix
13 March 2012	H&K produced a fourth version of the EM.
16 March 2012	H&K contributed to a statement that the Reference Design complied with SHTMs and HTMs.
19 September 2012	H&K produced a fifth version of the EM. This version retained the error with respect to air change rates for single bedrooms and open plan bays in the critical care department.

The ITPD and planned redundancy of the Reference Design EM

6.71. The Reference Design EM was included, and referred to, within the suite of documents that made up the Invitation to Participate in Dialogue (ITPD) and the subsequent Invitation to Submit Final Tenders (ISFT).

6.72. The ITPD was made up of 4 volumes. Each volume had a different purpose and status. Volume 1 contained general instructions on the procurement process to bidders, including how to demonstrate that they understood and could deliver on the procuring authority's requirements, what they would be assessed on, and how they would be assessed. Volume 2 contained the draft NPD Project Agreement. Volume 3 contained the Board's Construction Requirements (BCRs), which would form part of the Project Agreement following any amendments agreed during the procurement process. Volume 4 consisted of a "data room" containing other information required by bidders or information that was considered helpful or relevant.

6.73. The mechanism envisaged in the ITPD whereby bidders would specify the environmental parameters of their proposed designs was by the submission of Room Data Sheets and an "environmental conditions/room provisions matrix for both mechanical and electrical services for each room in the Facilities".[442] Bidders were required to prepare these and were provided with documents containing relevant information, including the Reference Design Environmental Matrix.[443] The extent to which the Reference Design EM was intended to be relied upon, and the implications of that for the project, are discussed in chapter 9.

6.74. However, as then envisaged, in so far as the Reference Design EM set out the environmental parameters of the rooms identified in the schedule of accommodation, it would be superseded by information contained in the complete set of room data sheets and matrix to be produced by the bidders.

442 ITPD volume 1 Appendix A(ii) C8.2 x. in A40236054 - ITPD Volume 1 - HC2023.B2 - page 1054.
443 A40236054 - ITPD Volume 1 - HC2023.B2 - page 965.

The EM during competitive dialogue

6.75. Three candidates – (A) B3, (B) IHSL, and (C) Mosaic were invited to take part in competitive dialogue.

6.76. In its final tender submission Bidder B (IHSL) promised compliance with SHTM 03-01 and other relevant guidance. With respect to mechanical and electrical engineering design proposals its final tender submission stated that "These outline designs have been reviewed for compliance with SHTM's etc…" Bidder B did not provide its own "environmental conditions/room provisions matrix" as requested in the ITPD. Instead, the proposal stated:

> "The mechanical and electrical services shall be provided in accordance with the reference design environmental matrix and we shall provide an addendum matrix for any rooms on an exception basis highlighting any changes at preferred bid stage."[444]

6.77. The document then stated: "The room temperature set points, air change rate and…shall be in accordance with SHTM-03 [sic]." This passage was followed by a table which included an entry for "HDU" with a supply ventilation of 10 ac/h.

6.78. Within the list of submission requirements for bidders the ITPD stated that "Whilst Bidders are required to undertake their own design, the Board has provided a draft Environmental Matrix as part of the ITPD documentation. Bidders must confirm acceptance of the Board's Environmental Matrix, highlighting any proposed changes on an exception basis".[445] Bidder B confirmed acceptance of the Board's Environmental Matix and stated that "…no changes proposed at this time nor envisaged in the future but we will continue to review and advise back."[446] Bidder B also submitted room data sheets for critical care rooms which contained air changes inconsistent with SHTM 03-01 but which complied with the erroneous values set out in the Reference Design EM for those rooms in critical care.

6.79. Another bidder, "Bidder C" (Mosaic), on the other hand, provided its own environmental matrix "derived from the reference design environmental matrices" but with changes marked up to show where design criteria were modified to reflect its engineering strategy.[447] This included a change, highlighted in red, to the air change rates for some bedrooms and open plan bays in critical care, to 10 ac/h. In its tender submission Bidder C stated that it was its intent:

> "…to generally follow the reference design environmental matrices except where the criteria are modified by the different engineering strategies proposed, for example the proposed use of chilled beams combined with fresh supply

444 A32793977 - I Lothian Final Tender for C8 'M&E Engineering Design Proposals' 13 January 2014 - HC2023.B6 - page 303.
445 ITPD volume 1 Appendix A(ii) C8.3 in A40236054 - ITPD Volume 1 - HC2023.B2 - page 1055.
446 A32793977 - I Lothian Final Tender for C8 'M&E Engineering Design Proposals' 13 January 2014 - HC2023.B6 - page 305.
447 A41323405 - Bidder C final tender for C8 - HC2024.B7 - page 156.

> rates based on occupancy… Some other criteria have been modified to enhance the proposed design criteria or adjust values based on the intended room use…"[448]

6.80. Bidder C also, separately, offered to comply with SHTM 03-01.

6.81. Thus, one bidder proposed no changes to the Reference Design EM and another proposed changes, while both stated that their ventilation designs would be compliant with SHTM 03-01.

Evaluation of bidder's responses

6.82. The "Core Evaluation Team" was responsible for the evaluation of tenders and was made up of members of NHSL's project team; a lead technical adviser (Mr Cantlay) from MML, legal adviser from MacRoberts and financial adviser from Ernst & Young. They were assisted by technical advisers from MML, including Graeme Greer, and Colin Macrae (Technical M&E Adviser), who all gave evidence to the Inquiry.

6.83. Bidder B's submission for "M&E engineering design proposals" received an overall score of 5, meaning "satisfactory".[449] This meant the evaluation team assessed that IHSL's approach:

- demonstrates a satisfactory understanding of all aspects of the Board's requirements; and/or
- proposes a solution which performs satisfactorily in complying with the Board's requirements.

6.84. This was despite its tender being assessed as "Lacking detail on design philosophy and BCR compliance". Furthermore, the submissions of both Bidder B and Bidder C were accepted as compliant despite offering different values in their EM's. Mr Greer accepted that statements of compliance with the BCRs by tenderers were essentially taken at face value. Compliance with the Board's Construction Requirements was to be assessed on a pass/ fail basis. A pass was to be awarded if the bidder's approach "demonstrates a satisfactory understanding of the Board's requirements; and delivers a satisfactory level of compliance with the Board's requirements."

6.85. Mr Cantlay told the Inquiry that:

> "bidders are bidding to design and construct the hospital. Bidders are not presenting in their bid a fully developed design. Bidders are presenting in their bid their approach to how they will do the design… You can't do a detailed assessment of the design at tender stage because it doesn't exist"[450]

448 A41323405 - Bidder C final tender for C8 - HC2024.B7 - page 158.
449 A36308914 - ITPD Evaluation Proforma for Bidder B 14 February 2014 - HC2023.B8 - page 92.
450 Transcript - Richard Cantlay - 09.05.2023 - column 65 to 66.

6.86. Witnesses from MML said that bidders providing different figures in their EMs while confirming compliance with SHTM 03-01 would not have been considered a "red flag" given the level of design development expected at this stage.[451]

6.87. The Inquiry heard that a detailed review of bidders submissions was also not feasible. Mr Greer described how each assessment team had perhaps two to three hours to review bidder's response to each question and that this was "not a massive amount of time".[452] Mr Greer considered that checking each tender to ensure compliance would have taken months.[453]

6.88. Graeme Greer told the Inquiry that a review of submissions was not a design check, and the onus was on bidders to confirm compliance with BCRs, rather than for NHSL to confirm compliance through its review of the submissions.[454] Mr Greer explained that MML used a sample approach to the review rather than conducting a detailed technical audit which "could in effect be taking on design responsibility" which MML was not set up to do. [455]

6.89. Thus, the evidence indicates that there was a low intensity review with respect to the technical detail contained in tender submissions, and that this was not unexpected or out of the ordinary.

6.90. Mr Cantlay of MML advised NHSL that he believed that from a technical perspective, the evaluation had been carried out in a manner consistent with the evaluation methodology.[456] Mr Cantlay stated that from a technical perspective, it was appropriate for NHSL to conclude the evaluation process and appoint the preferred bidder. At the NHSL Finance and Resources Committee meeting on 5 March 2014 Mr Cantlay is recorded as stating that: "…the scores were all appropriate and he was happy with the evaluation and satisfied that the preferred bidder was in full accordance with the requirements". Mr Currie stated at the same meeting that all three bids had been of an acceptable quality. The minute records, at paragraph 61.16, that: "Everything possible had been done to mitigate the risk of poor quality facilities and/or poor services being provided to NHS Lothian."[457]

6.91. Bidder B was selected as the "preferred bidder" on the basis of its overall score. Following authorisation by the Finance & Resources Committee, the Board of NHSL issued a preferred bidder appointment letter to IHSL on 5 March 2014 (the PBA Letter).[458] The PBA Letter formed the basis for the preferred bidder appointment. Schedule part 1 (Terms of Preferred Bidder Appointment) set out the terms of IHSL's appointment as preferred bidder. The terms included provision for

451 Transcript - Richard Cantlay - 09.05.2023 - column 40, Witness Statement - Graeme Greer - 28.04.2023 - paragraph 40; Transcript - Colin Macrae - 02.05.2023 - columns 20 to 21.
452 Witness Statement - Graeme Greer - 28.04.2023 - paragraph 22.
453 Transcript - Graeme Greer - 05.05.2023 - column 49.
454 Transcript - Graeme Greer - 05.05.2023 - column 93.
455 Transcript - Graeme Greer - 05.05.2023 - column 100.
456 A33887882 - F&R Review Committee 5 March 2024 - HC2023.B10.V1 - page 6.
457 A33887882 - F&R Review Committee 5 March 2024 - HC2023.B10.V1 - pages 6 to 7.
458 A36382455 - Preferred Bidder Letter 5 March 2014 - HC2023.B10.V1 - page 87.

IHSL to develop technical schedules of the Final Tender NPD Project Agreement, including room data sheets. Section 4.5 states that: "IHSL shall further develop their Design included within their Final Tender to the level set out in the Invitation to Submit Final Tender (as a minimum)."

The period to Financial Close – waiver of the requirement that IHSL produce room data sheets before completion of the contract

6.92. Following the appointment of IHSL as preferred bidder on 5 March 2014, Multiplex began the work of preparing room data sheets (RDS), through HLM Architects, its architectural designer. According to Liane Edwards-Scott (Design Manager, Multiplex), that work included convening user group meetings "to get each room developed in detail". Clinicians attended these meetings, but not engineers. The environmental parameters which were included in the RDS were taken from the EM. In that process some discrepancies in the EM came to light and were corrected, but Ms Edwards told the Inquiry that "review" would not be the right word to use to describe what HLM were doing. Rather HLM were: "…extracting the data from the Environmental Matrix into the room data sheets. As they do that, they were finding some discrepancies, which were really about consistency, and they were highlighting through me so that I was aware, but they were highlighting them to the MEP team just to question them."[459] She confirmed that "HLM were not reviewing the document for compliance. They don't have a remit or the ability to interrogate for compliance."[460]

6.93. Some RDS were completed. They included sheets for multi- and single-bedded areas in critical care.[461] The values included in the relevant RDS were those stated in the body of the EM containing room-specific information and, having regard to Ms Edwards's evidence, it can be assumed that they were copied from it.

6.94. By August 2014 NHSL had accepted that IHSL would not produce a full set of room data sheets prior to Financial Close as had initially been required.[462] NHSL have stated that they did not, in reality, have a choice but to depart from this requirement. Iain Graham noted that Multiplex strongly resisted completing 100% RDS as it would require too much time and cost prior to Financial Close.[463] Ms Goldsmith said that design meetings were tense and Multiplex got to a point where they refused to progress the design further without a formal contract.[464] This is supported by documentary evidence from the period.[465]

459 Transcript - Liane Edwards - 02.05.2023 - column 29 to 30.
460 Transcript - Liane Edwards - 02.05.2023 - column 32.
461 A32505840 - Schedule Part 6, Section 6 (Room Data Sheets) - HC2023.B5 - pages 1024, 1039, 1460.
462 A32676824 - Special Project Steering Board Action Notes 22 August 2014 - HC2023.B8 - page 12.
463 Witness Statement - Iain Graham - 25.04.2023 - paragraph 45 to 46.
464 Witness Statement - Susan Goldsmith - 09.05.2023 - paragraph 45.
465 A32676824 - Special Project Steering Board Action Notes 22 August 2014 - HC2023.B8 - page 11; A32676832 - Steering Board Commercial Sub-Group Minutes 31 October 2014 - HC2023.B8 - page 15.

6.95. Mr Cantlay (MML) said that it is not unusual for there to be tension between preferred bidder and procuring authority over the level of design development during this period, which is done at the bidders own cost and with the risk that the bidders do not get the contract.[466]

6.96. Consequential on NHSL waiving the requirement that IHSL produce a full set of room data sheets prior to Financial Close, it was agreed that design development be continued and completed after execution of the contract using the process for submission and approval of "Reviewable Design Data" in accordance with the provisions of section 5 (Reviewable Design Data) and schedule part 6 (Construction Matters) of the Project Agreement. The Reviewable Design Data (RDD) process under the Project Agreement and how it was operated during the construction phase of the project, is discussed later in this chapter.

6.97. Using the RDD procedure to continue design development, including for room data sheets, was considered a pragmatic way forward.[467] Ms Goldsmith explained that NHSL was comfortable with waiving the requirement for a full set of RDS because contractual responsibility for producing them would lie with IHSL after Financial Close.[468] Richard Cantlay (MML), whose role at this stage in the project was that of Lead NPD Procurement Adviser, noted that the bidder had put forward a fixed price, so the risk to the Board would be the same whether design issues were finalised pre or post Financial Close.[469]

The period to Financial Close – development of the environmental matrix

6.98. TÜV SÜD / Wallace Whittle[470] (TSWW) continued the development of mechanical and electrical engineering proposals, including the ventilation design. After IHSL was selected as Preferred Bidder there followed what Mr McKechnie, a senior engineer employed by TSWW, described as a "debate on the ownership" of the environmental matrix. By that he meant that NHSL was looking for IHSL to accept as an IHSL document the environmental matrix in the iteration which had been included in the ITPD, and which IHSL had confirmed they accepted. Mr McKechnie reluctantly agreed.[471] Accordingly, on 3 July 2014, Mr Ken Hall (Mechanical and Electrical Manager, Multiplex) asked for a version in Excel format to allow Mr McKechnie to populate it with any changes that might be required. MML acceded to the request on 11 July 2014. Thereafter the Reference Design EM was "re-badged" as an IHSL document. According to Mr Hall, the information contained within the Reference Design EM was taken as the client's brief, and was "reproduced" by TSWW.[472]

466 Transcript - Richard Cantlay - 09.05.2023 - column 76.
467 Witness Statement - Susan Goldsmith - 09.05.2023 - paragraph 41 to 45; Transcript - Janice MacKenzie - 26.04.2023 - column 34; Transcript - Richard Cantlay - 09.05.2023 - column 78.
468 Transcript - Susan Goldsmith - 09.05.2023 - column 59.
469 Transcript - Richard Cantlay - 09.05.2023 - column 78.
470 Wallace Whittle were acquired by TÜV SÜD.
471 Transcript - Stewart McKechnie - 04.05.2023 - column 79.
472 Witness Statement - Ken Hall - 28.04.2023 - paragraph 11.

6.99. TSWW undertook a review of the environmental matrix, but did not check every single parameter for compliance with guidance. Mr McKechnie said that this "would have taken months of work". It would have required further engagement with the Board and clinicians and "would almost be the circumstance where you were reinventing the Environmental Matrix."[473] From about July 2014, TSWW made some changes to the environmental matrix.[474] These were, for the most part, in response to comments made about it by, or on behalf of, NHSL. According to Mr McKechnie, it continued to be his understanding that NHSL retained responsibility for those parameters which had originally been included in the Reference Design EM and remained unchanged.[475]

6.100. During this period NHSL's project team identified an issue with TSWW's bedroom ventilation parameters contained in the environmental matrix.[476] They noted that bedroom air changes per hour were stated to be four on the EM, when SHTM 03-01 stated six air changes per hour. The EM also stated that bedrooms were to have positive pressure, while SHTM 03-01 stated balanced or negative pressure. [477]

6.101. It was Mr McKechnie's understanding that the comment concerned all single-bed rooms in the hospital (including in critical care) because in the context of these discussions about bedroom ventilation, no distinction was drawn between departments.[478]

6.102. In response to comments from NHSL, TSWW produced a further iteration of the environmental matrix on 31 October 2014.[479] This included a new guidance note, numbered 26, to explain that the design philosophy in single bedrooms was "mixed-mode". That is, it included the provision of natural ventilation as well as mechanical ventilation, which would allow the mechanical ventilation load to be reduced to two thirds (i.e., 4 ac/h instead of the recommended 6 ac/h). In the room function reference sheet attached to the environmental matrix, the pressure parameter for "Bedroom" was changed from "Positive" to "Balanced". The air change rate remained unchanged at 4 ac/h.

6.103. TSWW considered NHSL's comments regarding bedroom ventilation to apply to single bedrooms, and not to multi-bed rooms. The parameters for "multi-bed wards" were left unchanged, as "positive" at 4 ac/h.

473 Transcript - Stewart McKechnie - 04.05.2023 - column 77.
474 Transcript - Stewart McKechnie - 04.05.2023 - column 101 onwards.
475 Transcript - Stewart McKechnie - 04.05.2023 - column 109.
476 A35616759 - IHSL Comments on the Environmental Matrix October 2014 - HC2023.B4 - page 218.
477 A39975805 - Environmental Matrix Comments 13 October 2014 - HC2023.B4 - page 276.
478 Transcript - Stewart McKechnie - 04.05.2023 - column 122 onwards.
479 A35616783 - Environmental Matrix 31 October 2014 - HC2023.B4 - page 220.

6.104. TSWW removed the room function of "HDU" from the room function reference sheet. This change was not highlighted to the Board. Mr McKechnie explained to the Inquiry that he understood HDU to refer to the isolation rooms within the critical care department.[480] He explained,

> "To the best of my knowledge, there was no rooms designated as HDU within the Environmental Matrix. There's a line to the left-hand side of the matrix which states the area of the hospital it's looking at, which are PICU and HDU's – apostrophe, "S" – and then further in it lists each and every individual room. There's not a room called the HDU to the best of my knowledge, but there's certainly rooms called isolation rooms."[481]

6.105. TSWW removed the room function HDU because, according to Mr McKechnie, it did not appear to be a repeatable room and, he implied, it "could be tidied up".[482] The guidance note referring to an air change rate of 10 ac/h for HDU was retained.[483] Counsel to the Inquiry asked Mr McKechnie whether it would not strike him as "odd" if the room function of HDU was not to be used since the Board had gone to the extent of including a guidance note that specifically referred to HDU. Mr McKechnie told the Inquiry:

> "Not particularly because, with the hindsight of looking at that note, I think the note is not very clear as to what they are covering with on what they term HDUs…is it the whole of the critical care area? Which doesn't really stack up… we were trying to bring clarity to the situation here.[484]

6.106. Mr McKechnie acknowledged that there was some ambiguity attached to the guidance note but said that "At the time, we adopted it because we didn't want to… rock the boat too much, because it didn't really have that much of an impact on what we were designing."

6.107. NHSL and MML did not take note that the room function "HDU" had been removed. They continued however to raise concerns about TSWW's bedroom ventilation design, specifically, they questioned how balanced or negative pressure would be achieved. MML were concerned that with the current design the room would remain "at a slight positive pressure relative to the corridor which would allow infection such as MRSA or Norovirus to spread".[485] They noted that TSWW had said that the room would become balanced upon opening trickle vents and windows.

480 Transcript - Stewart McKechnie - 04.05.2023 - columns 95 to 97.
481 Transcript - Stewart McKechnie - 04.05.2023 - column 98.
482 Transcript - Stewart McKechnie - 04.05.2023 - column 140.
483 A35616783 - Environmental Matrix 31 October 2014 - HC2023.B4 - page 221 (guidance note 15).
484 Transcript - Stewart McKechnie - 04.05.2023 - columns 141 to 142.
485 A35614364 - Single Bedroom Ventilation - HC2023.B8 - page 71.

6.108. On 19 November 2014, a meeting was held to undertake a Development Stage 2 HAI-SCRIBE. HAI-SCRIBE stands for Healthcare Associated Infection System for Controlling Risk in the Built Environment. It is discussed further in chapters 7 and 8, but for present purposes can be described as a risk management tool applicable at different stages of healthcare building projects, with "Stage 2" conducted at the design stage.

6.109. It was noted in the HAI-SCRIBE report that:

> "Some concern has been raised in relation to a potential issue with ventilation with regard to negative/balance pressure in single bed rooms.
>
> Awaiting drawings and further information to fully understand if there is a risk/ issue."[486]

6.110. In response to this, TSWW produced a draft report on air movement to single bedrooms dated 27 November 2014. A second draft was produced on 12 January 2015. [487] The report reiterated that a mixed-mode ventilation strategy would be used for the bedrooms, which involves the use of windows and trickle vents, and a reduction of supply of air from 6 ac/h to 4 ac/h. The report states that this strategy provides "the most energy efficient solution for the space" and notes that this strategy was believed to comply "with the reference design concept as detailed within the original Environmental Matrix."

6.111. A further HAI-SCRIBE workshop was scheduled for 13 January 2015, but this did not go ahead "as key individuals were not present". [488] The bedroom ventilation issue was nevertheless discussed and NHSL requested further information from Multiplex in order that the HAI-SCRIBE could be signed off prior to construction as required.

6.112. On the same day, NHSL's HAI-SCRIBE Infection Prevention and Control Nurse (IPCN), sent an email to a consultant within HFS' Engineering and Environment department with a query around pressure in single bedrooms "other than the isolation rooms".[489] The consultant responded the next day, writing with respect to the use of openable windows:

> "…I am surprised at reference to the use of openable windows. This could lead to ingress of unfiltered air or egress of infectious air that could find its way to a nearby openable window (whether or not in an isolation room) or to a nearby air intake. In short, have sealed windows as this will enable ait [sic] flow patterns to be controlled." [490]

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486 A42416940, HAI-SCRIBE 19 November 2014 - HC2023.B12.V2 - page 1878. The draft document states this is a risk assessment in accordance with "HAI-SCRIBE June 2007: Development Stage 3, Construction" however the question set is that for HAI-SCRIBE Stage 2.

487 A34225453 - Wallace Whittle Air Movement Report for Single Bedrooms 12 January 2015 - HC2023.B8 - page 66.

488 A34813021 - Request for Information Summary, 20 January 2015 - HC2023.B10.V2 - page 15.

489 A35614504 - Email chain 14 January 2015 - HC2023.B8 - page 60.

490 A35614504 - Email chain 14 January 2015 - HC2023.B8 - page 59.

6.113. On 19 January 2015, Multiplex provided NHSL with “the sketches distributed at the meeting” and sought “confirmation/acceptance from the NHS review with infection control."[491] On 29 January 2015 Multiplex received a response from NHSL’s project team which stated:

> “Following your recent RFI [request for information], the Board respond as follows:
>
> - The single room with en-suite ventilation design shall comply with the parameters set out in SHTM 03-01.
> - The design solution should not rely in any way with [sic] the opening windows as these will be opened or closed by patient choice.
> - The critical factor from SHTM 03-01 for infection control will be the resultant pressure within the room being balanced with or negative to the corridor.
> - Isolation room ventilation shall comply with SHPN 04 Supplement 1.”[492]

6.114. The issue with single bedroom ventilation was one of a number of discrepancies and issues raised with respect to the EM which were not fully resolved prior to Financial Close.

6.115. IHSL had previously submitted a request to derogate from the requirement in the BCRs to comply with the EM. Project Co’s proposal stated:

> “Anomalies within the environmental matrix have been reviewed and proposals incorporated within the room data sheets (refer to schedule for proposed variations). This shall be further developed in conjunction with the board on the basis of the schedule of comments contained in Section 5 (RDD) Part IV.” [493]

6.116. NHSL approved this derogation request on 14 November 2014. The schedule of comments referred to above included a list of bullet points, amongst which was: “Detailed proposal awaited on bedroom ventilation to achieve balanced/negative pressure relative to corridor.” [494]

6.117. The errors in relation to critical care rooms were not detected by NHSL or its technical advisers before the Project Agreement was signed on 12 and 13 January 2015, bringing Financial Close.

491 A40107199 - Email 19 January 2015 - HC2023.B8 - page 78.
492 A34225421 - Email 29 January 2015 - HC2023.B8 - page 56.
493 A33653831 - Derogation Register 16 January 2015 - HC2023.B10.V1 - page 316.
494 A39975851 - Email 11 November 2014 - HC2023.B4 - page 245; A32435789 - Schedule Part 6 to the Project Agreement, Section 5: Reviewable Design Data - HC2023.B5 - page 880.

Date	Timeline of the procurement process 2012 to 2015
5 December 2012	NHSL published a contract notice in the Official Journal of the EU giving notice of its intention to seek offers in relation to a public contract process. It informed interested parties of the procedure that would be adopted, the value of the contract to be awarded and the procedures that would be adopted for the award of the contract. It stated that variant bids would not be accepted. The estimated value of the contract opportunity (excluding VAT) was stated as being between £140,000,000 and £165,000,000. NHSL also specified its needs, as required by regulation 18(5), and initiated its evaluation of economic operators, by issuing an Information Memorandum and a Pre-qualification questionnaire.
13 December 2012	NHSL held a Bidders Day to engage with prospective tenderers, provide information and clarification with respect to the project, its requirements and the procurement process.
21 January 2013 – 8 March 2013	Three candidates – (A) B3, (B) Integrated Health Solutions, Lothian (IHSL), and (C) Mosaic submitted a response to the Pre-qualification Questionnaire. The building contractor which IHSL intended to engage was Brookfield Multiplex Construction Europe Limited (Multiplex). A contracting authority had to ensure that the number of economic operators invited to participate in the dialogue was sufficient to ensure genuine competition (Regulation 18(13)). Having carried out its evaluation of prospective tenderers, on 22 February 2013 the Project Steering Board approved the recommendation to invite all three candidates to participate in dialogue.
12 March 2013	The 'Invitation to Participate in Dialogue' (ITPD) was issued to each of the three candidates and the competitive dialogue process began.
13 December 2013	NHSL concluded the competitive dialogue process.
16 December 2013	NHSL invited the submission of final tenders by issuing a letter to bidders along with a document entitled 'Invitation to Submit Final Tenders' (ISFT) volumes 1 to 3.
13 January 2014	Final tenders were submitted by each of the three bidders.
5 March 2014	NHSL identified IHSL as 'Preferred Bidder'. IHSL, through its contractor, Multiplex and Multiplex's sub-contractor, TÜV SÜD Wallace Whittle (TSWW), continued to develop the design of the ventilation system.

Date	Timeline of the procurement process 2012 to 2015
13 February 2015	The Project Agreement was formally concluded between NHSL and IHSL. IHSL entered into a construction contract with Multiplex. Multiplex entered into a sub-contract with TSWW to design the ventilation system. This marked 'Financial Close', which is the point at the end of the procurement phase for a privately financed project where the contract has been signed, any conditions precedent for financing are met and financing is in place so that Project Company can commence construction.
25 March 2015	NHSL published a notice confirming the contract award in favour of IHSL. The value of the contract was £150,014,000.

Key characteristics of the Project Agreement

6.118. The Project Agreement followed the NPD Standard Form Project Agreement and, therefore, was consistent with the NPD approach. The Project Company (IHSL) secured loans from the senior and junior lenders and entered into contracts with the construction contractor (Brookfield Multiplex or "Multiplex") and service provider (Bouygues) to enable it to discharge its obligations under the Project Agreement. Underlying this basic structure was a complex matrix of documentation including parent company guarantees, collateral warranties, performance bonds, an agreement between Multiplex and Bouygues to regulate arrangements between them and multiple sub-contracts and consultancy agreements, each of which was supported by collateral warranties. Similarly, the finance arrangements are set out in complex and lengthy documentation. None of this is unique to the RHCYP and DCN project. The contractual and funding arrangements were consistent with what would be expected in an NPD project.

6.119. It will be helpful at this point to touch on two key characteristics of NPD (and indeed other privately financed) projects that are reflected in the Project Agreement: transfer of design and construction risk; and transfer of availability risk.

6.120. The transfer of design and construction risk has been an important principle in private finance of public infrastructure projects for some time. The HM Treasury publication of 2007, Standardisation of PFI Contracts Version 4, (SoPC4) describes the concept as follows:

> "The design, construction, integration, installation, testing, commissioning, operation, maintenance and ultimate performance of any asset procured or developed for the purposes of meeting the requirements of the output specification are all the Contractor's responsibility and the Authority should not (save in exceptional circumstances) take any responsibility for this risk. Correspondingly, the Contractor should be afforded the freedom to manage its activities without interference from the Authority. It is the Contractor's risk whether the design and development it has carried out and the operational

> procedures it has put in place are capable of satisfying the Authority's service requirements. The Authority should not, save in exceptional circumstances … agree to any role before or following Service Commencement which involves the Authority taking back any part of the Contractor's risk."[495]

6.121. The SFPA followed the SoPC4 model in this respect and the design and construction risk was passed to IHSL.

6.122. Clause 12.1 of the Project Agreement required IHSL to carry out the Works to procure satisfaction of the Board's Construction Requirements, in accordance with Project Co's Proposals and in accordance with the other terms of the Project Agreement. The Works were defined in the contract as "the design…, construction, testing, commissioning and completion of the [hospital]…in accordance with this Agreement".[496] While responsibility for delivery of the Works lay with IHSL, responsibility for identifying the Board's Construction Requirements lay with NHSL.

6.123. Availability risk is the risk that the hospital, or parts of it, are not available for use for its designed purpose by NHSL during the lifetime of the Project Agreement. The rationale for this is again set out in SoPC4:

> "The substance of a PFI deal should be the procurement of a Service. The payment mechanism is therefore often structured around the availability or unavailability of the Service, with unavailability resulting in a reduced payment by the Authority or, in certain circumstances, no payment. … Among the most obvious examples of projects in which payment depends on availability are those that involve the provision of a building-based Service (such as a hospital, school, prison or office accommodation)."[497]

6.124. This approach takes effect from an early stage. IHSL would not receive any payment under the Project Agreement until the date on which the Certificate of Practical Completion was issued. That Certificate would only be issued when the Independent Tester was satisfied that the Works were complete in accordance with the criteria set out in the Project Agreement.[498] Accordingly, if the completion of the Works was delayed, in terms of the Project Agreement, IHSL bore the risk that they would not be paid until a later than anticipated date, which may have had implications for them under the financing agreements. The relevant payment provisions are discussed in detail in the Inquiry's Provisional Position Paper 10.[499] They are long and intricate.

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495 Standardisation of PFI Contracts, Version 4, February 2007 paragraph 3.2.1. A copy of SoPC4 can be found here: Standardised contracts - HM Treasury.

496 A33405351 - PA Schedule Part 1 Definitions and Interpretation - HC2023.B5 - page 188.

497 Standardisation of PFI Contracts, Version 4, February 2007 paragraph 8.1.1 - 8.1.2. A copy of SoPC4 can be found here: Standardised contracts - HM Treasury.

498 PA clause 34.1 and 17.12 read with appropriate definitions: A33405351 - Project Agreement - HC2023.B5 - page 77 and 35. See further discussion in chapter 7 of this Interim Report.

499 Provisional Position Paper 10 - The Contractual and Funding Structure Relating To The Royal Hospital for Children and Young Persons/ Department of Clinical Neurosciences Project.

Development of the ventilation design post Financial Close - the Reviewable Design Data process

6.125. With the conclusion of the Project Agreement and Financial Close on 13 February 2015, IHSL, as Project Co, undertook the obligation, set out in clause 12.1 of the Project Agreement to carry out the works:

> "12.1.1 so as to procure satisfaction of the Board's Construction Requirements;
>
> 12.1.2 in accordance with Project Co's Proposals; and
>
> 12.1.3 in accordance with the terms of this Agreement"

6.126. The Board's Construction Requirements took precedence over Project Co's Proposals. Under clause 12.7 of the Project Agreement, Project Co was obliged at its own expense to amend Project Co's Proposals, and rectify the works, if these proposals did not fulfil the Board's Construction Requirements.

6.127. However, notwithstanding conclusion of the contract, aspects of the design of the works, including the ventilation system, had not been finalised. Progress in that direction was represented by an incomplete set of Room Data Sheets and the EM, which had not been approved.

6.128. Clause 12.6 of the Project Agreement recognised that Project Co might require to develop and finalise the design and specification of the works. It therefore made provision for the review and approval by the Board of "Reviewable Design Data" (RDD). RDD was defined as "the Design Data listed at section 5 (RDD) of schedule part 6 (Construction Matters). The procedure for review of RDD was as provided by clause 12.6 and schedule part 8 (Review Procedure).

6.129. The RDD procedure was an iterative process whereby design proposals were submitted by Project Co to the Board for its approval. NHSL was required, within a contractual timescale, to respond by allocating one of four levels endorsement:

- "Level A – no comment" – An endorsed document with no further comment or amendment.
- "Level B – proceed subject to amendment as noted" – Project Co to make amendments as noted and to proceed to next level of design or to implement the works without re-submitting documents.
- "Level C – subject to amendment as noted" – do not act upon the Submitted Item, amend the Submitted Item in accordance with the Board's Representative's comments and re-submit the same to the Board's Representative within 10 business days.
- "Level D – rejected" – do not act upon the Submitted Item, amend the Submitted Item to the Board's Representative within 10 business days.

6.130. In terms of schedule part 8 of the Project Agreement, Project Co was not to commence or permit the commencement of construction of the part of the facilities to which the Reviewable Design Data related until that Reviewable Design Data had been submitted to the Board of NHSL and either:

- It had been approved; or
- Project Co disputed that the comments/objections made by the Board in relation to that Reviewable Design Data were on grounds permitted by the Project Agreement, in which case Project Co could proceed with further design or construction at its own risk pending the outcome of any reference to the Dispute Resolution procedure.

6.131. The EM and the available RDS were included in section 5 of schedule part 6. They thereby became RDD and subject to the RDD process outlined above.

6.132. There was a complication. The EM is included in part 4 of section 5 of schedule part 6. That part is headed "Non-Approved Project Co's Proposals Design Data comments".[500] It provides that IHSL was to submit, and the Board was to review, "the following Board comments in respect of relevant Project Co's Proposals (which shall be deemed to be Reviewable Design Data) … with such Project Co submission addressing the following Board comments in relation to such Reviewable Design Data". A table then follows in which comments by the Board are listed beside references to specified sections in Project Co's Proposals. The table includes an entry for the environmental matrix.[501] The associated comment provides that "Project Co shall update the Environmental Matrix to reflect the following board comments…". The listed comments, in seven bullet points, are those agreed at a meeting to discuss the environmental matrix during the preferred bidder phase, on 11 November 2014.[502] The intention appears to have been that IHSL would update the EM to address these comments, then submit the EM for review under the RDD procedure. The question arises as to whether the EM was reviewable design data in its entirety, or only in relation to the comments made in the seven points.

The review team

6.133. MML continued in its role as technical adviser to NHSL following Financial Close in terms of Contract Control Order (CCO) dated 26 February 2015.[503] The CCO refers to the benefits of "continuity of service from pre- to post FC services". It also refers to the MML team being "the continual presence we believe is required to support NHSL". The core MML team was to be "substantially co-located" with the NHSL Project Team in order to "continue to be part of an integrated delivery team with NHSL".

500 A32435789 - Schedule Part 6 to the Project Agreement, Section 5: Reviewable Design Data - HC2023.B5 - page 869.
501 A32435789 - Schedule Part 6 to the Project Agreement, Section 5: Reviewable Design Data - HC2023.B5 - page 880.
502 A39975851 - Email 11 November 2014 - HC2023.B4 - page 245.
503 A34607079 - Contract Control Order -HC2024.B13.V14 - page 47.

6.134. Appendix A to the CCO sets out a scope of the activities to be undertaken by the core team and the support team. These services include wide ranging support and advisory functions and, potentially, "Design Reviews" comprising (i) reviews of RDD items, (ii) technical reviews, and (iii) *ad hoc* design support. The services to be provided under the CCO also include, "Assistance with assessment and negotiation of any claims from SPV". It was emphasised to the Inquiry that MML were not appointed to be a shadow design team or to provide design assurance.

6.135. A "Construction Phase Project Execution Plan" produced by Mott MacDonald in June 2015 provided the structure of the team and their roles during the construction phase of the RHCYP and DCN. The RDD review procedure was managed as two separate processes, one involving Project Team Advisor Groups and the other, Clinical User Groups involving service leads.

6.136. Clinical User Groups were involved in the "Production Group review procedure", the purpose of which was to help finalise the design in relation to "operational functionality", to ensure the clinical needs and interests of the project were fully incorporated.[504] This review did not involve consideration of room environmental conditions such as ventilation.

6.137. The RDD Project Team Advisor Group included members from both the NHSL Project Team and technical advisers from Mott MacDonald:

- Board Representative (Brian Currie, NHSL)
- Lead Technical Adviser (Graeme Greer, Mott MacDonald)
- Infection Control
- Mechanical and Electrical (including Colin Macrae)
- Facilities Management (including Jacqueline Sansbury, NHSL)
- Clinical Management (including Janice Mackenzie NHSL, David Stillie from MML)

6.138. The Project Team Advisor Group was to "review the RDD Submitted Items to ensure the proposed design complies with Board Construction Requirements, Project Co Proposals and/or Reviewable Design Data and operational functionality".[505]

504 A33146594 - RHSC + DCN Construction Phase Project Execution Plan - pages 32 to 33.
505 A33146594 - RHSC + DCN Construction Phase Project Execution Plan - page 34.

Review of the environmental matrix by TÜV SÜD Wallace Whittle

6.139. Multiplex appointed TSWW as Mechanical and Electrical Engineer for the Project.[506] In terms of this appointment, paragraph 2.12.7 required TSWW to "carry out the Services in accordance with" the BCRs. Paragraph 2.12.16 required TSWW to:

> "… diligently and regularly review the various documents which are relevant to the performance of the Services… to ascertain whether any ambiguities, discrepancies, inconsistencies, divergences, design or construction impracticalities or omissions exist from, within or between any such documents so as to identify conflicts in the design".

6.140. As has previously been noted, in the case of rooms in critical care, the EM at Financial Close contained an inherent ambiguity. The room-specific entries for multi-bed and single rooms in critical care specified an air change rate of 4 per hour.[507] The EM also, however, included a guidance note (number 15) which read: "Critical care areas – Design Criteria – SHTM 03-01 – Appendix 1 for air change rates – 10 ac/hr Supply …". It was within TSWW's role to detect such a discrepancy.

6.141. Mr McKechnie confirmed that his team checked the parameters in the EM for compliance with guidance and that this involved a line-by-line check of the EM.[508] In the course of doing so they identified the discrepancy with respect to critical care rooms. In a revised version of the EM dated 26 November 2015, TSWW amended guidance note 15 by adding the words "for isolation cubicles".[509] It left the room-specific entries at 4 ac/h. The effect of this was to restrict the requirement for 10 ac/h to isolation cubicles only, as opposed to the whole of the critical care areas. According to Mr McKechnie, the change reflected his understanding of the guidance, that is, that the recommended parameters for critical care areas in Appendix 1 of SHTM 03-01, including the recommended 10 ac/h, applied only to isolation rooms.[510]

6.142. Mr McKechnie did not flag this change to NHSL or MML. Unlike other changes to the EM made by TSWW at the same time, this change was not highlighted in red text. According to Mr McKechnie, he did not consider this to be a change to the actual requirements; he was simply tidying up the guidance notes to ensure that the wording matched what he saw as the proper construction of the guidance set out in SHTM 03-01.[511]

506 A41744089 - TÜV SÜD Appointment 13 February 2015 - HC2024.B1 - page 1381.
507 A32623049 - Project Agreement Schedule Part 6, Section 6, Appendix 2 - Environmental Matrix -HC2023.B5 - page 1454 onwards.
508 Transcript - Stewart McKechnie - 29.02.2024 - column 22 and 85.
509 A46365871 - Environmental Matrix - HC2024.B13.V2 - page 101.
510 Transcript - Stewart McKechnie - 29.02.2024 - column 30.
511 Transcript - Stewart McKechnie - 29.02.2024 - columns 37 to 38.

6.143. It is not easy fully to understand Mr McKechnie's actions in amending guidance note 15. Making a unilateral change is difficult to reconcile with TSWW's position that the EM was a fixed client brief. Mr Maddocks gave evidence indicating that a client brief should not be changed without the approval of the client.

6.144. Even if allowance is made for Mr McKechnie's view that this was not a change, merely a "tidying up", there was no good reason for TSWW to have treated this amendment of the text differently from others that had been made. Failing to highlight the change was contrary to good industry practice and agreed protocol.[512] MML pointed out to the Inquiry that there were a number of other changes highlighted in red which could be seen to be "tidying", such as the insertion of the word "the" in guidance note 21.[513]

6.145. TSWW's failure to highlight this change or otherwise flag the discrepancy with NHSL and MML had the effect (even if this was not the intention) of disguising the error contained within the matrix. NHSL was not given the opportunity to consider whether the discrepancy in the EM lay with the wording of the guidance note (as TSWW understood it) or the body of the matrix. This is despite a protocol or procedure being in place for highlighting changes.

Single bedroom ventilation and the mixed mode ventilation strategy

6.146. As described earlier in this chapter, prior to Financial Close, MML, NHSL and the IPCT had raised concerns about TSWW's bedroom ventilation strategy in respect of the air change rate (which was lower than that recommended in SHTM 03-01) and the pressure regime. As a result, one of the comments from the Board included in the RDD schedule was to require Project Co to provide a proposal on how bedroom ventilation would achieve balanced or negative pressure relative to the corridor.[514]

6.147. TSWW's ventilation strategy to achieve room balance relied on air being extracted via ensuites at a higher rate than recommended in SHTM 03-01. The extract of air via the ensuite became an issue of concern for NHSL from 2015 because of some of the implications for "heat recovery" (an energy-efficient way to heat buildings by recycling warm air extracted from rooms) which would impact on running costs. This and the lower air change rate for bedrooms, was set out in a "compromises schedule" tabled at the Programme Board meeting of 24 July 2017.[515] The "technical solution" set out in the compromises schedule was that "Single bedrooms have reduced air supply rates to maintain correct pressure regime". The higher extract from ensuites was accepted. In other words, it was considered that to achieve the desired pressure regime under TSWW's design strategy, it was necessary to have a reduced air supply rate at 4 ac/hr.

512 Transcript - Ken Hall - 28.02.2024 - column 118; Witness Statement - Ronnie Henderson - 26.02.2024 - paragraph 34; Transcript - Stewart McKechnie - 29.02.2024 - column 37.
513 Closing Submission by Mott MacDonald to the Inquiry - paragraphs 64.6 and 167. See for example A46365871 - Environmental Matrix - B13.V2 - page 101.
514 A39975851 - Email 11 November 2014 - HC2023.B4 - page 245; A32435789 - Schedule Part 6 to the Project Agreement, Section 5: Reviewable Design Data - HC2023.B5 - page 880.
515 A33329538, Programme Board Papers 24 July 2017 - HC2024.B13.V8 - page 2315.

6.148. The compromises schedule noted that those consulted included Ronnie Henderson (Commissioning Manager), Janice Mackenzie (Clinical Director), the HAI-SCRIBE IPCN, a consultant microbiologist, the project manager, the service lead for redesign and commissioning (Children's Services) and the haematology oncology clinical team.

6.149. IHSL was required to submit a request to derogate from SHTM 03-01 so that they could provide 4 ac/h for single bedrooms instead of 6 ac/h, and a minimum of 10 ac/h extract for WCs, instead of the recommended 3 ac/h. While the derogation related only to single bedrooms, it is also relevant for multi-bed rooms, which ultimately were provided with the same ventilation strategy following a dispute which is discussed later in this chapter.

6.150. No formal risk assessment was carried out in relation to the decrease in air change rate in single bedrooms.[516] Lindsay Guthrie (Infection Control Nurse) and Dr Donald Inverarity (Infection Control Doctor) were not consulted although as noted the HAI-SCRIBE IPCN and a consultant microbiologist were consulted. It is not clear whether a formal risk assessment or involvement of other IPCT staff would have made any difference to the resolution for single bedrooms, given that there was an understanding that natural ventilation could add to the overall air change rate. Dr Inverarity explained that:

> "in relation to single rooms and multi-occupancy rooms in general ward areas (i.e. not in critical care), if the project team presented to IPCT that these areas were receiving 4 ac/hr mechanical plus 2 ac/hr natural ventilation they would be considered compliant with SHTM 03-01 as it would be 6 ac/h by mixed mode ventilation in a general ward area and therefore wouldn't need any risk assessment."[517]

6.151. The agreed resolution in relation to single bedroom ventilation was set out in Project Co Change 051 dated 12 December 2018. It confirmed the provision of 4 ac/h for single bedrooms and a minimum of 10 ac/h for ensuites and stated that the solution was "based on mixed mode operation where mechanical supply ventilation providing 4ACH is then supplemented by openable windows to provide a passive means of ventilation (where access to an openable window is available)".[518]

6.152. There is disagreement between the parties as to whether or not the derogation applied to rooms in critical care. This is a matter of contractual interpretation, which it is not for the Inquiry to resolve.

6.153. Darren Pike (Project Manager, Multiplex) was unable to identify anything apart from the wording of the derogation itself to confirm it was intended to apply to rooms in critical care.[519] The fact that the purpose of the derogation was to confirm the basis on which 4 ac/h had been selected for the single rooms, may be seen as an indication that it was intended to apply to all single rooms for which 4 ac/h had been

516 A45497403 - NHSL response to PPP8 - HC2024.B12.V1 - page 86.
517 Witness statement - Donald Inverarity - 05.03.2024 - paragraph 118.
518 A35004560 - Disputed Works Schedule Appendix 1 Item 12 - HC2024.B10 - page 69.
519 Transcript - Darren Pike - 28.02.2024 - column 46.

specified (whether in the critical care department or elsewhere). The Inquiry is not however aware of any evidence that NHSL consciously intended the derogation to apply to single rooms in the critical care department. No risk assessment was done on a derogation from 10 ac/h (as recommended in SHTM 03-01 for "Critical Care Areas") to 4 ac/h.

6.154. The rationale underlying TSWW's ventilation design for single bedrooms does not appear to have been directly translatable to, or appropriate for, single bed cubicles in the critical care department. TSWW's strategy for bedroom ventilation relied on openable windows. Openable windows were provided for bedrooms in critical care[520], but these were lockable and would produce the same seal as if they were not openable. It was not intended to use natural or mixed mode ventilation in the critical care department. The EM at Financial Close contained an error in this regard and stated that single bedrooms and multi-bedrooms in this department would have "natural and central supply" ventilation. However during the course of the RDD process and following comments from the Board, TSWW changed the "ventilation type" for most, but not all, of the single and multi-bed rooms in critical care to "central supply". That is, mechanical ventilation only. Similarly, the EM had been updated to provide bedrooms in the Child and Adult Mental Health Service (CAMHS) with 6 ac/h given that openable windows were not appropriate in this ward.[521] The EM was not similarly updated for bedrooms in the critical care department which also would not rely on openable windows for ventilation.

6.155. Similarly, TSWW's strategy for bedrooms relied on ensuites, but ensuites were not provided for the majority of single bedrooms and multi-bedrooms in critical care. The EM at Financial Close contained an error in this respect, which was flagged during the RDD process and corrected by TSWW.[522] This meant that the majority of bedrooms in critical care had a different design from bedrooms in other parts of the hospital, and were provided with extract from the bedroom in order to achieve room balance, rather than through the ensuite.

6.156. Despite the aforementioned differences between the ventilation strategy for critical care bed areas compared with standard single or multi-bed rooms, it would appear that no one from MML, NHSL, or TSWW considered the possibility that these rooms should not be treated in the same way as standard bedrooms with respect to the air change rate and pressure differential.[523]

Neutropenic Patient Ward

6.157. The Reference Design EM did not indicate that single bedrooms in the haematology and oncology ward should have specialised ventilation. Neither the guidance notes nor the "room function reference sheet" identified a specific requirement for "neutropenic patient area". However, in February 2017 a member of the NHSL project team identified that bedrooms in the haematology and

520 Multiplex response to Provisional Position Paper 8 Construction - HC2024.B12.V1 - page 123.
521 A34225493 - Environmental Matrix Revision 5 v11 - 11 Feb 2016.
522 For example A34225483 - Email with attachment 8 February 2016.
523 See for example Transcript - Darren Pike - 28.02.2024 - column 48 to 49.

oncology ward should have a different air change rate to what was contained in the EM, because it was a neutropenic patient ward.[524] This was discovered after considering the recommendations contained in Table A1 of SHTM 03-01.

6.158. TSWW and HLM (architects working for Multiplex) did not agree that the entire ward needed to cater for neutropenic patients and argued that this had not been made clear in NHSL's brief.[525]

6.159. NHSL did not undertake a written risk assessment, although the solution was risk assessed at a meeting in February 2017 where the project team, including IPC staff and clinicians, took the pragmatic decision to leave the specifications for single bedrooms in the haematology and oncology ward as outlined in the EM.[526] This took into consideration the cost and delay that would result from any changes to what was being provided; that what was being provided (single rooms with mechanical ventilation, and five dedicated isolation rooms) was already an improvement on what was available at Sciennes; and that any risks could be managed operationally. The solution was included in a "compromises schedule" tabled at a Programme Board meeting on 24 July 2017.[527] A derogation from SHTM 03-01 was agreed and referred to in the technical schedule to SA1, under item 4.

6.160. The discovery of this issue did not prompt any similar consideration of whether 4 ac/h was appropriate for critical care areas.

Four-bedded room ventilation dispute

6.161. The EM at Financial Close specified positive pressure for the multi-bed rooms throughout the hospital, including in critical care. This was different from the parameter for single bedrooms, which was for negative or balanced pressure.

6.162. Table A1 in SHTM 03-01 recommended ventilation parameters for different room types. It did not include an entry for multi-bed rooms, but did include entries for single rooms and general wards. For general wards, no recommendation was made for the pressure arrangement. For single rooms, the recommendation was for balanced or negative pressure. A debate arose between NHSL and IHSL about which entry applied to the multi-bed rooms.

6.163. NHSL's view was that the recommendation for single bedrooms applied to multi-bed rooms. NHSL wanted to be able to use the multi-bed rooms to treat children with similar infections in the same space (cohorting). They considered that this clinical use required the rooms to be at negative or balanced pressure compared to the adjoining space. It was believed that such a pressure arrangement would tend to keep pathogens within the multi-bed room, whereas a positive pressure arrangement (all other things being equal) might spread them beyond.[528]

524 A34225618 - Email 7 February 2017.
525 A49182112 - Email Chain 19 March 2018 - HC2024.B13.V14 - page 39.
526 A45497403 - NHSL response to PPP8 - HC2024.B12.V1 - page 85; Transcript - Ronnie Henderson - 26.02.2024 - column 131.
527 A33329538, Programme Board Papers 24 July 2017 - HC2024.B13.V8 - page 2315.
528 A45497403 - NHSL response to PPP8 - HC2024.B12.V1 - page 80 - paragraph 3.11.

6.164. In reaching this view, NHSL's project team sought further advice on what was required by guidance. On 20 January 2017 Mr Henderson asked the HAI-SCRIBE IPCN for advice on whether 4-bed bays should be treated the same as single bedrooms with balanced pressure or slightly negative to corridor, or whether the pressure regime does not matter. The IPCN responded, with respect to SHTM 03-01, that:

> "The 4 bedded rooms are considered to be the general ward. As you are aware each 4 bedded bay has an en-suite toilet – neg [ative] extract and an en-suite shower – neg [negative] extract. Should we get to the scenario that all sing[le] cubicles are full and we have 4 cohorted patients in a 4 bedded bay then yes we would want to ensure all infectious organisms are maintained in the room which yes shows that neg[ative] pressure in the 4 bedded area is of benefit."[529]

6.165. The IPCN referred Mr Henderson to MML or the Principal Engineer at HFS for further advice if needed. There is no indication that the IPCN was aware that the rooms in question included rooms in critical care, and there was no mention of the air change parameter.

6.166. NHSL also took advice from HFS in June 2017 regarding its "interpretation of the ventilation pressure requirements for four bed wards".[530] HFS responded:

> "it would not be unreasonable to treat this area as one would a single bed ward with respect to ventilation as the measures for infection control would be the same. Therefore the room should be neutral or slightly negative with respect to the corridor".[531]

6.167. HFS also referred to SHTM 03-01 Part A paragraph 1.37 "highlighting the need to seek guidance from Clinical colleagues". Paragraph 1.37 states that "In assessing the need for more specialised ventilation and the standards desired for patient care, managers will need to be guided by their medical colleagues and by information published by Health Facilities Scotland".[532]

6.168. In July 2017, Ms Mackenzie, the Clinical Director, led a risk assessment into the use of positive pressure in the multi-bed rooms (as the environmental matrix then proposed).[533] Ms Mackenzie consulted clinicians who expressed a preference for a balanced or negative pressure.

6.169. Also in July 2017, Mr Henderson sought advice from an estates department colleague at the QEUH on the pressure parameter for multi-bed rooms.[534]

529 A47086954 - Email 19 March 2018 - HC2024.B13.V7 - page 37.
530 A40072413 - HV Report 19 June 2016 - HC2024.B13.V8 - page 2340.
531 A40072413 - HV Report 19 June 2016 - HC2024.B13.V8 - page 2344.
532 A33662259 - SHTM 03-01 Part A v.2 2014 - HC2022.B1 - page 633.
533 A34443816 - Email 5 July 2017 with Record of General Risk Assessment - HC2024.B13.V8 - page 449.
534 A34443833 - Email chain 10 July 2017.

6.170. NHSL concluded, on the basis of advice from clinicians, IPC and HFS colleagues, that the multi-bed rooms should be considered to be analogous to single rooms and were therefore subject to a recommendation for balanced or negative pressure.

6.171. IHSL considered the multi-bed rooms to be akin to general wards, and therefore subject to no recommended pressure arrangement. They saw no obstacle in the guidance to the positive pressure which had been specified in the EM. This interpretation of SHTM 03-01 was outlined in a TSWW document titled "Accommodation Design Criteria – Single Rooms & Multi Bed Wards" dated 21 February 2017. [535]

6.172. The debate formed the basis for a sustained dispute about the contractual requirements. In simple terms, the dispute was to the following effect: NHSL considered IHSL to be obliged to deliver the balanced or negative pressure, regardless of any contrary requirement being set out in the environmental matrix, because of the requirement in the Project Agreement to comply with SHTM guidance and "good industry practice". IHSL considered that it was obliged to deliver the parameters specified in the EM even if they contradicted SHTM guidance. TSWW's view, furthermore, was that the parameters specified by the EM for the multi-bed rooms did not in any event conflict with SHTM guidance. IHSL was content to deliver the pressure arrangement which NHSL required, but the dispute bore upon who would carry the additional cost of doing so.

6.173. While the dispute was focused on the pressure regime rather than air change rates, it involved consideration of the ventilation requirements for the critical care department.

6.174. When Ms Mackenzie had undertaken the risk assessment into the use of positive pressure in multi-bed rooms, she was aware that some of the multi-bed rooms under consideration were in the critical care department, and her risk assessment took explicit account of that.[536] The risk assessment proceeded on the basis that the then current multi-bed room ventilation design, in providing for positive pressure, was not compliant with SHTM 03-01 recommendations. That statement was not correct for the multi-bed rooms in critical care if, as NHSL later came to consider, they were governed by the SHTM 03-01 recommendation for critical care areas. This is because SHTM 03-01 recommended a positive pressure regime for critical care areas.

535 A45500346 - Report, "Accommodation Design Criteria - Single Rooms & Multi Bed Wards" 21 February 2017 - HC2024.B13.V2 - page 678 to 679.

536 A34443816 - Email 5 July 2017 with Record of General Risk Assessment - HC2024.B13.V8 - page 449 and 455; Transcript - Janice MacKenzie - 26.02.2024 - column 220.

6.175. The risk assessment was circulated to, among others, Mr Currie, Mr Greer of MML in his capacity as project manager, and NHSL's commissioning manager, Mr Henderson. Mr Greer did not review the risk assessment. In the email circulating the risk assessment, Ms Mackenzie stated that at least one room was in critical care.[537] According to Ms Mackenzie, none of the recipients (or, indeed, anybody) told her that, as some of the rooms were in the critical care department, they were subject to the SHTM 03-01 recommendation of positive pressure at 10 Pa. Ms Mackenzie's recollection was that the statement in the risk assessment that the positive pressure regime for multi-bed rooms was "non-compliant with SHTM 03-01" was based on advice from a mechanical and electrical engineer employed by MML.[538]

6.176. Ms Mackenzie's evidence was that the assessment had been discussed with (and approved by) the HAI-SCRIBE IPCN. There is no communication available to the Inquiry indicating that anyone in the IPCT was shown the Risk Assessment, although NHSL pointed out that while the IPCN did not always give written advice, she was well-integrated into the Project Team, shared offices, and therefore may have given advice which was not formally recorded. There is no clear evidence however that the IPCN, in giving advice on multi-bed room ventilation, was aware that some of the relevant spaces were in critical care. The IPCN was not a signatory to the Risk Assessment and could not, by July 2019, remember being asked to advise on ventilation in the critical care department.[539] The risk assessment was not shared with Ms Guthrie or Dr Inverarity. It was not formally signed off by anyone in the IPCT.

6.177. The risk assessment was reviewed in January 2018.[540] The revised assessment proceeded on the same assumption that a positive pressure arrangement was not compliant with SHTM 03-01, including for multi-bed rooms in the critical care department. Again, the assessment did not consider the air change rates.

6.178. NHSL therefore developed its requirement for balanced or negative pressure in multi-bed rooms in critical care having erroneously failed to take account of the fact that SHTM 03-01 recommended positive pressure for such rooms.

6.179. While the focus of the risk assessment was on the pressure regime, a number of other documents explicitly showed that the air change rate to be provided for multi-bed rooms in critical care was 4 ac/h. For example, shortly after the risk assessment was undertaken, MML circulated to members of NHSL's project team a table with extracts from the EM showing positive pressure and supply at 4 air changes per hour for the multi-bed rooms in critical care.[541] The fact that the rooms were in the critical care department was apparent from the use of the department code, B1, and the reference to them being in "PICU and HDU" (paediatric intensive care unit and high dependency unit).There are other examples.[542]

537 A34443816 - Email 5 July 2017 - HC2024.B13.V8 - page 449.
538 Transcript - Janice MacKenzie - 26.02.2024 - column 227; Witness Statement - Janice MacKenzie - 26.02.2024 - paragraph 20.
539 A40986640 - Email 5 July 2019 - HC2024.B7,V1 - page 123.
540 A40981178 - Record of General Risk Assessment - HC2024.B6 - page 14.
541 A34443845 - 4 Bed Room Tracker - HC2024.B13.V5 - page 1243.
542 For example, A46365919 - Bedroom Ventilation Key Considerations - HC2024.B13.V2 - page 667.

6.180. However, the Inquiry heard evidence that neither Mr Henderson nor Mr Greer were aware of the meaning of the department codes.[543] This was despite it being common practice to identify a room's location using department codes. There was, for example, a page within the environmental matrix that stated that B1 was the code for critical care.[544] There were other signs that these rooms were in critical care. In contrast to the other multi-bed rooms, the ventilation strategy for critical care bedrooms was not reliant on the extract of air via the ensuite. TSWW's "Ventilation Amendment Proposal" went through a number of iterations which were circulated widely among the project teams, including to Mr Currie and Mr Henderson of NHSL, and Mr Macrae of MML.[545] Numerous meetings and workshops were held over a number of years to discuss ventilation proposals.

Assessment of the reasons for the failure to detect the issue with air change rates in Critical Care

6.181. Mr Greer's evidence was that the discussion around pressure in the multi-bed rooms proceeded on the assumption that all of the rooms, including those in critical care, were "effectively normal bedrooms, all normal multi bedded rooms".[546] He accepted that his colleague, Mr Macrae, would have realised that some of the rooms were in critical care, and that he himself was copied in to correspondence which made that explicit but he did not recall any conversations to the effect that some of the rooms, being in the critical care department, were subject to different ventilation recommendations. He pointed to the activities on the room data sheets for the critical care rooms being more akin to those expected in a normal bedroom, and to that being a difference from the activities listed in the Activity Database sheet for such rooms.[547] A Design Issues Report prepared by MML in June 2017 addressed the parties' disagreement about whether or not the ventilation design for single and multi-bed rooms complied with SHTM guidance, but drew no distinction between rooms in the critical care department and rooms elsewhere in the hospital, again, because all were being treated as normal bedrooms.[548]

6.182. Mr Hall likewise recalled no discussion, in the context of the review of pressure in the multi-bed rooms, about the possibility that, because some of the rooms were in critical care, they might be subject to different SHTM recommendations for air changes and pressure parameters.[549] When (on 5 July 2018) he circulated an extract of the environmental matrix for comment to MML and NHSL, showing the parameters agreed for the multi-bed rooms including 4 ac/h and positive pressure for the rooms in critical care, he received no objections.[550]

543 Closing Submission by Mott MacDonald to the Inquiry - paragraphs 198, 200, 202; Transcript - Ronnie Henderson - 26.02.2024 - columns 78 to 81.
544 For example A32623049 - Project Agreement Schedule Part 6, Section 6, Appendix 2 Environmental Matrix -HC2023.B5 - page 1460.
545 A45500123 - Ventilation Amendment Proposal - HC2024.B10 - page 179 to 182; A46365921 - Email 9 February 2017 - HC2024.B13.V2 - page 668.
546 Transcript - Graeme Greer - 27.02.2024 - column 132.
547 Transcript - Graeme Greer - 27.02.2024 - columns 133 to 141.
548 Transcript - Graeme Greer - 27.02.2024 - column 150.
549 Transcript - Ken Hall - 28.02.2024 - column 150.
550 Transcript - Ken Hall - 28.02.2024 - column 175.

6.183. The evidence of Mr McKechnie was that TSWW drew no distinction between the multi-bed rooms in critical care and the multi-bed rooms elsewhere in the hospital.[551] This was consistent with his interpretation of SHTM 03-01 that the recommendation of 10 air changes per hour and 10 Pa positive pressure only applies to isolation rooms and not to other bed spaces.

6.184. Mr Pike saw no issue with four air changes on the basis that, as he understood it, the contract already required that by way of the environmental matrix.[552]

6.185. Generally speaking, the requirement for a balanced or negative pressure regime was presented to Multiplex, TSWW and IHSL as a clinical requirement. Counsel to the Inquiry noted that was not something that an engineer would be likely to second-guess.[553] IHSL shared this view and added that this was a clinical decision which IHSL was unable to challenge.[554]

6.186. Mr Henderson, the commissioning manager in NHSL's estates team, was familiar with the table of recommended ventilation parameters in SHTM 03-01, and (contrary to the interpretation placed upon the guidance by Mr McKechnie) understood the recommendation for critical care areas to apply to such areas as a whole and not to be restricted in its application to isolation rooms. If he had known that something other than the recommended parameters of 10 air changes per hour and 10 Pascals of positive pressure were being proposed for a critical care area, he would have queried it as a non-compliance with guidance. He therefore had sufficient experience, knowledge of the guidance, and confidence to challenge the use of non-compliant parameters. He told the Inquiry that he did not do so on the RHCYP and DCN project because he did not realise that any of the multi-bed rooms under consideration were in the critical care department. This was despite the fact that information to that effect was available to him. Mr Henderson was unable to explain how it was (as he put it) that "the dots weren't joined", but he pointed to the ventilation proposal as being very narrowly focused on the pressure arrangements, and to the responsibility of others to point it out. He proceeded, throughout discussions on the multi-bed room ventilation proposal, on the mistaken assumption that none of the rooms were in the critical care department.[555]

6.187. Ms Mackenzie signed off NHSL's approval of the multi-bed room ventilation solution under the Project Agreement RDD process on 26 July 2018.[556] She expected MML to have thoroughly reviewed it before she did.[557] Although she knew some of the rooms were in the critical care department neither she nor the clinicians she consulted were aware that the proposed solution would involve a derogation from SHTM 03-01, for either the pressure regime or the air change rates.[558] Nobody explained that to her.

551 Transcript - Stewart McKechnie - 29.02.2024.
552 Transcript - Darren Pike - 28.02.2024 - column 43.
553 Closing Submission Bundle Edinburgh 3 - February 2024 - page 29 (paragraph 111).
554 Closing Submission Bundle Edinburgh 3 - February 2024 - page 135 (paragraph 2.32).
555 Transcript - Ronnie Henderson - 26.02.2024 - columns 71 to 125.
556 A45500123 - Ventilation Amendment Proposal - HC2024.B10 - page 182.
557 Transcript - Janice MacKenzie (Part 2) - 27.02.2024 - column 27.
558 Transcript - Janice MacKenzie (Part 2) - 27.02.2024 - column 4.

Escalation of the four-bedded room issue

6.188. On 6 March 2018 Susan Goldsmith (Finance Director) reported to the NHSL Finance & Resources Committee that there had been "no movement" on the issue of ventilation for four-bedded rooms, and this remained a residual key issue. The Committee approved the recommendation to raise a court action seeking an interim order requiring IHSL to install a compliant ventilation system with respect to four-bedded rooms "with an air change rate of 6 ac/hour".[559] It was felt that this approach was necessary, proportionate and showed NHSL's "seriousness of intent."[560]

6.189. NHSL subsequently entered into further correspondence on the matter with IHSL, and sent a draft court summons to IHSL on 21 March 2018. The draft set out that four-bedded rooms required to have negative or balanced pressure relative to the adjacent corridor. The draft summons was supported by affidavits from NHSL's Project Clinical Director and Lead Technical Adviser who stated that the basis for the requirement of balanced or negative pressure was the need to inhibit the spread of infection from the multi-bed rooms.

6.190. The threat of litigation was withdrawn following a proposal from IHSL on 22 March 2018 for a settlement agreement which would "deliver a facility to the Board's technical requirements, at the earliest opportunity and at the most efficient cost to the project."[561] This included agreeing to NHSL's requirement for balanced or negative pressure in fourteen of the multi-bed rooms, at 4 air changes per hour.[562] The TSWW proposal was approved by NHSL at level A under the RDD process in July 2018.[563] This proposal was referred to in the technical schedule to what became Settlement Agreement 1 (SA1).

Technical Schedule to Settlement Agreement 1

6.191. The technical schedule to SA1 summarised the agreed resolutions to a number of disputed issues. In addition to the issue with four-bedded rooms, SA1 recorded the resolutions that had been reached with respect to ventilation for single bedrooms and neutropenic patient areas, discussed above. These were included as items 4, 7, and 13.[564] The solutions were detailed in Disputed Works Schedule Appendix 1, and can be summarised as follows:

> Item 4: Bedroom ventilation pressure regime and air change rate in rooms for neutropenic patients. The solution was contained in what was formally Project Co Change 050 – Neutropenic Patients Ventilation. This provided "relief" from a number of provisions in the BCRs as well as from the recommendation in SHTM 03-01 for 10 ac/h and positive pressure for a neutropenic patient ward. This

559 A33887882 - F&R Committee Minutes, page 888.
560 A33887882 - F&R Committee Minutes, page 889.
561 A33393778 - Letter 22 March 2018 - HC2024.B13.V5 - page 2750.
562 Transcript - Susan Goldsmith - 06.03.2024 - column 29.
563 A46365854 - Multi Bed Ventilation Proposal - HC2024.B13.V2 - page 1279 to 1282.
564 A32469163 - Settlement Agreement 22 February 2019, Schedule 1, Part 1, Technical Schedule - HC2024.B4 - page 38.

confirmed the provision of 4 ac/h and balanced pressure for single bedrooms in the haemato-oncology ward (Lochranza).

Item 7: 4 bed ventilation. The solution was "for 14 No 4 bed rooms to be balanced or negative to the corridor at 4 ac/hr. The remaining 6 No 4 bed wards remain as per the environmental matrix…" The 4 bed bays and 3 cot bay in the critical care department were included among the 14 rooms to receive 4 ac/h and balanced or negative pressure.

Item 13: Single Bedroom Ventilation air changes. The solution was contained in what was formally Project Co Change 051. This provided a derogation from SHTM 03-01 recommendation of 6 ac/h for single bedrooms and 3 ac/h for single room ensuites ("WC" in SHTM 03-01). It confirmed the provision of 4 ac/h for single bedrooms and a minimum of 10 ac/h for ensuites, and stated that the solution was "based on mixed mode operation where mechanical supply ventilation providing 4ACH is then supplemented by openable windows to provide a passive means of ventilation (where access to an openable window is available)" [565]

6.192. NHSL have accepted that the effect of agreeing SA1 with its list of resolutions was an inadvertent derogation for multi-bed rooms in critical care. However there remains disagreement over whether or not the SA1 technical solution for single bedrooms applied to single bedrooms in the critical care department.

6.193. During the process of drafting the Settlement Agreement, IHSL requested that "the Board [..] confirm that all BCR clauses have been met". Mr Greer of MML raised concerns regarding this request with Mr Currie emphasising that, although MML was NHSL's technical adviser, it was not a designer and was not therefore in a position to provide design assurance to NHSL in relation to the technical solutions.[566]

6.194. MML expressed concern over the alteration of risk allocation[567] after Project Co issued a revised version of the technical schedule dated 17 July 2018.[568] Mr Greer told the Inquiry:

> "This revision included the insertion of an adjustment to clause 7.1 of the PA. The wording of this alteration suggested the Agreed Resolutions in the Technical Schedule were to be given precedence over the terms of the PA. As before, I was concerned a clause of this nature represented an alteration of the Project Risk allocation and included this as a comment on my review of the Technical Schedule."[569]

565 A35004560 - Disputed Works Schedule Appendix 1 Item 13 - HC2024.B10 - page 69.
566 A46802701 - Email 4 June 2018 - HC2024.B13.V5 - page 1272; Transcript - Graeme Greer - 27.02.2024 - column 162.
567 A46802705 - Email 20 July 2018 - HC2024.B13.V5 - page 1314.
568 A33406349 - 16 August 2018 Technical Schedule - HC2024.B13.V5 - page 1276.
569 Witness statement - Graeme Greer - 27.02.2024 - paragraph 71.

6.195. Once again, this was a reference to the design risk allocation in a standard form NPD contract, under which design risk rests with the project company except in relation to operational functionality, the risk of which rests with the health board.

6.196. Mrs Goldsmith was alert to the need to avoid any risk transfer to the board and took legal advice to ensure that this did not happen in the drafting of SA1.[570] NHSL proposed an approach which involved treating the agreed technical solutions in accordance with the existing procedures in the Project Agreement.[571] That approach is reflected in the technical schedule of SA1, where each of the ventilation solutions (4, 7 and 13) are referred to as approved under the Project Agreement procedure for RDD[572],the process under which NHSL's approval constitutes no more than confirmation that the proposed design meets its requirements for operational functionality.

Decision-making around Settlement Agreement 1

6.197. On 23 May 2018 in a paper to the Finance and Resources (F&R) Committee the Director of Finance recommended "that the Committee give support to a proposed commercial agreement between the Board and IHSL to resolve disputed issues and to effect the completion and handover" of the new facility.[573] This support was given.[574]

6.198. On 25 July 2018 Ms Goldsmith provided the F&R committee with an update on the proposed Settlement Agreement, attaching a supplementary business case. The business case sought "£10m capital contribution towards disputed works required for completion of the facility" in addition to "£1.6m contribution towards the shortfall in funding available to IHSL, under the enhanced early access element of the agreement".[575] It noted that "IHSL have indicated they are able to cover the remaining shortfall (£4.17m) via additional borrowing, although servicing such borrowing would reduce the level of surplus available to the public sector". [576]

6.199. According to NHSL, the benefits of the Settlement Agreement included:

- The cost to NHSL is fixed: capital contribution and commencement of Annual Service Payments.
- The timescale to completion was more certain.

570 Transcript - Susan Goldsmith - 06.03.2024 - column 36; See A33406223 - Report on PA Settlement Agreement 28 February 2019 - HC2024.B10 - page 156.
571 A47272803 - Email 12 June 2018 - B13.V9 - page 184.
572 A32469163 - Settlement Agreement Schedule 1 Part 1 Technical Schedule - HC2024.B4 - pages 40 to 46.
573 A35362520 - Proposed Commercial Agreement for Completion of RHSC/DCN Project - 23 May 2018.
574 A33887882 - F&R Committee Minutes - 23 May 2018.
575 A34823523 - Supplementary Business Case 25 July 2018 - HC2024.B10 - page 153 to 155.
576 A33406438 - Supplementary Business Case RHSC and DCN Project 25 July 2018 - page 7.

- NHSL would be able to access the facility and commence Board commissioning several months earlier than would be the case were it to wait until Actual Completion or until after litigation or dispute resolution had been completed.
- A mutually acceptable settlement preserves the relationship between the parties.
- A settlement avoids an expensive, protracted and resource intensive process via the Courts or DRP. [577]

6.200. While the risks were that:

- The programme to completion was challenging, but it included incentivisation for IHSL via milestone and longstop dates which ultimately permitted NHSL to terminate the Project Agreement if certain works were not completed by agreed dates.
- NHSL would be required to manage its commissioning programme while construction works were ongoing. The mitigation for this was an agreed protocol and programme.
- The Agreement is subject to a range of conditions precedent, including approval of the Scottish Government and funders.
- Failure to agree all details will leave issues outstanding that are not catered for within the agreement, leaving open the risk of further dispute.[578]

6.201. The F&R Committee agreed on the proposed way forward, with this agreement "conditional upon formal approval of the capital contribution from the Scottish Government."[579] The Cabinet Secretary was briefed on 27 July 2018. The proposal was approved by the SG Director of Health Finance, on 8 August 2018.[580] This was on the basis that it appeared to be the best solution in the circumstances.[581]

6.202. On 19 September 2018 Ms Goldsmith tabled a position paper to the F&R Committee which noted: "a completion date of 31 October is not now possible and certain elements of the business case will require revision. In addition to this, IHSL now report that they are close to financial collapse and require immediate intervention to prevent this from happening." The paper set out a number of next steps which would "require the full support of SG and F&R".[582]

577 A45002274 - NHS Lothian Response to PPP6 - HC2024.B12.V1 - page 27.
578 A45002274 - NHS Lothian Response to PPP6 - HC2024.B12.V1 - page 27.
579 A33887882 F&R Committee Minutes - 25 July 2018 - page 909.
580 A35289408 - Letter Christine McLaughlin to Jim Crombie - 8 August 2018.
581 Transcript - Alan Morrison - 13.03.2024 - column 106 to 127.
582 A35362520 - Position Paper on Settlement Agreement - 17 September 2018 - page 2266 to 2268.

6.203. IHSL's funding arrangements were based on the assumption it would start receiving payment from NHSL of the unitary charge (which fell due once NHSL accepted the completed hospital) in July 2017. Delays in completion of the hospital meant these payments had not begun at the anticipated time. Tim Davison told the Inquiry:

> "NHS Lothian were told that IHSL were close to liquidation as there was no cash flow to meet the cost of servicing the debt arrangements under the NPD structure. SA1 included agreement on the outstanding works along with the commencement of capital payments to inject cash flow to IHSL.
>
> I was aware of the severity of the concerns around the potential failure of the project and the potentially catastrophic level of further unlimited delay and uncertainty for the project's completion if IHSL collapsed. The full board of NHS Lothian and Finance & Resources Committee received reports updating on the progress with negotiations and seeking approval to enter into SA1…[583]

6.204. The F&R Committee "gave its absolute support to the project team in terms of the current strategy and approach" and asked that work progress on seeking resolution to current issues via the supplementary agreement.[584]

6.205. On 21 September 2018, Alan Morrison, (Capital Accounting and Policy Manager for Health Infrastructure, Scottish Government) updated the Cabinet Secretary on the delay in the construction of the hospital. He noted that "When the business case for the Settlement Agreement (SA) was approved by Scottish Government, NHS Lothian were of the view that the SA was agreed in principle and there were only a small number of technical and commercial issues needing to be finalised before both parties could sign the agreement. Since then, further commercial and technical issues have arisen which means that the hospital will not be complete by 31 October."[585] The main problem was the drainage system. The update also raised the issue of financial pressures on IHSL, "the inevitable questions over its solvency" which would "require considerable legal and financial analysis before any way forward is agreed." [586] One of the risks around insolvency was the potential for funders to step in, debt obligations to be called up and a requirement for NHSL (and ultimately the SG) to pay £150 million for the hospital. This risk was considered remote.[587] However, Mr Morrison recognised the need to resolve the complicated contractual and technical discussions and find a solution to get to the position where the hospital could be opened.[588]

583 Witness Statement - Tim Davison -08.03.2024 - paragraphs 31 to 32.
584 A33887882, F&R Committee 19 September 2018 - HC2024.B13.V7 - page 1050.
585 A35267750 - Update for Cabinet Secretary - 21 September 2018.
586 A35267750 - Update for Cabinet Secretary - 21 September 2018.
587 Closing submissions of Counsel to the Inquiry and IHSL in Closing Submission Bundle Edinburgh 3 - February 2024 - page 50 and 140.
588 Transcript - Alan Morrison - 13.03.2024 - column 113 to 114.

6.206. On 6 February 2019, the Board of NHSL approved the terms of the Settlement Agreement.[589] The minutes of that meeting set out the governance arrangements for approval, and included some discussion on whether the Board was competent to make a judgement on the Settlement Agreement. In response to this, Mrs Goldsmith referred to a paper that had been tabled which "recorded that all negotiations on the terms of this settlement agreement had been supported by the Board's legal and technical advisers." [590]

6.207. In terms of the agreement, three key outstanding technical matters (drainage, void detection and heater batteries) would be addressed after the completion date. These were designated "Post Completion Works". This would allow the Independent Tester to sign a Practical Completion Certificate against compliance with the contract, subject to the post completion work and snagging matters being addressed. Granting of a Completion Certificate by the Independent Tester was a condition for handover of the hospital from IHSL to NHSL, which would then trigger payments to IHSL. NHSL planned to carry out its commissioning work in parallel with completion of the building works. This was done with the aspiration of concluding all work in time to facilitate the opening of the hospital in summer 2019.

6.208. This arrangement meant that it was not possible to carry out the Stage 4 HAI-SCRIBE process at the time of the handover and it would therefore have to be deferred until a later stage, although this does not appear to have been the subject of conscious consideration at the level of NHSL's board.[591] This is discussed further in chapters 7 and 10.

6.209. The Scottish Government supported SA1. The resolution captured in SA1 necessitated around £10m of additional funding from the Scottish Government. SG was aware that the settlement resolved around 80 technical issues and that these included issues relating to the ventilation systems. It was aware of the financial challenges affecting IHSL. The SG was motivated by a strong desire to see the hospital opened, given the delays which had already affected it.

6.210. Settlement Agreement 1 was signed by NHSL and IHSL on 22 February 2019.[592] The hospital, with the exception of works still to be completed as identified by SA1, was handed over to NHSL.

589 A34978959, NHSL Board Minutes 6 February 2019 - HC2024.B13.V7 - page 1160 to 1163.
590 A34978959, NHSL Board Minutes 6 February 2019 - HC2024.B13.V7 - page 1163 - paragraph 37.3.
591 Transcript - Susan Goldsmith - 06.03.2024 - column 57.
592 A32469163 - Settlement Agreement 22 February 2019, Schedule 1, Part 1, Technical Schedule - HC2024.B4 - page 11.

Chapter 7

Adequacy and effectiveness of provisions for assurance in relation to the completion and functioning of the ventilation system

Chapter 7

Adequacy and effectiveness of provisions for assurance in relation to the completion and functioning of the ventilation system

Introduction

7.1. Term of Reference 6 requires the Inquiry to examine, during the life cycle of the RHCYP and DCN project, how NHSL secured assurance and supporting evidence that:

> "A. All necessary inspection and testing had taken place;
>
> B. All key building systems had been completed and functioned in accordance with contractual specifications and other applicable regulations, recommendations, guidance, and good practice and;
>
> C. Adequate information and training were provided to allow end-users effectively to operate and maintain key building systems."

7.2. Inspection and testing of building systems prior to handover comprehends the processes of commissioning individual components to ensure that they operate satisfactorily, and the process of validation to ensure that the installation as a whole is fit for purpose.

7.3. This chapter looks at the provisions of the Project Agreement for commissioning and certification of practical completion of the hospital, and the role of the Independent Tester in applying them. It contrasts these processes with independent validation of ventilation systems as recommended by Scottish Health Technical Memorandum 03-01 "Ventilation in Healthcare Premises" (SHTM 03-01) and eventually carried out by IOM. It then discusses the application of the HAI-SCRIBE procedures mandated by Scottish Health Facilities Note 30 (SHFN 30). It concludes by addressing what assurance NHSL had as to the provision of necessary information and training.

Commissioning

7.4. Commissioning a ventilation system is the process by which component parts of the ventilation system are subject to engineering checks to determine whether it is operating as designed and in accordance with specified requirements.[593] It is described in the context of hospital ventilation systems in chapter 11 of the current version of SHTM 03-01 (2022) as the process of advancing a system from physical completion to an operating condition. There it is explained that commissioning will often be divided into sections (for example, air handling unit, automatic controls, air side balance, building fabric and fittings). Each section may be commissioned by its specialist installer, and they are often accepted in isolation. The same definition and the same explanation are to be found in section 8 of SHTM 03-01 version 2.0 of 2014.

7.5. Responsibility for commissioning generally is that of the contractor, as it was under the Project Agreement. All buildings, services and equipment were to be commissioned by Project Co (IHSL), and therefore for all practical purposes Multiplex and, in relation to ventilation systems, its subcontractor Mercury Engineering. Thus, schedule part 6, section 3 of the Project Agreement which set out the Board's Construction Requirements stated that "As part of the commissioning process, Project Co shall be responsible for demonstrating compliance with the requirements included within the Room Data Sheets." [594]

7.6. Clause 17 of the Project Agreement, together with the Outline Commissioning Programme in part 10 of the schedule, sets out the manner in which the new hospital was to be completed. NHSL was to prepare a draft final commissioning programme not less than nine months before the Completion Date.[595] NHSL and IHSL were then to negotiate and agree the Final Commissioning Programme within three months, failing which the matter would be resolved in accordance with the contractual dispute resolution procedure.

7.7. The Final Commissioning Programme was to be in accordance with the Outline Commissioning Programme set out in part 10 of the schedule "and shall impose no greater or more onerous obligations on the Board than those set out in the Outline Commissioning Programme (unless otherwise agreed by the Board in its absolute discretion)."[596] The Final Commissioning Programme was to describe the necessary steps, the party responsible for carrying them out, and the timing and sequence of them.[597]

593 For a more formal definition A42783874 - CIBSE Commissioning Code A - page 5. Commissioning Code A is referenced - paragraph 4.1.29 of Appendix B to Schedule Part 10 to the Project Agreement: "The following list is indicative of the test documentation expected to be provided:…4.1.29 Air Distribution Systems in accordance with CIBSE Commissioning Code A". The same definition is provided in BSRIA Commissioning Air Systems (BG 49/2015), cited by Multiplex, A45002572 - Multiplex Response to PPP6 - HC2024.B12.V1 - page 37 - paragraph 3.3.

594 A33405670 - Project Agreement Schedule Part 6, Section 3 - HC2023.B5 - page 232.

595 Originally 2 July 2017, the date stipulated in the Project Agreement.

596 A33405351 - Project Agreement - HC2023.B5 - page 33 - clause 17.2.

597 A33405351 - Project Agreement - HC2023.B5 - page 33 - clause 17.3.

7.8. IHSL was obliged to give written notice to the Independent Tester of the commencement of Pre-Completion Commissioning and to invite them to that commissioning, providing such information as they may reasonably require in relation to it.[598] Access to the facilities was to be provided to enable the Board to carry out the Board's Commissioning.[599]

7.9. Provision was also made for a pre-completion inspection that required IHSL to give notice to the Independent Tester and the Board's Representative of the date on which it considered that the Works would be complete and the tests on completion required to be performed in accordance with the Final Commissioning Programme. Following receipt of such notice, the Independent Tester and the Board's Representative were entitled to inspect the Works and attend any of the tests on completion. The Independent Tester was required to notify IHSL and NHSL of any outstanding matters which needed to be carried out before the Works could be considered complete in accordance with the Completion Criteria[600] within 5 business days of such inspection. Provision was made for such inspections and notices to be repeated if necessary.[601]

7.10. Commissioning programmes were produced, which showed commissioning activities and sequence for each of the Mechanical & Electrical systems (which included ventilation) including proposed durations and dates. In addition, two-week lookahead programmes were prepared, setting out the exact dates when each system would be available for witnessing. Diary invitations were issued to all relevant parties, including NHSL, MML, Arcadis (the Independent Tester) and Bouygues, to attend the witnessing. All systems were made available for inspection by those parties. It was, however, a matter for each of them whether they attended - except for the Independent Tester who was obliged to witness at least a proportion of testing. None of the parties were contractually obliged to witness commissioning. The commissioning process was overseen and monitored through a series of meetings and trackers.

7.11. According to Ronnie Henderson, NHSL's Commissioning Manager for Hard Facilities Management, commissioning activities "were often cancelled at the last minute by Multiplex resulting in a significant backlog and ultimately parallel, or multiple commissioning tasks being carried out at the same time."[602] This meant that it was not always possible for a representative of NHSL to attend all commissioning activities.[603] Nevertheless, there would appear to be consensus among NHSL, Multiplex, IHSL and Arcadis that commissioning and witnessing were undertaken in accordance with the relevant contractual obligations.[604]

598 A33405351 - Project Agreement - HC2023.B5 - page 34 - clause 17.8.
599 A33405351 - Project Agreement - HC2023.B5 - page 34 - clause 17.9. Board's Commissioning means the pre-completion activities to be carried out by NHSL in accordance with clause 17 of the Project Agreement.
600 The Completion Tests as defined in Appendix B of Schedule Part 10 of the Project Agreement.
601 A33405351 - Project Agreement - HC2023.B5 - page 34 to 35 - clauses 17.10 and 17.11.
602 Witness statement - Ronnie Henderson - 26.02.2024 - paragraph 16.
603 Witness statement - Ronnie Henderson - 26.02.2024 - paragraph 17.
604 See Responses to PPP6 - HC2024.B12.V1.

7.12. Multiplex produced a Building Services Commissioning Plan which provided an outline of the procedures and processes for the testing and commissioning of the building services. That document stated that:

> "All commissionable systems shall be commissioned in accordance with the design principles and parameters set out by the Consultant Engineer or specialist contractor and be in accordance with all relevant codes of practice (BS EN ISO, HTM, SHTM, CIBSE[605], BSRIA[606] etc. where applicable)"[607]

7.13. The above codes of practice can be considered best practice. According to SHTM 03-01, procedures for commissioning air-handling systems are given in CIBSE Commissioning Codes[608] and BSRIA Application Guide Set COMPAK 1.[609] Its objective is "to ensure that the necessary performance and safety requirements are met."[610]

7.14. In terms of standard industry practice, and in accordance with the CIBSE Commissioning Code A procedure, ventilation systems are ordinarily commissioned against the airflow rates and other such criteria provided by the designer. The airflow rates to be achieved by the ventilation system in order to meet the overall performance specifications set out in the environmental matrix (EM) and room data sheets (RDS) were outlined in grille schedules.[611] The approved design flow rates were then used to commission the system.

7.15. Mercury Engineering was the subcontractor appointed by Multiplex to carry out the construction, testing, commissioning and completion of mechanical, electrical and public health services at the RHCYP and DCN. As part of its role, it prepared test and inspection plans and undertook quality inspections using checklists during construction.

7.16. Pre-completion commissioning of the ventilation system for critical care areas took place between February and October 2018 and was carried out by H&V Commissioning Services Ltd. The results of the commissioning tests were presented by H&V in commissioning reports.[612] These reports essentially compare the design air flow rates for each grille to the air flow rate actually being achieved to ensure that the actual air volumes are achieving the design rate. It is this comparison between design flow rate and actual flow rate that is witnessed and, assuming that the comparison is satisfactory, approved as commissioned.

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605 CIBSE is the Chartered Institute of Building Services Engineering, a professional body which, amongst other things, publishes guidance and advice on best practice.

606 BSRIA is the Building Services Research and Information Association and has published a series of documents explaining the Building Regulations and compliance testing.

607 A38138192 - Multiplex Commissioning Plan Revision 2 - September 2016.

608 Some of which were incorporated into the Project Agreement.

609 Not specifically referred to in the Project Agreement but referred to in Multiplex's Building Services Commissioning Plan.

610 A33662259 - SHTM 03-01 Part A v.2 2014 - HV2022.B1 - page 733 - paragraph 8.9; Transcript - Andrew Poplett - 10.05.2022 - columns 115 to 116.

611 A45002572 - Multiplex Response to PPP6 - HC2024.B12.V1 - page 37 - paragraph 4.7.

612 For example A38182002 - AHU04-06 Extract Report; A38181994 - AHU 04-06 Supply Report.

7.17. The four-bedded rooms were originally commissioned in October 2018,[613] although the results of this commissioning were rejected on 29 January 2019 due to a very low airflow volume recorded for one extract grille. Accordingly, additional commissioning tests were undertaken and subsequently approved by the Independent Tester on 18 February 2019.[614]

7.18. The Independent Tester had witnessed in excess of 50% of the Mechanical and Electrical services testing and commissioning, as required by its contract, by September 2018.[615]

The Independent Tester and the Certificate of Practical Completion

7.19. In terms of clause 15.1 of the Project Agreement, IHSL and NHSL agree that they have on or prior to the date of the Project Agreement "appointed a suitably qualified and experienced consultant to act as the Independent Tester". The Independent Tester Contract[616] was signed at Financial Close, and is an agreement among IHSL, NHSL, EC Harris LLP (the Independent Tester),[617] representatives of the funders and Multiplex. (The business of EC Harris LLP was taken over by Arcadis NV, and after the contract was signed the business ceased to trade with the separate name. Hence, the references to Arcadis as being the Independent Tester.)

7.20. The full scope of the services to be provided by the Independent Tester was originally set out in Appendix 1 to the Independent Tester's Contract.[618] In general, the Independent Tester was required to undertake regular inspections of the Works and monitor them against the Board's Construction Requirements, Project Co's Proposals, the Approved Reviewable Design Data and the Completion Criteria.[619] In addition, with particular regard to the duties most applicable to the question of quality assurance during the period of construction, the Independent Tester was obliged to:

- Attend monthly site progress meetings and provide IHSL and NHSL with a monthly report on the activities of the Independent Tester.
- Provide details of any tests carried out by IHSL (in practice, Multiplex) together with results obtained.

613 A38182002 - AHU04-06 Extract Report; A38181994 - AHU 04-06 Supply Report.
614 A34913531 - AHU 04-06 Commissioning Certificates.
615 See A35317524 IT Report No 42 September 2018 which notes - paragraph 1.2.12.1 that the It "has continued to witness a range of ventilation demonstrations and commissioning activities of individual building services exceed the 50% requirement; based on the Completion Commissioning Programme."
616 A33405351 - Independent Tester Contract - HC2023.B5 - page 1612.
617 The business of EC Harris LLP had been taken over by Arcadis NV, and after the contract was signed the business ceased to trade with the separate name. Hence, the references throughout this interim report to Arcadis as being the Independent Tester.
618 With effect from 22 February 2019, to be read subject to the Independent Tester Varied Services Letter discussed above. A33405351 - Independent Tester Contract - HC2023.B5 - page 1612.
619 A33405351 - Independent Tester Contract - HC2023.B5 - page 1612 - paragraphs 1.2, 1.9, 2.2 and 5.1.

- Provide details of compliance with the Quality Plans.
- Randomly check that the Works are being carried out in accordance with the Construction Quality Plan.
- Monitor Multiplex's quality assurance procedures.
- Identify any delays in the Programme and/or Final Commissioning Programme, any noncompliance by Project Co and any other quality control matters.
- Monitor and report upon the implementation of the Design Quality Plan.
- Monitor the detailed working drawings and specifications for a sample number and type of rooms which in his professional judgment is appropriate to be selected by the Independent Tester to verify that they comply with the Approved RDD as described in the Project Agreement.
- Review the written Mechanical and Electrical engineering services testing and commissioning procedure.
- Undertake selective witnessing of the Mechanical and Electrical services testing and commissioning.[620]

7.21. Clause 2.1 of the Scope of Services obliged the Independent Tester to familiarise himself with the Project Agreement, including design data, to the extent necessary to enable him to provide a report to NHSL and Project Co on any contradictory requirements.

7.22. The principal role of the Independent Tester was to issue the Certificate of Practical Completion "when he is satisfied that the Facilities…are complete in accordance with the Completion Criteria".[621] Paragraph 1.4 of Appendix 1 of the Independent Tester Contract simply states that the Independent Tester shall "Certify the Actual Completion Date[622] and issue a Certificate of Practical Completion in accordance with the Project Agreement".

620 A33405351 - Independent Tester Contract - HC2023.B5 - page 1612 - see Appendix 1 Scope of Services - paragraphs 1.10, 2.1, 3.1, 4.1 and 5.1.
621 A33405351 - Project Agreement - HC2023.B5 - page 4 - clause 17.12.
622 In terms of the Project Agreement, the Actual Completion Date is the date to be stated in the Certificate of Practical Completion as the date on which the buildings and other facilities to be provided under the Project Agreement by IHSL were completed according to the Completion Criteria.

7.23. Issue of the Certificate of Practical Completion is dependent on the Independent Tester being satisfied that the Facilities are complete "in accordance with the Completion Criteria", that is to say in accordance with those criteria as specified in the Project Agreement. The Completion Criteria relevant to the Inquiry's Terms of Reference include:

> "2.1.4 All mechanical and electrical Plant and systems shall be tested, commissioned and operate satisfactorily in accordance with the specified design criteria, any manufacturers' operating requirements and the Room Data Sheets.
>
> …
>
> 2.1.24 A final draft Operational Manual for the Facilities, in accordance with Clause 18.5 *(Operational Manuals)* of this Agreement, (containing, as a minimum, all the testing and commissioning information including as-built drawings / test results so far as it is reasonably practicable) have been made available by the Contractor to Project Co to allow the Facilities to be operated safely;
>
> …
>
> 2.1.31 Project Co shall provide completed Section 6 (Room Data Sheets) of Schedule Part 6 (Construction Matters) for all rooms and areas within the Facilities including the environmental data contained in the Environmental Matrix. These Room Data Sheets shall be complete in all respects;
>
> 2.1.32 Project Co shall provide the Environmental Matrix including Commissioning data test sheets as commissioned in accordance with CIBSE Commissioning Code C and demonstrating compliance with the Environmental Matrix; " [623]

7.24. In addition to the above, IHSL was required to demonstrate that conventional operating rooms including Operating Theatre suites, Digital Angiography and Intraoperative MRI areas "shall comply with the requirements of paragraph 8.60 of SHTM 03-01 for conventional operating rooms". IHSL was also required to provide indicative testing and commissioning documentation including:

> "4.1.6. Ductwork systems pressure test and volume flow rate certificates if appropriate
>
> …
>
> 4.1.29. Air distribution systems in accordance with CIBSE Commissioning Code A."

623 A33405351 - Project Agreement Schedule Part 10 - HC2023.B5 - page 1504 - Appendix B.

7.25. From the evidence available to the Inquiry there is no indication that the Independent Tester failed to carry out its duties. Between April 2015 and September 2018, for example, the Independent Tester produced 42 monthly reports. Depending on the stage of the project, these reported on key issues, design review, procedure review (including Reviewable Design Data review), construction review, project quality plan, testing and commissioning, certification matters, variations and Contract Project Construction Programme."[624] Reports also note (for example) reviews of quality management as part of "Activities undertaken" and inspection of particular quality plans dealing with aspects of work being carried out onsite as part of "Progress and site activity" reporting.

7.26. In this project, the issue of the Certificate of Practical Completion did not occur in the manner envisaged in the original Project Agreement but took place in accordance with the Independent Tester's "varied services" as provided by Settlement Agreement 1 (SA1). Recital D of SA1 narrates that:

> "The Parties understand that the Independent Certifier [sic] has completed the tests on completion in respect of the Works…and, subject to: (i) the terms of the Project Agreement as supplemented by this SA1 and (ii) the conditions set out in the Independent Tester's letter to Project Co dated 7 February 2019; is ready to issue a Certificate of Practical Completion…".

7.27. Clause 3.3.1 of SA1 provides that IHSL and NHSL shall jointly instruct the Independent Tester to provide the "following Varied Services", including "to issue the Certificate of Practical Completion pursuant to clause 17.12 (Completion Certificate) of the Project Agreement…when he is satisfied that the Facilities…are complete in accordance with the Completion Criteria as amended pursuant to this SA1…". notwithstanding any requirement to complete the Outstanding Works, a number of ongoing disputes between the parties, and Snagging Matters.

7.28. Clause 3.4 goes on to provide that IHSL and NHSL will sign and issue the Independent Tester Varied Services Letter to the Independent Tester on the date on which SA1 becomes effective (22 February 2019). The terms of the letter are set out in part 9 of the schedule to SA1 and include a provision in terms of which IHSL and NHSL instruct the Independent Tester to perform certain Varied Services, including that it should issue the Certificate of Practical Completion on the basis set out in clause 3.3.1. The letter was issued in the agreed terms on that date.[625] The Certificate of Practical Completion was issued in accordance with that letter and the terms of SA1 on 22 February 2019.

7.29. Part 1 of the schedule to SA1 (the technical schedule) provided revised ventilation requirements for a number of multi-bed rooms, including those within critical care. The agreed resolution was "for 14 No 4 bed rooms to be balanced or negative to the corridor at 4 ac/h. The remaining 6 No 4 bed wards remain as per the environmental

624 For example, A35317456 - Independent Tester's Report No 28 - July 2017.
625 A45020687 - Independent Tester Varied Services Letter - 22 February 2019.

matrix…".[626] This change only became a contractual requirement with the signing of SA1 on 22 February 2019. However, commissioning of the ventilation system had been ongoing since February 2018, and the Independent Tester had approved the commissioning of the four-bedded rooms on 18 February 2019.

7.30. The reason for this apparent anomaly is that the details of this change had been discussed between NHSL and IHSL during the period leading up to the execution of SA1, when the parties were negotiating the solution to a number of technical disputes. IHSL produced updated Room Data Sheets to reflect the agreed change prior to 31 October 2018. This is when IHSL first attempted to achieve Practical Completion. To allow early implementation of the revised ventilation requirements, Multiplex had undertaken the modifications to the system and completed its commissioning in October 2018.

7.31. NHSL formally approved the updated Room Data Sheets when SA1 was signed. Together with the technical schedule in SA1, this comprised the final environmental design criteria for ventilation in the four-bedded rooms.

7.32. Accordingly, by 22 February 2019, the works implementing the agreed resolution for the single and four-bedded rooms, and the testing and commissioning of the ventilation system serving those rooms, had already been completed. No further work and therefore no further commissioning was required. This meant that the Independent Tester could sign off that the commissioning of the ventilation system was complete.[627] The sign-off from the Independent Tester gave assurance that construction had been carried out in accordance with the Project Agreement as varied, and as understood by the Independent Tester.

7.33. The position was similar in relation to the other matters dealt with in the technical schedule. They had been discussed, implemented and inspected prior to February 2019. As Darren Pike (Project Director, Multiplex) explained at the third Edinburgh hearing when asked by Counsel as to why the certificate of practical completion was issued when it was:

> "I think because, in the main, the contract works were actually finished. The actual original contract was pretty much finished with the exception of the as-late-as-possible works, snagging Defects which would come post-contract anyway, and three other disputed items which came to the fore in mid to late 2018…So in terms of, again, probably more experience across the piece, is when practical completion was issued, judging it purely against the original contract, I would say that that was a fair point to issue it."[628]

626 A32469163 - Settlement Agreement 22 February 2019, Schedule 1, Part 1, Technical Schedule - HC2024.B4 - page 42.

627 A45002572 - Multiplex Response to PPP6 - HC2024.B12.V1 - page 37 - part 9; A45002274 - NHS Lothian Response to PPP6 - HC2024.B12.V1 - page 4, Appendix 1, item 7.8; . Witness statement - Ronnie Henderson - 26.02.2024 - paragraph 21; Witness statement - Darren Pike - 28.02.2024 - paragraphs 92 and 95. The Independent Tester had in fact notified IHSL that they were in a position to issue the Certificate of Practical Completion on 7 February 2019 - Witness statement - Matt Templeton - 06.03.2024 - paragraph 147 to 148.

628 Transcript - Darren Pike - 28.02.2024 - column 57.

7.34. That observation notwithstanding, there were still some significant works outstanding that would not be completed until after SA1 had been signed.

7.35. Further works were to be undertaken to the heater batteries in the isolation room lobbies and radiant panels in the isolation rooms in critical care. There was effectively a recommissioning of the ventilation systems serving these areas, including the remeasurement of flow rates, measurement of the pressure differentials between the bedroom and lobby and between the lobby and corridor.[629] As part of the Post Completion Works, IHSL was required to "undertake all necessary system commissioning and the revalidation/verification and pressure testing of the isolation room following completion of all works."[630] As part of the Completion Criteria for the Post Completion Works, it was provided that "Pressure testing of all relevant isolation room suites is completed satisfactorily."[631]

7.36. The final commissioning was carried out prior to the planned migration.[632] Validation reports dated 6 June 2019 detail the room pressure differentials for isolation rooms 1-B1-016, 1-B1-017, 1-B1-026 and 1-B1-036.[633] These were witnessed and signed by Multiplex, Mercury and Arcadis.[634] A Completion Certificate for these works was issued by Arcadis on 19 June 2019.[635]

The nature of the assurance offered by the Independent Tester

7.37. There is no suggestion that the Independent Tester did not do what it was required to do under its contract. The question remains whether the Independent Tester's wide scope of services, and particularly their involvement in commissioning and assessing the evidence that the Completion Criteria had been met, could provide NHSL with adequate assurance that:

> "A. All necessary inspection and testing had taken place;
>
> B. All key building systems had been completed and functioned in accordance with contractual specifications and other applicable regulations, recommendations, guidance, and good practice.

629 A45659224 - Arcadis Response to PPP 6 - paragraph 5.10; A45002572 - Multiplex Response to PPP6 - HC2024.B12.V1 - page 37 - paragraph 7.2.
630 A45002572 - Multiplex Response to PPP6 - HC2024.B12.V1 - page 37 - paragraph 7.3.
631 Schedule Part 5 Part C, paragraphs 3.5 and 3.5 in A32469163 - Settlement Agreement 22 February 2019 - HC2024.B4 - page 207.
632 A45002572 - Multiplex Response to PPP6 - HC2024.B12.V1 - page 37 - paragraph 7.5.
633 A45002572 - Multiplex Response to PPP6 - HC2024.B12.V1 - page 37 - paragraph 7.8; See A45003234 - 1-B1-017 validation report 6 June 2019; A45003698 - 1-B1-016 validation report 6 June 2019; A45003497 - 1-B1-026 validation report 6 June 2019; A45003501 - 1-B1-036 validation report 6 June 2019.
634 A45002572 - Multiplex Response to PPP6 - HC2024.B12.V1 - page 37 - paragraph 7.8.
635 A45002640 - Milestone 4 Completion Certificate; A45002572 - Multiplex Response to PPP6 - HC2024.B12.V1 - page 37 - paragraph 7.6.

7.38. There are a number of points to note. As previously observed, and which is made clear in the Completion Criteria, commissioning is carried out against "specified requirements". Accordingly, if the (contractual) specification of those requirements is in any way deficient, that may not come to light during the commissioning process. It is also the case that commissioning does not reconsider those specified requirements but merely assesses whether they have been met. This is an important qualification on the extent to which the quality and compliance of a system is assured by commissioning.[636]

7.39. This can be expanded into a more general point. Darren Pike explained:

> "…The independent tester's role, from my experience, is to check that the contract has been met. So, if there is a point in there that perhaps the starting point is debatable, he will not look to pick that up. He will look back at what he considers to be the contract.
>
> **Q** Yes, so the tester is not going to detect a discrepancy between the contract and the guidance?
>
> **A** No."[637]

7.40. This is an important qualification on the role of the Independent Tester. The expectations of NHSL's senior officers were different. For example, Susan Goldsmith, NHSL Director of Finance, confirmed in her oral evidence that the assumption of NHSL was that if the Independent Tester issued the certificate, that effectively certified compliance with the Project Agreement and published guidance, because NHSL's understanding was that these two matters (the Project Agreement and published guidance) amounted to the same thing. NHSL expected the Independent Tester to identify any issue where that was not the case.[638] (whereas, as Mr Pike explained, that was not the Independent Tester's role).

7.41. Similarly, Timothy Davison, the then Chief Executive of NHSL, noted that in his view it would have been "reasonable for the Independent Tester to at least query the ventilation arrangements for critical care as being materially non-compliant with published guidance".[639] In his evidence at the third Edinburgh hearing, he referred to:

> "…a lack of understanding on our part that the Independent Tester was testing against the Environmental Matrix…so testing against what he had understood to be agreed between the parties – in this case the derogations – rather than against the SHTM 03-01 standard, and so I think that confusion was not helpful, but also, I think the independent tester could have raised that contradiction.

636 See also Arcadis Response to PPP6 - paragraph 5.9: "For the avoidance of doubt, as IT, it was Arcadis' role to seek evidence of compliance of the installed ventilation systems with the contractual requirements as stated in the Project Agreement and Schedules, following the processes set out in the IT Contract. It was not the Arcadis' role to express a view on those requirements but to assess if those requirements had been met."

637 Transcript - Darren Pike - 28.02.2024 - column 108.

638 Transcript - Susan Goldsmith - 06.03.2024 - column 61.

639 Witness statement - Tim Davison - 08.03.2024 - paragraph 38.

> I think, again, I would just have expected the Independent Tester to say 'Well, I've looked at this and the air changes are only at four an hour. I see over here that you've agreed to that, but I'm flagging to you that that is in contradiction to your Board's construction requirements' Again, you know – but I don't know why. I understand, I think, now the rationale is 'because I was testing it against the contract, not against the standards,' but I think it would have been helpful if we'd been clear about that and it would have been helpful if the independent tester had been potentially doing both because if he'd been doing both, he would have said 'Well, there's you know, a dichotomy here; there's a contradiction.' At least it would have allowed us to have had a discussion at that point about the contradiction, even if we had been in error. It would have been flagged earlier."[640]

7.42. Even if the contract had not contained an ambiguity which resulted in a disconnect between some of the terms of the Project Agreement and the guidance, there are other factors to consider. Several of the completion criteria mentioned in the previous section do not involve any sort of commissioning in and of themselves – they are more in the nature of the Independent Tester being satisfied that commissioning has been carried out, and in some cases are "matters of checking and counting, not commissioning."[641] Furthermore, the Independent Tester enjoys a wide discretion in reaching a conclusion as to whether the criteria have been satisfied. As Mr Justice Edwards-Stuart held in a case in the Technology and Construction Court in England:

> "…if the Independent Tester reasonably considers that a departure from the specification or the [Trust's Construction Requirements – BCR equivalents] has not had and will not have any material adverse impact on the ability of the Trust to enjoy and use the buildings for the purposes anticipated by the contract, then he may conclude that the Completion Criteria have been met. As a matter of business efficacy and commercial common sense, I can see no justification for importing a requirement that any breach of the specification, however technical or minor, must prevent the Phase Certificate of Practical Completion from being issued."[642]

640 Transcript - Timothy Davison - 08.03.2024 - column 170 to 171; See also Witness statement - Ronnie Henderson - 26.02.2024 - paragraph 41; Transcript - Susan Goldsmith - 06.03.2024 - columns 71 and 125. See also Stewart McKechnie Transcript - Stewart McKechnie - 29.02.2024 - columns 139 to 140 where he considers that the Independent Tester "should have been testing - again, in my opinion - against SHTM compliance".

641 The expression used by Edwards-Stuart J in Laing O'Rourke Construction Ltd v Healthcare Support (Newcastle) Ltd and Newcastle upon Tyne Hospitals NHS Foundation Trust [2014] EWHC 2595 (TCC) at paragraph 40.

642 Laing O'Rourke Construction Ltd v Healthcare Support (Newcastle) Ltd and Newcastle upon Tyne Hospitals NHS Foundation Trust - paragraph 43. On the nature of a Certificate of Practical Completion more generally and the discretion afforded to the person granting it, see Mears Ltd v Costplan Services (South East) Ltd , Plymouth (Notte Street) Limited and J.R. Pickstock Limited [2019] EWCA Civ 502.

7.43. An examination of the Completion Criteria, having regard to these points, indicates that a certification that those criteria have been complied with does not, and cannot, provide assurance that the Facilities have been constructed entirely in accordance with the Project Agreement. Such qualitative criteria as are enumerated within the Completion Criteria tend to be at a general level – "operational", "operate satisfactorily", "available for use" and "necessary to allow the operational Services to commence" for example.[643] The Board's Construction Requirements are mentioned once in the Completion Criteria (in relation to acoustic testing); and five times in the Project Co's Proposals. The degree of assurance that can be taken from the issue of a Certificate of Practical Completion in these circumstances is therefore, at best, qualified.

7.44. The fact that the appointment of the Independent Tester is a joint one by many parties is also of significance. The role of the Independent Tester is not to act on behalf of NHSL or indeed any other individual party. It is "independent" of all of them. This is clear from recital (D) of the Independent Tester Contract which states: "The Independent Tester is an independent adviser willing to provide services to Project Co and the Board and for the benefit of the Secured Creditors and the Funders." Clause 2.2 then goes on to provide that the Independent Tester:

> "shall provide the services…independently, fairly and impartially to and as between Project Co and the Board…the Independent Tester shall have regard to the interest of and shall perform the same for the benefit of and with a duty of care to the Funders, the Secured Creditors, the Security Trustee and the Intercreditor Agent. Whilst the Independent Tester shall take account of any representations made by Project Co and the Board and the Contractor [Multiplex] (as appropriate), the Independent Tester shall not be bound to comply with any representations made by any of them in connection with any matter on which the Independent Tester is required to exercise his professional judgement."[644]

7.45. As a result, the Independent Tester could not (for example) make any alteration to the design of the Facilities or issue any instruction or direction to any contractor or consultant engaged in connection with the Project.[645]

7.46. The fees of the Independent Tester for matters falling within the scope of services were met by IHSL.[646] The contract was essentially a fixed fee contract. Arcadis were to be paid a total of £190,520 for the work it carried out.[647] The amount payable per month is set out in appendix 2 section 1 of the Independent Tester Contract. Using an average of the daily rates quoted in the contract, it would

643 A33405351 - Project Agreement Schedule Part 10 - HC2023.B5 - page 1504, Appendix B paragraphs 2.1.3, 2.1.4, 2.1.12 and 2.1.14 respectively.
644 A33405351 - Independent Tester Contract - HC2023.B5 - page 1612 - Appendix 1, paragraph 1.7.
645 A33405351 - Independent Tester Contract - HC2023.B5 - page 1612 - clause 6.1.1
646 A33405351 - Independent Tester Contract - HC2023.B5 - page 1612 - clause 5.1. Where either IHSL or NHSL commissioned additional services from the Independent Tester, they were responsible for meeting the fees charged in respect of those additional services.
647 Fees in respect of additional services were at the rates specified in A33405351 - Independent Tester Contract - HC2023.B5 - page 1612, Appendix 2, Section 2.

appear that the contract allows for a peak of just over 12.5 person days and a minimum of just over 2.75 person days[648] per month. There is clearly a limit on the amount of work, quality assurance related or otherwise, that flows from these figures, in particular when it comes to matters such as attending meetings, undertaking inspections, attending and certifying testing and monitoring the works against standards of construction quality. In short, the Independent Tester could not within this allowance be on site every day or monitor every day, particularly having regard to the scope and scale of the project.

7.47. The extent of the Independent Tester's duties are set out in the Independent Tester's Contract. There is nothing in that contract that requires the Independent Tester independently to carry out additional inspections, investigations or assessment beyond the specified tasks.[649]

7.48. Thus, the function of the Independent Tester was not exclusively to check that NHSL's requirements had been complied with. To the extent that the function did include such a role, it was circumscribed by the scope of the contracted services and the duties owed by the Independent Tester to other parties.

7.49. The Independent Tester's assessment of whether the Completion Criteria had been satisfied could properly have provided an element of assurance to the Board. Compliance with the Completion Criteria would tend to show that all key building systems had been completed and that they functioned in accordance with what was specified in the Project Agreement. However, what could properly be made of that depends on having a clear understanding of the role of the Independent Tester, and so exactly what assurance it could give, as well as there being a clear set of construction requirements accurately and sufficiently representing the client's intentions. If the brief is inadequate in some way, the Independent Tester's reports will not disclose that. They will simply confirm whether the contractual requirements, as understood by the Independent Tester, have been met.

Independent Validation

7.50. Validation is a process separate from, and serving a different purpose to, commissioning. It is defined in the version of SHTM 03-01 current at the date of handover of the RHCYP and DCN (version 2.0 of February 2014) as "a process of proving that the system is fit for purpose and achieves the operating performance originally specified". SHTM 03-01 (2014) further explained:

> "Validation differs from commissioning in that its purpose is to look at the complete installation from air intake to extract discharge and assess its fitness for purpose as a whole. This involves examining the fabric of the building being served by the system and inspecting the ventilation equipment fitted as well as measuring the actual ventilation performance."[650]

648 Excluding the months for which no allowance is made.
649 A45659225 - Arcadis headline response to PPP6 - paragraph 3.2.
650 A33662259 - SHTM 03-01 Part A v.2 2014 - Section 8 - Definitions - page 733.

7.51. Whereas commissioning is carried out by the contractor or its specialist sub-contractors, validation is generally carried out by an independent person[651] who has been instructed on behalf of the client. The scope of the process and criteria against which it is carried out are therefore matters for the client.

7.52. Section 8 of SHTM 03-01 (2014) is titled "Validation of specialised ventilation systems". A long list of departments requiring specialised ventilation is set out in the previous section at paragraph 7.2. It includes critical areas and isolation facilities (among which are chemotherapy and oncology units). In section 8, in an introductory note, having observed that "It will normally be a condition of contract that 'The system will be acceptable to the client if at the time of validation it is considered fit for purpose and will only require routine maintenance in order to remain so for its projected life'", it is stated that "Validation of [critical ventilation systems] should be carried out by a suitably qualified independent Authorised Person appointed by the NHS."

7.53. While the recommendation that specialised ventilation systems should be validated before handover is not departed from or qualified (and I took it to be accepted by core participants that that was the effect of SHTM 03-01 (2014)), the guidance which follows in section 8 is admittedly somewhat sparse. Notwithstanding the title of section 8, paragraphs 8.1 to 8.58 appear to relate to the commissioning process, (albeit that, following paragraphs under the heading "Bacteriological sampling" and the sub-heading "Conventional operating rooms", there is a reference at paragraph 8.63 to "the *additional* validation testing of UCV Operating suites", which might suggest that previous text had relevance to the validation process as well as the commissioning process). From paragraph 8.66 to the end of the SHTM detailed information is given about validation, but exclusively in relation to Ultra Clean Ventilation Operating suites, providing some 13 pages of detailed tests and procedures to be observed. This focus on operating suites reflects the origins of healthcare ventilation guidance when concentration was very much on operating theatres,[652] albeit that by 2014 the guidance had moved forward from those origins.[653]

7.54. As far as the validation of other ventilation systems is concerned, the 2014 version of the guidance is limited to what appears at paragraph 8.64: a recommendation that following commissioning and/or validation a full report detailing the findings should be produced, and a reiteration of the proposition that the system will only be acceptable to the client if at the time of validation it is considered fit for purpose and will only require routine maintenance in order to remain so for its projected life.

7.55. However, whatever precisely should be taken as intended by these provisions, they formed no part of the Project Agreement. There was no contractual requirement on either party to follow these recommendations, beyond the general references

651 Transcript - Andrew Poplett - 10.05.2022 - column 112 to 114.
652 Transcript - Andrew Poplett - 10.05.2022 - columns 78 to 80. See also A37465696 - Stephen Maddocks - Healthcare Ventilation Principles and Practice - HC2022.B6 - page 71 onwards.
653 See A33662259 - SHTM 03-01 Part A v.2 2014. HC2022.B1 - paragraphs 7.2 to 7.4 (Page 699) and Appendix 1 (Page 756) dealing with Recommended air-change rates in a variety of settings.

as to compliance with SHTMs. It was not part of the role of the Independent Tester to undertake validation of the ventilation system.[654] Moreover, Dr Inverarity did not consider, at least initially, that NHSL was obliged to secure validation of the complete system.[655]

7.56. Indeed, it might be said that some of the recommendations set out in SHTM 03-01 would be incompatible with the ethos, if not the substantive provisions, of the NPD standard form that formed the basis of the Project Agreement. It is not clear how, for example, the idea of a ventilation system "only" being "acceptable" to the client health board following validation instructed by it[656] is compatible with a regime of independent testing that is binding on both parties. This apparent contradiction was identified by Mr Henderson, (now the Senior Programme Capital Manager at NHSL), in his witness statement:

> "The contract to build the RHCYP/DCN was let as an NPD contract meaning the building does not belong to NHSL until the end of a concession period which I believe is 30 years from date of handover. Under that contract the SPV (IHSL) were to provide a fully compliant facility ready to occupy and put to use by NHSL. This, in my opinion, should have included validation to SHTM 03-01 and in this regard by handover Multiplex provided documentation to evidence that systems were commissioned, in addition this was witnessed and approved by the Independent Tester.
>
> As IHSL are the building owners it could be said that they were responsible for ensuring compliance and indeed they do have that responsibility to carry out verification on an annual basis now that the facility is operational. However, setting that aside, we wanted to ensure that our IPCT were satisfied that the documentation met their requirements and in light of concerns raised that it did not, we proceeded to engage IOM to carry out the validation.
>
> To clarify, in my view, the contract had some bearing on who was required to carry out the validation and I had to give due consideration to whether IHSL as building owners should have arranged validation. The documentation provided by Multiplex and approved by the independent tester may have been deemed to have met the requirements of SHTM 03-01 as it pertained to the contract. The additional layer of approval by the independent tester could be interpreted as the independent element. It was an unusual set of circumstances that we were navigating. However, to ensure all parties were satisfied with the approach to be taken, I began dialogue with IPCT, and it was clear they were not happy with the format of the data from Multiplex and that we would need to arrange an independent tester in relation to validation."[657]

654 A45659224 - Arcadis Response to PPP6 - paragraph 5.13.
655 A41295523 - Email from Dr Inverarity 24 August 2018 - HC2024.B13.V8 - page 460 to 461; Witness statement - Donald Inverarity - 05.03.2024 - paragraph 132.
656 Paraphrasing paragraph 8.64 A33662259 - SHTM 03-01 Part A v.2 2014 - HV2022.B1 - page 732.
657 Witness statement - Ronnie Henderson - 26.02.2024 - paragraphs 42 to 44; Transcript - Ronnie Henderson - 26.02.2024 - columns 29 to 32.

7.57. As indicated in the above quotation, by early May 2019, Mr Henderson had formed the view that the reports which Multiplex had produced by that time constituted acceptable documentation for the purpose of validation. He explained that this opinion was based on: "the level of commissioning information available, the experience of the specialist contractors for UCV canopies, the fact that the company used by Multiplex for commissioning (H&V Commissioning) had previously been used for validation and commissioning by NHSL, and most importantly that the results had been independently verified by the independent tester (Arcadis)."[658]

7.58. However, as has been previously discussed in chapter 2 of this report, the IPC Team continued to be concerned that they had not been provided with data regarding the performance of the ventilation systems in theatres and isolation rooms.[659] Following further discussions, it was concluded that the documentation already supplied by Multiplex did not meet the requirements of SHTM 03-01. Specifically, SHTM 03-01 provided that following commissioning and validation, a full report detailing findings should be prepared, concluding with a clear statement as to whether the ventilation system achieved or did not achieve the required standard. A copy of the report should be lodged with the user department, infection control and estates and facilities.[660] In NHSL's view, the reports provided by Multiplex did not clearly state whether the air pressure differences and air change rates were in conformity with SHTM 03-01.[661]

7.59. NHSL therefore appointed IOM to undertake an independent validation of the ventilation system against the recommended parameters set out in SHTM 03-01. It is not clear that, had Dr Inverarity and others not raised concerns in March 2019 onwards, any such validation would have been carried out.

7.60. However, as NHSL explained, at least in relation to the validation of the ventilation system:

> "Validation can only occur when all the commissioning is complete, the area is free of construction and cleaned by the contractor. Validation is at the very end of the whole process as a final check to make sure that the entire system and environment it serves are performing as anticipated and is ready for patient occupation."[662]

658 Witness statement - Ronnie Henderson - 26.02.2024 - paragraph 58.
659 Witness statement - Donald Inverarity - 05.03.2024 - paragraph 95.
660 A33662259 - SHTM 03-01 Part A v.2 2014 - HV2022.B1 - paragraphs 8.64 to 65.
661 Witness statement - Ronnie Henderson - 26.02.2024 - paragraph 58; Witness statement - Donald Inverarity - 05.03.2024 - paragraph 128. There is a full description of Dr Inverarity's involvement in discussions concerning validation at paragraphs 94 to 134.
662 A45002274 - NHS Lothian Response to PPP6 - HC2024.B12.V1 - page 4 - paragraph 4.2; Transcript - Janice MacKenzie (Part 2) - 27.02.2024 - column 22; Witness statement - Ronnie Henderson - 26.02.2024 - paragraph 18.

7.61. This gave rise to a problem in relation to this project as, due to the "Post Completion Works" under SA1 being undertaken in tandem with NHSL's installation and commissioning works, the RHCYP and DCN was not the fully clean environment required for validation until about June 2019.[663] Thus, it was only on 30 May 2019 that NHSL instructed IOM to commence validation of all specialist ventilation systems, including critical care, single bed isolation rooms and UCV theatres.[664]

7.62. IOM found that air change rates for certain rooms in the critical care department did not comply with SHTM 03-01. In this sense the ventilation system could be considered "not fit for purpose". The Project Agreement, following the NPD standard form, did not provide for the consequences of any defects or deficiencies in any system being identified during independent validation.

7.63. Contractual considerations meant that negotiations between NHSL, and IHSL and Multiplex on how to proceed following the IOM report became challenging.[665] Mary Morgan who, in her role as Senior Programme Director brokered and improved communication between NHSL and IHSL[666], agreed with the parallel drawn by Counsel to the Inquiry, between the difficulty of trying to renegotiate complicated contracts after they had been put in place, and the difficulty of trying to do works to a building after it has already been built.[667] These inevitable challenges contributed to the duration of the delay to opening the hospital.

7.64. As is further discussed in chapter 13 of this report, the 2014 version of SHTM 03-01 has recently been superseded by an interim version of February 2022.[668] Among the changes which appear in the new version is a very substantial development of the guidance on validation. It removes any ambiguity as to what it is that should be the subject of a validation process; paragraph 12.1 provides: "All new and refurbished ventilation systems should be independently validated prior to acceptance by the client".[669] A note explains that the client in this context means "the healthcare provider, not a contractor or service provider." Validation is defined in terms very similar to those used in the 2014 version of the guidance, albeit with an emphasis on how comprehensive the process is intended to be. Its purpose is to look at the complete installation from air intake to extract discharge and assess its fitness for purpose as a whole. Validation should be carried out by a suitably qualified competent engineer appointed by the client. That engineer is referred to in the 2022 version as the "validator".

663 A45002274 - NHS Lothian Response to PPP6 - HC2024.B12.V1 - page 5 - paragraph 4.3; Witness statement - Ronnie Henderson - 26.02.2024 - paragraphs 18 and 54.
664 A40988908 - Email 30 May 2019 - HC2024.B13.V8 - page 2367.
665 Witness statement - Matt Templeton - 06.03.2024; Transcript - Susan Goldsmith - 06.03.2024 - columns 110 to 118.
666 Witness statement - Mary Morgan - 07.03.2024 - paragraph 20.
667 Transcript - Mary Morgan - 07.03.2024 - column 206.
668 A37301626 - SHTM 03-01 Part A (February 2022) - HC2022.B1 - page 802.
669 A37301626 - SHTM 03-01 Part A (February 2022) - HC2022.B1 - page 941.

7.65. The validator is given a series of tasks. They begin with involvement in the initial client's brief and design specification "preferably prior to the project being put out to tender". The validator should acquire an understanding of the complete project and all the various decisions which have a direct effect on the likelihood of being able to achieve the desired ventilation performance. Following on a first fix inspection, the validator should attend site as frequently as necessary for follow-up inspections in order to try to eliminate any installation issues as the project develops. The validator should carry out a final acceptance inspection following the steps in the sequence specified at paragraph 12.30 of section 12, with a view to validating the system and providing a report on whether the system achieved or did not achieve the standard set out in the agreed design specification. The areas served by the system should be physically complete with final finishes applied. They should be free of rubbish, debris and obvious dust. Doors should fully close against the design pressure differential and all plant servicing the system should be operating correctly and have been commissioned in accordance with the project contract.

7.66. Again, the 2022 version of SHTM 03-01 makes explicit what was less clearly articulated in the 2014 version: that it is necessary that a healthcare provider should have independent assurance of the fitness for purpose of a new or refurbished facility before it accepts handover. Moreover, in its provision for a validator and setting out the task which the validator is to complete, the 2022 version identifies a mechanism for ensuring that parties are at one as to what the ventilation system has been designed to achieve and thereafter checking that is being built accordingly, thereby, it might be said, introducing something like the "Clerk of Works" function commended by Jeane Freeman (Cabinet Secretary for Health and Sport) in her evidence to the Inquiry.[670]

7.67. The value of such structured independent scrutiny, in the context of the quality of construction of buildings to be used by public authorities, is discussed and affirmed by Professor John Cole in the Report of the Independent Inquiry into the Construction of Edinburgh Schools, published in February 2017. Had the validation process described in the 2022 version of SHTM 03-01 been applicable to the RHCYP and DCN project, and diligently applied, it is not unlikely that a validator would have detected and commented on the discrepancy between what was recommended by guidance and what was specified in the environmental matrix. The development of SHTM 03-01 can therefore be seen as a significant and positive step.

7.68. However, a matter which remains unaddressed is what is the status and effect of the guidance where the underlying contractual structure does not support it. In a note to paragraph 12.30 of the 2022 version of SHTM 03-01 where the validation process is set out, it is stated that: "The main contractor has presented the installation as being complete, fully commissioned, achieving the specified level of performance and ready for handover. The validator's role is to check on behalf of the client that the contractor is correct in that assertion."[671] At paragraph

670 Witness statement - Jeane Freeman - 12.03.2024 - paragraph 156. Transcript - Jeane Freeman - 12.03.2024 - columns 78 to 80.

671 A37301626 - SHTM 03-01 Part A (February 2022) - HC2022.B1 - page 946.

12.31 it is stated that: "It is vitally important to complete the validation process before the system is accepted by the client." Now this may be quite coherent if the contract provides that acceptance of handover (and presumably the making or commencing of the making of payment) is conditional on the client, through its appointed validator, being satisfied that the system has achieved "the standard set out in the agreed design specification", to use the expression which appears in paragraph 12.31 of the text. It is less coherent if the contract, as was the case of the Project Agreement, has made different provision for determining whether the facility has been satisfactorily completed. The 2022 version of SHTM 03-01 makes the unequivocal recommendation that all new and refurbished ventilation systems should be independently validated prior to their acceptance by the client. While that would seem to be an entirely commendable objective, its utility is largely dependent on the assumption that the contractual position will be such as to allow the healthcare authority to refuse to accept handover of a facility, with all the consequences of that, until its validator is satisfied that the ventilation system meets the agreed design specification. That will not necessarily always be the case. In a revenue-funded project using the currently approved standard forms of contract, of which the RHCYP and DCN was an example, it will not be the case.

Healthcare Associated Infection System for Controlling Risk in the Built Environment (HAI-SCRIBE)

7.69. The Healthcare Associated Infection System for Controlling Risk in the Built Environment (HAI-SCRIBE) provides a framework around which potential infection risks associated with a proposed site development, design and planning, construction or refurbishment and ongoing maintenance of healthcare facilities can be identified, assessed and subsequently managed or mitigated.[672]

7.70. The HAI-SCRIBE procedure is set out in SHFN 30, which was originally published in 2002.[673] The use of HAI-SCRIBE was mandated by CEL 18 (2007) dated 13 December 2007.[674] It stated that "SHFN 30 [and] HAI-SCRIBE…is a mandatory requirement for all NHS Scotland capital projects and maintenance/refurbishment projects. This requirement takes immediate effect." The current version of SHFN 30, published in October 2014 and January 2015, was made mandatory in 2015 and so was applicable in 2019 when NHSL was preparing for handover and the opening of the hospital.[675]

7.71. SHFN 30 explains the "challenge" which the procedure is intended to address:

> "1.3 Patients using healthcare facilities are more likely to be immuno-compromised and also more likely to receive intensive medical interventions, which in turn increase their vulnerability to opportunistic infections. Every effort must be taken to acknowledge and ultimately reduce these risks. This includes

672 A33662208 - SHFN 30 Part B v3.0 Oct 2014 - HC2024.B13.V3 - page 464 - paragraph 1.7
673 All of which are available here: HAI-SCRIBE (SHFN 30 Archived)
674 A37816420 - Scottish Government CEL 18 (2007) 13 December 2007 - HC2024.B14.V1 - page 8
675 A32938400 - DL(2015)19.

risks associated with the built environment that can arise from, for example, demolition, construction and refurbishment activities.

1.4 Research and investigation have consistently confirmed that the healthcare environment can be a reservoir for organisms with the potential for infecting patients, whether internally or from external sources (via openable windows or fresh air intakes). For HAIs to be reduced, it is imperative that Infection Prevention and Control (IPC) measures are "designed-in" and IPC risks are "designed-out" at the very outset of the planning and design stages of a healthcare facility and that input continues up to, into and beyond the final building stage. Inevitably, there will be residual risks which will require identification, registering and monitoring."

7.72. The current version of SHFN 30 is published in three parts.[676] Part A provides built environment infection prevention and control information for design, construction, IPC and estates teams. Part B sets out the implementation and assessment process for identifying, eliminating or managing built environment infection control risks. It also describes the key personnel involved in this process together with their roles and responsibilities and the fact that collaboration among all those involved in the process is pivotal to its success.[677] Part C sets out question sets and checklists for use in the process.

7.73. The risk assessment process has been developed into a series of questionsets for each of the following four stages of development:

- Consideration of the proposed site and relevant implications;
- Design and planning;
- Construction and refurbishment work; and
- Pre-handover check, ongoing maintenance and feedback.[678]

7.74. When the project is ready for operation, the Stage 4 questionset provides a final, pre-handover checklist that everything in the brief for the project has been provided. It is "an assessment that the outcomes from the earlier questionsets have been successfully fulfilled".[679] Therefore, many of the questions to be posed at Stage 4 reflect questions that are relevant for previous stages and appear in earlier questionsets. Thus, in the Engineering services (Ventilation) section, the following questions are posed:

"4.26 Is the ventilation system designed in accordance with the requirements of SHTM 03-01 "Ventilation in Healthcare Premises"?

676 HAI-SCRIBE (SHFN 30).
677 A33662186 - SHFN 30 Part A v4.0 Oct 2014 - paragraph 1.1
678 The last named is sometimes referred to as "ongoing maintenance" - see for example A33662208 - SHFN 30 Part B v3.0 Oct 2014 - HC2024.B13.V3 - page 468. However, "Pre-handover check, ongoing maintenance and feedback" is the name used on the question sets for this stage: SHFN 30 Part C v1.0 Jan 2015 - page 2 and 38.
679 A33662208 - SHFN 30 Part B v3.0 Oct 2014 - HC2024.B13.V3 - page 528 - paragraph 3.35.

> 4.27 Is the ventilation system designed so that it does not contribute to the spread of infection within the healthcare facility? (Ventilation should dilute airborne contamination by removing contaminated air from the room or immediate patient vicinity and replacing it with clean air from the outside or from low-risk areas within the healthcare facility.) …
>
> 4.31 Is the ventilation of theatres and isolation rooms in accordance with current guidance SHTM 03-01, SHPN 04-01 Supplement 1 and the Scottish Hospital Infection Manual?"[680]

7.75. With respect to the Stage 4 questionset it is noted that:

> "Within the built healthcare facility, it is important to ensure there will be an ongoing application of HAI-SCRIBE. This is a verification process of particular importance not only where there are subsequent alterations to the building, but also to arrangements within the building, and to procedures and practices. The three key stages involved in HAI-SCRIBE have a continuous application:
>
> - identifying the hazard;
> - assessing the risk from the identified hazard;
> - managing the risk to eliminate or minimise impact."

7.76. The purpose of the Stage 4 process is therefore to assist in the ongoing identification and management of risk having regard to the state of the building at handover, involving the consideration of "high-level principles around infection control risks" and "high-level standards" that NHSL would look to achieve.[681] It is not intended as a check that contractual requirements have been met, or that the hospital is ready for handover in the contractual sense.

7.77. Nevertheless, the completion of a Stage 4 HAI-SCRIBE review can provide a health board with assurance that HAI risks related to the built environment have been identified and that there is a plan in place to manage these.

7.78. NHSL failed to complete the HAI-SCRIBE Stage 4 questionset prior to the commercial handover of the hospital. In his closing submission, Counsel to the Inquiry argued that the Stage 4 HAI-SCRIBE procedure should have been completed before handover. Further, the failure to complete an HAI-SCRIBE Stage 4 had resulted in NHSL accepting, and paying for, a hospital that it could not use and that it did not know was safe for patients to occupy. Counsel to the Inquiry continued:

> "When steps were taken to complete the Stage 4 HAI-SCRIBE in June 2019, the issues with the hospital ventilation system were detected. Had the HAI-SCRIBE procedure been completed before SA1 was signed, there is the possibility that

680 A33662208 - SHFN 30 Part B v3.0 Oct 2014 - HC2024.B13.V3 - page 533.
681 See for example Transcript - Lindsay Guthrie - 01.03.2024 - column 16; Transcript - Janice MacKenzie - 26.02.2024 - column 41; Transcript - Donald Inverarity - 05.03.2024 - column 27; A33662186 - SHFN 30 Part A v4.0 Oct 2014 - chapter 2.

the issues with the ventilation system would have been detected sooner than they were (in February 2019 instead of June 2019). Therefore, the failure to follow the standard procedure can be viewed as a missed opportunity."[682]

7.79. Counsel moreover suggested that because SA1 involved technical resolutions to briefing and design issues, NHSL should arguably have gone back and completed the Stage 2 HAI-SCRIBE procedure (which is to be completed at the design stage). The legal representative of the parents and representatives of affected children endorsed Counsel's approach and added his strong censure of NHSL's failure to have HAI-SCRIBE Stage 4 completed prior to handover of the hospital.

7.80. In response, the legal representative of NHSL submitted:

"HAI-SCRIBE Stage 2 is about design and planning intention for the project as a whole, rather than individual spaces or infrastructure elements. This means that at Stage 2, everything is still hypothetical, the aim being to identify hypothetical hazards from collective multidisciplinary experience, such experiences gained from other projects and buildings as highlighted in contemporary guidance or unpublished peer experience…Stage 4 HAI-SCRIBE assesses the building's performance based on how it has been built, and checks that the systems and spaces perform as anticipated against requirements. Where the building is found not to be performing as anticipated, Stage 4 aims to ensure that operational mitigations against any infection risk are in place. So…returning to Stage 2 mid-construction would be unusual. The HAI-SCRIBE process is intended to have a linear progression from Stage 1 to 2, 2 to 3, and then 3 to 4. Once construction has commenced, the HAI-SCRIBE assessment process is already considered to be at Stage 3.

It is important to note that at Stage 2 and Stage 4, the questions to be considered are essentially the same. So undertaking a Stage 2 HAI-SCRIBE during construction would be like trying to undertake a Stage 4 HAI-SCRIBE in a partially built environment, but without having the commissioning data available to test compliance. Such an assessment of clinical infection risk is more informed and fruitful once the installation is complete and running, i.e. at Stage 4, rather than trying to anticipate during construction how it might eventually work. It is, therefore, NHS Lothian's position that there would have been little point in undertaking a Stage 2 HAI-SCRIBE in 2018 because the design parameters which were developed from the clinical output specification remained the same for the project as a whole. The ventilation systems were already installed and construction was at an advanced stage. It was thought by NHS Lothian that the ventilation system was compliant with guidance, other than known derogations, and HAI-SCRIBE is not a tool with which to check compliance with guidance."[683]

682 CTI Closing Submission 2024 - page 5 - paragraph 18.
683 Transcript - Closing submissions for investigations into the RHCYP/DCN - 17.06.2024.

7.81. I accept this analysis. No very good purpose would have been served by carrying out an HAI-SCRIBE Stage 2 review following the agreement as to technical solutions in 2018. It is in any event mandated for the design and planning stage as opposed to the inspection of completed systems.

7.82. In relation to the pre-handover check, Lindsay Guthrie, Infection Prevention and Control Nurse (NHSL) had said in evidence that "my expectation would be that the Stage 4 SCRIBE would be done before, I suppose, the contractors…were almost allowed to leave site, so on completion of the project…So that you've got an opportunity to remediate any issues that you pick up as part of that Stage 4 process…"[684] While this might be handover, Ms Guthrie also said, "my expectation around the Stage 4 part of the process would be that that's undertaken on completion of all the construction or any refurbishment work. It would usually be done after what we call a "builder's clean."[685] Because of the post-completion works, this final clean only took place after handover and shortly before the hospital was due to open in July 2019.

7.83. In relation to the criticism that the HAI-SCRIBE Stage 4 review should have been completed earlier, and the suggestion that, had it been, the failures of compliance would then have been detected, I would reiterate that the Stage 4 review is not equivalent to, nor a substitute for, a certificate of practical completion, or other contractual means of confirming that construction requirements have been met. Nor should there be an expectation for an HAI-SCRIBE review to act as a safeguard or safety net for health boards to check that ventilation systems are compliant in the event of contractual ambiguity.

7.84. NHSL intended to complete the HAI-SCRIBE Stage 4 procedure prior to the admission of patients, albeit after having accepted handover. Very properly, the Infection Prevention and Control team insisted that they be provided with evidence that systems were safe and compliant, and that this should include a validation report as described in SHTM 03-01. The way in which the HAI-SCRIBE was implemented helped to identify risk, as was its purpose. The process was rigorous. The Stage 4 HAI-SCRIBE was not signed off until such time as residual risks could be managed operationally (see chapter 4).

7.85. Neither the available information and documentation nor the physical state of the building would have permitted the HAI-SCRIBE Stage 4 to have been completed in January 2019, but even if completion had been possible at that time, as Counsel to the Inquiry acknowledged, by that point the ventilation system had already been built. Earlier detection might have mitigated the disruption to some extent, but it would still have been necessary to carry out remedial works.

684 Transcript - Lindsay Guthrie - 01.03.2024 - column 22.
685 Transcript - Lindsay Guthrie - 01.03.2024 - column 21.

Training/Operation and Maintenance

7.86. Term of Reference 6 requires the Inquiry to examine how NHSL secured assurance and supporting evidence that "Adequate information and training were provided to allow end-users effectively to operate and maintain key building systems."

7.87. In relation to the RHCYP and DCN project, this requires to be put into the context of the NPD contract structure. From the point at which construction of the new hospital was complete until 2 July 2042,[686] responsibility for the operation and maintenance of the facility lay with Bouygues rather than NHSL. In the context of ventilation, this meant that responsibility for operation and maintenance of the ventilation plant or system equipment lay with Bouygues, and that it was its staff that required information and training for that purpose. NHSL staff only required training at the user interface level, such as, for example, the operation of room thermostats.[687] Nonetheless, provision was made for IHSL to provide such staff training as NHSL deemed necessary. Details of training proposed were to be submitted as Reviewable Design Data for review by NHSL.[688]

7.88. Clause 18 of the Project Agreement also required that IHSL make available to NHSL a draft operation and maintenance manual "to allow the Board to plan for the safe and efficient operation of the Facilities", a final draft operation and maintenance manual "to allow the Board to operate and use the Facilities…safely and efficiently" and a principal operations and maintenance manual, in all cases including all manufacturers' instructions relating to equipment installed by or on behalf of IHSL.[689]

7.89. In an exchange of correspondence between NHSL and HFS in March and April 2019, HFS had specifically asked for evidence as to "How the Board is assured that its staff and appropriate contractors are adequately trained to ensure engineering systems are managed and operated competently?"[690] NHSL's response stated that:

> "…IHSL are contractually obliged to provide sufficient staff with the requisite level of skill and experience for the provision of the maintenance and operation of the Engineering Systems.
>
> "The Board is entitled to review training records and training programs at its discretion and has undertaken this exercise in preparation for the handover of the facilities... NHSL has reviewed the training records to check that appropriate training and certification is in place."

686 The Expiry Date in the Project Agreement. Subject to earlier termination of the Project Agreement.
687 A45002274 - NHS Lothian Response to PPP6 - HC2024.B12.V1 - page 4, Appendix 2, item 6.2.28 in table.
688 A33405670 - Schedule Part 6, section 3 - HC2023.B5 - page 341, paragraph 8.15.
689 The original requirement in the Project Agreement to provide hard copies of the operation and maintenance manual was varied by Board Change Notice 118A dated 30 November 2018 so that electronic copies were provided instead.
690 A41231046 - Email attachment - HC2024.B13.V3 - page 59.

> "…The wider clinical staffing of the hospital has been provided with familiarization training of the site including the user interfaces for engineering systems where appropriate to their roles. Additional guidance on these user interfaces is being included in the Building User Guide for the hospital."[691]

7.90. This response indicates that NHSL was assured that appropriate training was in place, and could, if required, be verified.

7.91. In addition to the relationship between NHSL and IHSL (and through IHSL to Multiplex and Bouygues), given that Bouygues was responsible in the first instance for the operation and maintenance of the engineering plant and equipment, the relationship between Multiplex and Bouygues is also significant, particularly in relation to the provision of key information. It is therefore worth noting that Multiplex undertook to provide (in each case to Bouygues):

- The information on maintenance regimes and life expectancy not less than six months before the Actual Completion Date;
- Access to the electronic database of operation and maintenance manuals on the same timescale;
- Vendor information such as plant information, operating and maintenance manuals, equipment schedules and so on not less than three months before the Actual Completion Date; and
- Final drafts of the commissioning results on or before the Actual Completion Date.[692]

7.92. Multiplex undertook to provide training on the use of equipment installed, with the training programme to be agreed as part of the Final Commissioning Programme.[693]

7.93. The requirements to provide information to Bouygues mirror to some extent the requirement in the Project Agreement.[694] Bouygues is obliged to update as necessary those manuals.[695] The electronic copies of the final draft of the O&M [Operating and Maintenance] manuals were made available to all parties on 22 February 2019, and the principal O&M manuals were made available on 26 June 2019.[696]

691 A41231046 - Letter 1 April 2019 - HC2024.B13.V3 - page 69.
692 A32432831 - Interface Agreement between Bouygues, Brookfield Multiplex, and IHSL - Schedule Part 2 item 8. See also paragraph 2.12 of FM Guide to Design & Construction For The New RHSC & DCN Project, incorporated as Schedule Part 5 of that Agreement.
693 A32432831 - Interface Agreement between Bouygues, Brookfield Multiplex, and IHSL - item 6
694 See paragraph 2.1.24 of the Completion Criteria and the list of matters in relation to which records had to be kept.
695 A32432694 - Service contract between IHSL and Bouygues - clause 18.5.
696 A45020685 - IHSL response to PPP6 - HC2024.B12.V1 - page 55 - paragraphs 2.13 to 14.

7.94. The Inquiry has not uncovered any issues arising due to lack of, or deficiency in, training or operation and maintenance of the ventilation system at RHCYP and DCN since the hospital was finally fully opened, that adversely impacted on patient safety and care. Nor have any such issues been brought to its attention.

Chapter 8

Assurance of design quality

Chapter 8

Assurance of design quality

Introduction

8.1. There existed a number of tools and processes of the Scottish Government which were intended to assist with the development of a quality design. The Outline Business Case for the project conceived them as having a review function, noting that:

> "The reference design and development of the final design with the preferred bidder will both be subject to a range of reviews as work progresses. To date these have included the following, and findings from each have influenced the ongoing design development:·
>
> - Architecture + Design Scotland workshops
> - AEDET – a design evaluation tool for stakeholders to assess the architects' output
> - HAIscribe [sic] – infection control
> - Health Facilities Scotland NDAP – design assessment" [697]

8.2. All of these processes or procedures are set out in a letter to the chief executives of health boards, CEL 19 (2010), introducing A Policy On Design Quality for NHS Scotland 2010. This stated that support for the implementation of the design agenda relating to the Scottish Government's objectives and expectations for public investment was to be provided by means of a tripartite working arrangement between the Scottish Government Health Directorate, HFS and Architecture and Design Scotland (ADS).[698] This would facilitate the procurement of well-designed, sustainable, healing environments which support the policies and objectives of NHS Boards and the Scottish Government Health Directorates.[699]

697 A33431600 - Outline Business Case 2012 - HC2022.B3.V2 - page 672, paragraph 1.70.
698 ADS was established as a Non-Departmental Public Body in 2005 as the national champion for good architecture, design and planning in the built environment. ADS operates within the Scottish Government's policy framework on architecture and design, the aim of which is to raise the quality of new development and support the Scottish Government's National Outcomes for the built environment.
699 A37215536 - CEL 19 (2010) - HC2023.B1 - page 553 - paragraph 6.

Architecture + Design Scotland

8.3. The Policy on Design Quality for NHS Scotland[700] set out the role of ADS. Broadly, the aim was to raise the quality of new development so that high standards of layout and design became the rule. ADS worked with the Scottish Government Health Directorate to assist NHS Scotland in addressing design quality issues in the procurement of healthcare building projects, the summary objectives of which are to raise the level of design quality achieved through infrastructure investment, increase the capacity of health boards and central agencies in achieving that, and assist in sharing good practices. The principal activities that ADS were expected to engage in to achieve these objectives were set out in the Policy.[701]

8.4. It was not any part of the role or remit of ADS to provide any assurance in relation to the ventilation system. While ADS played a role in design assurance, that role was limited to matters of general architecture and design. Accordingly, it did not consider engineering or technical aspects of building services or their design.

Achieving Excellence in Design Evaluation Toolkit

8.5. A Policy on Design Quality for NHS Scotland 2010 also provides that "All NHS Scotland Bodies must use Design Quality Indicator (DQI) tools as appropriate to manage their design requirements through the life of a project. The English Department of Health's Achieving Excellence in Design Evaluation Toolkit (AEDET Evolution) and associated supplementary tools such as ASPECT are the exemplars towards achieving the appropriate level of project design management."[702] It is specifically stated to be applicable to Public Private Partnership projects, joint ventures including "hub", and conventionally funded projects.[703]

8.6. AEDET is a tool for evaluating the quality of design in healthcare buildings. The toolkit was developed in partnership by the NHS, CABE (Commission for Architecture and the Built Environment), the Construction Industry Council, and Sheffield University and was designed to be used by those involved in the commissioning, production and use of healthcare buildings. It was: "specifically directed towards achieving excellence in design rather than ensuring compliance with legislation, regulation and guidance. High scores in AEDET do not therefore necessarily guarantee compliance with statute."[704] This is reinforced by the initial statement in the Guidance applicable at the time which states that AEDET "evaluates a design by posing a series of clear, non-technical statements, encompassing the three key areas of Impact, Build Quality and Functionality."[705] Those listed as being appropriate for involvement in an AEDET workshop do not include technical construction or engineering professionals (other than as

700 Appended to A37215536 - CEL 19 (2010) - HC2023.B1 - see pages 559 to 562.
701 A37215536 - CEL 19 (2010) - HC2023.B1 - pages 561 to 562.
702 A37215536 - CEL 19 (2010) - HC2023.B1 - page 567 - paragraph 8. The versions of AEDET are AEDET, AEDET Evolution (applicable at the relevant time) and AEDET Refresh (current).
703 A37215536 - CEL 19 (2010) - HC2023.B1 - Annex B - page 571.
704 A37215536 - CEL 19 (2010) - HC2023.B1 - Annex B - page 571.
705 A37215536 - CEL 19 (2010) - HC2023.B1 - Annex C - page 594.

presenters or facilitators).[706] Ian Graham, Director of Capital Planning and Projects (NHSL) told the Inquiry that "The focus of the AEDET assessment is architectural. Although it did cover the technical areas, it was principally an architectural review."[707]

8.7. It is clear from this that AEDET is a means of obtaining assurance of design quality at a high level. It does not provide a level of detailed scrutiny to individual systems within a project such as the ventilation system. None of the criteria used in AEDET reviews specifically relate to compliance with technical guidance or standards; nor is there any specific criteria that addresses issues related to ventilation. It is difficult to see how the AEDET process could have identified any potential issues in the proposals for a ventilation system, and as noted above any such role for that process is disclaimed. One of the reports of the AEDET reviews conducted by NHSL specifically notes that it "does not provide an assessment of the compliance of the design with current healthcare planning or technical guidance."[708]

8.8. NHSL conducted AEDET reviews in respect of the hospital design in October 2009,[709] April 2010,[710] and August 2010 during the capital funded phase of the project and August 2011[711] and March 2012[712] after the switch to the NPD model. A further AEDET review was held with the bidders in relation to their proposals during the competitive dialogue process. The review with IHSL, the contractor, took place in June 2013.[713]

8.9. AEDET is now a part of the wider NHS Design Assessment Procedure (NDAP). Completed AEDET is part of the requirements for submission to the Scottish Government at Initial Agreement, Outline Business Case and Final Business Case stages of a project.[714]

NHS Design Assessment Procedure

8.10. The overall purpose of NDAP is:

> "to promote design quality and the service outcomes realised through this. It does this by mapping design standards to the key investment deliverables plus the Scottish Government's objectives and expectations for public investment, then demonstrating their delivery via self, and independent, assessments. NDAP supports continuous investment improvement, through sharing design

706 A39822335 - AEDET Toolkit 01 2008 - HC2023.B10.V2 - page 997.
707 Witness Statement - Iain Graham - 25.04.2023 - paragraph 25.
708 A35230312 - AEDET workshop - 12 August 2010 - page 2.
709 A35230315 - AEDET review - 15 October 2009.
710 A35230332 - AEDET workshop - 22 April 2010.
711 The Inquiry does not appear to hold any report from this review, but it is referenced, and the scores awarded for each section, in A40787632 - Atkins Report - HC2023.B10.V2 - page 145.
712 A34956909 - AEDET workshop - 8 March 2012.
713 The history of the AEDET reviews conducted by NHSL is in Witness Statement - Janice Mackenzie - 26.04.2023 - paragraphs 93 to 99.
714 A44601394 - Scottish Capital Investment Manual - NHSScotland Design Assessment Process 2017 - page 10 to 12; also page 35 to 37.

> standards and learning from comparable projects, thus building upon the best of what has gone on before."[715]

8.11. At each of Initial Agreement, Outline Business Case and Final Business Case stages, a design review should be carried out by HFS and ADS and the outcome reported to the Scottish Government's Capital Investment Group which considers the business cases. NDAP was stated not be an additional information burden but rather a formalisation of both the self and independent assessments of each project team's own evidence of their design's optimisation.[716]

8.12. NDAP became part of the business case approval process with effect from 1 July 2010. For projects that had not received approval of their Outline Business Case by 1 July 2010, these "shall be considered for the assessment process on a case by case basis…"[717] Since the RHCYP and DCN project had already been through the OBC process by the time the NDAP process was introduced, the NDAP was not mandated in terms of these transitional arrangements. Michael Baxter, the Deputy Director (Capital Planning and Asset Management) in the Scottish Government Health and Social Care Directorate at the time, explained in his evidence to the Inquiry, NDAP "was obviously introduced at a point in time and the idea was not about retrofitting to projects that had already passed progressive stages."[718] Accordingly, no NDAP was carried out in relation to the RHCYP and DCN project.[719] The statement in the OBC (cited in the introduction to this chapter) was in error in stating otherwise.[720]

8.13. Even if an NDAP had been carried out, this process was not intended to detect unintentional non-compliance with guidance resulting from data-entry mistakes at the granular level of individual room parameters; nor was it intended to replicate the project team's detailed consideration of specifications and technical standards.[721] This was confirmed by Alan Morrison, Interim Deputy Director of Health Finance and Infrastructure in the Scottish Government:

> "On 5 July 2019 I emailed Susan Grant of HFS in relation to NDAP. Susan responded to my email later that same afternoon… The purpose of my email was to better understand whether NDAP should have identified the problem with the ventilation system (at RHCYP) which had recently been discovered. If the answer was 'no, NDAP does not get into that level of detail', we would need

715 A44601394 - Scottish Capital Investment Manual - NHSScotland Design Assessment Process 2017 - page 2.
716 A44601394 - Scottish Capital Investment Manual - NHSScotland Design Assessment Process 2017 - page 10. For evidence heard by the Inquiry in relation to the NDAP process generally see, Witness statement - Julie Critchley - 14.03.2024 and Witness Statement - Susan Grant - 09.05.2023
717 A35299820 - SCIM Design Assessment in the Business Case Process - HC2023.B10.V1 - page 52.
718 Transcript - Michael Baxter - 16.05.2022 - column 47.
719 Confirmed by Witness Statement - Brian Currie - 18.05.2022 - paragraph 66; Witness Statement - Iain Graham - 25.04.2023 - paragraph 24; Transcript - Iain Graham - 17.05.2022 - columns 61 to 62; Transcript - Sorrel Cosens - 17.05.2022 - columns 47 to 49.
720 See explanation in Transcript - Brian Currie - 18.05.2022 - columns 89 to 91.
721 This based on Closing Submission - Counsel to the Inquiry - paragraph 317 and 287 to 88.

> to consider what we would have to put in place to identify issues before they became a problem. If the answer was 'yes, it should have spotted the problem', then we would need to consider why it did not and what we would need to change about the process. Susan's response was to explain that because NDAP is "only a proportionate review" she could not guarantee the process would detect problems (such as arose at RHCYP) in future projects."[722]

8.14. To this should be added that from a practical point of view, the resources to offer an in-depth review at NDAP (or indeed any other) stage were very limited. The Inquiry heard that from 2009 until the creation of NHS Scotland Assure in 2021, there was only one engineer within HFS to support health boards and to engage in activities like NDAP.[723]

Healthcare Associated Infection System for Controlling Risk in the Built Environment (HAI-SCRIBE)

8.15. Of most relevance to considering issues with building systems that could impact on patient health and safety is HAI-SCRIBE, set out in Scottish Health Facilities Note 30 (SHFN 30). As described in chapter 7 the Healthcare Associated Infection System for Controlling Risk in the Built Environment (HAI-SCRIBE) provides a framework around which potential infection risks associated with a proposed site development, design and planning, construction or refurbishment and ongoing maintenance of healthcare facilities can be identified, assessed and subsequently managed or mitigated.

8.16. Previous discussion of the relevance of HAI-SCRIBE has concentrated on Development Stage 4: Review of completed project. My current focus is Development Stage 2: design and planning, which has been previously touched on, but rather more lightly.

8.17. The 2007 version of SHFN 30, which was applicable at the design stage of the project, stated that the application of HAI-SCRIBE was "essential in the planning and design of a new healthcare facility or a major redevelopment, refurbishment or extension of an existing healthcare facility. It is at the planning and design stage that hazards associated with potential HAI risk should be identified and assessed and measures taken to manage the risks. It is sensible to "design-in" at this stage, measures which will eliminate or minimise the impact of identified hazards and effectively manage the HAI risk. It is also essential to ensure that the appropriate guidance as applicable in Scotland is being followed."[724]

722 Witness Statement - Alan Morrison - 1 of 2 - 16.05.2022 - paragraph 15; A32616357 - Email 5 July 2019 - HC2022.B3.V2 - page 1309; see also Witness Statement - Brian Currie - 18.05.2022 - paragraph 68.
723 Transcript - Edward McLaughlan - 09.05.2022 - column 5.
724 A33662213 - SHFN 30 Part 2 v2 Jun 2007 - HV2024.B27.V6 - page 38.

8.18. The CEL mandating the use of HAI-SCRIBE reiterated a key principle of the guidance, which is the need for designers, architects, engineers, facilities managers and planners to work in collaborative partnership with Infection Prevention and Control (IPC) teams, healthcare staff and users to deliver facilities in which IPC needs have been anticipated, planned for and met:

> "Implementation of HAI-SCRIBE and indeed SHFN 30 should be the responsibility of a specialist multi-disciplinary professional staff team who have the necessary and appropriate skills in relation to the healthcare facility being planned, designed, constructed, refurbished or maintained. The use of a multi-disciplinary team is necessary for the success of a new build or refurbishment healthcare project. Therefore the planning and implementation process should include an array of both healthcare professionals and contractor personnel. However, it is essential that all members of the project team have a background understanding of the principles of prevention and control of infection in the built healthcare environment." [725]

8.19. The intention for the review procedure at Stage 2 (the design stage) was for a systematic and thorough review of the plans for the project, with a view to identifying and assessing potential hazards and managing the risks by eliminating or minimising their impact. This may involve amendments to plans as it is likely to be more cost effective to manage HAI risk at the planning stage rather than after completion.[726]

8.20. Guidance was given on issues to be considered during the review, which includes consideration of the "fitness for purpose" of the ventilation system, use of natural ventilation and provision for isolation rooms, although this was at a fairly high level. The questionset contained a question numbered 2.2, "Is the ventilation system design fit for purpose, given the potential for infection spread via ventilation systems?". What is meant by "fit for purpose" is not elaborated upon.

8.21. The 2007 version of SHFN 30 also contained a section concerning common errors in design or construction "due to inept or non-existent risk management" which included "incorrect air turnover and air flow patterns".[727] This level of detail was not included in the questionset itself.

8.22. In relation to the RHCYP and DCN project, the evidence suggests that the review procedure was undertaken at the high level that one might expect from the questionset, and involved the engagement of healthcare professionals and contractors.

725 A37816420 - CEL(2007)18 - HC2024.B14.V1 - page 18.
726 A33662213 - SHFN 30 Part 2 v2 Jun 2007 - HV2024.B27.V6 - page 38.
727 A33662182 - SHFN 30 Part 1 v3.0 Jun 2007 (Oct 2014 archived) - HC2024.B13.V3 - page 574, paragraph 5.5.

8.23. IHSL confirmed its compliance with SHFN 30 in its tender submission and Project Co Proposals.[728] It stated "Our design is currently now well-developed. It has done so in accordance with the requirements of HAI-Scribe [sic] guidance notes and the relevant SHTM's and HBM's. A diligent design review and compliance with HAI-Scribe [sic] protocols has been part of the ongoing review as the design has continued to develop and this will continue through into the Preferred Bidder phase. This work will be done in close co-operation with the Board's team members."[729]

8.24. As described in chapter 6, an HAI-SCRIBE review took place during the preferred bidder stage, prior to Financial Close, in November 2014.[730] The draft report states that the review was attended by the infection prevention and control adviser, Liane Edwards-Scott (Design Manager, IHSL) David Stillie (Architect Lead, MML), Colin Macrae (Technical Adviser and engineer), Janice MacKenzie (Clinical Director), the lead architect from IHSL, as well as NHSL's project manager and contracts manager.

8.25. With respect to the question, "Is the ventilation system design fit for purpose, given the potential for infection spread via ventilation systems?" the assessment contained a cross next to "no" with the further explanation:

> "Some concern has been raised in relation to a potential issue with ventilation with regard to negative/balance pressure in single bed rooms.
>
> Awaiting drawings and further information to fully understand if there is a risk/ issue."[731]

8.26. The review procedure did not identify the issue with air change rates in the critical care department. This is not surprising considering the high level of the questionset and the fact that there was no expectation of a derogation from the guidance in respect of critical care ventilation.

8.27. A further review was scheduled to take place but this was cancelled due to the lack of attendance of key people.[732] However, ventilation was discussed by those who attended. Considering the chronology of the project set out in chapter 6 it is apparent that the review procedure was a factor that led to further discussions that were to take place between Multiplex, TÜV SÜD/Wallace Whittle, Mott MacDonald Limited and NHSL with respect to the design of bedroom ventilation, and which included the consideration of drawings and proposals, as well as further risk assessments.

728 For example - HC2023.B5 (Project Co's Proposals 1) - page 352 and 3661.
729 HC2023.B5 (Project Co's Proposals 1) - page 3661.
730 A42416940, HAI-SCRIBE 19 November 2014 - HC2023.B12.V2 - page 1878. The draft document states this is a risk assessment in accordance with "HAI-SCRIBE June 2007: Development Stage 3, Construction" however the questionset is that for HAI-SCRIBE Stage 2.
731 A42416940 - HAI-SCRIBE 19 November 2014 - HC2023.B12.V2 - page 1878. The draft document states this is a risk assessment in accordance with "HAI-SCRIBE June 2007: Development Stage 3, Construction" however the questionset is that for HAI-SCRIBE Stage 2.
732 A34813021 - Request for Information Summary 20 January 2015 - HC2023.B10.V2 - page 15.

8.28. The version of SHFN 30 applicable when the Stage 2 HAI-SCRIBE was undertaken for the RHCYP and DCN project has been superseded. The current version of SHFN 30, which was published in 2014 and became mandatory in 2015, contains some changes. One of the changes noted by Counsel to the Inquiry is that it does not contain a section on "common errors", which in the 2007 version included mention of incorrect air flow.[733] During the third Edinburgh hearings, Dr Donald Inverarity was asked if these "common errors" had been ironed out by the time of the 2014 guidance. He responded, "I don't know why they're not mentioned in the later guidance, but they certainly hadn't been ironed out."[734] In his Closing Submission, Counsel to the Inquiry suggested that consideration should be given to whether the "lessons learned" process introduced by NHS Scotland Assure adequately addresses this issue. In response to this, NHS NSS explained that there was an effort to incorporate "common errors" into the new questionsets and that the "expansion of the questions was intended to proactively facilitate discussions, which would reduce the risk of common errors being repeated. The questionset in the 2014 version of SHFN 30 was expanded to achieve that, and so to generate a more informed design choice".[735]

8.29. The 2014 version is more detailed, both with respect to the questionsets and to the guidance provided on the issues which should be considered by those engaged in the HAI-SCRIBE process. The Stage 2 questionset now contains the following questions in the section headed "Engineering services (Ventilation)":

> "2.32 Is the ventilation system designed in accordance with the requirements of SHTM 03-01 'Ventilation in Healthcare Premises'?
>
> 2.33 Is the ventilation system designed so that it does not contribute to the spread of infection within the healthcare facility? (Ventilation should dilute airborne contaminants by removing contaminated air from the room or immediate patient vicinity and replacing it with clean air from the outside or from low-risk areas within the healthcare facility.)…
>
> 2.37 Is the ventilation of theatres and isolation rooms in accordance with current guidance?"[736]

8.30. Thus, this change to SHFN 30 draws explicit attention to SHTM 03-01 in the questionset, which the 2007 version did not do. This could be seen as an improvement, although it is not an explicit direction to check for common errors such as "incorrect air turnover and air flow patterns" and so remains at a fairly high level of specificity.

733 Closing Submission by Counsel to the Inquiry - Closing Submission Bundle Edinburgh 3 - February 2024 - page 108 - paragraphs 433 to 435.
734 Transcript - Donald Inverarity - 05.03.2024 - column 37; see also Transcript - Lindsay Guthrie - 01.03.2024 - column 31.
735 Closing Submission by NHS NSS - Closing Submission Bundle Edinburgh 3 - February 2024 - page 361, paragraphs 10 to 11.
736 A33662208 - SHFN 30 Part B v3.0 Oct 2014 - HC2024.B13.V3 - page 509 to 511.

8.31. Furthermore, while the questionset invites reviewers to give particular consideration to the ventilation requirements for theatres and isolation rooms, the same is not asked in relation to critical care areas (or any other areas requiring specialised ventilation as set out in Table A1 of SHTM 03-01).

8.32. The omission in the questionset is reflective of a general lack of attention to critical care areas that is given in Part A of SHFN 30 in comparison with isolation rooms and theatres. The section on ventilation in Part A for example contains a list of areas "which usually have specialised ventilation requirements for infection prevention".[737] The list includes:

- operating department
- source isolation
- bronchoscopy and sputum induction rooms, where a risk assessment has indicated a tuberculosis risk
- protective isolation accommodation for highly immuno-compromised patients
- cardiac catheter, interventional radiology units
- microbiology containment laboratories
- mortuaries

8.33. Critical care areas (or, to be even more specific, patient accommodation and treatment areas in the critical care department) are not included in the list, nor are other units found within critical care departments such as high dependency, or intensive care. Ventilation for isolation facilities is discussed in multiple sections of the guidance, ventilation for critical care is not.

8.34. The section on ventilation in Part A also does not mention the significance of air change rates for infection prevention and control, but rather focuses on pressure.

8.35. While enhancements could be made to SHFN 30 to include in the HAI-SCRIBE procedure specific reference to the ventilation requirements for the relevant areas of the critical care department and the significance of air change rates, I acknowledge the recent developments in assurance processes and relevant guidance that have occurred since the RHCYP and DCN project was completed. These include an update of SHTM 03-01, the publication of "NHS Scotland Assure Lessons Learned" and a Note on infection prevention and control risks in the design of a critical care unit. Of greatest significance is the role of design supervision given to the Ventilation Safety Group in the update of SHTM 03-01, as discussed in chapter 13.

737 A33662186 - SHFN 30 Part A v4.0 Oct 2014.

Chapter 9

Arrangements for strategic definition, preparation and brief, and concept design

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Arrangements for strategic definition, preparation and brief, and concept design

Introduction

9.1. Term of Reference 2 directs the Inquiry:

> "To examine the arrangements for strategic definition, preparation and brief, and concept design, including the procurement, supply chain and contractual structure adopted for the financing and construction of the buildings, to determine whether any aspect of these arrangements has contributed to such issues and defects"

9.2. The "issues and defects" with which the Inquiry's Remit and Terms of Reference are concerned are identified in chapters 2, 4 and 6 of this report, where it is also explained how they occurred. They relate to the inadequacy of the ventilation system in the new hospital which came to light in June and July 2019 and which led to the postponement of the opening of the hospital until March 2021, a delay of 20 months.

9.3. Shortly stated, the central issue, as narrated in chapter 3, was the discovery in June 2019 that the ventilation system serving 4 multi-bed rooms and 5 single-bed rooms in the critical care department[738] in the new hospital did not achieve the air change rates and pressure differentials recommended for critical care areas by the authoritative source of guidance, SHTM 03-01, these being 10 ac/h and 10 Pa of positive pressure respectively. Because the ventilation system as constructed as of June 2019 could not achieve these outputs and because these are the outputs recommended for critical care areas such as those situated within the critical care department, it was "defective" as that expression is used in the Terms of Reference.

9.4. That central issue and, separately, the lack of confidence on the part of the Cabinet Secretary to which that issue gave rise, provided the reasons for the Cabinet Secretary's decision to postpone opening the new hospital.

738 Department B1 paediatric intensive care unit (PICU), high dependency unit (HDU) and neonatal unit.

9.5. In this chapter I address the question focused by Term of Reference 2, that is whether any aspect of the arrangements referred to in the term of reference contributed to the "issues and defects" discussed in the preceding chapters. In doing so I shall consider not only the nature of these arrangements but how they were put into effect.

9.6. As is set out in chapter 6, the genesis of the issue which became apparent in June and July 2019 can be seen to be the transcription of details of the recommended output specifications for the ventilation of the critical care area of the hospital into the Reference Design Environmental Matrix (EM) spreadsheet, which did not correspond to the outputs recommended by SHTM 03-01. As was confirmed by Michael O'Donnell of Hulley and Kirkwood (H&K), who was responsible for the initial and other early iterations of the EM, that discrepancy and the internal inconsistency as between guidance note 15 on the guidance notes page of the EM and the content of the cells of the spreadsheet relating to Department B1, were mistakes. In other words, the H&K engineer who actually carried out the transcription can be taken to have been instructed simply to copy the recommended parameters from SHTM 03-01 into the cells of the spreadsheet and had intended to do so, but had failed to do so entirely accurately.

9.7. Once embedded, that discrepancy was not detected through the various iterations of the EM, with the result (so it is maintained by them) that IHSL, its contractors and subcontractors, treated the air change rates and pressure differentials set out in the EM as the ventilation outputs to be achieved, and designed and built the system accordingly.

9.8. IHSL argue that on a proper construction of the Project Agreement, and the status accorded to the EM by the Project Agreement, that is what it was obliged to do. The EM was understood to be NHSL's brief, a statement of the outputs that the ventilation system was required to achieve in respect of the various rooms in the hospital and therefore the basis for its design.

9.9. NHSL disagree. It stated to the Inquiry that at no time did it intend to derogate from 10 ac/h and 10 Pa positive pressure for critical care areas. Its intention was for the RHCYP and DCN to be designed and built in a way that fully complied with the recommendations of the various then current Scottish Health Technical Memoranda and that is what the Project Agreement required. In so far as the parameters set out in the EM deviated from those recommended in SHTM 03-01 they were in error but of no contractual effect. The Project Agreement obliged IHSL to design and build the hospital and its building systems in terms of the Board's Construction Requirements (BCRs) and the BCRs required compliance with SHTM 03-01; that was the brief.

9.10. Given that NHSL intended that the rooms in critical care should be ventilated at 10 ac/h with 10 Pa of positive pressure to the outside, whereas IHSL and its contractors understood that the rooms were required to be ventilated at 4 ac/h and balanced

pressure, the history of the project points to a failure on the part of the Board successfully to communicate its intentions in respect of the outputs of the ventilation system to Project Co.

9.11. It is that failure, which I see as a failure to provide a clear brief for the required outputs of the ventilation system, which determined the course of subsequent events. The error embedded in the EM had a part to play, but the root cause of the issues which led to postponement of opening of the new hospital was the lack of a clear brief set by NHSL. That said, what gave the error in the EM the potential to produce a significant effect, was a series of decisions during the procurement and construction phases of the project, the implications of which were not anticipated. Having been introduced into the procurement process, the EM assumed a status which it was not intended to have. The tender and contractual documentation was ambiguous and confusing, as was the continuation of the process of ventilation design after Financial Close through the Reviewable Design Data process. When an issue arose between the parties during the course of construction over the pressure cascade applicable to four-bedded rooms, it was resolved without reference to the fact that some of these rooms were situated within the critical care department, thereby confirming an output specification which did not comply with the recommendations provided by Scottish Health Technical Memorandum 03-01.

9.12. What follows is a fuller assessment of the Inquiry's examination of the arrangements referred to in Term of Reference 2 and how they contributed to the relevant issues and defects.

A public private partnership using the NPD model

9.13. As already discussed, the project for the provision of the RHCYP and DCN was financed through a public private partnership using the non-profit distributing (NPD) model. The consequent complex financing and contractual structure, as reflected in the Project Agreement, is detailed in Provisional Position Paper 10 (PPP 10), which was issued to relevant core participants for comment in October 2023.[739]

9.14. The contractual structure provides the legal and financial context within which the procurement and construction of the new hospital took place and, as such, is important in understanding how the project moved forward. Nevertheless, PPP 10 set out the provisional conclusion of the Inquiry that "there is no evidence that in and of itself the contractual structure for the financing and construction of the building adopted in relation to the RHCYP and DCN project directly contributed to issues that arose in relation to RHCYP and DCN that are the subject of the Inquiry's investigations."[740] Having had regard to the responses of the core participants to whom PPP 10 was circulated, but also to all the evidence

739 This was revised following responses from Core Participants. Provisional Position Paper 10 - The Contractual and Funding Structure Relating To The Royal Hospital for Children and Young Persons/ Department of Clinical Neurosciences Project.

740 Provisional Position Paper 10 - The Contractual and Funding Structure Relating To The Royal Hospital for Children and Young Persons/ Department of Clinical Neurosciences Project - paragraph 1.2.1 This was subject to qualifications set out in paragraphs 1.2.2 to 1.2.4.

available to the Inquiry and the closing statements, I would confirm that provisional conclusion: neither the form of the contract nor the funding arrangements of themselves materially and directly contributed to what were the material issues which came to light in 2019.

9.15. This proposition was challenged by NHSL to the extent of an invitation in its closing statement that I conclude that the procurement method and the contractual structure for the project contributed to the delay in opening the hospital.[741] That is to take a much wider view of the scope of the Remit and Terms of Reference of the Inquiry than I have done, and than would be justified by the evidence heard by the Inquiry. As I have already stated, the focus of the Inquiry has been on the issues which emerged in 2019 and which led to the 20 month delay in opening the hospital between July of that year and March 2021. I do not see these issues and that delay to have been directly contributed to by the fact that the project was revenue funded or that it was structured as an NPD public private partnership. I appreciate that there were other delays in completing construction. The original contractual completion date was in July 2017. That date had to be delayed. I would understand NHSL to ascribe these other delays to a combination of failures on the part of IHSL and Multiplex and the weak bargaining position in which NHSL was placed by reason of the contractual structure flowing from the NPD model. This is as may be, but I do not consider these to be matters which directly contributed to the issues with which the Inquiry is concerned.

9.16. That said, I acknowledge that I did hear evidence, particularly from Susan Goldsmith, NHSL's Director of Finance, and Tim Davison, the Chief Executive of NHSL from 2012 to 2020, to the effect that a revenue funded public private partnership, necessary as it was in financial circumstances where capital funding was not available, weakened the position of the procuring authority, introduced complexities and distanced the procuring authority from the building contractor (Multiplex) and the eventual service provider (Bouygues) in ways which made the rectification of defects and the resolution of issues when they arose, the more difficult.[742] It was argued that the assumption of risk by the private sector which is advanced as a benefit of a public private partnership is more theoretical than practical, and that there is very little scope within the NPD structure for the procuring authority to require changes to a building during construction which the rapid development of healthcare may necessitate. It was the position of Ms Goldsmith that while NHSL did engage directly with Multiplex, because it had no contract with Multiplex it had no leverage in negotiations, and that when problems arose a number of parties with a variety of interests became involved. This made the resolution of issues more complicated in comparison to the case of a capital funded design and build project, where the procuring authority can deal directly and straightforwardly with the building contractor.

741 Closing Submission for NHS Lothian to the Inquiry - Edinburgh Hospital - paragraph 31.
742 Transcript - Tim Davison - 08.03.2024 - column 216 to 217; Transcript - Susan Goldsmith - 06.03.2024 - columns 19 to 29.

9.17. These problems led Ms Goldsmith to question whether the NPD model of contracting is appropriate for acute hospitals at all.[743] While accepting her evidence as to the challenges with which the Board was presented which were particular to a public private revenue-funded project, I did not hear sufficient other evidence to come to a view on this wider matter, which, in any event, is not a question to which I am specifically directed by the Remit and Terms of Reference. I would merely record that, according to one of the witnesses to the Inquiry, while the healthcare sector presents more challenges than others, "…I think there's probably over 700 PFIs in the UK, and the vast majority are successful and do deliver the outcomes that the clients wants."[744] Of these, I would understand that 160 are hospitals or acute care projects, 24 of which are in Scotland.[745] These numbers exclude NPD projects, therefore four additional hospital and acute care projects fall to be added to the 24,[746] giving a total of 28 revenue funded hospital and acute healthcare projects in Scotland.

A Reference Design

9.18. As Mott MacDonald Limited (MML) explained in its report to NHSL on "RHSC + DCN Procurement Options", dated June 2011, previously an exemplar design approach had been adopted on revenue-funded projects.[747] However, having discussed matters with representatives of the Scottish Government (SG) and Scottish Futures Trust (SFT) and having the advice of MML on the advantages of a reference design model, NHSL decided to progress the project by providing prospective bidders with a reference design mandating "Clinical (otherwise Operational) Functionality". The main features of the reference design approach are referred to at paragraphs 6.40 to 6.48 of chapter 6. Again as previously mentioned, NHSL's F&R Committee approved the reference design approach at its meetings on 12 January and 9 February 2011. There was nothing in the evidence heard by the Inquiry to suggest that this was an inappropriate course to follow and it is understood to have been encouraged by SFT and the SG. However the adoption of a reference design had consequences for the way in which procurement, and then after Financial Close, the Reviewable Design Data process, were conducted.

9.19. The reference design approach adopted by NHSL allocated only a limited design responsibility to the Health Board, that being for the elements of the design that related to what was referred to as Operational Functionality. This was a qualification of the principle, frequently cited by MML and NHSL and which they were anxious not to infringe upon, that in the case of revenue-funded projects

743 Transcript - Susan Goldsmith - 06.03.2024 - column 25; Transcript - Graeme Greer - 27.02.2024 - columns 120 to 121; Closing Submission for the Scottish Futures Trust - paragraphs 6 to 12.
744 Matthew Templeton, a director of IHSL since January 2019 - Transcript - Matt Templeton - 06.03.2024 - column 195.
745 Private Finance Initiative and Private Finance Project: 2019-21 summary data.
746 RHCYP/ DCN, Acute Mental Health & North Ayrshire Community Hospital, Dumfries & Galloway Acute Services and NHS Orkney (Balfour Hospital). See Infrastructure investment - Government finance and NPD/hub programme: unitary payment charges.
747 A36878620 - Procurement Options Paper June 2011 - HC2023.B10.V2 - page 2874.

design risk should always sit with the Special Purpose Vehicle (SPV), it being for the SPV to design and then build the facility, taking the consequences of any deficiencies that might emerge.

9.20. One of the reasons why NHSL adopted the reference design approach was to preserve the benefit of the work done prior to November 2010 by the design team engaged for the capital-funded project. With that in view, team members, including H&K, were reappointed to form the Reference Design Team, continuing work that had begun before November 2010. In its report of June 2011 MML had explained that "only associated elements of the design that are required to prove the robustness of the clinical functionality solutions will be developed and these will be released for information to bidders".[748] However, a later report by MML, the "RHSC-DCN Approach to Reference Design", outlining the reasons and purpose of the reference design and the progress of its development, included the advice that "Previously in PFI and PPP projects, draft or indicative Room Data Sheets could be issued with an Invitation to Negotiate (ITN) with the responsibility for completion resting with the Preferred Bidder to be carried out in conjunction with NHS Board", whereas, "In NPD projects with a Reference Design there is a requirement for a more complete set of Room Information".[749] H&K's development of the three versions of the "Reference Design Envisaged Solution Environmental Matrix" was part of the Reference Design Team's work in developing this room information.

9.21. As explained by MML in its "Approach to Reference Design" report, the purpose of the reference design was to delineate the design elements in the new hospital which were mandatory and therefore which had to be included in tenderers' proposed designs. The reference design was intended only to subsist during the competitive dialogue stage of procurement during which, so MML advised, it would be stressed that the mandatory elements of the reference design were not matters for debate. However, following the close of the competitive dialogue, and the appointment of the Preferred Bidder, the reference design would be replaced with the Preferred Bidder's full design solution and would accordingly "become extinct".

9.22. Just as adopting the reference design approach was seen as a way of preserving the benefit of work previously carried out by the design team engaged for the capital-funded project, it was also seen as a way of preserving the benefit of previous clinical input and reducing further demands on the valuable time of clinical staff. The evidence was that clinicians were not involved in the competitive dialogue process. Stewart McKechnie (Design Team Lead, TSWW) said that this was "reasonably unique" and that on previous projects he had been used to engaging directly with end users.[750]

748 A36878620 - Procurement Options Paper June 2011 - HC2023.B10.V2 - page 2874.
749 A32824397 - Mott MacDonald Approach to Reference Design August 2012 - HC2023.B2 - page 626. This report underwent many iterations from January to August 2012.
750 Witness statement - Stewart McKechnie - 04.05.2023 - paragraph 7.

9.23. While there was nothing inherent in the adoption of a reference design which necessarily required this, it was decided that members of the Reference Design Team should be ring fenced from any other work on the project in order to allow them, having completed their commissions for NHSL, to take on engagements from the consortia participating in the bidding process. This meant that the Reference Design Team were not involved in preparing the tender documents to be issued by NHSL, and also that they were not available to deal with queries about the reference design during competitive dialogue. That this was an inevitable consequence of the release of the Reference Design Team was explicitly recognised in the "RHSC-DCN Approach to Reference Design" report.[751] The fact that H&K were not available during the procurement process following the issue of the Invitation to Participate in Dialogue (ITPD) meant that there was no scope for potential tenderers, or indeed anyone else, to raise with H&K why values in relation to critical care rooms were lower than those set out in SHTM 03-01. Mr McKechnie described it as not being "a great idea to have somebody prepare … a reference design and not keep them in place".[752] I would agree. A theme that emerges from the history of the procurement of the project is of failure in communication. Excluding the Reference Design Team from the possibility of dialogue with prospective bidders increased the risk of that occurring.

9.24. Adoption of the reference design approach influenced the time allowed for the procurement process. The period for competitive dialogue was reduced from 209 days to 155 days and the period for tender evaluation shortened from 75 days to 39 days, after the Project Steering Board (PSB) agreed to adopt a compressed programme.[753] The reason for compressing the programme was "to create an attractive as possible proposition to the market given the current economic situation". The advice of SFT was that the use of a reference design and the Standard Form of Project Agreement allowed such a compression. [754]

9.25. The existence of a reference design was taken into consideration in the weighting given to various components of bidder's submissions during the final tender evaluation. Specifically, it helped to justify the cost to quality ratio of 60:40 (meaning a higher weighting given to the lowest cost bid) because it was considered that use of the reference design would ensure good quality proposals.

9.26. As I have indicated, there was nothing inappropriate in NHSL's decision, following on advice, to adopt a reference design approach with its concept of a core element of Operational Functionality (essentially the adjacency of spaces) around which tenderers were free to develop their own designs. However, on the evidence, the existence of a reference design and the way in which it was seen to have been developed, would appear to have led to a disconnect as between NHSL and its adviser MML, on the one hand, and IHSL and its contractors, on the other, as to what was expected of bidders with respect to documents associated with the reference design.

751 A32824397 - MML Approach to Reference Design August 2012 - HC2023.B2 - page 605.
752 Transcript - Stewart McKechnie - 04.05.2023 - column 119.
753 A32676792, Project Steering Board 9 November 2012 - HC2023.B10.V2 - page 729.
754 A32676792, Project Steering Board 9 November 2012 - HC2023.B10.V2 - page 729.

9.27. Witnesses from Multiplex described how the reference design, and the context of time pressure and pre-existing design work that had led to its adoption and development, created a perception that bidders were not to change anything from what was seen as NHSL's design.[755] This was expressed by Paul Serkis, Multiplex's commercial director for public and private projects during the procurement period, who told the Inquiry:

> "This project had been in circulation for a few years and it hadn't reached Financial Close, and my own personal view was that I believed fatigue had set in on the basis that a number of people were just wanting to get this across the line, get it to Financial Close and just move on and get it built…[756]
>
> "…They had a reference design and we were being told, 'Don't change any of it. Just get on with it and deliver it… We've spent enough time modelling this. We've met with the user groups. We've met with the clinicians. Please don't change it, just deliver what we want."[757]

9.28. John Ballantyne, Multiplex's bid leader, told the Inquiry:

> "My understanding was the expectations of the Board were very specific, as much as they ever could be, and that, having taken the time to develop those expectations, they were not to be compromised."[758]

9.29. Mr McKechnie's impression was that NHSL "had a design team in place for quite a lengthy period and had progressed the design to a much more advanced stage that you would normally have when you were starting off an initial tender."[759] On other projects he had worked on, "I was more used to direct contact, if you like, with the end user. Whereas, in Edinburgh, that direct contact had, I assume, already been carried out by the reference designers, therefore we didn't have the same input."[760]

9.30. According to these witnesses, that perception was confirmed by the issue, together with the ITPD documentation, of an EM with the appearance of a comprehensive statement of the environmental parameters for the rooms in the hospital in the absence of an alternative statement of this information, such as would have been provided by Room Data Sheets (RDS).

The need for a clear ventilation brief – ADB and RDS

9.31. As has been previously discussed, the precise specification of the outputs to be achieved by a hospital ventilation system is important from the perspective of patient welfare. It determines the clinical uses to which rooms can be appropriately put. Accordingly, for a room to be sufficiently described, the description must state

755 Witness Statement - Paul Serkis - 03.05.2023 - paragraphs 28 to 29.
756 Transcript - Paul Serkis - 03.05.2023 - column 20.
757 Witness Statement - Paul Serkis - 03.05.2023 - paragraph 28.
758 Transcript - John Ballantyne - 03.05.2023 - column 12.
759 Witness statement - Stewart McKechnie - 04.05.2023 - paragraph 7.
760 Transcript - Stewart McKechnie - 04.05.2023 - column 9.

or provide a ready means of ascertaining its ventilation requirements. It would seem inevitably to follow that the ventilation output required by a healthcare authority in respect of particular clinical applications and therefore in respect of particular rooms in a proposed hospital, is a matter for the client, having had the benefit of clinical and technical advice. It is for the client authority to tell the contractor what it requires and to communicate what it requires in clear terms.

9.32. The "Scottish Capital Investment Manual NPD Guide: Section 1 Preparing for NPD Procurement" (which was under revision in 2009) provided apposite guidance on defining NHS Scotland body's requirements.[761] Section 2 "From OJEU to Contract Award", addresses what information should be included in the ITPD.[762]

9.33. In paragraphs 6.12 and 6.13 of section 1 there is the following:

> "The facilities and services to be provided under the project will need output specifications that outline the NHS Scotland body's requirements. Those requirements will include:
>
> - facilities that both support the clinical and other services that will be offered there and meet the NHS Scotland body's investment objectives;
> - support services (hard and soft FM);
> - other services (both clinical and non-clinical) that will continue to be provided by the NHS Scotland body.
>
> The specification of the NHS Scotland body's requirements should not be too prescriptive. They should be outlined in terms of the performance standards, which the NHS Scotland body will require. The output specifications should be based on the NHS Scotland body's needs not wants and the NHS Scotland body should ensure that services are quantifiable and measurable. The private sector will then be given scope to decide how the services should be provided."

9.34. With respect to defining requirements and performance standards, paragraph 6.18 states:

> "The NHS Scotland body's requirements for facilities and services should be precise, quantifiable and provide a means of objectively assessing the extent to which the standard has been achieved. Requirements should cover statutory requirements, Patient Charter requirements, National Targets, NHS Scotland body policies, requirements of end users, good practice and NHS Scotland body defined standards."

761 A36382831 - Scottish Capital Investment Manual NPD Guide Section 1: Preparing for NPD Procurement - 17 December 2009 (Draft).

762 A36382813 - Scottish Capital Investment Manual NPD Guide Section 2: From OJEU to Contract Award - 17 December 2009 (Draft).

9.35. Section 2 states with respect to an ITPD:

> "A well drafted and comprehensive ITPD is vital to the smooth running of a project. It will help the participants produce accurate proposals and will avoid misunderstandings that can lead to later problems. The NHS Scotland body should have substantially completed its proposed ITPD including the draft contract, NPD principles, payment mechanism and performance regime prior to advertising for the scheme in the OJEU. In particular, areas such as the development of output specifications are very time consuming to produce and the NHS Scotland body should have completed work on these before commencing the formal procurement process."[763]

9.36. Not only are output specifications very time consuming to produce, as is identified in the Scottish Capital Investment Manual (SCIM), but, in relation to ventilation at least, they will have a direct bearing on the nature and scale, and therefore the cost, of a large variety of construction features. As Mr O'Donnell explained, "the air change rates that are in the matrix then inform a whole bunch of other things: duct work distribution sizing, air handling plant sizing, …heat plant sizing, cooling sizing, all sorts of things".[764] Once particular items of plant, air handling units for example, have been selected and installed, the output of which they will be capable of producing becomes fixed. Hence the necessity of an early determination of what is the output specification that the client requires. This point was emphasised by NHSL in its closing statement.[765] There it is pointed out that ventilation parameters need to be known early in a project as they will dictate, among other things, the size of pipes, which in turn will dictate the size of roof voids. The consequence of leaving ventilation design open at Financial Close is to increase the risk of delay should, for instance, architectural and engineering design turn out to be incompatible. According to NHSL's closing statement, the installation by Multiplex of air handling units that were not capable of delivering a ventilation system that complied with guidance before the ventilation design had been completed meant that any discussions thereafter were necessarily predicated on what the installed units could actually achieve.[766]

9.37. Just as the output that a ventilation system is to achieve will determine the nature and size of that system and the spaces required to accommodate it, so it will impact on its energy consumption and consequential energy cost.

9.38. As has been touched on in chapter 6, the principal means of providing a brief for the environmental parameters of a new hospital is by the compilation of Room Data Sheets.

763 A36382813 - Scottish Capital Investment Manual NPD Guide Section 2: From OJEU to Contract Award - 17 December 2009 (Draft) - page 12 - paragraph 5.9.
764 Transcript - Michael O'Donnell - 25.04.2023 - column 25.
765 Closing Submission for NHS Lothian to the Inquiry - Edinburgh Hospital - paragraphs 32 and 33.
766 Closing Submission for NHS Lothian to the Inquiry - Edinburgh Hospital - paragraph 33.

9.39. The evidence of Stephen Maddocks was that an engineer responsible for designing a ventilation system, will need to know what parameters the system is to achieve. In Mr Maddocks' view, the room data sheet is the only way for a client to inform the design team of their requirements; and therefore RDS should be completed by the client or its advisers prior to conclusion of the construction contract.[767] Mr Maddocks considered that room data sheets should be generated "…early in the briefing and design process".[768] He described the room data sheet as a "starter for ten", by which he meant it could be used as the basis for dialogue between clinicians and engineers about the brief.[769] Mr Poplett explained the process of refining or fully developing the room data sheets will continue until the detailed design has been completed.[770] According to Mr Maddocks, the Board's requirements ought to have been in their final form no later than the conclusion of the Project Agreement.[771]

9.40. As mentioned in chapter 6, at all relevant dates it was a mandatory requirement of the Scottish Government, expressed in CEL 19 (2010) that:

> "All NHS Scotland bodies engaged in the procurement of both new-build and refurbishment of healthcare buildings must use and properly utilise the English Department of Health's Activity Data Base (ADB) for briefing, design and commissioning. [If deemed inappropriate for a particular project and an alternative tool or approach is used, the responsibility is placed upon the body to demonstrate that the alternative is of equal quality and value in its application.]"

9.41. The function of the ADB is to populate Room Data Sheets (RDS). It follows that at all relevant times NHSL was subject to an instruction from the Scottish Government to prepare RDS using ADB (or an equivalent) in order, for example, to brief prospective tenderers as to what it required as ventilation outputs for the various rooms of the new hospital.

9.42. That indeed is what NHSL set out to do, both in relation to the capital-funded project and, thereafter, in relation to the revenue-funded project.

9.43. In its paper, "Narrative on the Activity Database (ADB) and Room Data Sheets", submitted to the Inquiry on 3 February 2023, NHSL explained how it proceeded in the period prior to the issue of the ITPD.[772] When the project was intended to be capital funded NHSL issued an RHSC ADB database to BAM. That ADB database included clinical activity, equipment lists and environmental data for the rooms in the new hospital. H&K however, in its email of 15 February 2010, requested that the project architect, Nightingale Associates (NA) provide H&K with access to CodeBook, an alternative building information software.

767 Transcript - Stephen Maddocks - 12.05.2022 - column 90.
768 Expert Report - Stephen Maddocks - Ventilation Principles and Practice - page 66.
769 Expert Report - Stephen Maddocks - Ventilation Principles and Practice - page 67; Transcript - Stephen Maddocks - 12.05.2022 - column 92.
770 Transcript - Andrew Poplett - 10.05.2022 - column 147.
771 Transcript - Stephen Maddocks - 13.03.2024 - column 16.
772 A42408446 - NHS Lothian's Narrative on ADB and RDS - HC2023.B12.V1 - page 70.

9.44. On 16 June 2010, MML provided a copy of (the recently issued) CEL 19 (2010) and the appended Policy on Design Quality to NHSL by email, advising that BAM was aware of the revised document, as, self-evidently, was MML. According to NHSL it met with the design team on 22 June 2010 when Nightingale Associates demonstrated that CodeBook was of equal quality and value to ADB and offered advantages to it. It was accordingly decided that Nightingale Associates should use CodeBook to generate "a full set of ADB information" while H&K would use an EM to capture the mechanical and electrical engineering information.

9.45. This method of presenting room information was retained after the switch to a revenue funded model. The design team for the capital funded project were reappointed as the Reference Design Team, Nightingale Associates and H&K retaining their previous functions. On 4 January 2012 Davis Langdon replied to NHSL's request for clarification as to "how H&K will feed into the process on page 2 Environmental" by stating:

> "H&K will feed into the RDS by producing a spreadsheet document 'RDS Environmental Matrix' based on the final SoA [schedule of accommodation]. The purpose of this matrix is that it will take the place of the ADB RDS sheets per room relating to the environmental criteria covered to make for a simple and easy reference tool which relates back to current SHTM/HRM/HBN guidance. The content of this doc will cover guidance on the following by room type: … Ventilation – air change rate provisions, relative pressure, minimum filtration levels …"[773]

9.46. Thereafter NA continued to meet with MML and NHSL project team to develop the RDS "and other room information". The RDS were scheduled for completion by NA by 14 May 2012.

9.47. Thus, initially, NHSL proposed to prepare room information to be used for briefing prospective tenderers using RDS, generated by CodeBook supplemented by an EM which included, among other material, the ventilation output specifications. If, as the NHSL Narrative suggests, NHSL was in a position to demonstrate that this alternative to RDS generated by ADB, was of equal quality and value in its application, then what was proposed would have been compliant with CEL 19 (2010).

9.48. That is not to say that a combination of RDS and an EM would necessarily have accurately presented the recommendations in SHTM 03-01. The Inquiry heard evidence that accessing the appropriate room data from the ADB is not entirely straightforward.[774] In the Scottish context ADB-generated data needs to be checked against Scottish guidance, and information in the ADB may not always be up to

773 Available at A42408614 - Email 4 January 2012 - HC2023.B15 - page 139.

774 A number of witnesses spoke to this: Witness Statement - Graeme Greer - 28.04.2023 - paragraph 60; Witness Statement - Stewart McKechnie - 04.05.2023 - paragraph 13; Witness Statement - Michael O'Donnell - 25.04.2023 - paragraph 24; Witness Statement - Susan Grant - 09.05.2023 - paragraph 34; Expert Report - Stephen Maddocks - Ventilation Principles and Practice - page 15.

date, accurate or complete. Furthermore, the ADB does not contain data for every type of room which a hospital may require. There is no standard room naming convention for hospitals, and hospital design is not standardised. It may also sometimes be appropriate to use parameters which differ from those set out in underlying guidance. The implication of this is that some rooms may be project-specific, as may be the requirements for a given room or department, and this may differ from what is maintained in the database. The room data for such project-specific elements, selected on the basis of professional judgment, will require to be inserted manually in the RDS.[775] This involves "tailoring" the ADB's template room data sheets into project specific room data sheets.[776] Tailored room data sheets prepared in this way can then be stored digitally for use by those working on the particular project.

9.49. A specific, and relevant, example of the limitations of ADB was provided by NHSL: whereas the ADB template in its 2013 revision stipulated 10 ac/h for single bed isolation cubicles and 10 ac/h for multi-beds in critical care departments, there was no ADB template for single rooms in critical care.[777]

9.50. The use of RDS produced using ADB does not therefore remove the risk of errors, firstly because the database itself is not sufficiently reliable and secondly because the process of tailoring involves considering project-specific room requirements and manually inputting data, which introduces the risk of errors of interpretation and transcription.[778]

9.51. While so doing may not exclude the risk of human error, NHSL's narrative demonstrates the possibility of setting out Board's requirements in the manner mandated by CEL 19 (2010). Moreover, NHSL's narrative illustrates that, whatever its utility for assisting in the finalising of RDS or for other purposes, an EM is not essential for presenting the ventilation specification appropriate to particular rooms. Appendix 1 of the NHSL Narrative includes sample extracts of the RHSC ADB Database for critical care which NHSL supplied to the Reference Design Team. The appearance of these extracts is consistent with the evidence heard by the Inquiry and summarised in chapter 6 at paragraph 6.9. The sample extracts include supply and extract air change rates and pressure differentials. Significantly, the sample extracts are headed "Project: RHSCE Royal Hospital Sick Children First Draft".

775 Witness Statement - Graeme Greer - 28.04.2023 - paragraph 60; Witness Statement - Michael O'Donnell - 25.04.2023 - paragraphs 23 to 25.
776 Witness Statement - Graeme Greer - 28.04.2023 - paragraph 60.
777 Closing Submission - Lothian Health Board - Edinburgh Hospital - paragraph 60.
778 Closing Submission by Mott MacDonald to the Inquiry - paragraph 11 and 15; Susan Grant gave evidence about the steps being taken by HFS and Talon to update the database and to produce a suite of repeatable rooms consistent with Scottish guidance - Witness Statement - Susan Grant - 09.05.2023 - paragraph 34 to 38, see also A49159832 - NHS NSS comments dated 28 June 2024 - HC2024.B13.V14 - page 34.

9.52. In responding to Counsel to the Inquiry's first closing statement, NHSL's legal representative, in his closing statement, questioned the weight placed on the proposition, derived from CEL 19 (2010), that ADB was necessarily "an appropriate tool for briefing, design and commissioning" in the case of, as here, a design and build contract; and, further, the proposition that it was for the client, whatever the form of contract, to provide a "fixed client brief" that defined ventilation parameters. It would, so it was argued on behalf of NHSL, be entirely inappropriate for the procuring authority in a design and build contract to brief or design aspects of a building beyond what is properly set out in the employer's requirements. The underlying assumption that it was for the client to provide a fixed client brief was not accepted. The word "brief" had no technical meaning and could only be understood within the particular contractual context in which it was used. That means that what is required from a client brief will inevitably vary depending on the nature of the contract in question.[779]

9.53. What NHSL put forward, framed in the way it was, may well be correct, but it does not detract from what I took from Counsel to the Inquiry's submissions (which, properly understood and limited to the matter of concern here, I do not understand to be controversial). Where, as under this NPD project with its reference design model, Project Co had the responsibility for designing the hospital, including its ventilation systems, it was not for NHSL, as the procuring healthcare authority and employer, to prescribe what that design should be beyond the mandatory elements of the Reference Design. While that may be, it was however for NHSL to set out what it wanted for the hospital and its various constituent parts: "the employer's requirements" referred to by NHSL or, in language of the Project Agreement, the Board's Construction Requirements (BCRs). *How* it was to be achieved was a matter for Project Co in fulfilment of its design obligations but *what* was to be achieved was a matter for the procuring authority in setting out its requirements. Clearly, and very properly, among those requirements were what NHSL wanted by way of outputs from the ventilation system.

9.54. The NHSL submission found an echo at paragraph 20 of the final closing statement on behalf of MML where Counsel to the Inquiry's position is characterised as (erroneously) conflating the concept of a design brief, with that of a fully developed design. I disagree. While I accept that a distinction is to be made between the two concepts, I do not accept that Counsel to the Inquiry confused them. What environmental parameters (including air change rates and pressure differentials) were to be achieved in particular spaces of the hospital, was an aspect of what MML described, appropriately enough, as the design brief. That was a matter for NHSL, as procuring authority. Determining the physical mechanisms of how that was to be achieved, was an aspect of the developed design, responsibility for which, and its associated risk, lay with the contractor. There is nothing about the PPP model in general or the NPD model in particular which is inconsistent with a healthcare authority identifying in its design brief what it requires by way of air change rates and pressure differentials for specific spaces in the hospital.

779 Closing Submission - Lothian Health Board - Edinburgh Hospital 2023 - paragraphs 55 to 57.

9.55. "Brief" may not be a technical term but its meaning is reasonably clear and an appropriate way of referring to the means by which a healthcare authority conveys its requirements to the party contracted to meet these requirements through, for example, a design and build contract. "Briefing", as used in CEL 19 (2010), means the process of providing such a brief. CEL 19 (2010) mandates the provision of RDS based, in the way discussed, on ADB or an equivalent. NHSL did not provide RDS as room information when issuing its Invitation to Participate in Dialogue or at any time during the procurement process and before Financial Close. This led Counsel to the Inquiry to submit that it was not clear, by the date of conclusion of the Project Agreement, that NHSL had provided an adequate briefing of its requirements for environmental parameters. That was challenged by the legal representative for NHSL in his closing statement where it is stated: "The BCRs were the brief, including the reference design (which did not include the H&K Environmental Matrix), the schedule of accommodation and the clinical output specifications. The BCRs specified, *inter alia* the guidance that was to be followed for environmental parameters …SHTM 03-01 defined the parameters…in the context of a design and build contract specifying compliance with SHTM 03-01 is an alternative approach that is suitable to the contractual context."[780] I shall return to that response to the question raised in Counsel to the Inquiry's submission, but for the moment I would observe that Counsel were at one on the need for NHSL to stipulate the outputs it required from the ventilation system and that the mandated means for doing that was the provision of RDS based on ADB, or an alternative of equal quality and value in its application.

9.56. The NHSL Narrative provides background as to how it came about that NHSL did not, as it had originally intended, provide RDS to prospective tenderers as part of the ITPD.[781] The Narrative states that Nightingale Associates failed to meet the 14 May 2012 deadline. By Contract Control Order (CCO) dated 17 May 2012 Nightingale Associates were instructed by MML on behalf of NHSL to cease production of RDS. NHSL cannot now recall the reasoning behind this CCO. On 3 July 2012 there was a Room Data Sheet Review meeting among NHSL, its healthcare planner, Hiltron, and MML, during which it was agreed that Hiltron was to prepare RDS, but only in relation to clinical activities, rather than environmental data. However, the instruction of Hiltron was shortly thereafter rescinded, as was confirmed by MML in its email to NHSL of 15 August 2012. The email went on to list "all of the room information you wish to pass on to the bidders is/will be included in: The Clinical Output Specifications, The Schedule of Accommodation, The Adjacency Matrix, The Environmental Matrix, The Equipment List, The Schedule of Operational/Design Notes, and The Operational Functionality elements of the Reference Design".[782] Again, NHSL does not now know why it decided against instructing Hiltron to prepare RDS.

780 Closing Submission - Lothian Health Board - Edinburgh Hospital 2023 - paragraphs 55 to 57.
781 A42408446 - NHS Lothian's Narrative on ADB and RDS - HC2023.B12.V1 - page 70.
782 A42408591 - Email 15 August - HC2023.B15 - page 145.

9.57. As had been proposed in MML's email of 15 August 2012, RDS were not included with the documentation forming the Invitation to Participate in Dialogue. However, again as foreshadowed in the email of 15 August 2012, the documentation did include the EM (in its version dated 19 September 2012). As with its predecessors, it contained the errors in respect of critical care.

Potential for confusion as to the status of the Environmental Matrix – the inclusion of the EM with the tender documents

9.58. Whatever may have been the intentions of NHSL and its advisers at the time of the email of 15 August 2012, it was not intended by NHSL, when H&K's third Reference Design EM was included with the ITPD issued on 12 March 2013, that it be read as a mandatory statement of room parameters.

9.59. Brian Currie (Project Director, NHSL) told the Inquiry that the Reference Design EM was included with these tender documents because:

> "It was considered that whilst this information was not warranted by the Board and should not be relied upon for accuracy… it may prove useful to engineers employed by the bidders in any initial design assessments and in informing further investigations and studies they may care to undertake."[783]

9.60. Mr Currie explained that the EM was no more than a "draft"; the procurement documents made it clear that NHSL required full compliance with the SHTMs. In the language of the contractual documentation (Project Agreement clause 7), the EM was "Disclosed Data", in respect of which the Board gave no warranty as to its accuracy and assumed no liability.

9.61. Ms Goldsmith told the Inquiry:

> "Prospective tenderers did not need M&E engineering information because it was up to tenderers to develop the design of M&E building services. If we had started on an NPD project initially, then all of that would have been developed by IHSL from the word go. However, it was because we had invested £2 million on the development of a design during the capital phase, which was supported by an EM, that we reached the decision to make it available…The provision of the draft EM did not mean that prospective tenderers or preferred bidders would not then need to refer to SHTMs or use the ADB. SHTMs should have been their starting point."[784]

783 Witness Statement - Brian Currie - 18.05.2022 - paragraph 45.
784 Witness Statement - Susan Goldsmith - 09.05.2023 - paragraph 19.

9.62. Mr O'Donnell had understood that the Reference Design EM was being prepared only for information and was not intended to be prescriptive.[785] While he considered an EM a more convenient way of recording design information than Room Data Sheets, Mr O'Donnell did not intend the EM to be a substitute for RDS, which run to 4 pages. [786] Similarly, for Mr Currie, the EM "extracts the environmental information and holds it in one place as an aid for engineers".[787] While it is true that MML required each member of the Reference Design Team to confirm that the Reference Design conformed with NHS guidance and key legislation, and that H&K contributed to a statement that the Reference Design (which Mr O'Donnell accepted included the EM in its then current version) did indeed comply with SHTMs and HTMs,[788] the evidence as to how the EM was produced and developed did not indicate that it was a document that could prudently be used as a source of contractual obligation.

9.63. The first version of the EM was produced at a time (September 2010) when the project was still intended to be capital funded. The EM was put together by an engineer manually inserting figures into a spreadsheet as he did not have available to him the facility of an automated digital drawdown of information (and I heard no evidence to indicate that such a facility for populating a spreadsheet with environmental information exists). It is understood that the errors originally arose in the course of this mechanical exercise. If, as Mr O'Donnell envisaged had happened, the air change rate and pressure differential parameters were taken directly from HTM 03-01 (the equivalent SHTM did not, as at that date, include that information), the engineer populating the spreadsheet (and anyone subsequently reading the spreadsheet) did not have the prompt provided by a reference to a clinical activity which would be the case with a RDS.[789] Given the nature of the task of manually transcribing information from a number of sources into a matrix, there is a clear risk of making a mistake by populating a cell in the spreadsheet with the wrong parameter. The errors as to the recommended specification for critical care were not the only errors contained in the various versions of the EM. Similar errors were made in respect of the neutropenic patient ward, 4 ac/h rather than the recommended 10 ac/h and balanced pressure rather than 10 Pa positive pressure. The air change rate for single rooms was specified as 4 ac/h rather than 6 ac/h, albeit that this was justified on the basis that natural ventilation could make up the discrepancy.

9.64. What may be more fundamental is that the EM was produced solely by engineers, and therefore depended on an engineer's judgement as to how the recommendations in guidance applied to particular departments of the hospital. Mr O'Donnell had intended that the data and its application to the rooms in the various departments of the hospital would be "signed off" or approved by NHSL.

785 Witness Statement - Michael O Donnell - 25.04.2023 - paragraph 17.
786 Witness Statement - Michael O Donnell - 25.04.2023 - paragraph 24 to 25.
787 Witness Statement - Brian Currie - 22.02.2024 - paragraph 43.
788 A37318840 - Email from MML 28 February 2012 - HC2023.B4 - page 322; A37318849 - Joint Statement 16 March 2012 - HC2023.B4 - page 324.
789 Witness Statement - Graeme Greer - 28.04.2023 - paragraph 95.

He described the EM as an "easy reference as a sign off tool". He explained, "the Environmental Matrix is something that needs to have discussion. Whilst we take the lead in populating it, it needs to be shared with the client team to make sure that what we think is, for example, a treatment room is indeed a treatment room and that the environmental data that goes with that room is the right approach". Minimising errors is not simply a matter of checking for accuracy, it requires a process of peer review through sharing the information for discussion.[790] However, contrary to Mr O'Donnell's expectation, there was little feedback from NHSL at the capital funded stage of the project.[791] Critically, there appears to have been no clinical input whatsoever.[792]

9.65. Thus, for NHSL, the EM was no more than a repository of information which could not be relied upon.

9.66. According to Mr McKechnie, IHSL, Multiplex and TSWW understood the EM very differently. For Mr McKechnie it represented NHSL's brief in substitution for RDS. Accordingly, it had to be followed. Mr McKechnie told the Inquiry that he considered the EM to form part of NHSL's brief and that it would replace the ADB sheets as a briefing tool. He was not surprised at its use during competitive dialogue:

> "The idea of having all the building services engineering information in one document makes sense from a practical point of view, in that it brings everything we need into the one place and saves having to extract it from, or cross refer to, other documents…"[793]

9.67. Asked what, if anything, he took from the fact that the Reference Design EM was described as a "draft", Mr McKechnie told the inquiry that while he would have expected some changes, he would not have expected changes to the performance criteria because, "in any contract of my experience you have to have your performance criteria that you're going to provide your systems to, nailed down."[794] As a mechanical and electrical designer Mr McKechnie said he would not be able to nail these down himself "without referencing it back to the client". Without performance criteria being "nailed down", he would not have had the information he needed to produce the detailed design that was required.

9.68. John Ballantyne was a main board director of Multiplex Europe. He explained in his evidence to the Inquiry that, as bid leader, he worked closely with Mr Serkis in taking the IHSL project team through the competitive dialogue and preferred bidder stages of the procurement up to Financial Close, "making sure that IHSL ticked off all the deliverable boxes". He was aware of the EM as "a document that

790 Transcript - Michael O'Donnell - 25.04.2023 - column 58.
791 Transcript - Michael O'Donnell - 25.04.2023 - column 72.
792 Transcript - Michael O'Donnell - 25.04.2023 - column 36; See also with respect to a later stage of the project, Provisional Position Paper 9 (Revised) - The Governance Structure within the project to construct the Royal Hospital for Children and Young People and Department of Clinical Neurosciences, Edinburgh.
793 Witness statement - Stewart McKechnie - 04.05.2023 - paragraph 4.
794 Transcript - Stewart McKechnie - 04.05.2023 - column 64.

emerged as part of the suite of Board expectations of outcome".[795] In his witness statement he asserted that "We were told at competitive dialogue meetings that the EM was mandatory and there was to be no deviation".[796] I accept, as was submitted on behalf of MML in its closing statement, that when he came to give his oral evidence, Mr Ballantyne was not so definite about what he had been told and was unable to recall who in NHSL had said that the EM was mandatory.[797] Mr McKechnie, who was present at some of the competitive dialogue meetings, made no such claim. Neither Richard Cantlay of MML or Brian Currie of NHSL recalled making such statements and given how I would accept they regarded the EM it would seem unlikely that they so expressed themselves. Nevertheless, Mr Ballantyne maintained his understanding that NHSL's expectations were very specific and, NHSL having taken time to develop those expectations, they were not to be compromised. While he was surprised by the elevated importance given to the EM, he understood that it was, from the perspective of NHSL "what we want and that is the definition of it".[798] For Mr Serkis "the Environmental Matrix set the parameters of what the brief was and, effectively, what the Board were looking for to be delivered".[799] The understanding of Ken Hall, Multiplex's Mechanical and Electrical Manager, was that the EM defined the Board's requirements and that this was aligned to the BCR section 8 where it was defined that the works had to comply with the EM.[800]

9.69. That the status of the EM might be misunderstood in this way is not entirely surprising. The Inquiry heard from a number of witnesses that environmental matrices are now commonly used in hospital construction projects. This was the evidence of Richard Cantlay (Lead Technical Adviser, MML), Colin Macrae (Senior Building Services Engineer, MML), Mr Greer, Willie Stevenson (Technical Adviser, MML), Mr McKechnie and Mr Hall although Mr Maddocks, in contrast, could not recall a healthcare project where one was used and he did not consider them to be helpful for briefing an engineer about a client's requirements.[801] Many witnesses spoke to the usefulness and practicality of using a matrix for discussing environmental parameters. Susan Grant (Principal Architect, HFS) explained that matrices are useful in any context where briefing requires consideration of numerous details, and their use is not confined to environmental data.[802] Scottish guidance on Sustainable Design and Construction (Scottish Health Technical Note 02-01, October 2021) now requires the use of an environmental matrix.[803] When Thomas Rodger, the Chief Engineer of NHSS Assure (Assure) came to give evidence he spoke to Assure having produced a template for an environmental matrix at the request of stakeholders.[804]

795 Transcript - John Ballantyne - 03.05.2023 - column 8.
796 Witness Statement - John Ballantyne - 03.05.2023 - paragraph 13.
797 Witness Statement - John Ballantyne - 03.05.2023 - column 27.
798 Witness Statement - John Ballantyne - 03.05.2023 - column 13.
799 Transcript - Paul Serkis - 03.05.2023 - column 24.
800 Witness Statement - Ken Hall - 28.04.2023 - paragraph 21.
801 Transcript - Stephen Maddocks - 12.05.2022 - column 88 onwards.
802 Witness Statement - Susan Grant - 09.05.2023 - paragraph 64.
803 Witness Statement - Michael O'Donnell - 25.04.2023 - paragraph 12; SHTN 02-01 SdaC Guide - page 27.
804 Transcript - Thomas Rodger - 14.03.2024 - page 111.

9.70. Thus, a matrix can be an effective way of storing and presenting, for example, the environmental parameters which are appropriate or proposed or agreed for a complex building such as a hospital. The EM sent with the ITPD was precisely defined. It was a well-populated document with the look of being complete; it was not simply a blank pro forma. The provision of such a document, if only because of the degree of precise detail that it contains, suggests that it is being provided as an authoritative statement of these details for some such purpose. Accordingly, it will be important for parties using an environmental matrix to be explicit, and clear, about its function on a particular project. If they are not intended to be authoritative, it will reduce the risk of misunderstanding for that to be stated explicitly on the document. Indeed, it may be inadvisable for a procuring authority to issue a set of detailed parameters at all, if they do not intend them to be taken as requirements for the project or having some other clearly identified object. It was the evidence of Ms Goldsmith that, in hindsight, NHSL should not have included the environmental matrix with the tender documents.[805] It is difficult to disagree with that assessment.

9.71. Mr Currie's rationale for sending the EM to prospective tenderers is not easy to understand. As Mr Maddocks explained in his report, and in his evidence, there is little point in providing a "draft" environmental matrix that could not be relied on. Providing the EM offered no very obvious benefit to the prospective bidders. If it was for tenderers to develop the design of M&E building services using SHTMs as their starting point, it is difficult to see how the provision of the EM assisted them. Before using the EM, tenderers would have had to check all the values set out in it. As the Inquiry heard, such a full line-by-line review of the EM would take a considerable amount of time given the number of data entries. The inclusion of the EM as a draft was simply likely to cause confusion to tenderers particularly where it had been prepared by engineers who saw it as little more than a repository of design information but received by engineers whose understanding of its function was likely to be informed by how it was described or otherwise referred to in the tender documentation. However, it does not appear that any detailed consideration was given to whether the inclusion of an environmental matrix populated with parameters could give rise to confusion on the part of tenderers. In particular, there appears to have been no consideration of whether such a document could be misinterpreted as a fixed client brief for the ventilation system.

Potential for confusion over the status of the Environmental Matrix – the text of the procurement documents

9.72. As Counsel to the Inquiry submitted in his first closing statement, when one looks at the provisions of Volumes 1 and 3 of the ITPD, there is a distinct lack of clarity as to what was the intended status of the Environmental Matrix and in particular whether or not it was a fixed client brief capable of superseding or derogating from, for example, SHTM 03-01. That lack of clarity gave rise to at least the potential for confusion. This is not a conclusion which was supported by those of the core participants who took a position on the matter in their respective closing

805 Witness Statement - Susan Goldsmith - 09.05.2023 - paragraph 20.

statements. NHSL and MML maintained that the procurement documents clearly required compliance with SHTMs and that no reliance could be placed on the EM. Multiplex and IHSL, on the other hand, maintained that there was a clear requirement for the EM to be complied with.

9.73. Parties' respective positions were supported with well-developed and detailed arguments as to why their respective interpretations of the tender documents are not only correct but clearly so. They can be viewed in the core participants, closing submissions for the first and second Edinburgh hearings on the Inquiry's website.[806] I do not intend to reproduce them other than in the briefest of summaries. NHSL contended that the EM was a "draft" (and was so described) and that the hierarchy of standards (provision 2.5) meant that SHTMs would always take precedence over any lower standard. They also pointed to the fact that the EM was developed by Multiplex/ IHSL in the period up to Financial Close and thereafter; it became Project Co's document. Therefore, it could not be seen as a fixed specification. Multiplex and IHSL, on the other hand, maintained that there was a clear requirement for the EM to be complied with. Where values in the spreadsheet differed from SHTMs, the spreadsheet entries took precedence. They pointed to provisions identifying the EM as a source of Room Information for inclusion in room data sheets. They emphasised that compliance with the EM was a stated requirement with any derogations being specifically highlighted. They also pointed to the statement in the guidance note of the EM which stated that it was being used in substitution for room data sheets produced using ADB. Therefore, they contended, it was the client's brief.

9.74. I do not see it as my function to resolve the question of which interpretation of the documentation comprising the ITPD is to be preferred. What I would point to is that it contained material supporting each of the contradictory positions adopted by the parties.

9.75. The ITPD was made up of 4 volumes. Each volume had a different purpose and status. Volume 1 contained general instructions on the procurement process to bidders, including how to demonstrate that they understood and could deliver on the procuring authority's requirements, what they would be assessed on, and how they would be assessed. Volume 2 contained the draft NPD Project Agreement. Volume 3 contained the Board's Construction Requirements (BCRs), which would form part of the Project Agreement following any amendments agreed during the procurement process. Volume 4 consisted of a "data room" containing other information required by bidders or considered helpful or relevant.

9.76. The Environmental Matrix was defined in Volume 3 (the BCRs) as:

> "…the Environmental Matrix, which details the room environmental condition requirements of the Board required within each department/unit/ space/area. The title is 'Reference Design Envisaged Solution – RHSC/ DCN Environmental Matrix version third issue' as set out in Appendix C of this Section 3 (Board's Construction Requirements) of Schedule Part 6 (Construction Matters) (as

806 Closing submissions for the first and second Edinburgh hearings.

varied, amended or supplemented from time to time in accordance with the Project Agreement)"[807]

9.77. In Volume 1 of the ITPD, the "Environmental Matrix" is defined as: "…the matrix contained in ITPD Volume 3, Schedule Part 6, Section 3, Appendix C". Thus, the "Environmental Matrix" was defined by reference to a specific document contained in Volume 3, appendix C. That was a well-populated document rather than a blank pro forma that required to be populated by tenderers. At no point in the definition section is there any reference to the EM being a draft or a document that required to be completed or revised by prospective tenderers.

9.78. The definition of the EM as a document "which details … requirements of the Board" strongly suggests a client brief. It is difficult to understand how a tenderer could be expected to know, or to create, the "requirements of the Board".

9.79. The provisions of the procurement documents do not however all point in the same direction. Volume 1, paragraph 2.5, sets out the "Reference Design and Mandatory Reference Design Requirements".[808] The mandatory elements concerned "Operational Functionality". The EM was not listed as a mandatory requirement. This would support the view that the EM was not a fixed document or a client brief.

9.80. Volume 1, paragraph 2.6, is entitled "Indicative Elements of the Reference Design". It states that "…other information has been generated both as a by-product of preparing the Reference Design itself and as a general Project requirement". This included: "Building services engineering solutions". The ITPD stated that: "Such information is issued to the Bidders for "information only" so that they may understand the intent of the Reference Design." This might suggest that the Environmental Matrix, as a document setting out "building services engineering solutions", was included for information only and could not be relied upon.

9.81. Similarly, Volume 1, appendix A (ii) C 8.2 states that: "The following information should also be provided to help demonstrate the design proposals noted above…". Included in the list which follows is item x: "An environmental conditions/ room provisions matrix for both mechanical and electrical services for each room in the Facilities…". Thus, the EM is being presented as no more than "information"; it was for bidders to develop their own environmental matrix.

9.82. However, that looks to be qualified in Volume 1, appendix A (ii) C8.3. This provides that: "Whilst Bidders are required to undertake their own design, the Board has provided a draft Environmental Matrix as part of the ITPD documentation. Bidders must confirm acceptance of the Board's Environmental Matrix, highlighting any proposed changes on an exception basis." This is the first time that the EM is described as a "draft". The reference is inconsistent with the definition quoted above which indicates the EM is a document setting out NHSL's requirements. On the other hand, Volume 1, C21 provides that: "Bidders must confirm their compliance with the Board's Construction Requirements. If as their design has

807 A33554028, ITPD Volume 3 March 2013 - HC2022.B3.V3 - page 11.
808 A35608423 - ITPD Volume 1 March 2013 - HC2022.B3.V3 - page 178.

been developed there are specific areas of the Board's Construction Requirements that Bidders would seek to change, these shall be scheduled and provided in support of the statement. The Board shall not be required to accept any proposed amendments." This indicates that, at least broadly speaking, the Board's Construction Requirements (which include the EM) should be followed, any changes having to be raised with and agreed to by NHSL.

9.83. There were further relevant provisions in Volume 3. The Project-wide requirements were stated to include the provision of: "…high-quality, patient-centred services from modern Facilities."[809] Bidders were to comply with this "general ethos" while also addressing the detailed requirements. The ITPD further provided that: "Project Co shall ensure that the design of the Facilities draws upon and endeavours to further develop, improve and exceed current best practice (and Good Industry Practice) standards achieved in other similar schemes, and meets the requirements of the prospective patient groups, staff and the public." The requirement to "improve and exceed current best practice (and Good Industry Practice) standards…" is significant. It is not clear how a tenderer could seek to meet this general ethos without checking that the ventilation specification in the EM complied with (or exceeded) best practice guidance, and given that the SHTMs are described as "best practice" guidance, it is not clear how the general ethos could be complied with without a tenderer checking, for example, that the ventilation requirements complied with (or exceeded) the recommendations in SHTM 03-01 and then giving them precedence over anything to contrary effect in the EM.

9.84. Paragraph 2.3 of Volume 3 was entitled "NHS Requirements". It provides that: "In addition to the standards listed in paragraph 2.4 of this Sub-Section C, unless the Board has expressed elsewhere in the Board's Construction Requirements, a specific and different requirement, the Facilities shall comply with but not be limited to the provisions of the NHS Requirements as the same may be amended from time to time: …h) HTM and SHTM;…p) Health Department Letters (or Management Executive Letters) as appropriate published by SEHD and SGHSCD…" . Thus, in terms of this provision, while there is a general requirement to comply with SHTMs, compliance is not required if NHSL has expressed a specific and different requirement. At least on one reading, the Environmental Matrix is a specific and different requirement. While on the evidence available to the Inquiry it is difficult to imagine a situation where NHSL would have wanted a different requirement than that recommended by a SHTM, if the intention was for there to be absolute compliance with SHTMs, this could have been stated. It was not.

9.85. On the other hand, the section "Health Technical Memoranda & Scottish Health Technical Memoranda (HTM & SHTM)" looked to give unqualified precedence to the guidance provided by HTMs and SHTMs and provided that: "Project Co shall, in relation to all SHTM and all HTM (except HTM where an SHTM exists with the same number and covering the same subject matter): take fully into account the guidance and advice included within such SHTM and HTM; ensure that the

809 A33554028, ITPD Volume 3 March 2013 - HC2022.B3.V3 - page 21.

Facilities comply with the requirements of such SHTM and HTM; and adopt as mandatory all recommendations and preferred solutions contained in such SHTM and HTM." In contradistinction to what appears in paragraph 2.3, this provision is stated in absolute terms. There is no qualification that the guidance should only be complied with unless a contradictory standard is set out elsewhere.

9.86. Moreover, Volume 3 of the ITPD, at paragraph 2.5, contained a provision entitled "Hierarchy of Standards". This provision (the hierarchy of standards clause) is relevant to the analysis of the clarity of the drafting (and was stressed by NHSL and MML in their respective closing statements as being of particular importance). It provided that: "Where contradictory standards/advice are apparent within the terms of this Section 3 of Schedule Part 6 (Construction Matters) and the Appendices then subject to the foregoing paragraph then (1) the most onerous standard/ advice shall take precedence and (2) the most recent standard/advice shall take precedence. When the more onerous requirement is to be used the Board will have the right to decide what constitutes the more onerous requirement." Thus, the most onerous standard is stated to take precedence where there is contradiction.

9.87. This allows an argument which is relevant at two levels. At a general level, if there was a disconnect between the environmental matrix and SHTMs, with the latter setting a more onerous standard, the values in the SHTMs should take precedence. More specifically, the hierarchy of standards clause can be applied where there is an internal inconsistency within a document. As already discussed, the EM contained internal inconsistencies. The correct values for critical care areas were outlined in the "Guidance Notes" section but different values were stated in the body of the EM in relation to certain critical care areas. The hierarchy of standards clause, so it may be argued, should have required a tenderer to apply the more onerous standard set out in the "Guidance Notes" section if a tenderer considered that the EM was a derogation from the general requirement to comply with published guidance.

9.88. However, the hierarchy of standards clause is stated to apply where "contradictory standards/advice are apparent". That looks to be a reference to a potential conflict between two different sources of external guidance rather than a potential conflict between a source of guidance and what was presented as a requirement of the Board, and hence, it can be argued, is of no relevance to the issue dividing the parties: whether the procurement documents provided that the EM took precedence over SHTM 03-01.

9.89. Volume 1, section 2.5.3. sets out the requirements for the production of Room Data Sheets and mentions the EM as a source of "room information" to be used to compile room data sheets: "Standard format Room Data Sheets have not been prepared by the Board for the Project. The specific room requirements (the "Room Information") are detailed in a combination of the following documents." The list of following documents includes "…The Environmental Matrix …". Thus, as a matter of ordinary language, tenderers were told that the room requirements were contained within the Environmental Matrix. On the other hand, paragraph 3.6.3 of Volume 3 stated that: "For the avoidance of doubt, Project Co shall

provide mechanical ventilation, comfort cooling and air conditioning to suit the functional requirements of each of the rooms in the Facilities. Irrespective of the ventilation requirements in Room Data Sheets, where rooms are clearly intended to be occupied and / or become internal spaces during design development and natural ventilation is not possible, mechanical ventilation and / or extract ventilation shall be provided as appropriate to suit the function of the space." In the absence of Room Data Sheets this might suggest that there was a requirement that mechanical ventilation must suit the functional requirements of, for example, critical care rooms, as set out in the relevant guidance or otherwise, irrespective of what appeared in the EM.

9.90. The precedence of guidance over anything else is also indicated by paragraph 5.2 of Volume 3 which concerned "Infection Prevention & Control". It stated that: "Project Co shall ensure all aspects of the Facilities allow for the control and management of any outbreak and/or spread of infectious diseases in accordance with the following: … f) Ventilation in Healthcare Premises (SHTM 03-01);" It is not clear how this provision could be met by simply adopting the EM, as opposed to ensuring that provision for infection control is indeed ensured in accordance with SHTM 03-01.

9.91. A further lack of clarity in the procurement documents concerning the status of the environmental matrix is apparent in section 8 of the BCRs in Volume 3. Under the heading, "8. Mechanical and electrical engineering requirements", it stated: "Project Co shall provide the Works to comply with the Environmental Matrix. Project Co shall in carrying out the Works comply with the following non-exhaustive list of mechanical & electrical requirements. Project Co shall provide mechanical and electrical systems that help create a "state-of-the-art" building with innovative design. …For the avoidance of doubt the hierarchy of standards and advice detailed in paragraph 2.5 shall apply to this paragraph 8." This is a direct instruction to tenderers that they require to comply with the EM. It is difficult to understand why this wording was included if the intention was that the document was a draft which bidders could place no reliance upon.

9.92. Other provisions in section 8 pointed to the primacy of SHTM 03-01 over the EM. Paragraph 8.1 was entitled "Minimum Engineering Standards". It stated that: "In addition to the publications in paragraph 2 of this Sub-Section C Project Wide Requirement, Project Co shall ensure that the design, construction and selection of components for the mechanical and electrical works comply with, including but not limited to, the following design reference documents : … SHTM 03-01: Ventilation in Healthcare Premises".

9.93. Further, paragraph 8.7 was entitled "Mechanical Systems". It provided that: "The Project Co shall design, supply, install, test, commission, operate and maintain all mechanical building services necessary to support the Clinical Services at the Facilities. The following systems are indicative of those anticipated by the Board but are not exhaustive and sole responsibility shall be Project Co's to determine all

necessary systems are included. Systems shall be designed, supplied, installed, tested, commissioned, operated and maintained all in accordance with the regulations and standards." The term "regulations and standards" is not defined but, given the status of SHTMs as best practice guidance, the term might be seen as a shorthand reference to the standards (including SHTMs) set out in earlier sections of the document. Given the requirement to install, test, commission and operate the mechanical systems in accordance with "regulations and standards", it is not clear how a bidder could offer to comply without ensuring that the minimum standard (i.e., SHTM 03-01) was going to be met by the system.

9.94. Linked to this is paragraph 8.7.8, which provided that: "Project Co shall demonstrate how the proposals facilitate the control and management of an outbreak and spread of infectious diseases in accordance with SHTM 03-01, SHFN 30 and HAI-SCRIBE." Once again, it is difficult to see how a tenderer could offer to meet this requirement if it had not designed a solution that met the requirements of SHTM 03-01 and had simply offered to comply with the parameters set out in the Reference Design Environmental Matrix.

9.95. While Counsel's analysis related to the ITPD, there were no material changes in the Invitation to Submit Final Tenders (ISFT). Therefore the same issues arise in relation to the entire procurement exercise.

9.96. To summarise, the ITPD and ISFT contained ambiguous statements in relation to the status of the EM. It was not clear whether it was a document that tenderers required to comply with. NHSL's intention, namely for responsibility for the selection of parameters in the EM to sit with the successful tenderer, was not clearly communicated. This gave rise to a real risk of confusion on the part of tenderers in relation to the status of the document and the requirements for the ventilation system. There was no clear statement that the Environmental Matrix was a document that could not be relied upon, and that tenderers required to develop their own solution to comply with published guidance.

9.97. As Counsel to the Inquiry submitted, the procurement documents were not such as could be interpreted consistently by the reasonably well informed and normally diligent (RWIND) tenderer.[810]

Waiver of the requirement for the production of Room Data Sheets prior to Financial Close

9.98. As mentioned in chapter 6, paragraphs 6.92 to 6.97, the requirement that, as preferred bidder, IHSL had to produce room data sheets for every space in the hospital by Financial Close was waived by NHSL. This meant that finalisation of the ventilation parameters was deferred for resolution through the RDD process. It also meant that the precise terms of the Reference Design EM continued to have the potential to determine aspects of the ventilation design, including the output specifications by reference to which the design was being developed.

810 Closing Submission - Counsel to the Inquiry - Edinburgh Hospital - paragraph 176.

9.99. Had the requirement originally incumbent on IHSL been insisted upon (something I understood NHSL to have considered impractical given what was said to be the position taken by Multiplex), there would have been a full suite of room data sheets by Financial Close. That would have supplied a clearly articulated and comprehensive brief of NHSL's requirements for ventilation parameters; made the EM obsolete; and removed the need to include it as a contractual document. However, the RDS would not necessarily have completely corresponded with SHTM 03-01, given HLM Architects' reliance on the EM for environmental specifications. Indeed, the relevant RDS for critical care, prepared by HLM, provided parameters which were not compliant with SHTM 03-01.[811] Thus, although going through the process of producing RDS offered the opportunity to detect discrepancies between the EM and the data available on ADB for that particular room type (and it would appear that some discrepancies were detected), that process, as carried out by HLM, clearly did not guarantee a brief that was fully compliant with guidance. I should add for the avoidance of doubt that checking for compliance was not something that HLM were tasked with doing.

9.100. Nevertheless, in the event of a full suite of RDS having been produced by IHSL, might that have meant that the error would have been detected by MML when presented with the RDS? Mr Macrae of MML explained that such RDS as were produced by IHSL prior to Financial Close were not supplied to him for review. Had they been, he might have spotted some of the discrepancies between parameters recorded in the RDS and the guidance published in SHTM 03-01.[812] Moreover, while it is speculative as to how such other information might have been used, other information existed which might have alerted a reviewer, if appointed, to the fact that the relevant rooms in critical care were not "normal" bedrooms. For example, in September 2014 Multiplex provided NHSL with a list of rooms for which room data sheets were to be provided for Financial Close. In this list, patient accommodation in the critical care department was differentiated from generic single bed rooms and multi-bed rooms.[813]

9.101. Against that, not only does it appear that the RDS that were produced were not reviewed when tenders were assessed, but MML and NHSL did not have much motivation to do so, given that, except in relation to operational functionality, design risk lay with Project Co. As a matter of contract, once the Project Agreement was concluded, it would be for IHSL to ensure that its design met the Board's Construction Requirements, which, on MML and NHSL's understanding, included complete compliance with the recommendations in SHTM 03-01. There is also the question of practicality; according to MML the RDS were not reviewed in the period prior to Financial Close "given the timescales involved."[814]

811 A32505840 - Schedule Part 6, Section 6 (Room Data Sheets) - HC2023.B5 - pages 1024, 1039, 1460.
812 Transcript - Colin Macrae - 02.05.2023 - column 41 to 42.
813 A43053244 - Key and Generic Rooms - HC2023.B12.V2 - page 1841.
814 Closing Submission by Mott MacDonald to the Inquiry - Edinburgh Hospital - paragraph 97.

9.102. MML put forward a further consideration which, it argued, makes it doubtful as to whether the failure appropriately to specify environmental parameters would have been detected, even if IHSL had produced a full suite of RDS and they had been subject to review prior to Financial Close. As already discussed, the work of preparing RDS typically involves "tailoring" the generic information derived from a building information database such as ADB by adjusting it to include project-specific requirements. In this case it appears that the "tailoring" included specifying 4 ac/h for single bedrooms and multi-bed rooms in the critical care department as provided in the EM. A further difference between the ADB sheet for a multi-bed room in critical care and the RDS produced by HLM was to the description of the "activities" that would take place in these rooms compared to what was contained in the ADB RDS.[815] Specifically the ADB template for multi-bed rooms in critical care has clinical activities including "Accommodating a patient needing continuous medical and nursing care using piped medical gases, vacuum and life-support systems".[816] This activity was absent from Project Co's Room Data Sheet and instead an activity "rest and relaxation" was included, which did not feature in the original ADB sheet. The change had the effect of giving certain rooms in critical care the appearance that they were normal bedrooms. MML argued that given these changes a review of the RDS would not have alerted reviewers to an issue with compliance.

A further potential source of confusion – a lack of clarity over the references to the Environmental Matrix in the Project Agreement and its status as Reviewable Design Data

9.103. The Environmental Matrix was appended to the Project Agreement signed on 12 and 13 February 2015. Its status continued to be uncertain.

9.104. The Project Agreement at Financial Close included in its schedules a set of room data sheets.[817] It also included the EM.[818] The room data sheets were for certain key and generic rooms in the hospital. They included sheets for multi-bedded and single-bedded areas in critical care, which set ventilation parameters of 4 ac/h and positive pressure relative to adjoining space.[819] In requiring positive pressure for the single-bedded areas, the RDS conflicted with the EM which set a requirement for balanced pressure.[820]

815 Closing Submission by Mott MacDonald to the Inquiry - Edinburgh Hospital - paragraph 209 to 212
816 A42878410 - B1609 (ADB) - HC2023.B10.V2 - page 1112.
817 A32505840 - Schedule Part 6: Construction matter, section 6 (Room Data Sheets) Appendix 1 (RDS Pack) - HC2023.B5 - page 882.
818 A32623049 - Schedule Part 6: Construction matter, section 6 (Room Data Sheets) Appendix 2 (Environmental Matrix) - HC2023.B5 - page 1454.
819 A32505840 - Schedule Part 6: Construction matter, section 6 (Room Data Sheets) Appendix 1 (RDS Pack) - HC2023.B5 - pages 885, 1010, 1024, 1030, 1034, 1039.
820 A32623049 - Schedule Part 6: Construction matter, section 6 (Room Data Sheets) Appendix 2 (Environmental Matrix) - HC2023.B5 - page 1460.

9.105. The Board Construction Requirements in the Project Agreement required IHSL to comply with those RDS, and to produce sheets for the remainder of the hospital as "Reviewable Design Data".[821] The schedule which defined the reviewable design data (the reviewable design data schedule) listed "Room Data Sheets", without any qualification to limit it to those which had not been included in the schedule.[822] There was therefore ambiguity about whether or not the room data sheets forming part of the Project Agreement were, or were not, reviewable design data.

9.106. The Board's Construction Requirements in the Project Agreement required IHSL to provide the contract works "to comply with the Environmental Matrix".[823] "Environmental Matrix" is defined as the version included in the Project Agreement, as varied, amended or supplemented from time to time in accordance with it.[824] The effect of this provision, taken on its own, is to treat compliance with the EM, in the form in which it stood from time to time, as one of the Board's Construction Requirements. The EM at Financial Close conflicted with the room data sheets by requiring balanced pressure for single-bedded areas in critical care.

9.107. However, IHSL's obligation to comply with the EM was the subject of an express derogation. To the extent of the derogation, IHSL was not obliged to comply.[825] There is room for argument about the extent of the derogation (and thus IHSL's release from the obligation to comply with the EM). On one view, the derogation relates to the whole of the EM. On another view, the derogation is from complying with the EM to the extent it was the subject of the Board's comments recorded in the reviewable design data schedule. The extent of the derogation had the potential to be significant, in that the parameters in the environmental matrix were in conflict with the guidance, SHTM 03-01. The Board's Construction Requirements in the Project Agreement required compliance with guidance such as the SHTMs, except insofar as they expressed a specific and different requirement.[826] The EM was, at least arguably, a specific and different requirement capable of overriding compliance with guidance, but that argument was at least weakened if compliance with it was excused by the derogation.

9.108. The EM was classified as Reviewable Design Data. Its status as such derives from its inclusion in a table (in part 4 of section 5 of schedule part 6 to the Project Agreement). That part is headed "Non-Approved Project Co's Proposals Design Data comments".[827] It provides that IHSL was to submit, and the Board was to review, "the following Board comments in respect of relevant Project Co's

821 A33405670 - Schedule Part 6: Construction matters, section 3 (BCRs) - HC2023.B5 - page 231.
822 A32435789 - Schedule Part 6: Construction matters, section 5 (Reviewable Design Data) - HC2023.B5 - page 860.
823 A33405670 - Schedule Part 6: Construction matters, section 3 (BCRs) - HC2023.B5 - page 289 - paragraph 8.
824 A33405670 - Schedule Part 6: Construction matters, section 3 (BCRs) - HC2023.B5 - page 199.
825 A33405670 - Schedule Part 6: Construction matters, section 3 (BCRs) - HC2023.B5 - page 217; A33653831 - Derogation Register 16 January 2015 - HC2023.B10.V1 - page 316.
826 A33405670 - Schedule Part 6: Construction matters, section 3 (BCRs) - HC2023.B5 - pages 211 and 289.
827 A32435789 - Schedule Part 6: Construction matters, section 5 (RDD) - HC2023.B5 - page 869.

Proposals (which shall be deemed to be Reviewable Design Data) … with such Project Co submission addressing the following Board comments in relation to such Reviewable Design Data". A table then follows in which comments by the Board are listed beside references to specified sections in Project Co's Proposals. The table includes an entry for the EM.[828] The associated comment provides that "Project Co shall update the Environmental Matrix to reflect the following board comments…". The listed comments, in seven bullet points, are those agreed at a meeting to discuss the environmental matrix during the preferred bidder phase, on 11 November 2014.[829] The intention appears to have been that IHSL would update the EM to address these comments, then submit the EM for review under the applicable contractual procedures. There is, however, room for argument about whether the environmental matrix was Reviewable Design Data in its entirety, as opposed to simply in relation to those specific comments.

9.109. The procedures for submission and review of the Reviewable Design Data were governed by clause 12.6 and schedule part 8 of the Project Agreement. Clause 12.6 made provision for IHSL to develop and finalise the design and specification of the works, and for the Board to review the Reviewable Design Data. Approval by the Board was limited in its effect to confirmation that the submitted item met its requirements for Operational Functionality.[830] Operational Functionality is a concept defined by the Project Agreement and is limited in scope.[831] Put short, it is concerned with the layout of the hospital and the adjacency of spaces insofar as that bears upon its use for the health board's services.

9.110. IHSL would otherwise be responsible for the submitted items of data, including warranting that it had used reasonable skill and care in the design,[832] and ensuring that it met the Board's Construction Requirements. For these purposes, compliance with the BCRs would be subject to the derogation from compliance with the EM. There was no such derogation from compliance with SHTMs.[833]

9.111. As things stood at Financial Close, therefore, there was neither a full set of Room Data Sheets for the hospital, nor an approved Environmental Matrix with a complete set of binding parameters for the ventilation system. Both were, at least to some extent, to be produced by IHSL and submitted through the reviewable design data procedure. There was scope for argument about the extent to which the EM and the RDS were Reviewable Design Data, and therefore about the extent to which they were subject to the contractual review procedure. There was also scope for argument about the extent to which IHSL was obliged to implement parameters in the EM or was, due to the derogation, excused from doing so.

9.112. A further point can be made. The EM was treated in the Reviewable Design Data schedule as if it were one of Project Co's Proposals. That is noteworthy, because

828 A32435789 - Schedule Part 6: Construction matters, section 5 (RDD) - HC2023.B5 - page 880.
829 A39975851 - Email 11 November 2014 - HC2023.B4 - page 245.
830 A33405351 - Main body of contract - HC2023.B5 - page 25 - clause 12.6.2.
831 A33405351 - Definitions and interpretations - HC2023.B5 - page 167.
832 A33405351 - Main body of contract - HC2023.B5 - page 24 - clause 12.3.
833 A33405670 - Schedule Part 6: Construction matters, section 3 (BCRs) - HC2023.B5 - page 211 and 289 (clause 2.3 and 8 respectively).

the EM was not itself formally part of those proposals: it is not included in the part of the Project Agreement schedules in which those proposals are set out.[834] Further, the Board's Construction Requirements are drafted on the basis that compliance with the EM forms part of NHSL's requirements.[835]

9.113. By treating the EM in part as if it were one of NHSL's requirements, and in part as if it were one of the contractor's proposals, the Project Agreement reflected the confusing presentation of the matrix in the tender documents. The complexity of these arrangements left scope for argument about exactly how they were intended to work after Financial Close, and where contractual responsibility lay for the ventilation parameters in the EM and the RDS.

9.114. This was an unpromising basis upon which to resolve the problem arising from the absence of a clear design specification at an early stage. The subsequent history of the project exemplifies the difficulties associated with making significant changes to the technical specification after Financial Close in a revenue-funded project.

Continuing potential for confusion after Financial Close

9.115. The inclusion of the Environmental Matrix as Reviewable Design Data was to perpetuate the consequences of the confusion over its status and purpose. The ambiguity and confusion about its status that began during the procurement process persisted through the period after Financial Close. It was a document to which parties referred and it continued to be revised. It remained the starting point for the contractor's design and its understanding of NHSL's wishes as to how the hospital was to be put to use.

9.116. Further confusion arose as to the precise nature of the process in which parties were engaged from the way in which the RDD review procedure was conducted.

9.117. Multiplex and TSWW expected review of the EM to be limited to the points recorded against it in the Project Agreement as at Financial Close. They were surprised by the range and number of comments made about it by, and on behalf of, NHSL.[836] That surprise reflected their understanding that the EM constituted NHSL's brief on the matters it contained. They saw NHSL's comments as attempts to change that brief.

9.118. The RDD review procedure provided by the Project Agreement was not intended as a means whereby the procuring authority could confirm that a proposal by Project Co met with its requirements; the only contractual effect of NHSL's approval through the RDD review procedure was to confirm that the approved item satisfied NHSL's requirements for Operational Functionality. That was not understood by TSWW or Multiplex. Mr McKechnie was unfamiliar with the concept of Operational Functionality, as defined in the Project Agreement, until asked about it by the Inquiry. He did not realise that NHSL's approval under the RDD review procedure

834 Schedule Part 6 Construction matters, section 4 (Project Co's Proposals) - HC2023.B5.V2
835 A33405670 - Schedule Part 6: Construction matters, section 3 (BCRs) - HC2023.B5 - page 289 - paragraph 8.
836 See for example Witness Statement - Stewart McKechnie - HC2024.WB.V2 - paragraph 25.

was limited to confirming that an item of design data conformed to Operational Functionality. Rather, he treated NHSL's approval as confirming, in a much broader sense, that they were happy with the proposals: as "an acknowledgement by the client that what we were putting forward met with their expectations".[837] Mr McKechnie saw himself as engaged in a process of attempting to clarify what NHSL wanted and was frustrated by the number of comments made about the EM and the number of revisions it went through without reaching a finalised form. Mr Hall of Multiplex had a similar understanding.[838] Darren Pike of Multiplex was familiar with the concept of Operational Functionality but still saw the RDD process as in part confirming NHSL's agreement to parameters such as air changes.[839]

9.119. NHSL, and its technical advisers MML, on the other hand, approached the RDD process with an attitude which more closely reflected the design risk allocation of the Project Agreement.[840] They understood, and noted, that NHSL's approval was limited in its effect to matters of Operational Functionality. Notwithstanding the origins of the EM in NHSL's Reference Design, they did not regard it as NHSL's brief, but as part of IHSL's design response to that brief. They considered themselves free to comment on the EM, including to highlight what they considered to be non-compliances with SHTM guidance, but did not consider themselves obliged to do so or as being in any way responsible for the compliance of its contents with guidance. In the words of Mr Greer of MML, they intended these comments to be "helpful pointers".[841]

9.120. Parties were thus at cross-purposes. Consequently, development of the EM proceeded in an unsatisfactory way. TSWW was frustrated by what it perceived as the difficulty in getting NHSL to confirm its agreement to its parameters. NHSL and MML were frustrated by what they perceived as a failure by TSWW to bring the parameters into line with those recommended by guidance.

9.121. Notwithstanding the scrutiny applied by NHSL and MML to the contents of the EM, the detailed comments they made about it, and the fact that those comments included concerns about non-compliance with SHTM 03-01, no concerns were raised about the air change parameters for critical care rooms.

Practical effect of the RDD status given to the Environmental Matrix

9.122. Although the Inquiry has not seen a copy of every iteration of the document, it would appear that the EM at Financial Close (dated 13 February 2015) went through ten revisions to reflect Board comments during the course of the construction phase before emerging as Revision 11 dated 25 October 2017, which was intended to be used "at site to check off against what is installed within the rooms."[842]

837 Transcript - Stewart McKechnie - 29.02.2024 - column 6.
838 Transcript - Ken Hall - 28.02.2024 - columns 131 to 132.
839 Transcript - Darren Pike - 28.02.2024 - columns 10 to 26.
840 Closing Submission by Mott MacDonald to the Inquiry - Edinburgh Hospital 2024.
841 Witness statement - Graeme Greer - 27.02.2024 - paragraph 18.
842 A34225692 - Notes of EM Rev 10 RDD Review - 28 September 2017.

9.123. The RDD status given to the EM changed a number of times during the course of the RDD process:

- February 2016: level C
- April 2016: level B
- October 2016: level C
- November 2016: level B
- June 2017: level C
- July 2017: level B

9.124. As noted above, NHSL on three occasions up to July 2017 gave the EM "Level B" status. The meaning of Level B status according to the Project Agreement is, in full: "proceed subject to amendment as noted; Project Co to make amendments as noted and continue next level of design or to implement the works without re-submitting documents."[843]

9.125. Given that NHSL was only responsible for Operational Functionality this status was not an indication that NHSL or MML thought the EM was fully compliant. However without approval at Level B, progress could not be made even in respect of aspects of the EM that NHSL was content with. The practical effect of Level B status was that design, construction and installation of the system progressed in accordance with the figures in the EM, even while the EM was still being reviewed by MML and NHSL.

9.126. The specification to which a ventilation system is designed has a significant impact on the construction work required in order to achieve that specification. Mr McKechnie explained that further developing the design of the ventilation system required calculating the airflows for each room.[844] For this calculation Mr McKechnie used the air change rates specified in the version of the EM current at Financial Close, "as we understood they formed part of NHSL's brief and were therefore part of the Board's Contract Requirements (BCRs)".[845] This work took place in 2015 to 2016, during which period the design documents were submitted to NHSL and its advisers through the RDD process.[846] Thus, Mr Hall noted that when, in October 2016, the status of the EM was changed from Level B to Level C (meaning "do not act on the submitted item") "by this point in time a considerable amount of the detailed design drawings and schedules had been through the RDD process, had been approved, procured and was being installed on site."[847] This included drawings and schedules relating to critical care.[848]

843 A33405351 - Schedule Part 8: Review Procedure - HC2023.B5 - page 1498.
844 Witness Statement - Stewart McKechnie - 04.05.2023 - paragraph 15.
845 Witness Statement - Stewart McKechnie - 04.05.2023 - paragraph 25.
846 Witness Statement - Stewart McKechnie - 04.05.2023 - paragraph 17.
847 Witness Statement - Ken Hall - 28.02.2024 - paragraph 59.
848 Witness Statement - Ken Hall - 28.02.2024 - paragraphs 40 to 44, 60; Design documents contained in HC2024.B13.V2.

9.127. According to Mr Maddocks, it is not standard practice to design a ventilation system with additional capacity.[849] TSWW designed the ventilation system to achieve 4 ac/h, this is the capacity that the detailed design reflected, and what was to be installed. Mr McKechnie told the Inquiry that had TSWW been asked to adopt 10 ac/h for any patient accommodation other than isolation rooms, the ventilation systems "would have required a redesign."[850]

9.128. Mr Greer told the Inquiry:

> "Although I do not have a detailed technical knowledge of AHUs [Air Handling Units], I understand they are a significant piece of plant with a long procurement lead time. Ventilation capacity of the facility was therefore "baked in" at a very early stage of the construction phase. If additional capacity was required to allow an alteration, I understand this may have necessitated significant programme delay and additional expense."[851]

9.129. Multiplex further pointed out that a post-bid increase from 4 ac/h to 10 ac/h in critical care areas would give rise to increased construction and maintenance costs, energy consumption and energy costs. As Multiplex noted, "It would also impact the BREEAM scoring/rating, which was linked to the funding criteria."[852]

Perhaps no actual confusion – the role of Mr McKechnie

9.130. The position of Multiplex, as underlined by its legal representative in his final submission, was that what it had been led to understand through the procurement process was that the EM was the client's brief.[853] That understanding was never lost; it was the basis of what was a fixed price bid. That too was the IHSL position.

9.131. MML, on the other hand, argued that whatever the witnesses who had suggested that this was the case had come to believe, Multiplex's claim that it had always proceeded on the basis that the EM was a mandatory document imposing NHSL's unalterable requirements for the ventilation system, was in direct contradiction to the actions of the parties, both before and after the appointment of IHSL as preferred bidder. As was apparent from these actions, there was in fact no confusion about the status of the EM. Rather, it was clear that IHSL fully understood that its design had to comply with SHTM 03-01, without qualification. In its tender documents that is what it undertook to do. As for the suggestion that Multiplex and TSWW relied on the EM, that is inconsistent with the terms of TSWW's appointment by Multiplex. TSWW was to carry out its services in accordance with the BCRs. It was diligently and regularly to review relevant documents. Multiplex gave no warranty in respect of Disclosed Data (which included the EM) and TSWW acknowledged that it had satisfied itself as to the accuracy, completeness and fitness for purpose of the Disclosed Data on which it

849 Stephen Maddocks - RHCYP/DCN Critical Care Ventilation Systems Review - page 27.
850 Witness statement - Stewart McKechnie - 04.05.2023 - paragraph 20.
851 Witness Statement - Graeme Greer - 27.02.2024 - paragraph 50.
852 Closing Submission - Multiplex - Edinburgh Hospital 2023 - paragraph 6.28.
853 Transcript - Closing submissions for investigations into the RHCYP/DCN - 17.06.2024 - column 121 to 122.

placed reliance. After the appointment of IHSL as preferred bidder Multiplex, and thereafter TSWW, agreed to take ownership of the EM, thereby converting the document and its contents into a contractor's proposal for which the contractor (and not NHSL) had responsibility. Having taken ownership of the EM, IHSL's contractors proceeded to review it and make changes to it. NHSL made comments on the various iterations of the EM produced by Multiplex. That was inconsistent with the EM being a source of mandatory requirements taking precedence over SHTM 03-01 but understandable if the EM was a contractor's document in the course of development. A derogation was granted from the provision in the BCRs requiring the works to comply with the EM. The inclusion of the EM as RDD again was only consistent with the EM being an unfinalised aspect of the contractor's design, as opposed to a part of the employer's brief. MML had repeatedly reminded Multiplex throughout the RDD procedure that IHSL's obligation was to comply with the BCRs and the SHTMs. It was understood by Multiplex that (i) compliance with BCRs required more than simply complying with the EM; (ii) there was an overarching requirement to comply with SHTMs; and (iii) the onus to develop the EM and provide a compliant facility rested with IHSL regardless of any comments on the EM made by NHSL or MML.

9.132. Thus, it was the position of MML (as it was essentially also the position of NHSL) that, given the history detailed in its closing statement and summarised above, notwithstanding the evidence of the Multiplex witnesses, there was no question of Multiplex having proceeded on the basis of the EM, rather than SHTM 03-01, being the authoritative source of the mandatory specification with which IHSL had to comply. However, quite apart from that, and whatever might be said about the drafting of the procurement and contractual documents, and any ambiguities as to whether the required ventilation specification was to be found in SHTM 03-01 or the EM, none of this was of causal significance. The key causative factor leading to the installation of a defective ventilation system serving critical care was the outlier interpretation of the relevant guidance by Mr McKechnie.[854]

9.133. I have already observed that the discrepancy between the recommendations made in SHTM 03-01 for critical care areas and what appears in the EM was not identified, notwithstanding the attention given to the EM during the RDD process. What might have given rise to further scrutiny was the internal contradiction in the EM as at Financial Close, in that the room-specific entries for multi-bed and single rooms in critical care specified an air change rate of 4 per hour, whereas the EM also included a guidance note which read: "Critical care areas – Design Criteria – SHTM 03-01 – Appendix 1 for air change rates – 10ac/hr Supply …".

9.134. However, in the course of the RDD procedure, in a revised version of the EM dated 26 November 2015, TSWW amended that guidance note by adding the words "for isolation cubicles".[855] As I have discussed in chapter 5, this reflected Mr McKechnie's view as to what SHTM 03-01 requires. Mr McKechnie adopted, and still adopts, an interpretation of the 2014 version of SHTM 03-01: that the recommendation of 10 ac/h and 10 Pa positive pressure only applies to isolation

854 Transcript - Closing submissions for investigations into the RHCYP/DCN - 17.06.2024 - column 89.
855 A46365871 - Environmental Matrix - HC2024.B13.V2 - page 101.

rooms. That I consider, with all due respect to Mr McKechnie's unquestioned relevant qualifications and experience, to be untenable as a matter of textual interpretation. My conclusion was shared by all the witnesses who gave evidence on the matter but, for present purposes, it does not matter whether or not I am right and Mr McKechnie is wrong. What is important is that Mr McKechnie was the man on the spot at the time, leading a team which I was encouraged by the legal representative of TSWW to assume, shared Mr McKechnie's view of what the relevant guidance required, and which was making the relevant decisions. That his view as to what SHTM 03-01 required was as he explained it to be in his evidence is confirmed by the fact of his having added "for isolation cubicles" to guidance note 15 where it appears in the version of the EM of 26 November 2015.

9.135. Mr McKechnie was a senior engineer originally employed by Wallace Whittle and then by TÜV SÜD (Wallace Whittle were acquired by TÜV SÜD). TSWW was appointed as designers by Multiplex. Mr McKechnie joined the project in November 2012, prior to the issue of the ITPD on 12 March 2013. Mr McKechnie had long-term experience of involvement with healthcare ventilation systems. He led a team. For him, an unusual feature of the RHCYP project was that he did not have direct contact with clinical staff or NHSL engineering staff. His evidence was that he took the EM to be the client's brief. TSWW had no input into its details during the procurement process but Mr McKechnie and his team reviewed the key engineering parameters which would affect the final design. The rooms which had specialised ventilation requirements would have attracted their attention. The review of the key engineering parameters by TSWW would have included a consideration of whether they aligned with guidance.

9.136. It was Mr McKechnie's evidence, at the third Edinburgh hearing, that TSWW had, on a number of occasions, sought a line-by-line review of the matrix with NHSL and MML to "agree that the parameters that we had then recorded in the matrix was the client's brief", but that offer was declined by MML on behalf of NHSL.[856] The context of that evidence was a meeting on 28 September 2017 recorded in an email from Mr Hall of Multiplex which stated that: "TÜV SÜD requested a review line by line, Motts noted if TÜV SÜD can confirm a check has been made line by line then there was no requirement to do a line by line check. TÜV SÜD confirmed the line by line check had been carried out in their office. Item closed."[857] In evidence Mr McKechnie confirmed that a review of the contents of the EM had indeed been carried out. In a follow-up question, Counsel asked whether the review had involved a check on whether the EM parameters complied in all respects with applicable guidance. Mr McKechnie replied that "We had already done that".[858] Mr McKechnie accepted that if there were found to be ambiguities in the EM or inconsistencies as between the EM and relevant guidance it would have been for TSWW to draw this to the attention of NHSL. However, no discrepancies were identified during the competitive dialogue phase of the procurement process, nor indeed after IHSL had become the preferred bidder and up to and beyond Financial Close.

856 Transcript - Stewart McKechnie - 29.02.2024 - column 81; Transcript - Ken Hall - 28.02.2024 - column 154 to 158

857 A46365818 - Environmental Matrix meeting - HC2024.B13.V2 - page 1048.

858 Transcript - Stewart McKechnie - 29.02.2024 - column 79 to 80.

9.137. As has already been explained, it so happened that Mr McKechnie's view as to what SHTM 03-01 required for critical care corresponded exactly with what appeared in the relevant cells of the EM. This would seem to be the most probable explanation for why WW's line-by-line check of the EM did not disclose any discrepancies. On Mr McKechnie's reading, there were no discrepancies. The specifications in the cells of the spreadsheet exactly corresponded to what Mr McKechnie would have expected them to be. As far as the failure to highlight the change to guidance note 15, is concerned, Mr McKechnie explained that "we did not take the view that we were changing anything in the matrix …we were tidying the document up".[859]

9.138. There would therefore not seem to be any question of Mr McKechnie, and therefore TSWW as Multiplex's designer, being misled by what appeared in the EM. This allowed MML to argue that the whole question of the status of the EM was academic. Mr McKechnie was of the view that "the EM did accord with SHTM 03-01" and that 4 ac/h in critical care "did not appear to be a mistake".[860] Accordingly, it did not matter whether the Reference Design EM was mandatory or not. Even if the Inquiry were to conclude that there was some ambiguity in the procurement or contractual documentation regarding the status of the EM, any such ambiguity has no causal relationship to the issues that subsequently developed and resulted in the delayed opening of the hospital. The fact that the EM continued to stipulate 4 ac/h for single bedrooms and multi-bedded rooms in Critical Care was because Mr McKechnie considered that this was what SHTM 03-01 required: not because of any uncertainty on his part about the status of the EM and whether TSWW's design required to comply with SHTM 03-01. It followed that any ambiguity or uncertainty regarding the procurement documents was of no causative significance in relation to the delayed opening of the hospital.[861]

9.139. NHSL's submission was to similar effect. From NHSL's perspective the proximate cause of the situation which came to light in June 2019 was the fact that IHSL, through Multiplex and TSWW, considered the ventilation rates specified in the draft EM for critical care to be compliant with SHTM 03-01.[862] Mr McKechnie's outlier views on the proper interpretation of SHTM 03-01 were not, apparently, reviewed internally. His decision to change guidance note 15 was not challenged. Multiplex's and TSWW's internal processes apparently allowed Mr McKechnie to constitute a single point of failure. But, in addition to this, so it was submitted, the Inquiry must bear in mind that NHSL was not responsible for the design of the hospital, that responsibility lay with IHSL and its contractor Multiplex, and this was ultimately a design error.[863]

859 Transcript - Stewart McKechnie - 29.02.2024 - column 37 to 38.
860 Witness statement - Stewart McKechnie - 04.05.2023 - paragraph 24 to 26.
861 Closing Submission by Mott MacDonald to the Inquiry - Edinburgh Hospital 2024 - paragraph 75.
862 Closing Submission for NHS Lothian to the Inquiry - Edinburgh Hospital 2024 - paragraph 11.
863 Closing Submission for NHS Lothian to the Inquiry - Edinburgh Hospital 2024 - paragraph 12.

9.140. I understand the logic of the argument advanced on behalf of NHSL and MML and I can see that, in relation to his understanding of ventilation requirements for four-bedded and single rooms in critical care, it does not matter whether Mr McKechnie was following the EM or SHTM 03-01. Either would have taken him in the same direction, given his understanding of what the relevant guidance meant. However, that appears to me to illustrate the weaknesses of each of these two contenders as a brief, and to underline the importance of a clear articulation of the Board's requirements for the hospital's ventilation system. As previously discussed, I consider such a clear articulation to have been necessary. I therefore return to Counsel to the Inquiry's question: did NHSL provide an adequate brief for the ventilation system?

Did NHSL provide an adequate brief for the ventilation system?

9.141. In his first closing statement, the legal representative for NHSL stated that NHSL's "brief" to tenderers was contained in the Board's Construction Requirements. These, so it was submitted, made it overwhelmingly obvious that Project Co was going to be required to provide facilities that complied with all relevant guidance, including SHTM 03-01.

9.142. That NHSL required Project Co to comply with SHTMs, including SHTM 03-01, was entirely appropriate. As has been discussed, the memoranda give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery of healthcare. It is to be expected that the Board would wish to ensure that Project Co followed that guidance. It does not however follow that a requirement to "comply" with SHTM 03-01, unaccompanied by RDS or any other document or mechanism linking the rooms listed in the schedule of accommodation with specific ventilation parameters, constituted an adequate brief of NHSL's requirements.

9.143. On the evidence I heard I have concluded that, notwithstanding that SHTM 03-01 is couched as guidance, where it offers specific recommendations, as it does in Table A1, in respect of a newly built hospital they should be read as being prescriptive in the sense of setting out standards which should be followed unless, on a fully informed consideration, there are good reasons not to do so. I have further concluded that it is possible to arrive at a confident textual interpretation of the application of the recommended air change rates and pressure differentials for "Critical Care Areas", at least once it is accepted, as a purely textual consideration would suggest, that these are areas in which critical care is administered. I have felt able to reject Mr McKechnie's different interpretation of Table A1 as untenable.

9.144. However, the fact that one can find in SHTM 03-01, properly interpreted, specific air change rates and pressure differentials for "Critical Care Areas" does not mean that a requirement to comply with the SHTM constitutes an adequate ventilation brief. SHTM 03-01 contains a great deal of advice (Part A in version 2 of February 2014 extends to 184 pages), some of which is particular but some of which is very general. It is not written as a contractual specification.

9.145. More than one witness described SHTM 03-01 as "open to interpretation". As Mr Macrae of MML put it: "The biggest problem with these type of projects, in my opinion, is that the guidance is too open to interpretation, and the table of rooms within SHTM 03-01 is not comprehensive enough and doesn't detail the different clinical needs or patient needs."[864]

9.146. Many documents can be said to be "open to interpretation", but whereas Table A1 provides very specific parameters for ventilation type (supply, natural, extract); air change rate; pressure differential; supply filter type; noise and temperature levels, that is not quite the case with the identification of the spaces to which these parameters fall to be allocated. As Mr O'Donnell explained, there is no generally accepted and applied room-naming convention.[865] The descriptors used in SHTM 03-01 did not exactly correspond to the descriptors used in the schedule of accommodation or clinical output based specifications.

9.147. For example, the schedule of accommodation includes reference to "HDU". Table A1 does not have such a reference, although it does have "Critical Care Areas", which, I would accept, should be interpreted as including high dependency units but that is not stated explicitly in SHTM 03-01. There was a clinical output based specification for the haematology and oncology ward of the RHCYP but there is no reference to haematology and oncology in Table A1. One of the applications is "Neutropenic patient ward", requiring 10 ac/h and 10 Pa of positive pressure, but a reader with no specialist knowledge might regard haematology and oncology as simply one example of a general ward with no specialised ventilation requirements. On the other hand, a reader with specialist knowledge would be aware that haemato-oncology patients are not necessarily neutropenic. Whereas some of the applications relate to individual rooms, others refer to larger spaces, for example "Neutropenic patient ward" and "Critical Care Areas", without further information as to just what parts of these spaces were included.

9.148. Some possible spaces are not included, or at least not specifically included, among the applications in Table A1. For example, among the applications is "General ward" but there is no application for multi-bedded rooms. Some spaces might be regarded as falling within more than one application, for example a four-bedded room in critical care, but there is no indication as to which entry should take precedence. Then there is the question as to whether the requirement to comply with SHTM 03-01 included exercising a judgment as to whether the recommended outputs in Table A1 might or should be adjusted to allow for an element of natural ventilation, reliance on which is contemplated elsewhere in the memorandum. Mr O'Donnell felt able to propose reducing the air change rates for general wards and single rooms from 6 ac/h to 4 ac/h on the basis that the difference could be supplied by natural ventilation and that this complied with the general tenor of the guidance.

864 Transcript - Colin Macrae - 02.05.2023 - column 47.
865 Transcript - Michael O'Donnell - 25.04.2023 - column 95.

9.149. Thus, Table A1, on which the attention of the Inquiry particularly focused, is not only “open to interpretation”, it is also in need of interpretation; it is neither comprehensive nor explicit as to which applications or rooms in a particular hospital its recommendations refer.

9.150. That is not intended as a criticism of the drafting of SHTM 03-01. Clinicians and engineers working together should be able to apply its recommendations in order to arrive at the parameters appropriate for the ventilation of particular clinical spaces. However, it is a criticism of relying on the document as a contractual specification, which is what NHSL did.

9.151. Irrespective of what view one takes of the clarity of the procurement and contractual documentation, I conclude that NHSL went through the procurement process and concluded the Project Agreement without providing a clear and robust ventilation brief to prospective bidders and then the preferred bidder. Had it done so, and ensured that the brief was the result of a collaboration between clinicians, infection prevention and control specialists, and engineers, and that the spaces in the schedule of accommodation and clinical output specifications comprehensively correlated with the appropriate environmental parameters, it is unlikely that the issues with which the Inquiry has been concerned would have occurred.

Chapter 10

Adequacy and effectiveness of national oversight and support, and the governance processes put in place by NHS Lothian

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Adequacy and effectiveness of national oversight and support, and the governance processes put in place by NHS Lothian

Introduction

10.1. In the previous chapter I set out what I see as the heart of the issues that arose with respect to ventilation at the RHCYP, that is the failure on the part of the Board successfully to communicate its intentions in respect of the outputs of the ventilation system to Project Co. In this chapter I address the questions relating to governance and management that are posed in Terms of Reference 3 and 5, which are:

> "3. To examine during the delivery of the RHCYP/DCN project:
>
> A. Whether the Boards of NHS Lothian put in place governance processes to oversee the project and whether they were adequate and effectively implemented, particularly at significant project milestones;
> B. Whether operational management provided by the Board of NHS Lothian was adequate and effective for the scale of such infrastructure projects;
> C. The extent to which decision makers involved with the projects sought and facilitated the input and took account of the advice and information provided by, or available from, the clinical leadership team; infection control teams; estate teams; technical experts and other relevant parties to ensure that the built environment made proper provision for the delivery of clinical care;
>
> 5. To examine whether, based on the governance arrangements in place, national oversight and support of such large-scale infrastructure projects was adequate and effective and whether there was effective communication between the organisations involved.

10.2. I will begin with a brief explanation of the high-level division of responsibility between Scottish Ministers and health boards in projects such as that for the provision of the RHCYP and DCN. I will turn to examine the mechanisms for national oversight of and support for the project. I will then consider NHSL's governance and management arrangements.

10.3. In what follows the relevant processes and arrangements are described very shortly. For more detailed explanations I would refer to the Inquiry's Provisional Position Paper 9 as revised.[866]

The NHS in Scotland - legislative background

10.4. In terms of section 1 of the National Health Service (Scotland) Act 1978, the Scottish Ministers have a broad statutory duty to promote a comprehensive and integrated health service designed to secure:

- the improvement in the physical and mental health of the people of Scotland, and
- the prevention, diagnosis and treatment of illness.[867]

10.5. To assist in the discharge of that and their other statutory duties, the Scottish Ministers have powers to establish health boards, special health boards and a Common Services Agency. Health boards exercise such of the functions of the Scottish Ministers relating to the health service as Scottish Ministers may determine.[868] While section 36 of the 1978 Act imposes a duty on the Scottish Ministers to provide hospital accommodation "to such extent as [they] consider necessary to meet all reasonable requirements",[869] this function was transferred to health boards by an order made under the Act.[870] Decisions regarding whether and where new hospitals are needed, and arrangements for their construction and operation, are matters for health boards, subject to the financial approvals process overseen by the Scottish Government Health and Social Care Capital Investment Group.

10.6. In her closing submission after the final hearing held by the Inquiry in relation to RHCYP and DCN, the legal representative for the Scottish Ministers explained that the framework established by the 1978 Act gave "ministers … high level overall responsibility to secure the provision. But the day-to-day management, delivery, operation of that is carried out by the relevant health boards in conjunction with the help and assistance they derive from the [Common Services] Agency and from HIS [Healthcare Improvement Scotland], and indeed from other knowledge acquired through its cooperation with other health boards and other authorities."[871] To similar effect, the former Cabinet Secretary for Health and Sport, Jeane Freeman, explained that the role of the Cabinet Secretary is to set the strategic direction for the NHS in Scotland and make decisions about the overall resourcing of those, but that health boards are the "delivery arm" of the NHS. A key reason for this is that health boards are best placed to acquire and use the knowledge of local circumstances, and the opportunities and constraints of the area that they are responsible for, to ensure that what they deliver makes sense for their own area.[872]

866 Provisional Position Paper 9 (Revised) - The Governance Structure within the project to construct the Royal Hospital for Children and Young People and Department for Clinical Neurosciences.
867 Section 1 of the National Health Service (Scotland) Act 1978 (c.29).
868 Section 2(1) of the 1978 Act.
869 Section 36(1) of the 1978 Act.
870 The Function of Health Boards (Scotland) Order 1991 S.I. 1991/ 570 Article 4(c).
871 Transcript - Closing submissions for investigations into the RHCYP/DCN - 18.06.2024 - column 23.
872 Transcript - Jeane Freeman - 12.03.2024 - column 6 to 7.

National oversight - financial approval

10.7. In order to deliver services, health boards are reliant on funding from the Scottish Government, and funds are allocated to health boards for this purpose as part of the Scottish Government budget process.[873] However, health boards are subject to limits in relation to the amount that can be spent by them in relation to capital projects. These delegated limits are set out in letters to the Chief Executives of health boards from the Scottish Government Health Finance Directorate. The letter that was applicable for the commencement of the RHCYP and DCN project was dated 19 August 2010 (which was subsequently amended by CEL 5 (2019), which specified the delegated limit for NHSL Board as £5 million (other health boards had different limits). The RHCYP and DCN project cost was considerably beyond this delegated limit.

10.8. Provision of funding for a capital project where the value is greater than the delegated limit requires submission of a business case by the health board and approval of that business case by the Scottish Government Health and Social Care Capital Investment Group (CIG). CIG's role covers all infrastructure and investment programmes and projects regardless of the ultimate funding route pursued by the procuring organisation. The process followed by CIG is intended to provide the necessary assurances to Scottish Ministers that proposals are robust, affordable and deliverable.[874]

10.9. It was explained to the Inquiry that the principal examination of the business cases is to ensure that they meet the requirements of the Scottish Public Finance Manual and the Scottish Capital Investment Manual. Alan Morrison, who chaired the CIG, explained that CIG is interested in:

> "the health board's Management Case, to look at whether the Board have a suitably resourced and experienced project team in place to deliver the project and also whether the health board's governance arrangements are appropriate. CIG also examines the extent to which the project is aligned with national, regional and local priorities (the last as articulated in Local Delivery Plans and associated Property and Asset Management Strategies). For example, I would look for health boards to mention the Quality Strategy relevant to its area or explain how more services could be delivered at home or in a community setting (which is a long established policy objective of the Scottish Government) or, where possible, link to the National Planning Framework, which is a long term plan for Scotland that sets out where development and infrastructure is needed."[875]

873 See for example Annex A.1 - NHS Recovery, Health & Social Care - Scottish Budget: 2024 to 2025 - gov.scot (www.gov.scot) allocating £13.2 billion to health boards.

874 Further information on the role of CIG can be found here: Scottish Government Health Directorates Capital and Facilities Division; Witness Statement - Michael Baxter - 16.05.2022 and Witness Statement - Alan Morrison - 2 of 2 - 16.05.2022.

875 Witness Statement - Alan Morrison - 16.05.2022 - paragraph 33.

10.10. CIG's review of the business cases is, according to Mr Morrison, "at a reasonably high level. By that, I mean that CIG is concerned to note that all relevant requirements have been met (such as technical specifications) but CIG recognises that, ultimately, it is the health board who are delivering the project. Thus, if the health board undertakes that a certain element of its design is compliant with the relevant technical memorandum then CIG does not check that the actual design is, as a matter of fact, compliant."[876]

10.11. CIG is chaired by a Deputy Director in the Scottish Government Health Finance Directorate (now the Directorate for Health and Social Care Finance, Digital and Governance) The role was held by Michael Baxter from February 2009 to December 2014. He was succeeded by Mr Morrison, the Capital Accounting and Policy Manager for Health Infrastructure, who became Interim Deputy Director for Health Infrastructure in March 2020.

10.12. It will be clear from the above that the role of CIG, and therefore the degree of oversight that it exercises, is limited. In particular, it is not part of CIG's role to conduct any form of review of technical specifications for the project.

National oversight - scrutiny of performance

10.13. Ms Freeman explained to the Inquiry her understanding of her statutory role with respect to oversight of health boards in the delivery of projects;

> "Section 2(2) [of the National Health Service (Scotland) Act 1978, as amended)] gives the Scottish Ministers very wide powers, and I was satisfied that it was open to me, as the Cabinet Secretary holding the health portfolio, to apply those powers in a proportionate way. By that I mean adopting a 'light touch' if I had assurances from those advising me that the health boards were dealing with matters well; and increasing my level of direct scrutiny and intervention if that became necessary in light of it being reported to me that a health board was performing less well or if failures came to light."[877]

10.14. The Scottish Government monitored the performance of health boards. John Connaghan was the Chief Performance Officer of the Scottish Govenrment between January 2019 and July 2021. The purpose of this role was to aid the government's objectives in terms of reducing waiting times and improving performance across the NHS, although Mr Connaghan explained that the focus was on the delivery of healthcare services rather than the delivery of capital projects. Mr Connaghan was also, at the time, the principal adviser to the Government's Health and Social Care Management Board (HSCMB) on the level of escalation that was required for NHS Boards in line with the NHS Board Performance Escalation Framework. The HSCMB: "provides an opportunity for Directors and other key participants to formally meet to discuss strategic, practical, and operational activities which contribute to the delivery of health and care

876 Witness Statement - Alan Morrison - 16.05.2022 - paragraph 36.
877 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 15.

services across Scotland. It also provides a platform for the Director General/Chief Executive of NHS Scotland to seek assurances on the progress of work, seek assurances that mitigations are in place for any identified risks, and seek advice that enables them to carry out their functions as accountable officer."[878]

10.15. The "NHS Board Performance Escalation Framework" has five stages. Mr Connaghan explained:

> "The higher the escalation level the more the Scottish Government are involved, culminating in Level 5, which is essentially full control. When a health board reaches Level 4 escalation, it is usually because of a serious service failure in one critical service area or, for a combination of services where the Scottish Government is of the view that the management team need general support."[879]

10.16. On 12 July 2019 NHSL was escalated to Stage 3 of the Escalation Framework. The delay to opening the RHCYP and DCN was just one of a number of factors in the HSCMB's decision.[880] Escalation to Stage 3 of the Framework meant that NHSL would be provided with a tailored package of support with a view to improving performance. The nature of that support is outlined in a letter to Timothy Davison (Chief Executive, NHSL) from Mr Connaghan dated 13 August 2019.[881] An Oversight Group was established, chaired by Mr Connaghan, to support NHSL in the development and delivery to the Scottish Government of a formal single recovery plan focused on mental health, cancer waiting times, and other deliverables.

10.17. NHSL was escalated to Stage 4 of the framework on 13 September 2019 as a result of the issues with the RHCYP and DCN project[882] "because of a combination of risks between operational aspects of the health board, which needed to have full-time focus for the management team, as well as the focus on resolving the hospital ventilation and other issues of the new RHCYP and DCN project."[883] The decision of the HSCMB was informed by the findings of two independent reviews into the project which had been commissioned by the Cabinet Secretary. This decision was also taken in the context of previous escalation of NHSL to Stage 3 of the escalation framework, as well as advice from the Oversight Board which had been appointed to address issues arising in relation to the delivery of the RHCYP and DCN project. The decision was conveyed to Brian Houston (NHSL Chair) on 13 September 2019.[884]

878 Witness Statement - John Connaghan - 07.03.2024 - paragraph 57.
879 Witness Statement - John Connaghan - 07.03.2024 - paragraph 60.
880 A41430802 - Email from Calum Henderson 9 July 2019 - HC2024.B7.V1 - page 285.
881 A41227221 - Email 13 August 2019 - HC2024.B7.V3 - page 26.
882 A41225979 - Email 10 September 2019 - HC2024.B7.V3 - page 441.
883 Witness Statement - John Connaghan - 07.03.2024 - paragraph 60.
884 A41231071 - Letter NHS Lothian Level 4 Escalation Sept 2019 - HC2024.B13.V4 - page 91.

10.18. Escalation to Stage 4 allowed SG to provide increased support and have more direct oversight of NHSL's programme of work. Scottish Government put in place a Senior Programme Director to strengthen the management and assurance arrangements for completing all the outstanding works necessary to open the new facility. Mary Morgan, Director of Strategy, Performance and Service Transformation, NSS, was appointed to this role on 16 September 2019.

10.19. In chapter 4 I have set out the role of the Oversight Board and the steps taken by SG, and NHSL, in delivering the project. These included undertaking remedial works to address a number of issues that had been identified. I am satisfied that this was achieved.

National Support - the Common Services Agency

10.20. The 1978 Act constitutes a body to be called the Common Services Agency, on which is conferred certain statutory functions in addition to which Ministers may by order delegate and withdraw delegation of such of their functions as they think fit.[885] In carrying out its functions the Agency shall act subject to, and in accordance with, such directions as may be given by Scottish Ministers.

10.21. For the purpose of carrying out its functions the Agency has adopted the name NHS National Services Scotland (NSS). Ms Morgan explained: "NSS is a non-departmental public body…constituted by a number of distinct departments who are responsible for the delivery of specialist services and support to the NHS in Scotland."[886] NSS has a wide range of services under its umbrella including Antimicrobial Resistance and Healthcare Associated Infection (ARHAI); legal services of the Central Legal Office; National Screening Oversight; National Procurement and Logistics; Scottish National Blood Transfusion Service; National Programs; Counter Fraud; and Health Facilities (including decontamination, incident reporting sustainability and engineering).

10.22. During the period when it operated under this name, Health Facilities Scotland (HFS) was described as a "division" of NSS. It was formerly known as the NHS Scotland Property and Environment Forum. Its function was to provide operational guidance to NHS Scotland bodies, including health boards, in relation to facilities, decontamination, equipment and other technical matters. Prior to 1 April 2020, another division of NSS was Health Protection Scotland (HPS). HPS was responsible for the coordination of health protection in Scotland including protection against the spread of infectious disease. ARHAI was part of HPS.[887] ARHAI remained within NSS after 1 April 2020. In June 2021, HFS and ARHAI and, accordingly, the services they provide, were incorporated into what is referred to as a new "directorate" of NSS with the name NHS Scotland Assure.[888]

885 Section 10 of the 1978 Act.
886 Witness Statement - Mary Morgan - 07.03.2024 - paragraph 8.
887 On 1 April 2020 the functions of HPS, minus those of ARHAI, were transferred to Public Health Scotland. Public Health Scotland is a Special Health Board. It succeeded NHS Health Scotland which was a Special Health Board constituted in 2003 and dissolved in 2020.
888 Witness Statement - Julie Critchley - 14.03.2024 - paragraph 5.

10.23. Among the services which were provided to healthcare organisations by HFS was the provision of the advice and guidance contained in the Scottish Health Technical Memoranda (SHTMs), a suite of documents compiled, published and from time to time revised and republished by HFS. As has been discussed, these documents provide guidance on a number of topics, including ventilation.

10.24. During the design and construction of the RHCYP and DCN, HFS provided advice to the project on an *ad hoc* basis, when asked, generally in relation to interpretation of guidance or advice and support where guidance did not cover a specific issue. This was consistent with the nature of the relationship between HFS and all Scottish health boards. HFS also commented upon a design review commissioned by Scottish Futures Trust (SFT), although this did not go into the technical detail around ventilation requirements.[889]

10.25. However, the involvement of HPS and HFS in the RHCYP and DCN project was limited. This situation was summarised by Mr Morrison after the issue with ventilation came to light in June 2019 and he was called on to provide some information to the Cabinet Secretary. He explained that HFS and HPS had no official involvement in the project as "typically HFS are not involved in projects unless they go wrong."[890] There had been engagement with the Project Team at an informal level, for example sharing of some information on what happened at the Queen Elizabeth University Hospital in Glasgow where there had been incidents of infection potentially linked to the building. HFS were now required to be involved with new builds through the national design assessment process (NDAP), however, "the Sick Kids predates that development and HFS' role has been minimal." He noted that at present only HFS was involved in NDAP, but there were plans to involve HPS too.[891]

National Support - The Scottish Futures Trust

10.26. National oversight and support for the project also came from SFT. This involved assistance for NHSL in preparing the project for procurement under an NPD structure and in carrying out Key Stage Reviews at important stages in the procurement process.[892]

10.27. It was a condition of Scottish Government funding support that the SFT undertook Key Stage Reviews (KSRs) of the project.[893] This was to provide an assessment of its readiness and whether the project had applied best practice (including an assessment of SFT Value for Money) before the build could move onto the next

889 A37280324 - HFS Comments on Independent Design Review 27 January 2012 - HC2022.B3.V2 - page 883.
890 A41020637 - Email 3 July 2019 - HC2024.B7.V1 - page 48.
891 A41020637 - Email 3 July 2019 - HC2024.B7.V1 - page 48.
892 Provisional Position Paper 9 - The Governance Structure within the project to construct the Royal Hospital for Children and Young People and Department of Clinical Neurosciences, Edinburgh. - section 27.7.
893 A33046853 - Letter 22 March 2011 - HC2023.B10.V2 - page 137.

stage in the procurement process. It was an independent assurance review of a project.[894]

10.28. The KSR process was described in the funding letter dated 22 March 2011 from the Scottish Government:

> "Key Stage Review provides a structured, independent 'due diligence' review of projects, supporting Project Managers and Sponsors at commercially critical procurement stages. Key Stage Reviews help to ensure that procuring authorities are sufficiently advanced in their project development and have put in place the necessary delivery arrangements and documentation in order to secure high quality, sustainable bids. They also ensure that authorities are adequately resourced to effectively and efficiently carry out the procurement, construction and operational stages of the projects. Key Stage Reviews are a formal requirement for all projects delivered through the NPD model and will be conducted by SFT."[895]

10.29. Peter Reekie, the Chief Executive Officer of the Scottish Futures Trust, explained in evidence to the Inquiry that KSRs represent a point in time for NHSL (in this case) to reflect on certain points that SFT considered to represent best practice for the relevant stage of the project and confirm them with input from its advisers as required. He went on: "The KSR process was not and was never intended to be a detailed audit where SFT staff would seek technical and documentary evidence for every statement made and/or question members of the project team and its advisers to verify the information provided and contributions of the senior team members that SFT generally interacted with."[896]

10.30. With regard to assurance in respect of the design development, Mr Reekie explained that the KSRs conducted during the procurement process included questions that prompted NHSL to reflect on whether it believed the design was sufficiently developed to move onto the next stage.[897]

10.31. It is clear from these statements that the KSR process was not intended to give detailed consideration to the technical aspects of a project, and that it was not part of SFT's role to conduct a detailed audit of any aspect of the design. Rather, KSRs are about project assurance, which is "about effecting that projects have a solid foundation in terms of governance, resources and clarity in relation to expected outcomes. It also seeks to ensure that best practice is applied, that lessons learnt from previous projects are taken into account and that arrangements are in place for the continuous review of process and performance against appropriate benchmarks."[898]

894 A40787624 - Validation of Revenue Funded Projects.
895 A33046853 - Letter 22 March 2011 - HC2023.B10.V2 - page 139.
896 Witness Statement - Peter Reekie April 2023 - 05.05.2023 - paragraph 52.
897 Witness Statement - Peter Reekie April 2023 - 05.05.2023 - paragraph 53.
898 SFT - Project Assurance 2013 - page 1 - section 2; see also Witness Statement - Donna Stevenson - 05.05.2023 - page 4 to 5.

10.32. Further details of the KSR process and the KSRs carried out in relation to the project can be found in PPP 9 as revised, sections 27.7 and 27.8.[899] It is sufficient to note for present purposes that five KSRs were conducted in relation to the project between December 2012 and February 2015.[900]

10.33. SFT's focus, consistently with the nature of its expertise, was on the commercial and financial aspects of the project. This included an interest in design and the terms of the Project Agreement but only insofar as they impacted upon those aspects. It was not part of SFT's role to consider compliance with technical guidance such as SHTMs, let alone to detect errors at the level of detailed parameters in an environmental matrix of which the Board and its advisers were unaware.

Assessment of national oversight and support

10.34. The question was raised in the closing statements of Counsel to the Inquiry and core participants as to whether, before approving Settlement Agreement 1, the Scottish Government could, or indeed should, have sought a review of the technical schedule by HFS. While Mr Morrison accepted that with the benefit of hindsight it would have been reasonable for the government to ask HFS for a review, and, again with hindsight, that there was a gap in governance procedures on the part of the Scottish Government, he said that the approach to decision making was in line with the division of accountability between government and health boards at the time.[901] Mr Morrison explained that in 2018 to 2019, "the Scottish Government's role was principally around reviewing the governance arrangements that NHS Lothian had established. They would consider "what are their legal advisers advising them on? Have other technical specialists…are they content with the proposal going forward? Has it gone through the Board? Has it been signed off by the senior team?" He noted that all of this was completed to the Scottish Government's satisfaction, which is why the director of finance approved, in principle, the Settlement Agreement and agreed to fund the cost of it. The procedures used for a business case for a capital investment were modified for this purpose.

10.35. It is to be observed that at this point in time HFS had a limited number of engineers, no more than three and perhaps only one. Instructing a view from HFS would likely to have involved the instruction of an external engineer.

899 Provisional Position Paper 9 - The Governance Structure within the project to construct the Royal Hospital for Children and Young People and Department of Clinical Neurosciences, Edinburgh; see also Witness Statement - Peter Reekie - 19.05.2022 - paragraphs 37 to 53.

900 See Key Stage Reviews at HC2023.B9 and HC2023.B10.V2 - pages 21 and 75. SFT confirmed to NHSL that no further KSRs would be carried out after the last mentioned on 30 July 2018. This is in accordance with SFT's guidance - A40787624 - Validation of Revenue Funded Projects - page 3.

901 Transcript - Alan Morrison - 13.03.2024 - columns 118 and 125.

10.36. With respect to the assurance she would seek as Cabinet Secretary, Ms Freeman told the Inquiry that "the starting point in relation to any NHS project was for me to be assured, at the highest-level, that projects being run by the health boards were progressing on time and within budget." In this regard she said:

> "The Scottish Government has to have a reasonable degree of trust in each NHS Board. If you asked a health board that managed a large budget, had an experienced Chief Executive, a director of estates and a medical director whether they had carried out what they were supposed to and they confirmed that they did, it is reasonable for the Scottish Government Health Directorate to rely upon assurances given."[902]

10.37. In a similar vein, Ms Freeman was questioned over whether the Scottish Government should have checked that the Stage 4 HAI-SCRIBE had been followed and completed before providing money for SA1. Ms Freeman answered that she was in two minds, noting that "to take on that role is to compromise the legal standing of a health board and the statutory responsibilities and roles that it has" but it is nevertheless "a legitimate area for future discussion".[903] Ms Freeman said that were she given a blank piece of paper she may not do things the same way. She continued that NHS Scotland Assure, introduced by the Scottish Government following the events at the RHCYP,

> "was my attempt to walk the tightrope between the position of health boards in terms of their legal standing and statute and what I consider to be the responsibilities of Scottish Government and a Cabinet Secretary. So, without throwing up in the air the legislation that underpins health boards, with all the furore and time that that would involve, NHS Scotland Assure, in my mind, was the means by which Scottish Government could have – independent of a health board, to a degree independent of Scottish Government – levels of assurance across a range of matters greater than had been the case up until that point."[904]

10.38. Ms Freeman also saw a gap in the support provided to health boards, that is, that they did not have "a single central point of support to which they could turn for all relevant infrastructure design and build experience and expertise".[905] She told the Inquiry:

> "What we did not have and what I thought would be useful to health boards in dealing with infrastructure projects, was essentially a single place that they could refer to for the expertise, advice, and guidance that they could follow, regardless of whether they had been in charge of a major or minor infrastructure project at any point in their career. Such a body would itself grow in expertise through experience, could look at design and build elsewhere in the UK and beyond and could, critically, ensure that infection prevention and control would be key drivers in the design and build of all healthcare facilities."[906]

902 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 25
903 Transcript - Jeane Freeman - 12.03.2024 - column 32.
904 Transcript - Jeane Freeman - 12.03.2024 - column 34.
905 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 154.
906 Witness Statement - Jeane Freeman - 12.03.2024 - paragraph 154.

10.39. The establishment of NHS Assure, discussed further in chapter 13, was intended to address that gap.

10.40. Notwithstanding what Mr Morrison and Ms Freeman were prepared, in hindsight, to accept, when considering the adequacy and effectiveness of national oversight and support, one must bear in mind what the mechanisms for oversight and support were intended to achieve and, to an extent, the resources available to do so. The function of providing healthcare and in particular the function of providing hospital accommodation are delegated to health boards. Powers are retained by Scottish Ministers, including power to exercise financial control over capital projects but construction of the new hospital was the responsibility of NHSL, and, as Ms Freeman observed, Scottish Government must have a reasonable degree of trust that health boards will discharge their responsibilities. In the course of 2018 NHSL had negotiated the terms of an agreement which it understood had resolved the outstanding issues, including the outstanding technical issues, between it and IHSL. NHSL considered that these technical resolutions sufficiently met its requirements. A business case was presented to Scottish Government for approval of what was proposed. The Inquiry heard no evidence to suggest that there was anything deficient in the business case or that there were other circumstances to alert Scottish Government that the technical resolutions, which had been accepted by NHSL, were other than appropriate. In these circumstances, I do not see the fact that Scottish Government did not require anything more by way of an assessment of the technical resolutions prior to it approving additional funding as an indication that national oversight or support were inadequate or ineffective, when regard is had to what the mechanisms in place were intended to achieve.

10.41. Similarly, I would not see it as an indication of inadequate or ineffective national oversight or support, that Scottish Government did not insist on completion of a Stage 4 HAI-SCRIBE, as a precondition of accepting handover in terms of the Project Agreement and the commencement of service payments. With all due respect to those who put this forward as a possibility, I do not regard such a proposal as either logical or practical. While carrying out a Stage 4 HAI-SCRIBE may incidentally disclose a deviation from guidance or other deficiency, that is not its primary purpose. It is of the nature of a multi-disciplinary risk assessment. It is not a mechanism for technical validation. It is intended to be carried out when a facility is ready for handover and in a clean state. To have sought to impose such a condition would have required renegotiation of the terms on which NHSL and IHSL were prepared to settle and it is at least doubtful that IHSL would have accepted such a radical departure from the Project Agreement's provisions as to certification of Practical Completion. Crucially, even as at January 2019, the condition of the hospital was not such that a complete Stage 4 HAI-SCRIBE could be carried out.

NHSL – governance processes and operational management

10.42. The Board of NHS Lothian is the ultimate decision-making body within NHSL. It oversaw the project and, once it was operational, the performance of the facility and either took or approved key decisions at a number of points during the project.

The Scottish Ministers appoint all NHSL Board members.[907] During the lifespan of the RHCYP and DCN project up to July 2019 the Chief Executives of the Board were James Barbour (from 1 August 2001 to 20 April 2012) and thereafter Mr Davison (until 15 July 2020).

10.43. The Finance and Resources Committee (the F&R Committee) was the principal NHSL Board governance committee overseeing capital programme and capital projects, including the RHCYP and DCN. Until October 2012, this committee was called the Finance and Performance Review (F&R) Committee. The overall remit of the F&R Committee was to keep under review the financial position of NHSL and to seek to provide assurance that suitable arrangements were in place to secure economy, efficiency, and effectiveness in the use and management of all financial resources and capital assets. It also provided assurance to the Audit and Risk Committee and the Board that risks were being recognised, recorded and assessed and that the annual Financial Plans were subject to robust scrutiny prior to approval by the Board. The committee reported to the Board of NHSL.

10.44. The Senior Responsible Officer (SRO) (also referred to as the "Project Owner") was the individual NHSL employee accountable for the project meeting its objectives, delivering the projected outcomes and realising the required benefits. This role was tasked with providing strategic direction and leadership. NHSL viewed this role as the key link between the system of governance and the system of management within NHSL. The SRO was directly accountable to the Board and reported to the Chief Executive. Jackie Sansbury was the Senior Responsible Officer from the start of the planning and business case stages until she stood down as then Chief Officer, NHS Lothian University Hospitals & Support Services Division on 30 June 2012. Susan Goldsmith, Director of Finance, was SRO from 1 July 2012 to 13 February 2015 (and subsequently from end June 2019 to 12 September 2019). When the Project Agreement was signed between NHSL and IHS Lothian Ltd, Jim Crombie, then Director of Scheduled Care, took over the role until the end of June 2019. The appointment of Ms Morgan as Senior Programme Director, on 12 September 2019, reporting directly to the Scottish Government, superseded the role of SRO.

10.45. In terms of project specific arrangements, the Project Board (also called the Programme Board or the Project or Programme Steering Board) and the Project Management Executive were the two key bodies. The Project Board was described to the Inquiry as:

> "…the key programme management committee for approving business cases and monitoring project performance and any variations required. Each Project Board/Programme Board reported to the Finance and Performance Review Committee. In the initial stages, the Project Board had a significant focus on the engagement with the wider stakeholder groups and therefore included many

907 Further details of the individuals concerned can be found here: Board Members - Lothian NHS Board.

external representatives on it. The Project Board reviewed the detailed project and programme governance for the project delivery, and was also required to:

- Establish project organisation
- Authorise the allocation of programme funds
- Monitor project performance against strategic objectives
- Resolve strategic issues which need the agreement of senior stakeholders to ensure progress of programme
- Maintain commitment to the programme
- Manage the project management structure
- Produce the FBC document
- Prepare for transition to operational phase"[908]

10.46. The membership of the Project Board or Project Steering Board changed at different stages of the project but included the Project Owner (who chaired the Board), the Project Director, a number of other senior NHSL officials together with a representative from SFT and an observer from the Scottish Government. The Project Board maintained a Project Dashboard and Risk Register, would commission and consider official reports on the project, and provided regular updates to the F&R Committee, escalating any issues as required.

10.47. The Project Management Executive was a group whose remit it was to support the development of the project from business case through procurement and consisted of NHSL leads and advisers. This group monitored project delivery and made recommendations for approval to the Project Board. It coordinated submission of papers to all governance groups as required.

10.48. The Project Director had day-to-day responsibility for the Project. The Project Director reported to the Senior Responsible Officer. The SRO chaired the Project Board. The Project Board received input from various internal stakeholders through the project and NHSL Committees, for example the Executive Management Team and the F&R Committee.

10.49. The Project Director was supported by a wider Project Team which included a project manager, commissioning manager, workstream leads and external advisers. User groups and other stakeholders were engaged at different stages.

10.50. NHSL recognised the need to supplement internal resources and expertise and accordingly appointed a range of advisers. That included appointing Mott MacDonald Limited as lead technical adviser. MML were integrated into the project team and provided advice on an *ad hoc* basis, as well as formal advice.

908 Witness Statement - Iain Graham - 18.05.2022 - paragraph 7.

10.51. Following the decision to delay opening the hospital, the governance arrangements put in place by NHSL and summarised above were considered by two external reviews. Firstly, in September 2019 NHSL instructed Grant Thornton to carry out an audit of internal control and governance. Grant Thornton reported in July 2020.[909]

10.52. The Grant Thornton report identified a "collective failure" by the parties involved and concluded that it was not possible to identify one single event which resulted in the relevant errors in relation to the content and status of the environmental matrix as there were several contributing events. The report went on to list a number of "missed opportunities" to identify and potentially rectify the error. By way of explanation of the "collective failure" conclusion, the report noted:

> "47. These opportunities were not identified by the clinical director for the project, the Project Director, the project team, the technical advisers, those parties involved in reference design, Project Co including Multiplex, and the Independent Tester. Collectively the error was missed by all parties."

10.53. The recommendations made in the Grant Thornton report were generally accepted by NHSL and implemented by it. This is discussed further in chapter 13 of this report.

10.54. The second review was commissioned by the Cabinet Secretary for Health and Sport, who asked KPMG to report on the governance of the project. KPMG were asked, among other things: "To establish the governance arrangements that were in place in relation to the Project and the line of sight of NHSL and the Scottish Government ("SG"), along with the escalation arrangements to NHSL and SG". [910] The report found:

> "The governance processes and procedures surrounding the construction and commissioning of the Hospital operated in line with the structure that was put in place. There was regular dialogue between NHSL and the Scottish Government (SG) throughout the Project, with evidence of escalation of issues where required, albeit this was more focused on financial rather than technical matters."[911]

10.55. As with Grant Thornton, KPMG identified a number of "missed opportunities".

10.56. The evidence provided to the Inquiry generally supports these reports. Appropriate governance processes and an appropriate management structure were in place, but the issue with ventilation in critical care was collectively missed despite opportunities to identify it. That is to raise the question, which was articulated by Ms Freeman and forcefully pressed by some core participants, as to whether governance processes and operational management arrangements were effective. The focus was on the resolution of the technical issues which were the subject

909 A32405341 - Grant Thornton Report - HC2022.B3.V1 - page 30.
910 A32512397 - KPMG Report 2019 - HC2024.B13.V3 - page 1153.
911 A32512397 - KPMG Report 2019 - HC2024.B13.V3 - page 1168.

of SA1. NHSL had agreed to a solution which, in relation to the ventilation of bedrooms in the critical care department, resulted in a built environment which was not appropriately safe for patients.

10.57. In her evidence to the Inquiry Ms Freeman criticised the manner in which governance had been implemented:

> "So, we're looking at a situation where a mistake is made, and human beings make mistakes, but the point of governance, which is about scrutiny and challenge is, amongst other things, to identify where mistakes might have been made and through scrutiny and constructive challenge, address those and resolve them. So in my view, that process also did not work…there is an issue around governance in my opinion, and that is you can have governance structures, so you can have the bit of paper that sets out very clearly which committee is where and who does it report to and so on, but governance is a proactive exercise"[912]

10.58. With respect to the "scrutiny and challenge", as Ms Freeman put it, of the technical schedule to SA1, Counsel to the Inquiry noted that while the project team determined that the proposed technical solutions set out in SA1 were acceptable to NHSL, there was no vouching to support this view. Statements that advisers were happy with the technical solution were effectively taken on trust with no paperwork or reports provided to the governance bodies concerning the technical advice being provided. There was no report from Infection Prevention and Control team (IPCT), engineers or technical advisers. The IPCT had not been involved in the discussions leading up to the agreement and the technical advisers had declined to sign off on the appropriateness of the solution. These difficulties do not appear to have been reported to the governance bodies, including the F&R Committee and the Board of NHSL.

10.59. Counsel to the Inquiry suggested that this failure to require more formal reporting in support of the proposed technical solutions set out in SA1 could, on one view, be regarded as a weakness in the governance and oversight procedures. However he accepted that "the only way that the problems would have been detected is if a full technical audit had been insisted upon by the governance bodies".[913]

10.60. The above observation which is effectively about the lack of consideration of technical detail echoes an observation made in both the Grant Thornton audit and the KPMG report regarding the limited discussions of technical matters at the Project Board, and the absence of escalation of these. The Grant Thornton report comments in relation to the Project Steering Board:

> "Whilst the disputes between NHS Lothian and Project Co were outlined via project director updates the underpinning technical matters were not set out and discussed in detail. Ventilation is mentioned three times in the minutes between

912 Transcript - Jeane Freeman - 12.03.2024 - column 19.
913 Closing Submission Bundle Edinburgh 3 - February 2024 - page 13 - paragraph 58

> 2015 and 2019. Within the minutes there is no evidence over the scale of the difficulty and the exact dispute. Actions are noted including correspondence with the Independent Tester and Project Co but follow up action and resolution is not reported back in a consistent way."[914]

10.61. In responding to PPP9, NHSL explained that matters of a highly technical and specialised nature were dealt with by those with the appropriate expertise, including technical advisers but issues were flagged, and the implications and risks were discussed at project or programme boards and within the governance framework.[915] Those with responsibility for governance were not there to manage highly technical matters. The frequent reporting to governance committees and the NHSL Board highlighted the importance of the project, the significance of the issues arising and the interest of the NHSL Board in resolving matters.[916] As the Project Agreement was intended to transfer the technical (design and construction) risks to the private sector, the Board's key risk was financial and therefore it was natural to make that the focus. Where technical matters impacted on financial or commercial matters and timelines for the opening of the new facility, then they became more relevant.

10.62. With respect to the consideration by the NHSL Board of SA1, NHSL submitted that it would not have been "appropriate, practical, or proportionate to have an independent technical audit of proposed solutions undertaken, either before the solutions were implemented or before Settlement Agreement 1 was signed".[917] It was considered appropriate for NHSL to rely on advice from its external technical advisers. This view was shared by IHSL, MML, and also Ms Freeman. Scottish Ministers stated that it is really a matter for NHSL, but advanced the observation that any requirement for a technical audit might create difficulties in terms of design responsibility and risk.[918]

10.63. NHSL's then Chief Executive, Mr Davison, said with respect to the consideration of technical matters by governance bodies:

> "You have to think, if you look at a board agenda, there are huge amounts of paperwork dealing with several major issues often, you know, within a meeting, and the extent to which, particularly in a big organisation, non-executive members, particularly, of governance structures can identify the killer question is, to some extent, limited. So, there has to be a reliance that other bits of the governance system, like advisers for example, are doing the job that we're expecting them to do."[919]

914 A32405341 - Grant Thornton Report - HC2022.B3.V1 - page 86.
915 A46159695 - Response by NHSL to PPP9 - HC2024.B12.V3 - page 404 - paragraph 2.2 to 2.6 and page 421 to 422.
916 A46159695 - Response by NHSL to PPP9 - HC2024.B12.V3 - page 404 - paragraph 2.2 - 2.6 and page 421 to 422.
917 Transcript - Closing submissions for investigations into the RHCYP/DCN - 17.06.2024 - column 56.
918 Transcript - Closing submissions for investigations into the RHCYP/DCN - 18.06.2024 - column 33.
919 Transcript - Tim Davison - 08.03.2024 - column 159.

10.64. I accept much of what was put forward on behalf of NHSL and said by Mr Davison. It is unrealistic to expect any system of high-level oversight or governance to identify the sort of error discussed in the previous chapter, namely the failure on the part of the Board successfully to communicate its intentions in respect of the outputs of the ventilation system to Project Co. That would involve considering matters of a technical and specialised nature at a level of detail that would be expected to be dealt with by those with technical expertise. The role of the Board of NHSL is not to review every technical specification or every piece of technical advice but rather to obtain assurance that appropriate advice had been obtained, taken and (if necessary) actioned.[920] However, that turns attention to consideration of whether appropriate advice was obtained. I have not been satisfied that it was. Whether that can be seen to reflect on the effectiveness of governance or the effectiveness of operational management may not very much matter.

10.65. MML was appointed to provide a project management role and to provide "*ad hoc*" advice on a range of technical matters. However, it would appear to have been often unclear when and if NHSL were instructing, and when and if MML were providing, formal advice on technical matters which NHSL was entitled to rely upon.

10.66. This allowed scope for misunderstanding and assumptions which may not have been warranted and certainly were not shared. On the one hand, NHSL considered that specific input and assurance was being provided on technical solutions. Both Mr Henderson and Ms MacKenzie gave evidence that they considered MML to be providing a very wide range of technical advice and assistance including advising on the suitability of the technical matters in SA1.[921]

10.67. That was also the perception at Board level. What were taken to be assurances from technical advisers on the suitability of technical solutions formed the basis of decision-making.[922] Communications were also provided to Scottish Government on certain technical solutions being appropriate because there had been input and assurance from advisers. Ms Goldsmith, who was a member of the NHSL Board as the Director of Finance, told the Inquiry: "My understanding was that Mott MacDonald were providing assurance to the Board or advising the Board that the IHSL were delivering a hospital that would meet the Board's construction requirements."[923] On the other hand, as Mr Greer explained, MML understood that they had a more limited role. They had not agreed to have any responsibility for the technical solution set out in SA1. The point was put very specifically by Mr Greer in his email of 4 June 2018 to Brian Currie: "I don't think the Board is in a position to fully confirm compliance with the BCRs, the burden of responsibility should always remain with Project Co. As we are not the designers, Mott MacDonald would not be in a position to provide that design assurance to NHSL". [924]

920 A34978959, NHSL Board Meeting 6 February 2019 - HC2024.B13.V7 - page 1163 - paragraph 37.3; Transcript - Tim Davison - 08.03.2024 - column 158 to 9.

921 Transcript - Ronnie Henderson - 26.02.2024 - columns 145 to 146; Witness statement - Ronnie Henderson - 26.02.2024 - paragraph 27; Transcript - Janice MacKenzie (Part 2) - 27.02.2024 - columns 31 to 33.

922 A34978959, NHSL Board Meeting 6 February 2019 - HC2024.B13.V7 - page 1160.

923 Transcript - Susan Goldsmith - 06.03.2024 - column 46.

924 A46802701 - Email 4 June 2018 - HC2024.B13.V5 - page 1272; Transcript - Graeme Greer - 27.02.2024 - column 162.

10.68. Mr Greer's anxiety to avoid a shift in the design risk was reflected in the mechanism adopted in SA1 whereby each of the ventilation solutions (items 4, 7 and 13) were referred to as approved through schedule part 8 (Review Procedure), that is the RDD procedure. That meant no more than confirmation that the proposed design met the requirements of operational functionality and hence, as Counsel to the Inquiry put it in a question to Mr Greer, subject only to "a light touch review".

10.69. As Counsel was to go on to submit, "there is …an air of unreality about treating the ventilation solutions in that way. There had been serious dispute between the parties about the ventilation and SA1 resolved it following detailed involvement by technical experts on both sides. The solution for the multi-bed rooms featured a pressure arrangement which, whilst contrary to the recommendation for rooms in a critical care department, was based upon a risk assessed, clinical preference of NHSL's paediatric clinicians. It was one which NHSL were prepared to litigate to obtain, and they had taken additional expert advice in support of it."[925]

10.70. Susan Goldsmith in her evidence described SA1 as capturing what had been agreed as acceptable to the Board. It cut across design and brief, but all through the lens of how the hospital was going to function and what the risk would be for the Board. The technical schedule was NHSL clarifying its brief.[926]

10.71. In these circumstances, I would have seen there to have been a need, if not as an aspect of effective governance, then as a matter of effective operational management, for NHSL to obtain assurance from its technical advisers that "This is what we want"[927] (and to ensure that it had indeed obtained that assurance). I do not understand why doing so would have endangered the allocation of design risk.

10.72. Counsel to the Inquiry addressed the point in his closing statement:

> "It would be understandable for MML to refrain from taking design responsibility for the contractor's solution. It is less clear why MML would not take responsibility for a brief it was assisting a client to draft. That is particularly so given that MML had, at an earlier stage in the project, assembled the reference design documents and confirmed (based on confirmation from Hulley & Kirkwood) that the environmental matrix complied with all relevant guidance, including SHTM 03-01. [However a] situation appears to have arisen whereby NHSL considered it was getting technical advice and assurance from MML (albeit MML were not shadow designers and were not therefore taking full design responsibility) while MML considered it was not providing any such assurance as doing so would be contrary to the principles of the NPD model and would involve MML going beyond their remit."[928]

925 Closing Submission Bundle Edinburgh 3 - February 2024 - page 43 - paragraph 161.
926 Transcript - Susan Goldsmith - 06.03.2024 - columns 40 to 43.
927 The expression used by Counsel to the Inquiry in a question to Susan Goldsmith - Transcript - Susan Goldsmith - 06.03.2024 - column 43.
928 Closing Submission Bundle Edinburgh 3 - February 2024 - page 5 - paragraph 11.

10.73. That NHSL did consider that it had received assurance from MML that the technical solutions were in accordance with its requirements (and, as I would understand it, the need for such assurance prior to concluding SA1) was confirmed in NHSL's closing statement where it was explained: "There is no inconsistency in NHSL relying on MML's input as technical advisers and MML not becoming responsible for a design that it has reviewed. For instance, an adviser would not assume responsibility for a particular engineering design by reviewing whether or not the proposed outputs of the design complied with guidance", but "that does not mean NHSL did not or should not have relied on technical advice from MML, including on compliance with guidance".[929]

10.74. That a situation arose where NHSL assumed it was receiving assurance in respect of technical matters by its appointed advisers when in fact it was not, gives weight to the criticism made by Counsel to the Inquiry (corresponding with an issue highlighted by Grant Thornton in its report to NHSL) that there was a lack of any clear procedure for instructing and recording advice from technical advisers. Counsel noted that the lack of clarity in relation to technical advice can be contrasted with the role of the solicitors. When legal advice was sought, there tended to be a very clear instruction with a very clear statement of the advice provided in response. Counsel submitted that a similar procedure should be considered when technical advisers (particularly engineers) are providing specific technical advice.[930] Grant Thornton had made some recommendations with respect to arrangements for instructing and recording technical advice, but Counsel noted that while NHSL has taken steps to address the issue, it is not clear from the available evidence that any such changes have taken place more widely within the NHS.[931] I accept the force of these submissions and that will be reflected in my recommendations. Clarity as to what technical advice has been received before decisions are made is essential in projects of this nature.

10.75. Among the aspects of effective operational management is making provision for and putting into effect means for the identification, assessment and management of risk. It cannot be said that that always occurred during the RHCYP and DCN project. No consideration appears to have been given as to whether NHSL's manner of briefing prospective tenderers, and later the preferred bidder, was in line with NHS Scotland's design policy set out in CEL 19 (2010) or SCIM guidance on the need to specify the board's requirements. The risks of using the environmental matrix from the capital funded phase for the revenue funded phase appear to have been neither identified nor assessed. No consideration appears to have been given as to possible consequences of the inclusion of the EM in the ITPD. As described in the previous chapter, NHSL has been unable to explain the reasons behind the decision to not provide bidders with room data sheets. I would accordingly accept Counsel to the Inquiry's submission that "the lack of a suitable risk assessment is the genesis of many of the problems that arose on the project."[932]

929 Closing Submission for NHS Lothian to the Inquiry - Edinburgh Hospital 2024 - paragraph 46 to 47.
930 Closing Submission Bundle Edinburgh 3 - February 2024 - page 111 - paragraph 449 to 451.
931 Closing Submission Bundle Edinburgh 3 - February 2024 - page 111 - paragraph 452.
932 Closing Submission Bundle Edinburgh 3 - February 2024 - page 106 - paragraph 425.

10.76. Term of Reference 3C requires an examination of the extent to which decision makers sought out and had regard to appropriate expert advice.

10.77. It is true to say that, generally speaking, input was provided during the course of the project from clinicians, IPC, estates officers and technical experts. Despite this, the issue with air change rates in the critical care department was not identified or prevented, hence Grant Thornton's conclusion that there had been "collective failure". When asked if she would agree with that conclusion, former Cabinet Secretary for Health and Sport Ms Freeman responded:

> "…in part, I think [that] would be my view. I don't think it is fair to pinpoint the blame, if you like, on any one individual. I think it is a failure of governance, and that means that either the right people weren't in the room when these matters were – when governance was being practised, or the right questions were not being asked or pursued…"[933]

10.78. One problem, echoed in the responses by some of the CPs, would appear to have been that not all relevant disciplines were always involved at the correct times. The particular examples identified by Counsel to the Inquiry was that the Infection Prevention and Control team were not involved in the decision to accept the technical solution set out in SA1 or in the decision to accept the hospital without the standard Stage 4 HAI- SCRIBE procedure being completed.[934] Another problem was that NHSL staff with the requisite knowledge did not always combine it to reach the correct conclusion: NHSL's project clinical director and commissioning manager between them knew enough about the clinical context, the proposed technical solution, and the SHTM guidance, to identify that a proposed solution represented a departure from that guidance, but did not identify that departure because each lacked information the other had.[935] The consequence was that decisions were taken which resulted in a built environment that could not be regarded as safe for the patients who were to be treated there.

10.79. Clearly it is necessary to have the "right people in the room" during the process of developing or changing the brief for the construction or refurbishment of the ventilation system of a hospital. The introduction of a requirement for a Ventilation Safety Group, constituted and functioning as provided for in the 2022 version of SHTM 03-01, should ensure that this will happen. This is discussed in chapter 13 of this report.

933 Transcript - Jeane Freeman - 12.03.2024 - column 91.
934 Closing Submission Bundle Edinburgh 3 - February 2024 - page 55 - paragraph 202 and 203.
935 Closing Submission Bundle Edinburgh 3 - February 2024 - page 93 - paragraph 358.

Chapter 11

Knowledge transfer arrangements and whether NHSL had an opportunity to learn lessons from the QEUH

Chapter 11

Knowledge transfer arrangements and whether NHSL had an opportunity to learn lessons from the QEUH

Introduction

11.1. This chapter considers the evidence to the Inquiry in relation to Terms of Reference 11 and 12 which require the Inquiry to examine:

> "11. …whether there are systematic knowledge transfer arrangements in place to learn lessons from healthcare construction projects and whether they are adequate and effective.
>
> 12. …whether NHS Lothian had an opportunity to learn lessons from the experience of issues relating to ventilation, water and drainage systems at the QEUH and to what extent they took advantage of that opportunity."

11.2. The chapter is concerned with the position at the time of the RHCYP and DCN project rather than arrangements that have been put in place subsequently by NHS Scotland Assure. These are discussed in chapter 13.

11.3. There is an obvious linkage between these two Terms of Reference – if there are systematic knowledge transfer arrangements in place to learn lessons from healthcare construction projects, then it is more likely that NHSL would have had an opportunity to learn lessons from experiences at other hospitals, including QEUH. Such arrangements have the potential to offer benefits to those engaged in healthcare construction projects, including reduction of errors, minimising risk, increased efficiency, cost savings and better facilities. However, the existence of such systematic arrangements is not essential for opportunities to learn from experience elsewhere. The two Terms of Reference are therefore considered separately with a view to assessing the situation in relation to knowledge transfer, particularly of lessons learned, during the project.

Systematic knowledge transfer arrangements

11.4. During the project, there were no formal systematic knowledge transfer arrangements in place. There was no centralised system for capturing and recording learnings from healthcare construction projects. While there was scope for the Scottish Government and/or NHS bodies to communicate with health boards, there was no structured mechanism to ensure that lessons were learned from previous projects. A statement to this effect was made in the closing statement of Counsel to the Inquiry following the third hearing in relation to the project.[936] That statement was not contradicted by any of the core participants submitting closing statements in response, which included those from NHSL,[937] NHS NSS[938] and the Scottish Ministers.[939] NHSL considered it to be "of note that there is still no formal transfer arrangements in place to learn lessons from other healthcare construction projects."[940]

11.5. Therefore, any health board faced with a new build hospital project would not have been able readily to access learnings from previous projects.

11.6. When asked if the lack of a formal structure for knowledge transfer was an impediment, Dr Donald Inverarity responded "Yes. It's an impediment. It would help to have some kind of repository of being able to say, 'Has anybody else dealt with this?' and in what context it was dealt with."[941]

11.7. The lack of systematic knowledge transfer arrangements meant that lessons learned from the RHCYP and DCN project have not been made available to other health boards, including the findings and recommendations in the KPMG,[942] Grant Thornton[943] and NHS NSS[944] reports. While these reports are available on the internet,[945] that does not mean that those engaged on similar projects in the future will know of their existence or their potential relevance. This could increase the risk of similar issues arising in the future. During the third Edinburgh hearing Alan Morrison noted however that the technical issues at the Edinburgh Children's Hospital were discussed by the Strategic Facilities Group (SFG), but the SFG did not consider it appropriate to share the reports with the rest of the health service given that these were locally commissioned reports. Mr Morrison contrasted this with the independent review at the Queen Elizabeth University Hospital which the

936 Closing Submission by Counsel to the Inquiry - paragraph 299.
937 Closing Submission for NHS Lothian to the Inquiry.
938 Closing Submission by NHS National Services Scotland to the Inquiry.
939 Closing Submission for the Scottish Ministers to the Inquiry.
940 Closing Submission for NHS Lothian to the Inquiry - page 45.
941 Transcript - Donald Inverarity - 05.03.2024 - column 76. See also Transcript - Tracey Gillies - 08.03.2024 - columns 50 to 53.
942 A32512397 - KPMG Report - HC2024.B13.V3 - page 1153.
943 A32512442 - Grant Thornton Report - HC2024.B10 - page 4. That the Grant Thornton report went no further appears confirmed by for example Witness statement - Alan Morrison (NHS Assure) - 13.03.2024 - paragraph 74; see also discussion at Transcript - Alan Morrison - 13.03.2024 - column 174 to 176.
944 A47172405 - NHS NSS Review of Water, Ventilation - HC2024.B13.V8 - page 904.
945 Grant Thornton Report; KPMG Report; and NHS NSS Reports.

SFG thought contained wider lessons:

> "They wrote that review for that wider audience, and so we distributed that to chief execs, and then as part of the Capital Investment Group, a standard question will be, 'Have you taken into account the recommendations from the Queen Elizabeth Independent Review?' So, I think that that learning is still there and that kind of consideration of what we've learned is within the service."

11.8. To provide further context, there are four sub-groups of the SFG, including the Soft Facilities Management Group (SFMAG), the Scottish Engineering Technology Advisory Group (SETAG), the Scottish Property Advisory Group (SPAG) and the NHSS Environmental Advisory Group (NESG). The four groups identify the main risks, for example in relation to building services and any need to revise guidance, and the SFG provides a forum for NHS Directors of Estates and Facilities to discuss relevant issues. SETAG is the forum at which any need to revise, improve or modernise guidance applicable to building services is discussed. The National SFG is now chaired by the Director of NHS Scotland Assure, and it is up to Assure to set the agenda and do all of the administration. In this way, knowledge is centralised and can be distributed as considered appropriate. The landscape for projects has changed with the creation of Assure, a specialist body which is intended to gather knowledge and experience about healthcare building projects and make it available to boards undertaking new projects. I consider Assure in chapter 13.

Whether NHSL had an opportunity to learn lessons from the experience of issues relating to ventilation, water and drainage systems at the QEUH and to what extent they took advantage of that opportunity

11.9. Term of Reference 11 will be kept under review until further evidence has been heard regarding the QEUH. That said, evidence led thus far allows for some observations to be made.

11.10. While there was no centralised system for sharing information, the Scottish Government wrote to health boards in relation to certain discrete issues that arose on the QEUH project, and initiated work to update guidance (which would ultimately be shared with health boards) on the basis of lessons learned from QEUH.

11.11. Specifically, on 25 January 2019 the Chief Executive of NHS Scotland requested health boards to confirm, among other things, that controls to ensure that "all critical ventilation systems [are] inspected and maintained in line with 'Scottish Health Technical Memorandum 03-01: Ventilation for healthcare premises'" were in place and working effectively.[946] The text of the letter makes reference to "the ongoing incident at the Queen Elizabeth University Hospital", and it was apparently

946 A35270542 - Letter 25 January 2019 - HC2024.B4 - page 8.

well understood that this letter reflected experience at the QEUH.[947] The letter noted that HFS had been asked to co-ordinate responses and briefly described further actions being taken by the Strategic Facilities Group, and the Ventilation Group which responds to the Scottish Engineering and Technology Advisory Group (SETAG). The latter would "consider whether SHTM 03-01 needs to be revised and updated in view of recent developments."

11.12. The letter explains that the cause of the Cryptococcus infections in the QEUH "is not fully understood at present, and we continue to gather further intelligence on the situation which is resulting in further hypotheses being developed and investigated". This suggests that as at that date, there may have been limited knowledge about what the experience at QEUH was and therefore what lessons should be learned from it. There is, however, no further explanation as to what the issues were, and so NHSL would not have had the opportunity to consider, independently, their relevance in relation to the RHCYP and DCN project.

11.13. NHSL could not, without assistance, confirm "all critical ventilation systems [are] inspected and maintained in line with 'Scottish Health Technical Memorandum 03-01: Ventilation for healthcare premises'", and sought and received letters providing confirmation of compliance from IHSL. The last two of these letters refer to compliance with the relevant Construction Contract standards, as varied by the Settlement Agreement [SA1]", or, simply, "the Project Agreement", rather than to compliance with SHTM 03-01.[948] When questioned about this Darren Pike, the Project Director for Multiplex who prepared this letter, told the Inquiry:

> "I think that all of our works and engagement is under the contract standards or under the construction contract, and therefore our obligation is to meet that, and within that construction contract there are – there is a large variety of applicable standards and guidance and various other documentation to comply with. However, overarching obligation on us is to comply with the construction contract.…" [949]

11.14. Mr Pike confirmed that he gave the assurance that he felt able to give at the time and that he did not feel comfortable simply giving a straight assurance that all guidance was complied with.[950]

11.15. If the contract and the recommendations contained in guidance were one and the same then this would not be an issue. However, seeking letters of assurance from contractors could not help in detecting non-compliance with guidance where there existed ambiguity in the Project Agreement with respect to NHSL's exact requirements for the ventilation system.

947 Transcript - Darren Pike - 28.02.2024 - column 68; see also Transcript - Susan Goldsmith - 06.03.2024 - column 70.
948 A46440419 - Letter 31 January 2019 - HC2024.B13.V1 - page 766; A46440421 - Letter 12 February 2019 - HC2024.B13.V1 - page 769 to page 771.
949 Transcript - Darren Pike - 28.02.2024 - column 74 to 75.
950 Transcript - Darren Pike - 28.02.2024 - column 74 to 75.

11.16. On 8 March 2019 HFS wrote to NHSL again in relation to lessons learned from previous healthcare projects. HFS requested NHSL to provide evidence of how the Board sought assurance in respect of a number of matters relevant to the commissioning and readiness for operation of building systems.[951] NHSL noted in response to HFS that the project was procured by way of the non-profit distributing initiative and therefore the evidence they could provide was "set against that background of the Contract Structure and Roles and Responsibilities of the Respective Parties."[952] The contractual arrangements for quality assurance, inspection and testing are discussed in chapter 7. They were not capable of detecting the issues that this Inquiry is concerned with.

11.17. The above examples of opportunities for NHSL to learn lessons from QEUH took place in the context of a broader lessons learned exercise being undertaken by HFS and other groupings within the Scottish Government. The lessons to be learned from a project are not always clear until after the project is completed. While there were clearly emerging issues at the QEUH in late 2018 and early 2019, they had not yet been fully investigated. Moreover, the QEUH had a different specification for the ventilation system. Given the fact that the systems were not identical, there were no clear and obvious opportunities for lessons to be learned, and shared, on technical matters. By the time that any formal lessons could be taken from investigations into issues at the QEUH, it was too late for these to have been of any real benefit to the RHCYP and DCN.

11.18. Other opportunities for learning lessons came about through personal contacts and informal networks between infection prevention and control professionals.[953] As Dr Inverarity explained regarding his correspondence with Dr Teresa Inkster, a consultant microbiologist at QEUH, "At that time there was an informal 'network' of the IPCDs [infection prevention and control doctors] in Scotland such that we had each other's e-mail contact details and it wasn't too unusual for an IPCD in one health board to contact IPCDs in other boards to check if an issue they were experiencing was being experienced in other boards and compare ways of dealing with the same problem."[954] In addition, some details of the problems at QEUH emerged through media reports, word of mouth and some information from HPS.[955]

11.19. Dr Inverarity had "some awareness" from microbiology colleagues in Glasgow that there had been issues with the functioning of PPVL isolation rooms identified after the QEUH was opened. This was as a result of emails sent round the informal network of IPCDs in May 2016, followed by a conversation with those colleagues.[956]

951 A41231046 - Email attachment - HC2024.B13.V3 - page 59.
952 A41231046 - Letter 1 April 2019 - HC2024.B13.V3 - page 69.
953 See Witness statement - Donald Inverarity - 05.03.2024 - paragraphs 152 to 154; see also Transcript - Tracey Gillies - 08.03.2024 - column 77 to 80 and 82 to 87; Transcript - Alex McMahon - 07.03.2024 - column 33 to 34.
954 Witness statement - Donald Inverarity - 05.03.2024 - paragraph 152.
955 Witness statement - Donald Inverarity - 05.03.2024 - paragraph 154. See also Transcript - Tracey Gillies - 08.03.2024 - column 44.
956 Witness statement - Donald Inverarity - 05.03.2024 - paragraph 95; A47150212 - Email 20 May 2016 -HC24.B13.V8 - page 463.

This was one of the factors behind his email to members of the project team on 24 August 2018 regarding the independent validation of theatre and isolation room ventilation, where he noted "This is an issue we need to get right given the recent experience of my microbiology colleagues in Glasgow with their new children's hospital.…Glasgow have identified many issues since accepting their building that they are in the process of retrospectively addressing and we should avoid finding ourselves in that position."[957]

11.20. Dr Inverarity's point was made more than once, including by email on 4 January 2019.[958] He had flagged the requirement for formal validation reports rather than "a collection of documents". This was raised with the project management team before SA1 was formally signed, but as discussed previously, the hospital was not in a fully clean state required for independent validation, and Ronnie Henderson (Commissioning Manager, NHSL) was under the impression that the documents Multiplex had supplied to the Independent Tester with respect to commissioning of the ventilation system provided the necessary information. In March 2019 Dr Inverarity had a discussion with consultants at QEUH who explained that all of the isolation rooms there had had to be refitted as the original design did not provide appropriate pressures and air flows when the rooms were occupied, and on that basis he asked his colleague to ensure that similar details were properly assessed in the context of NHSL's Stage 4 HAI-SCRIBE review of the RHCYP and DCN building.[959]

11.21. In July 2019 Dr Inverarity had a number of email exchanges and a telephone discussion with Dr Inkster in relation to the Institute of Occupational Medicine's (IOM) emerging findings, in the course of which Dr Inkster summarised the issues that had to be dealt with at the QEUH from an HAI perspective.[960] Not all of the issues identified by Dr Inkster were relevant to the RHCYP and DCN project but the summary did draw attention to the operation of ventilation in the operating theatres and the functioning of the positive pressure ventilated lobby isolation rooms.[961] Dr Inkster specifically referred to the recommended number of air changes set out in SHTM 03-01 as not having been delivered in the Glasgow hospitals.[962]

11.22. Given that the IOM investigations were under way by this time, the issues at RHCYP and DCN would in all likelihood have been discovered without this information. Nonetheless, Dr Inverarity considered it: "extremely useful to have that shared insight into what technology or design was being considered problematic at QEUH and which HAI risks might arise from them. Much of it was not relevant to RHCYP and DCN but some of it was critical. Without that direct contact with Dr Inkster, I would have had no awareness of these issues as it was not

957 A41295517 - Email - HC2024.B7.V1 - page 218 to 219.
958 A40979097 - Email 4 January 2019 - HC2024.B4 - page 4.
959 A40988853 - Email Chain 20 March 2019 - HC2024.B13.V3 - page 462; Transcript - Donald Inverarity - 05.03.2024 - column 77 to 79.
960 Witness statement - Donald Inverarity - 05.03.2024 - paragraphs 136 and 142; A40986380 - Email 5 July 2019 - HC2024.B13.V8 - page 2226.
961 Transcript - Donald Inverarity - 05.03.2024 - column 128.
962 Transcript - Donald Inverarity - 05.03.2024 - columns 135 to 137. See also Transcript - Tracey Gillies - 08.03.2024 - columns 53 to 57.

information accessible in the public or professional domain…Such information wasn't being volunteered by any other agency we had contact with at the time in as much detail or microbiological insight."[963]

11.23. Dr Inverarity shared the information from Dr Inkster with members of the Executive Steering Group, which had the remit of addressing the ventilation system issues. This heavily influenced discussions about the RHCYP and DCN operating theatres.[964]

11.24. The more difficult question is whether such opportunities as there were to learn from the experiences at the QEUH arose at a point in time when knowledge about them might have avoided similar issues at the RHCYP and DCN. The key dispute in relation to the RHCYP and DCN came to a head in 2018. Agreement was reached and the works to the ventilation system were carried out in 2018, albeit the agreement was not formally approved and documented until February 2019. Over this period of time, there was little concrete evidence available to NHSL about the problems with the QEUH ventilation system. Therefore, learning opportunities were limited. The Inquiry has yet to hear detailed evidence about the issues relating to ventilation at the QEUH. The point as to whether NHSL had the opportunity to learn from experience of issues in relation to ventilation at the QEUH will, therefore, be kept under review until this evidence is heard.

963 Witness statement - Donald Inverarity - 05.03.2024 - paragraph 154 to 156.
964 Witness statement - Donald Inverarity - 05.03.2024 - paragraph 157.

Chapter 12

Whether the organisational culture within NHSL encouraged staff to raise concerns and whether any individual or body deliberately concealed or failed to disclose evidence of wrongdoing or failures

Chapter 12

Whether the organisational culture within NHSL encouraged staff to raise concerns and whether any individual or body deliberately concealed or failed to disclose evidence of wrongdoing or failures

Introduction

12.1. This chapter considers Terms of Reference 3D and 4, which as regards the RHCYP and DCN project require the Inquiry:

> "3. To examine…
>
> D. Whether, the organisational culture within the Board of… NHS Lothian encouraged staff to raise concerns and highlight issues in relation to the project at appropriate times throughout the life cycles of the project;…
>
> 4. To consider whether any individual or body deliberately concealed or failed to disclose evidence of wrongdoing or failures in performance or inadequacies of systems whether during the life of the project or following handover, including evidence relating to the impact of such matters on patient care and patient outcomes; and whether disclosures of such evidence was encouraged, including through implementation of whistleblowing policies, within the organisations involved."

12.2. These matters are linked. A culture that promotes the raising of concerns reduces the scope for deliberate concealment and failure to disclose wrongdoing. It is less likely that people will engage in that kind of conduct if they know that it is possible, if not likely, that others will challenge them and that management will take steps to investigate. A strong culture of internal reporting drives better communication

and trust within an organisation. It also helps minimise risks and costs, whereas deliberate concealment and failure to report can create a situation that is expensive to resolve.

12.3. NHSL had formal policies and procedures in place that were directed at encouraging staff to raise concerns, and to prevent deliberate concealment or failure to disclose evidence of wrongdoing, at the time of the RHCYP and DCN project.

12.4. The topics covered in this chapter were addressed in the Inquiry's Provisional Position Paper 9,[965] the content of which in this respect was not challenged by any of the core participants. As a result, and as a result of my findings in relation to the Terms of Reference, while these matters are important, they can be dealt with relatively shortly in relation to the RHCYP and DCN project.

12.5. As will be understood, what follows relates to the RHCYP and DCN project and NHSL. I will require to return to these topics after I have heard the relevant evidence relating to the QEUH and NHS GGC.

Organisational culture – whistleblowing and raising concerns

12.6. From September 2005, NHSL had in place a "Freedom of Speech Policy and Procedure".[966] This policy was intended to address those occasions where staff had concerns about what was happening at work and where the NHSL grievance procedure and wider polices such as race equality and equal opportunities would not be appropriate. The concerns covered by the policy included concerns relating to "danger to patients". The policy was introduced "to enable NHS Lothian employees to raise concerns about such issues at an early stage and through an agreed procedure. It is important that any matter of concern is raised at the earliest possible stage in order to protect the safety of patients, staff or members of the public and/or public resources." The policy stated that NHSL was committed to an "open, honest organisational culture" and a "climate which ensures employees have absolute confidence in the fairness and objectivity of the procedures through which their concerns are raised and are assured that concerns raised will be acted upon."[967] Employees were, in the first instance, directed to raise concerns with their line manager, or where that was not appropriate, with a "Disclosure Officer". The person to whom the matter was referred was to determine the most appropriate manager to undertake the formal investigation, although it was stressed that the investigator should not have had any previous knowledge of the concern raised.

965 Provisional Position Paper 9 (Revised) - The Governance Structure within the project to construct the Royal Hospital for Children and Young People and Department of Clinical Neurosciences, Edinburgh.
966 A33334034 - Freedom of Speech Policy and Procedure September 2005.
967 A33334034 - Freedom of Speech Policy and Procedure September 2005 - page 3

12.7. In September 2016 this policy was replaced with the "Whistleblowing Policy and Procedure".[968] This document reflected a development and refinement of its predecessor and adopted a similar approach. It emphasised that the policy was intended "to reassure all staff that it is safe and acceptable to speak up, and to enable them to raise any concern which they may have at an early stage and in the right way. Rather than wait for proof, it is preferable if a matter is raised when it is still a concern."[969] It also stated that if a member of staff raised a genuine concern, they would not be at risk of losing their job or suffering any detriment even if they were mistaken or there was a genuine explanation for their concerns. It was hoped that concerns would be raised "openly", though provision was made for anonymity for the complainant in certain circumstances.

12.8. The procedure in the Whistleblowing Policy differed from that in its predecessor. Concerns were to be raised with the individual's line manager or lead clinician. If having done so the individual still had concerns, or it was not appropriate for concerns to be raised with their line manager, then the matter could be raised with the persons named in the policy who had been given special responsibility for dealing with whistleblowing concerns. Finally, if the individual still had concerns, or if the matter was so serious that they could not discuss it with any of those named at step two, they were to contact the Chief Executive, the Medical Director or the Nurse Director. The possibility of referral to the Whistleblowing Alert and Advice Services for NHS Scotland was also highlighted.

12.9. The Policy set out advice for managers responding to a concern and explained how NHSL would handle the matter, providing a range of responses including informal review, an internal inquiry or a more formal investigation. The Policy also provided for a Non-Executive Whistleblowing Champion to be appointed at Board level. Their role was to ensure that all reported concerns are investigated in a timely and appropriate way, staff members are updated on progress throughout the process, outcomes are fed back to those raising concerns and recommended actions are progressed by NHSL.[970] Monitoring information around cases raised was to be provided at each meeting of the Staff Governance Committee to allow the assurance and scrutiny role to be carried out in a timely and appropriate way, and an annual report was to be provided to that Committee on the implementation of the Policy.[971]

12.10. In 2019 NHSL introduced Speak Up, an initiative designed to encourage staff to feel safe and supported in raising concerns. This initiative supported the policy discussed above in that it was set up so that staff who had a concern had someone to speak to about it on a confidential basis, and who could provide them with advice and guidance as to what they might want to do next. As with the Whistleblowing Policy, staff were encouraged to speak to their line manager or lead clinician in the first instance about any concerns they had, or to contact their trade

968 A33334035 - Whistleblowing Policy and Procedure. This was updated in 2019 and 2020.
969 A33334035 - Whistleblowing Policy and Procedure - page 4.
970 A33334035 - Whistleblowing Policy and Procedure - page 9.
971 Whistleblowing performance reports can be found here: Whistleblowing Performance Reports - Raising Concerns.

union or professional organisation representative. If they felt unable to go to any of these individuals, they could approach a Speak Up Advocate, who would help them to identify the best way to raise their concern. The role of Speak Up Advocates was to encourage staff to raise concerns at the earliest opportunity, to help identify the best way to raise the concern, to provide support in raising the concern and to help create a culture of openness. Speak Up Advocates were supported by Speak Up Ambassadors, who reported directly to the Chief Executive, and had overall responsibility for ensuring that staff were supported in speaking up and any organisational barriers were dealt with. Contact details of both Advocates and Ambassadors were provided.

12.11. The current version of the process for raising staff concerns is dated April 2021.[972] This followed on from the introduction, from 1 April 2021, of a staged process by the Independent National Whistleblowing Officer (INWO).[973] The INWO publishes national whistleblowing standards, including whistleblowing principles, whistleblowing procedures, standards of governance and sector specific information.[974] This set out two stages of the process for NHSL (and other health boards) to deliver, with the INWO acting as a final independent review stage if required. Under the standards it is not possible to raise an anonymous concern nor can anonymous concerns be raised with the INWO, but NHSL's guidance states that they will continue to investigate any anonymous concerns raised so far as practical to ensure that any actions required are taken.[975] While complaints may not be made anonymously, however, confidentiality is still key and NHSL's guidance provides that the individual's details must not be shared with anyone who does not need to know them and the manager, Speak Up Advocate or Ambassador must discuss with the individual how their details will be used and stored.[976] Given Term of Reference 4, it is worth noting that the definition of concerns that may be brought within whistleblowing now includes not only patient safety issues and unsafe working conditions, but also deliberately trying to cover them (or any other concern) up.[977]

12.12. The two stages set out under the process are for concerns where there is a straightforward solution (stage 1) and concerns raising serious risks or complex issues that require investigation (stage 2). For stage 1 concerns, a response should be provided within 5 days with an escalation to stage 2 if the individual raising the concern remains unsatisfied. For stage 2 concerns, these should be acknowledged within 3 days and a response within 20 days.[978] However, NHSL's experience is that investigations take longer than that to conclude, and to help staff know what to expect during the investigation, the Board has set out a detailed guide to the steps in the investigation process.[979]

972 Speak Up has been superseded by the policy set out in - Raising Concerns - NHS Lothian and Whistleblowing Procedure - Guidance for Staff.
973 A role undertaken by the Scottish Public Services Ombudsman. For national standards and other information see National Whistleblowing Standards.
974 National Whistleblowing Standards.
975 Whistleblowing Procedure - Guidance for Staff - page 3; Anonymity and unnamed concerns.
976 Whistleblowing Procedure - Guidance for Staff - page 4.
977 Definitions: What is whistleblowing?
978 Whistleblowing Procedure - Guidance for Staff - page 3.
979 Stage 2 Whistleblowing Investigation Process.

12.13. The INWO will normally only investigate a concern after it has been through both stages of the local process, or if more than 12 months have passed since the individual first became aware of the issue.[980]

12.14. The whistleblowing policy directs individuals who feel that they cannot raise the issue within NHSL to an external organisation, such as the independent whistleblowing advice and information line operated by the INWO, Healthcare Improvement Scotland, NHS Scotland Counter Fraud Services, the Health and Safety Executive and Audit Scotland.

Other routes for staff concerns

12.15. Other than whistleblowing, during the period of the project there were other avenues that staff could use to raise concerns about the project.[981]

12.16. NHSL had in place Incident or Adverse Event Management Policies throughout the period of the project.[982] The policies were supported by operational procedures.[983] An adverse event or incident was considered to be one that could have caused, or did result in, harm to people, including immediate or delayed emotional reactions or psychological harm. This also included harm to all or parts of NHSL as an organisation, such as system failures or service disruption. The policy stated that it is the responsibility of all staff to report all adverse events and near-misses. The process for reporting was set out in the policy and comprised five stages: identification and immediate actions following the adverse event; initial reporting and notification; analysis and rating the severity of the harm; review and improvement planning and monitoring. The emphasis was on learning and promoting best practice at all levels. One of the aims of the policy was to ensure that staff involved in an adverse event are offered support at a time and in a way that meets their needs.

12.17. Within NHSL there was an NHS Lothian Partnership Forum at which concerns could be discussed. This was chaired jointly by the Chief Executive and a non-executive Employee Director and included trade union or employee representatives and management. In addition, there were other local partnership forums where any concerns regarding the RHCYP and DCN could have been raised by staff. These were the Royal Infirmary of Edinburgh Partnership Forum (after 2016, the Women and Children's Services Partnership Forum), Western General Hospital Partnership Forum and the Corporate Services Partnership Forum.

980 Independent external review.
981 The following summary is drawn from A33333995 - NHSL Response to the Inquiry.
982 A33333999 - Incident Management Policy - September 2007; A33334010 - Incident Management Policy - August 2011; A33334000 - Incident Management Policy - August 2012; A33333969 - Adverse Event Management Policy - March 2014; A33333967 - Adverse Event Management Policy - June 2018.
983 See A33334005 - Incident Management Operational Procedure - August 2011; A33333980 - Incident Management Operational Procedure - June 2012; A33333990 - Incident Management Operational Procedure - April 2013; A33333987 - Adverse Event Management Procedure - July 2018.

12.18. Within the RHCYP and DCN project there were a number of local health and safety committees, namely the Royal Hospital for Sick Children Health and Safety Committee, the Western General Hospital Health and Safety Committee, the Corporate Services Health and Safety Committee and the Royal Infirmary of Edinburgh Health and Safety Committee.[984] Each of these sat below the NHSL Health and Safety Committee and together ensured compliance with the NHSL Health and Safety Policy. The NHSL Health and Safety Committee was a formal sub-committee of the Board, and included staff representation. Its remit included ensuring that health and safety risks are identified and managed. Reports were provided on a quarterly basis from the health and safety management system and the information was reviewed and summarised by each of the local health and safety committees to determine local levels of assurance. These were reviewed by the NHSL Health and Safety Committee to provide assurance at a wider corporate level. In terms of the policy, members of staff were instructed immediately to notify their manager or supervisor of all health and safety hazards that they identify. In terms of the Health and Safety Policy, employees were to ensure that they "Report any hazards or defects in the equipment, arrangements or procedures and systems of work to their immediate line managers as soon as possible [and] Report any incident occurring to them or brought to their attention by informing their line manager".[985] Where a member of staff believed it was inappropriate to raise a legitimate concern with their manager under this policy, they could consider raising it in terms of the Whistleblowing Policy discussed above.

12.19. These are the formal means by which concerns could be expressed but there were also informal methods by which concerns could be raised. It was open to members of staff throughout the RHCYP and DCN project to raise concerns, ideas or seek clarification through user groups and workstreams or in response to newsletters which invited staff comment, inductions and familiarisation visits. There was nothing in the evidence heard by the Inquiry to suggest that staff felt limited in their ability to communicate more informally. While I appreciate that he was a senior member of staff in an important role, I saw it as significant that, as described more fully at chapter 2, Dr Donald Inverarity clearly had no inhibitions in challenging what he considered to be inadequately vouched information provided to him for the purpose of completing Stage 4 of the HAI-SCRIBE procedure in January 2019. Of equal significance was Ronnie Henderson's willingness to respond by providing Dr Inverarity with the material that he was looking for.

Deliberate Concealment

12.20. I have found no evidence indicating any deliberate concealment or failure to disclose wrongdoing in relation to the matters that are the subject of this interim report. Very clearly, NHSL and MML remained unaware of the specifications by reference to which IHSL's contractor and subcontractor was developing and building the ventilation system for the new hospital until a very late date, but this was due to error and not the result of deliberate concealment.

984 See organisation chart attached to A33557631 - Health and Safety Policy.
985 A33557631 - Health and Safety Policy - page 11.

12.21. What might be seen as an instance of concealment was the removal from the room function reference sheet of the reference to high dependency units (HDU), and the amendment to guidance note 15 of the environmental matrix by TSWW by inserting "for isolation cubicles" so that it read "Critical care areas – Design Criteria – SHTM 03-01 – Appendix 1 for air change rates 10 ac/hr supply for isolation cubicles". This is discussed in chapter 6 from paragraphs 6.104 and 6.141. Unlike other proposed amendments to this version of the EM, the changes were not made in red text which was used to denote changes made to the matrix from the previous version according to an agreed protocol and thus was concealed in the sense of not being highlighted. It was explained that this was not considered to be a "change" but was rather tidying up and clarifying the document and that there was no attempt to conceal any technical change.[986] While it would have been better had the changes been made in red text or otherwise flagged to NHSL,[987] I accept that what was done was not with a deliberate intention to conceal anything.

986 See Transcript - Stewart McKechnie - 29.02.2024 - column 29 to 38; Witness statement - Stewart McKechnie - 04.05.2023 - paragraph 41.

987 A point accepted by Mr McKechnie - Transcript - Stewart McKechnie - 29.02.2024 - column 38.

Chapter 13

Recent developments

Chapter 13

Recent developments

Introduction

13.1. This chapter reviews some developments that have occurred either since the construction phase of the RHCYP and DCN project was completed or that occurred at such a late stage of that phase that they were not applicable or relevant to the project. Some of these developments have already been touched upon in earlier chapters but are explained more fully here.

13.2. Some of those developments have clearly been influenced by events during the construction phase of the RHCYP (and/or events at QEUH).

13.3. I have seen it as important to notice and have regard to these developments to avoid making recommendations where what is recommended is already in hand. I have also thought it appropriate to offer comment on what has been put in place, to the extent that the evidence which I have heard allows me to do so, particularly as to whether, had what is now in place been current during the RHCYP and DCN project, it might have avoided or mitigated the issues which arose.

Creation of NHS Scotland Assure[988]

13.4. A direct consequence of the consideration given to the issues that arose during the construction of two new hospitals (the QEUH as well as the RHCYP and DCN) was the establishment of NHS Scotland Assure (Assure). This was explained by Alan Morrison, the Deputy Director of Health Infrastructure and Sustainability in the Scottish Government, who noted that the Scottish Government was concerned that these two healthcare projects had defects in the built environment. This concern led to a review of the effectiveness of the build assurance process that was then in place. That review led to the creation of Assure.[989]

13.5. The creation of Assure had been foreshadowed in a statement to the Scottish Parliament by Jeane Freeman, the Cabinet Secretary, in September 2019 concerning the delay in moving to the new RHCYP and DCN hospital.[990] Ms

988 On NHS Scotland Assure generally, see Provisional Position Paper 9 (Revised) - The Governance Structure within the project to construct the Royal Hospital for Children and Young People and Department for Clinical Neurosciences.

989 Witness statement - Alan Morrison (NHS Assure) - 13.03.2024 - paragraph 8. On the creation of NHS Scotland Assure generally see that witness statement paragraphs 8 - 20; Witness statement - Julie Critchley - 14.03.2024 - paragraphs 5 to 11; Witness statement - Jeane Freeman - 12.03.2024 - paragraphs 151 to 158.

990 See A41229927 - Statement - HC2024.B7.V3 - page 544.

Freeman announced that in view of the issues that had arisen and the need to avoid a repetition of them, "we [the Scottish Government] will move swiftly to establish a new national body for reducing and effectively managing risks in the healthcare built environment. The new body will have oversight for the design, planning, construction and maintenance of major NHS infrastructure developments – not least to ensure effective infection prevention and control."[991]

13.6. That commitment was repeated in the Scottish Government's Programme for Government 2019 to 2020.[992] Following publication of this document, NHS NSS established a dedicated team to develop the detail of how that commitment could be delivered and to report to the Scottish Government. The service at that time was known as Quality in the Healthcare Built Environment ("QHBE"), and NHS NSS produced a Target Operating Model for it in February 2020.[993] That document set out a vision for QHBE "To be an internationally recognised national centre for reducing risks in the healthcare built environment and ensuring they are safe, fit for purpose, cost effective and capable of delivering sustainable services over the long term."[994] In this context, "safe" meant "free from avoidable harm including infection, burns and electrocution, ligature and medical gases intoxication." The document explained that over time, QHBE would extend its capabilities to take an increasingly proactive and preventative approach, improving the identification of risks and the coordination of a response across the system to ensure (among other things):

- increased patient safety through reducing the risk of HCAIs and other avoidable harms; and
- reduced costs in relation to building retrofit costs, delays to opening new hospitals and additional stays in hospital due to HCAIs.

13.7. The creation of Assure was announced to health boards by a letter from the Scottish Government Director of Health Finance and Governance and the Chief Nursing Officer on 27 May 2021.[995] This letter explained that:

> "NHS Scotland Assure has been co-designed with users to deliver a co-ordinated approach to the improvement of risk management in new builds and refurbishment projects across NHS Scotland. The new service will underpin a transformation in our approach to minimising risk in our healthcare buildings and environments, protecting patients from the risk of infection and supporting better outcomes for patients in Scotland. NHS Scotland Assure…will provide assurance that the Healthcare Built Environment is safe, fit for purpose, cost effective and capable of delivering sustainable services over the long term."

991 A41229927 - Statement - HC2024.B7.V3 - page 556 to 7. See discussion in Witness statement - Alan Morrison (NHS Assure) - 13.03.2024 - paragraphs 9 to 13.
992 A46528785 - SG Programme for Scotland 2019-20 - HC2024.B13.V4 - page 247.
993 A32341688 - Target Operating Model - HC2024.B9 - page 4.
994 A32341688 - Target Operating Model - HC2024.B9 - page 14.
995 A43494369 - Letter 27 May 2021 - HC2024.B9 - page 70.

13.8. Assure carries out a range of functions and provides a number of support services including the production of guidance and policies, research and knowledge management, the co-ordination of subject matter experts, responding to incidents, alerts and issues in the healthcare built environment and workforce planning and development.[996] Of particular interest to the Inquiry given the issues that arose in relation to the RHCYP and DCN project are two matters falling within Assure's remit, namely its assurance function and key stage assurance reviews; and its functions in relation to the development of standards and guidance.

NHS Scotland Assure - Key Stage Assurance Reviews

13.9. The Inquiry was advised that Assure's assurance function focusses on new builds and major refurbishments within the healthcare estate, as well as projects that are identified as complex due to the needs of patients using the facilities and projects that may be of significant value outwith the acute estate.[997] Broadly speaking, for such projects it seeks "to ensure compliance with all relevant guidance and to help health boards demonstrate this at the key review stages of a facility's design and build process."[998] Its work does not, however, change accountability for the projects in which it is engaged. Health boards remain accountable for the delivery of the projects, while Assure is accountable for the services it provides that support delivery of the health board's projects.[999] Thus, the "ultimate responsibility for defining standards applicable to a particular project remains with the Health Board and their Project Team."[1000] Assure does not, therefore, provide a shadow design service or a checking service.[1001]

13.10. It follows from this that Assure's role is supportive of health boards rather than taking on or policing their functions: "NHS Scotland Assure will not operate in an inspection or enforcer capacity…The Assurance Service will operate in an advisory, assurance and compliance capacity, and will work with Health Boards throughout these three levels with approval of reports and action plans."[1002] Thus, Assure is not set out to be either an inspector or a regulator. It does not certify that design solutions are adequate or safe. It does not, for example, provide confirmation that the projects have complied with all applicable guidance.

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996 See generally Witness statement - Julie Critchley - 14.03.2024 and the description of NHS Scotland Assure's activities here: Assurance.

997 The role of Assurance in NHS Scotland; Witness statement - Alan Morrison (NHS Assure) - 13.03.2024 - paragraph 21; Witness statement - Julie Critchley - 14.03.2024 paragraph 7; Witness statement - Thomas Rodger - 14.03.2024 paragraph 31. Other projects can still use the KSAR process, but these are not assessed by NHS Assure: Witness statement - Thomas Rodger - 14.03.2024 - paragraph 36.

998 Witness statement - Alan Morrison (NHS Assure) - 13.03.2024 - paragraph 21.

999 A43494369 - Letter 27 May 2021 - HC2024 - B9 - page 70; Witness statement - Thomas Rodger - 14.03.2024 - paragraph 25.

1000 Witness statement - Thomas Rodger - 14.03.2024 - paragraph 75.

1001 Witness statement - Thomas Rodger - 14.03.2024 - paragraph 136.

1002 Key Stage Assurance Reviews (KSAR).

13.11. The principal means by which the assurance function is delivered is by means of Key Stage Assurance Reviews (KSARs).[1003] KSARs are carried out by members of the Assure Assurance Team. The Assurance team comprises built environment professionals from a number of backgrounds including infection prevention and control, fire safety, design, construction and operational healthcare estates. The reviews are carried out at key stages within the life cycle of a healthcare build, namely Outline Business Case, Full Business Case, construction stage, commissioning stage and handover stage.[1004] Formerly, a KSAR was carried out at initial agreement stage as well, but this is no longer the case. It has been superseded by a "lessons learned" workshop with health board stakeholders which gives them an opportunity to learn and helps establish a solid foundation for subsequent stages of the project.

13.12. KSARs focus on making sure that infection prevention and control are a key consideration in the following parts of a build project: water and drainage, ventilation, electrical, medical gases, and fire.[1005]

13.13. In his evidence to the Inquiry, Thomas Rodger, the Head of Engineering at Assure was unable to confirm whether these topics were chosen by virtue of those being the principal issues that arose at the RHCYP and DCN and the QEUH, as the development of the scope of the KSARs predated his appointment. However, he noted that "these topics represent some of the more complex areas within any build. The mechanical and electrical (M&E) services can sometimes constitute fifty per cent, if not more, of the cost of a project."[1006]

13.14. Assure describes its KSARs as delivering "an independent peer review" and "a challenge to the robustness of the Health Board's brief, plans and processes"[1007]. The KSARs aim to gain assurance that the boards have suitable expertise and procedures in place to ensure proper decision-making about their requirements in relation to these matters, and that they maintain appropriate records about those decisions. Mr Rodger emphasised the importance of a "golden thread" by which key project decisions are documented for future reference.[1008] In the context of ventilation design, the KSARs require (for example) evidence that the ventilation requirements for particular rooms have been signed off by various stakeholders and that the board's authorising engineer has been involved and reviewed the design proposals.[1009]

13.15. In Mr. Rodger's words, the Key Stage Assurance process "aims to ensure that the Health Board's project governance and procedures are such that the risk of inadvertent non-compliance with guidance is reduced". The KSAR process is

1003 For details of the Key Stage Assurance Process see Witness statement - Thomas Rodger - 14.03.2024 and Witness statement - Julie Critchley - 14.03.2024.
1004 A43406829 - Project Procurement Journey and KSAR Process - HC2024.B9 - page 90. Note that KSARs do not cover the operational stage of the building.
1005 Key Stage Assurance Reviews (KSAR)
1006 Witness statement - Thomas Rodger - 14.03.2024 - paragraph 40.
1007 A43494374 - KSAR Outline Business Case Workbook - HC2024.B9 - page 120.
1008 Transcript - Thomas Rodger - 14.03.2024 - column 131.
1009 A43494374 - KSAR Outline Business Case Workbook - HC2024.B9 - page 137.

not a guarantee that such risk will be eradicated.[1010] He explained that Assure does not check all project details for compliance with guidance but, rather, it conducts sample reviews to a degree necessary to gain confidence in the project's management. The degree of scrutiny required to gain that confidence may vary from project to project.[1011] The process therefore depends on the exercise of judgement on the part of the Assure staff who carry it out.

13.16. Reviews are conducted by Assure using a series of workbooks that are available on Assure's website.[1012] The workbooks provide guidance on the structure of the reviews and the areas of investigation to be addressed by the review team at the relevant stages, and include question sets for each of the areas identified above, with an additional specific set for infection prevention and control. However, the question sets are designed to be indicative rather than prescriptive and the review team may choose to probe particular areas further.[1013]

13.17. An overview of the process was given in his statement to the Inquiry by Mr Rodger in the following terms:

> "The structure of a KSAR can be thought of in distinct sections, specifically the "information exchange process" where health boards provide a response to NHS Scotland Assure in relation to the KSAR workbooks, moving on to a "gap analysis" to ensure successful transmission of a KSAR response from the health board to NHS Scotland Assure, and then ultimately the "review period" itself where we assess the evidence provided by the health board in detail. These stages are outlined for each KSAR project in a Dashboard…"[1014]

13.18. The final result of the KSAR process is a written report issued to the relevant health board and the Scottish Government in parallel. At the same time, notification is given in writing as to whether a project is supported or unsupported as a result of the KSAR. The supported or unsupported status is of some significance for a project. As was explained at the time of setting up of Assure,

> "The assurance function does not only provide assurance to health boards, but also to the Scottish Government at the point of approval by the NHS Capital Investment Group where that approval is necessary. This was made clear in the letter announcing the creation of Assure:
>
> "From 1 June 2021, all NHS Board projects that require review and approval from the NHS Capital Investment Group (CIG), will need to engage with NHS Scotland Assure to undertake key stage assurance reviews (KSARs). Approval from the CIG will only follow once the KSAR has been satisfactorily completed. The KSARs have been designed to provide assurance to the Scottish Government that guidance has been followed."[1015]

1010 Transcript - Thomas Rodger - 14.03.2024 - column 118.
1011 Transcript - Thomas Rodger - 14.03.2024 - columns 165 and 175.
1012 Key Stage Assurance Reviews (KSAR).
1013 Transcript - Thomas Rodger - 14.03.2024 - columns 134 to 5.
1014 Witness statement - Thomas Rodger - 14.03.2024 - paragraph 81.
1015 A43494369 - Letter 27 May 2021 - HC2024.B9 - page 70.

13.19. Thus, approval for a project from CIG, which in effect determines whether a project subject to its oversight may proceed or not, requires the relevant KSAR to have been satisfactorily completed. Scottish Government may also commission Assure to undertake reviews on other projects where it considers that appropriate.[1016] Since 6 February 2023, no building project undergoing Assure's KSARs may open to the public until it has received "supported status" from Assure.[1017]

13.20. In practical terms, when CIG discusses a business case, the starting point is the KSAR – if the KSAR has not been signed off, then it is very unlikely that CIG will review the business case.[1018] Prior to a business case reaching CIG, the relevant KSAR will have been discussed at a regular monthly meeting with Assure, which allows any issues to be flagged early in the process. Thus, when the business case is ultimately presented, any loose ends of the KSAR process can be tied off prior to approval.

13.21. The Assure KSAR at Full Business Case stage considers "if the Health Board can provide assurance that the designs have been developed to a RIBA Stage 4 level of detail…At this stage we would expect the Health Board to have concluded its detailed design and there [to] be confidence that the project can move on to the construction stage."[1019]

13.22. The workbook for the Assure KSAR at Full Business Case stage identifies a number of questions to be answered that would appear to be relevant to the issues with which the Inquiry has been concerned. First, it asks "How does the Health Board assure itself that all variations / derogations which may be required to the ventilation systems are investigated and agreed by all parties before they are incorporated in the design?" The evidence expected to be produced is "Evidence that each variation / derogation has a detailed technical analysis and has been referred to the Board and agreed with their ventilation safety group, clinical, engineering, Estates, infection control and FM teams."[1020]

13.23. The second question posed is: "Is there evidence of stakeholder input to ventilation strategies?". The evidence expected is:

> "Addition to or supplement to the Environmental Matrix which confirms the following, on a room by room basis:
>
> a) the type of ventilation (to SHTM 03-01)
>
> b) patient group and / or function related to the space.
>
> c) name of the Consultant, Clinical Lead or Department Lead who has agreed to the room requirements.

1016 Witness statement - Alan Morrison (NHS Assure) - 13.03.2024 - paragraph 29.
1017 A43494372 - Letter 6 February 2023 - HC2024.B9 - page 75.
1018 Witness statement - Alan Morrison (NHS Assure) - 13.03.2024 - paragraphs 31 to 32.
1019 Witness statement - Thomas Rodger - 14.03.2024 - paragraph 131.
1020 A43494373 - KSAR Full Business Case Workbook - HC2024.B9 - page 169.

d) name of the Infection Prevention and Control Doctor or equivalent who has agreed to the room requirements.

e) name of the Infection Prevention and Control Nurse who has agreed to the room requirements.

f) name of the Estates / FM team representative who has agreed to the room requirements.

g) name of the NHS Project Manager who has agreed to the room requirements.

h) name of the Decontamination Manager who has agreed to the room requirements (where this is part of the project)."[1021]

13.24. The third question is "Is there evidence of the Health Board developing Ventilation Commissioning Proposals?", in relation to which the expected evidence is:

"• Evaluation of the suitability of the proposed plans in the context of the FBC, are these sufficient do the [sic] meet the requirements of the project, guidance and the design of the system?

• What plans have been made for independent validation of the ventilation systems?

• What plans have been made for independent verification of the ventilation system?

• What plant and ductwork cleaning has been specified?

• What safe adequate access has been allowed for access to dampers?"[1022]

13.25. These topics are developed in other workbooks according to the relevant stage. Thus, for example, the workbook for the construction phase of the project seeks evidence that the health board has ensured that the ventilation systems are being installed to the correct standard and reflect the agreed design and that all pre-commissioning inspections are completed and recorded before commissioning can commence.[1023]

13.26. Overall, experience in relation to the KSAR process has been positive. That is evidenced by the feedback which Assure has received from health boards. Health boards have intimated to Assure that they have changed some of their processes as a result of learning through the KSAR process. There have been several examples of behavioural changes evidenced by health boards, particularly where they have undertaken KSARs across different complexities of projects

1021 A43494373 - KSAR Full Business Case Workbook - HC2024.B9 - pages 169 to 170
1022 A43494373 - KSAR Full Business Case Workbook - HC2024.B9 - page 170.
1023 A43494368 - KSAR Construction Workbook - HC2024.B9 - pages 199 to 201.

and business case stages. One example is where a health board had received an "unsupported" status on a project, primarily as a result of lack of evidence in relation to their governance processes. This was subsequently addressed through the board's own action plan. In subsequent projects, the health board in question was able to demonstrate that it had learned from this experience and was able to provide evidence and assurance for its project in response to the KSAR team's request. Assure has also found through the experience of a number of KSARs, that the KSAR process and workbooks have helped health boards to enhance their governance processes, including how they are documenting key decisions. The KSAR workbooks promote a theme of good governance throughout all stages of a project.[1024]

13.27. The Inquiry received a range of views as to whether the existence of Assure, and in particular the KSAR process, would prevent issues such as those that arose at the RHCYP and DCN from arising again. Mr Morrison considered that the risk of such happening again "has certainly been reduced". Assure was an "appropriate, proportionate and sufficient resource to address the problems that arose on the RHCYP/ DCN project…However, it is important to be mindful that the mere existence of NHS Scotland Assure does not guarantee that every NHS Scotland construction project will avoid problems. Building a major piece of health infrastructure is a complicated and demanding undertaking…".[1025]

13.28. Mr Rodger stated that he "would not be willing to say categorically 'Yes, it would have.'" He explained that Assure has, through the KSAR process, identified issues with ventilation on projects, including issues with air change rates. Some of those issues were simple, such as "typos" in documents. Other issues have involved a lack of evidenced discussion and dialogue regarding the patient cohort. However, as he was not party to all the information relating to the Edinburgh project, it was not possible for him to give a definitive yes or no answer.

13.29. Mr Rodger reiterated that Assure is not a shadow design team and "we are not a checking service". Accordingly, it does not check every line of every calculation or document that is provided to it. It has neither the time nor the resources to do that – it is someone's job to do that within the health board's project team. Assure looks for assurance that the health board can demonstrate that such a check has been undertaken. Assure considers what assurance the health board has provided and whether it has robust protocols in place. It looks for assurance around how the health board has assessed the patient cohort and how it has looked at what the actual functional clinical requirements of that space will be, in order to inform an engineering design. Assure considers if the health board has a clear and common understanding of that patient cohort and what these patients are going to require in terms of relevant guidance.[1026]

1024 Witness statement - Thomas Rodger - 14.03.2024 - paragraph 47 to 50; see also Witness statement - Julie Critchley - 14.03.2024 - paragraph 105, and Transcript - Thomas Rodger - 14.03.2024 - column 183 referencing an example of a KSAR revealing discrepancy between the room data sheets and the environmental matrix.

1025 Witness statement - Alan Morrison (NHS Assure) - 13.03.2024 - paragraphs 80 to 81.

1026 Witness statement - Thomas Rodger - 14.03.2024 - paragraphs 237 to 243.

13.30. Julie Critchley (Director, NHSS Assure) considered it "likely that such significant issues as did emerge [during the RHCYP and DCN project] could be identified through the governance processes that NHSS Assure and Health Boards now have in place."[1027] When asked why she said that, she explained "I think that because we now have the tube map with the KSAR and the National Design Assessment Process (NDAP) and Sustainable Design process, that we would have a number of points within a healthcare build programme at which we would seek to identify any risks and any non-compliance with guidance, and whilst I cannot say categorically that that wouldn't happen again, I think that we would have the opportunity to identify risks now in perhaps a way that we didn't before."[1028]

13.31. KSARs are not intended solely to be critical. KSARs also look to identify any positive lessons learned from a project. Assure has found many instances of good work being done by health boards in the course of a project that they do not formally record. That has been a key theme that Assure has been trying to get health boards to address through the KSAR process.[1029]

13.32. Witnesses who were asked about their experience of and opinions as to the effectiveness of Assure, recognised that the organisation and its processes were early in their development and would require time to adjust. Favourable views were expressed about the establishment of Assure and the introduction of the KSAR procedure. Professor John Connaghan, the current chair of NHSL and former Chief Executive of NHS Scotland welcomed Assure and particularly welcomed the concept of KSARs.[1030] Similarly, Ronnie Henderson, who was able to provide an operational perspective based on his experience as Senior Capital Programme Manager for NHSL and former member of the Project Team for the RHCYP and DCN, was of the view that Assure "can only be welcomed".[1031] Graeme Greer, a civil engineer formerly employed by MML on the RHCYP project and now working for NHSL, considered that the KSARs would be a positive step for major hospital build projects which would definitely reduce the risk of errors.[1032]

13.33. Indeed, some witnesses argued for a deeper engagement in projects on the part of Assure and, in particular, something of the nature of an inspection role to confirm that applicable guidance was being properly interpreted and followed.[1033]

13.34. Mr Greer, however, drew attention to the consequent cost in time and money of the KSAR process as currently implemented by Assure. There was duplication, with projects that are already subject to NDAP and Sustainable Design and Construction (SDC) reviews now being required to go through a series of KSARs.

1027 Witness statement - Julie Critchley - 14.03.2024 - paragraph 126.
1028 Transcript - Julie Critchley - 14.03.2024 - columns 86 to 87.
1029 Witness statement - Thomas Rodger - 14.03.2024 - paragraph 37.
1030 Transcript - John Connaghan - 07.03.2024 - column 155.
1031 Transcript - Ronnie Henderson - 26.02.2024 - column 181.
1032 Transcript - Graeme Greer - 27.02.2024 - column 194.
1033 Transcript - Ronnie Henderson - 26.02.2024 - column 182; Transcript - Janice MacKenzie (Part 2) - 27.02.2024 - columns 79 to 81; Transcript - Stewart McKechnie - 29.02.2024 - columns 132, 142, 144; Transcript - Tracey Gillies - 08.03.2024 - columns 67 to 68, 72 to 76.

Assure did not always deploy the same personnel at each KSAR with the potential for inconsistent feedback.[1034] For a health board, responding to a KSAR involves taking inevitably scarce staff resources away from other duties. Mr Greer mentioned "a lack of available IPC, …a lack of estates."[1035]

13.35. Mr Rodger acknowledged that Assure was very conscious that a health board has to commit time to support its response to the KSAR process. "We would never like to think," he went on, "that we were wasting anyone's time…".[1036] Later in his evidence he explained that work was being done within Assure to reduce the amount of duplication between the NDAP and the KSAR processes with a view to reducing the burden on boards.[1037]

13.36. Dr Donald Inverarity, Lead Infection Control Doctor, Associate Nurse Director, Lindsay Guthrie, and Sarah Jane Sutherland, Lead Infection Control Nurse, all with NHSL, spoke of the weight of the demands placed on infection prevention and control teams by the recently imposed Assure KSAR process over and above what is required by the much longer established HAI-SCRIBE procedures, this being work additional to their clinical duties.

13.37. In his witness statement at paragraph 278, Dr Inverarity sets out what is required of an IPCD where a health board is submitting a project for a KSAR and needs to demonstrate IPCT involvement. The IPCD would have to: evidence their qualifications and previous experience supporting new build projects; produce evidence of risk assessments of derogations and satisfaction that there is no impact on patient safety; perform walk-round audits during the construction phase; and provide evidence that fixtures and fittings do not present infection risks. As Dr Inverarity goes on to explain in the following paragraph of his statement, the time required to do this for one project is substantial and hard to deliver in addition to the many other aspects of the IPCD role that do not involve the built environment. It was, as Dr Inverarity said when he came to give his oral evidence, incredibly difficult for infection control teams to actually support the amount of input required in KSARs.[1038]

13.38. Ms Guthrie referred to a history of incremental changes to the workload and the expectation placed upon infection control teams for many years which has not been matched with any investment in capacity or resource. In consequence, where any additional system is put in place it will be challenging to find sufficient IPC resource to implement it.[1039] It was the case that NHSL had designated a post of IPCN with responsibility for advising on the built environment (Ms Sutherland had been appointed to that post in succession to a previous incumbent) but the demands of the rest of the IPC service were such that Ms Guthrie recently had had to withdraw Ms

1034 Transcript - Graeme Greer - 27.02.2024 - column 195.
1035 Transcript - Graeme Greer - 27.02.2024 - column 198.
1036 Transcript - Thomas Rodger - 14.03.2024 - column 129.
1037 Transcript - Thomas Rodger - 14.03.2024 - column 143.
1038 Transcript - Donald Inverarity - 05.03.2024 - column 175.
1039 Transcript - Lindsay Guthrie - 01.03.2024 - column 154.

Sutherland from her designated post in order to work in the rest of the service. There was also a question over the availability of training in order to provide IPCNs with a competence to advise in relation to the built environment. A designated post such as held by Ms Sutherland is not an attractive role in that it does not align with the usual skills and experience of a nurse coming into infection control who might therefore be asked to comment on something in respect of which they have neither training nor competence. At a practical level, where there are not enough IPCNs to carry out clinical duties and not enough IPCNs in Scotland with the requisite qualifications to do this more technical work, what the IPC function of health boards was being asked to do under the new KSAR system was undeliverable.[1040] Ms Guthrie considered that the new processes have created unrealistic workloads for IPC teams. In her opinion, in larger boards such as NHSL where there may be multiple capital projects running in parallel, there was a risk that the Assure processes were setting up boards for failure.[1041] Ms Sutherland agreed:

> "…we don't have the capacity and capability to cover all those projects … Boards will be set up for failure because you can't guarantee that you are going to have Infection Control representation at every single meeting that they are expecting you to be at, or potentially Boards may not even have the capacity to dedicate anyone to the whole project, certainly at the moment."[1042]

13.39. Ms Sutherland also spoke to what she saw as the unrealistic nature of what was expected of IPC during KSARs, both in relation to the topics on which IPC teams were to comment on which were outside their scope of practice, and in relation to what could be done by a limited workforce which already had a huge remit to cover.[1043] Ms Sutherland was not aware of any specific training being provided to IPCNs to carry out these new tasks. There have been problems across Scotland in recruiting people into IPC roles and there have been people who have left IPC teams because they do not want to be plumbers or ventilation experts. Ms Sutherland said: "the whole built environment thing has just put them off."[1044] She herself had felt that she was effectively a building control officer and that it was not "fair and realistic" to expect an IPCN to undertake that role.

13.40. Professor Alexander McMahon has been the Chief Nursing Officer since 2021. Previously, from 2016, he was Executive Director for Nursing, Midwifery and Allied Health Professionals in NHSL. Latterly in that role, IPC became part of his remit. From his perspective as the Chief Nursing Officer, Professor McMahon accepted, when giving his evidence, that "the system as it is and the capacity that we have [does not] meet the demand".[1045] It was not just about the Assure KSAR itself; it was "about the requirements of the current facilities that people are in, and any new build, and expectations of the role that IPC will play in these". However, in

1040 Transcript - Lindsay Guthrie - 01.03.2024 - column 166.
1041 Transcript - Lindsay Guthrie - 01.03.2024 - column 168.
1042 Transcript - Sarah Jane Sutherland - 29.02.2024 - column 206 to 207.
1043 Transcript - Sarah Jane Sutherland - 29.02.2024 - columns 197 - 198
1044 Transcript - Sarah Jane Sutherland - 29.02.2024 - column 200.
1045 Transcript - Alex McMahon -07.03.2024 - 26.02.2024 column 66.

relation to the establishment of Assure and the systems it had put in place, Professor McMahon explained that "My view would be that the ask to set up Assure was an ask and it was implemented …we had not understood what demands that would place on the capacity we had at the time, and now we are trying to marry the two up".[1046]

13.41. Professor McMahon accepted that there were capacity issues and that the system was very pressured, but he did not accept that the new KSAR system was undeliverable. Additional funding may not have been provided to health boards, but the Chief Nursing Officer Directorate was providing them with assistance in the form of making available training and online materials and preparing new job specifications setting out what was required of IPC teams and individual IPC practitioners. The response to the KSAR and HAI-SCRIBE processes had to be made by a partnership of relevant professionals. No one should have to do anything that compromises the regulation of their professional body. Professor McMahon would not expect a nurse to do anything that they were not fit to give advice on, however "the process is hugely important, but equally it is for all stakeholders to play their role …having those people with their clear responsibilities and accountabilities in the same room, hearing the same conversation at every step in the process is hugely important…".[1047]

13.42. Dr Inverarity considered this was not to do with numbers but a misalignment of the tasks being allocated to particular staff groups. A lot of what IPC teams were being asked to do did not actually require a doctor and a nurse. For example, there was an expectation that IPC be involved in the design of buildings which did not have a clinical purpose and therefore where infection risk was not of relevance. Ms Guthrie also pointed to a lack of precision in what was required of IPC teams in the KSAR process. "Involvement" was expected at all stages of the process even where there was no clearly defined need or benefit to be derived from that.[1048]

13.43. The Assure service which was announced on 27 May 2021 and the processes which it has developed since then, do not conform to the model of a clerk of works carrying out on-the-spot inspection and random testing initially envisaged by Ms Freeman when she set the project for its creation in motion. Some of those within health boards who are involved in planning and implementing construction projects have been disappointed by the unwillingness of Assure to commit to authoritative interpretations of the guidance, how that guidance is to be applied, and to advise on risk in the event of derogations.[1049] Assure is, after all, a centre of excellence and therefore expertise, and is responsible for developing and publishing the relevant guidance. Nevertheless, I did not understand any of the core participants to quarrel with Counsel to the Inquiry's assessment that the KSAR process put in place by Assure provides a robust challenge to help improve health boards' governance and compliance with guidance, both on the project undergoing review and for future projects, and to provide assurance to government (and indirectly

1046 Transcript - Alex McMahon -07.03.2024 - column 69.
1047 Transcript - Alex McMahon -07.03.2024 - column 77.
1048 Witness Statement - Lindsay Guthrie -01.03.2024 - paragraph 270.
1049 See for example, Transcript - Tracey Gillies - 08.03.2024 - columns 67 to 68.

to boards and the public) about these matters. I would accept, as Counsel suggested, that this looks to be reasonable, not only from the perspective of cost and practicality but also from the perspective of not wishing to interfere with the position of contractual risk in respect of particular projects or, more generally, with the division of responsibility as between government and health boards on which the NHS in Scotland is currently based.

13.44. To judge from the evidence of Ms Critchley and Mr Rodger, Assure would seem to be well resourced and committed to making improvements in its procedures in the light of its experience in conducting KSARs. However, in considering how Assure's procedures might be improved, I would recommend that regard should be had to the points which emerge from the evidence of the IPC practitioners which I have referred to above.

13.45. Very clearly, an IPC team represents a valuable resource, but a resource which is limited by the number of available experienced practitioners and the variety of tasks they are expected to carry out. Equally clearly, the introduction of Assure's KSAR procedure has imposed significant additional demands on what was already a hard-pressed service. Professor McMahon accepted that the establishment of Assure did not bring with it the provision of additional capacity to health boards to respond to the demands of the KSARs. Indeed, as Dr Inverarity pointed out, experienced IPCNs had left health boards to join Assure.[1050] However, providing extra capacity, in the sense of funding additional staff numbers would not, in any event, have been a straightforward matter. Posts may be created but there is the difficulty, experienced throughout Scotland, of recruiting and retaining suitably qualified and well-motivated IPC practitioners.

13.46. Professor McMahon spoke to a national IPC workforce review being in progress. I understand that the result of that has been the issue, on 2 May 2024, from the Directorate of the Chief Nursing Officer, of DL (2024) 11, which sets out in its appendices non-mandatory descriptors of team and specialist IPC roles. This may advance a general understanding of the parameters within which IPC teams can be asked to work, although I was advised by NHSL's legal representative in the course of his final submissions that there was disappointment among senior IPC practitioners that concerns over the content of the letter expressed pre-publication were not resolved before its issue. Independent of how this matter may develop, in the context of advising on the built environment, there must be clarity, as Dr Inverarity argued, as to where the role of the IPCD role stops and what is better delivered by an Authorising Engineer or clerk of works begins.[1051] IPC input is undoubtedly a necessary input to the KSAR process. But what I took from the IPC practitioners who gave evidence was that, as that process has developed thus far, Assure's requirements mean that what is a scarce resource is not being deployed efficiently. IPC professionals are being asked for comment on matters which would be better addressed by those from other disciplines and are being asked to participate in relation to projects or stages in projects where they have little of relevance to offer. While I see the force, at least in general terms, of

1050 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 283.
1051 Witness Statement - Donald Inverarity - 05.03.2024 - paragraph 280.

Professor McMahon's observation that it was important that people with different responsibilities should be "in the same room, hearing the same conversation at every step in the process", that has to be balanced by Dr Inverarity's stark statement that quite simply there are not sufficient people in IPC teams to be involved to the level expected by Assure when conducting a KSAR.

13.47. Ms Critchley and Mr Rodger expressed a desire to streamline and improve Assure's procedures, and I would recommend that they consider how best to address the points made by Dr Inverarity, Ms Guthrie and Ms Sutherland.

NHS Scotland Assure – Guidance[1052]

13.48. Assure develops and maintains guidance related to the design, build and maintenance of acute healthcare built environments, including SHTMs and manuals to support operational delivery across a wide range of areas, including IPC, Engineering, FM Services and Property and Capital Planning. As with KSARs, in doing so, the intention is to ensure that those environments are free from avoidable risk and infection. Its guidance service is also charged with the production of the standards by which compliance within the healthcare built environment is measured in order that assurance can be provided.

13.49. The evidence given to the Inquiry was that in developing guidance, Assure identifies and prioritises the need for new guidance and standards. New developments from other organisations and countries are taken into consideration. Assure adopts an evidence-based approach throughout, ensuring that guidance is up to date with the latest scientific and technical developments. There is a rolling programme for updating guidance and Assure is currently consolidating and reviewing the production of all guidance it has produced.[1053]

13.50. Dependant on the nature of the topic to be covered by the guidance, the lead is taken by different divisions of Assure according to specialism. By way of example, ARHAI produces the National Infection Prevention Control Manual ("NIPCM") to which health boards are required to adhere when reporting infection outbreaks, while FM Services produces the NHS cleaning manual which is used by Health and Social Care providers.

13.51. The Head of Engineering is the corporate record owner within Assure for the engineering SHTM guidance. The Principal Engineering Managers effectively take on the day-to-day role of managing the actual development of individual pieces of published guidance relative to their engineering specialism. Assure is the primary technical author of the engineering guidance that it is responsible for, but the approach taken is a collaborative one.[1054]

1052 See generally NHS Scotland Assure Guidance.
1053 Witness statement - Julie Critchley - 14.03.2024 - paragraph 16 and 17.
1054 For the following paragraphs on NHS Assure - Witness statement - Thomas Rodger - 14.03.2024 - paragraph 213 to 230.

13.52. Among those working with Assure in the production of guidance is the Scottish Engineering Technology and Advisory Group (SETAG). Underneath SETAG there are a number of National Advisory Groups (NAGs). Those groups include the National Water Safety Advisory Group, the National Heating and Ventilation Group, the National Electrical Advisory Group, and the National Medical Gas Advisory Group. Each of the groups contain subject matter experts from across all the health boards in Scotland. That structure makes sure that all the health boards have a voice in the development of guidance. In addition, health boards have an opportunity to share their knowledge in relation to the practical application of guidance during scoping exercises when producing engineering guidance undertaken by Assure in conjunction with health boards and other key stakeholders, to identify any areas that need to be changed or clarified within the guidance.

13.53. After the scoping exercise is complete, Assure, in conjunction with SETAG, will assess who is the most appropriate author to write or amend a section. Following the section being drafted or amended, Assure will undertake an internal quality assurance process. Through that process it works with colleagues to undertake accessibility checks and review the technical accuracy of the document. The document would then be put to SETAG, the NAGs and the identified stakeholder group for the particular piece of guidance, for review and approval prior to formal publication.

13.54. Assure also works closely with colleagues in NHS England, NHS Wales and NHS Northern Ireland. This is to help ensure a unified approach to the production of guidance. Historically, NHS England has typically taken the lead on producing a piece of engineering guidance, which would then be reviewed by Assure and SETAG, to adapt to any specific NHS Scotland requirements. There can be nuances in the production of “local guidance” – for example as a result of Building Regulations in Scotland being different from Building Regulations in England.

13.55. There are topics where Assure is the lead on the production of a piece of guidance. In these cases it will be responsible for delivery of the programme, supported by SETAG and the NAGs. Assure will work with the other UK health services to identify, through collective dialogue, any additional expertise that may be required to produce a particular piece of guidance. The aim is to make sure that the guidance is informed and technically accurate. This may involve engagement with research partners, academic partners, and partners from industry, to support the production of a particular guidance document.

13.56. Assure aims to review each piece of engineering guidance on a five-yearly cycle. However, that cycle has been significantly impacted due to the COVID-19 outbreak. The availability of stakeholders was limited, and updates to guidance were delayed when Assure, SETAG and the NAGs were focused on responding to the pandemic. Accordingly, Assure has worked in conjunction with those parties on a programme to identify the priority for updating the existing suite of guidance documents.

For example, SETAG and the NAGs identified that SHTM 03-01 Ventilation for Healthcare Premises was an immediate priority in 2021. That resulted in an interim version of SHTM 03-01 being published in 2022, with the support of SETAG and the National Heating & Ventilation Safety Advisory Group. Another example of a priority piece of guidance following the pandemic is the current work being done on SHTM 06-01 "Electrical Services Supply and Distribution". That guidance was published in 2015, and the wiring regulations (BS7671) were updated in 2018.[1055] A revision of the SHTM to reflect these changes was a priority for 2024.[1056]

13.57. There are at least two points of contact between Assure's guidance function and the KSAR process discussed above. First, the situation may arise where a health board considers that extant guidance does not cover a particular situation. In such a case, Assure will request assurance from the health board as to how it can make that assertion and request details as to how it developed its technical proposals. This would also involve consideration as to whether the health board contacted Assure for any clarification on the guidance, whether it sought to meet with the relevant NAG, or whether it considered other guidance that may be applicable to the topic.

13.58. Second, there is the situation where Assure is approached for assistance with interpretation of the guidance. This facility is available regardless of whether or not a project is going through a KSAR.

13.59. There are, however, other mechanisms which health boards can use to approach Assure for support. One of its core functions is to provide health boards access to Subject Matter Experts to give support in technical matters of that nature. Further, there are opportunities within a KSAR and the NDAP when a health board is setting out its requirements for a project, where health boards can approach NHS Scotland Assure for support in developing these requirements.

Update to SHTM 03-01

13.60. An interim update to SHTM 03-01 was published in February 2022.[1057] That the 2022 edition is a major revision is evidenced by the fact that Part A ("The concept, design, specification, installation and acceptance testing of healthcare ventilation systems") has grown by 43 pages and is now 227 pages long; Part B ("The management, operation, maintenance and routine testing of existing healthcare ventilation systems") has grown by 19 pages and is now 65 pages long. The main changes in the 2022 version from the 2014 version are conveniently summarised in the introductory section to Part A. Some of the changes made by this update have a particular bearing on matters falling within the Inquiry's Remit and Terms of Reference. Two of these, namely, the introduction of specified levels of care, and the expansion of provisions relating to validation, have been discussed in chapters

1055 And amended in 2020 and 2022.
1056 Witness statement - Thomas Rodger - 14.03.2024 - paragraph 222.
1057 A37301627 - SHTM 03-01 Part A and A37301626 - SHTM 03-01Part B (2022) - HC2022.B1 - pages 802-1029. A revised version of HTM 03-01 was published in June 2021: HTM 03-01 (2021).

5 and 9 respectively, and are not discussed further here. I will however say something about the introduction of the provision for a Ventilation Safety Group.[1058]

13.61. The Ventilation Safety Group (VSG) is responsible for overseeing the management of the ventilation systems of a healthcare provider. The VSG should have clearly defined roles and responsibilities, be part of a healthcare organisation's governance structure and report to the Designated Person at Board level.[1059] It should be led and chaired by a person who has appropriate management responsibility, knowledge, competence and experience (for example, the Designated Person).[1060]

13.62. The VSG should be a multidisciplinary group and should typically comprise:

- An Authorising Engineer/independent adviser for ventilation (AE(V))
- An Infection Prevention and Control person
- The Authorised Person(s) for ventilation services (AP(V))
- Estates (operations and projects) staff
- Clinicians and specialist departments (for example, theatres, critical care areas, pharmacy, medical microbiology, nursing, decontamination)
- Personnel from the finance department with accountability for capital and revenue evaluation
- Other stakeholders as appropriate
- Co-opted expertise (for example, ventilation designers, consultants and suppliers).[1061]

13.63. The Authorising Engineer (Ventilation) is a person designated by the person ultimately accountable for the safety of the premises to provide independent auditing and advice on ventilation systems, to review documentation on verification and validation and witness the process as necessary. It is expressly provided that Authorising Engineers should be able to show that they are free to provide independent advice and have been subject to an assessment of their competence by a registration body.[1062] The Authorised Person is an individual with adequate

1058 Detailed comments on the 2022 version of SHTM 03-01 were submitted by NHSL and can be found in A49129754 - NHS Lothian comments - HC2024.B13.V14 - page 3. The comments do not deal with the first issue discussed below, though it does offer some commentary on the increased role of the Authorising Engineer that arises in the second.

1059 Designated Person is defined at paragraph 2.7 of Part B of SHTM 03-01 as "This person provides the essential senior management link between the organisation and professional support. The Designated Person should also provide an informed position at board level" and confirms the appointment of certain key staff members.

1060 A37301627 - SHTM 03-01 Part A - HC2022.B1- page 825 - paragraph 4.4.

1061 A37301627 - SHTM 03-01 Part A - HC2022.B1 - page 825 - paragraph 4.5.

1062 A37301626 - SHTM 03-01Part B (2022) - HC2022.B1 - page 1050 - paragraph 2.8.

technical knowledge and training who is responsible for the practical implementation and operation of safety policy and procedures relating to the engineering aspects of ventilation systems.[1063]

13.64. The VSG is expected to assess all aspects of ventilation safety and resilience required for the safe development and operation of healthcare premises. It should ”inform the following areas”:

- The design process for new healthcare premises
- The design process for modifications to existing premises
- The commissioning and validation process
- Operational management and maintenance
- Annual verification and performance testing
- Prioritising the plant replacement programme
- Decommissioning and removal of redundant equipment.[1064]

13.65. SHTM 03-01 expressly states that it is important that decisions affecting the resilience, safety and integrity of the ventilation systems and associated equipment are not taken without the agreement of the VSG. The VSG should ensure that appropriate expertise and competence is available when making such decisions.[1065]

13.66. Any derogations or alternative design strategies from the guidance set out in SHTM 03-01 should be subject to the scrutiny and agreement in writing by the VSG. The reason for the derogation or alternative design strategy and limits to its application should be recorded. Designers proposing a derogation or alternative design strategy should be able to supply a body of evidence that their proposal will provide a degree of safety no less than if the guidance in this document had been followed.[1066]

13.67. During the latter stages of the RHCYP and DCN project, NHSL had in fact created an entity called a Ventilation Safety Group. This preceded publication of the revised version of SHTM 03-01, and there were therefore some differences between the NHSL Group at that time and the position set out in SHTM 03-01. The NHSL Group did not, for example, report to an individual at board level.

1063 A37301626 - SHTM 03-01Part B (2022) - HC2022.B1 - page 1051 - paragraph 2.9.
1064 A37301627 - SHTM 03-01 Part A - HC2022.B1 - page 826 - paragraph 4.6. In a note to that paragraph, it is provided that where estates and facilities provider services are part of a contract (including PFI), it is essential that these providers participate fully in all those aspects of estate and facilities management that can affect patients. This includes responding to specific requests from the VSG, which may be in addition to relevant guidance and documentation.
1065 paragraph 4.7.
1066 paragraph 4.10-11. See also paragraphs 4.17 and 4.70.

13.68. The work of the NHSL Group anticipated some of the functions of the SHTM 03-01 VSG. Both Dr Inverarity and Ms Guthrie attended NHSL's Water Safety Group (established as part of the same process) and the Ventilation Safety Group and it was noted that the work generated by these groups became almost a full time job.[1067] In his oral evidence, Dr Inverarity agreed that the creation of this group had been a positive development, providing a forum where matters can be progressed faster than via email discussions by virtue of having all the stakeholders together.[1068] The work of NHSL's Ventilation Safety Group was general and was not solely dedicated to the RHCYP and DCN project.

13.69. The provision in the recent version of SHTM 03-01 for the creation of VSGs throughout NHS Scotland was welcomed by those giving evidence to the Inquiry. In his report, Mr Maddocks noted that the creation of VSGs was a welcome improvement to current SHTMs because:

> "Historically design engineers have not been given the opportunities to sit with the operational staff to understand the day-to-day challenges faced and likewise operational staff have not had the opportunity to inform designers of operational constraints particularly when considering existing hospitals. The creation of multi-stakeholder Safety Groups provides an opportunity before significant time and expenditure is committed for complex engineering systems to be thoroughly reviewed and agreed to mitigate the risks of future projects."[1069]

13.70. Dr Inverarity also considered their introduction an "improvement", similarly noting that they would provide a forum to "bring staff who have the correct skill mix to answer the questions being asked. So, in particular, authorising engineers in ventilation systems, their function, their role is very much compliance, and not just in relation to infection risk, but in relation to the manufacturing process, the suitability of components, the function of the design, the appropriateness to healthcare, and those are skills that the Infection Control team just simply don't have, but the need for them is sometimes projected onto the Infection Control team. So, having an authorising engineer present to speak to those issues is a distinct advantage."[1070]

13.71. After noting that VSGs were "a good step forward", Stewart McKechnie (Design Team Lead, TSWW) sounded a note of caution in relation to their functions in relation to derogations. While accepting that VSGs would take some pressure off Assure, he stated that in his view it would still be necessary to involve Assure in the derogations process in order to maintain a Scottish or UK standard and to ensure consistency given that VSGs were essentially local in character.[1071]

1067 Witness statement - Donald Inverarity - 05.03.2024 - paragraph 44.
1068 Transcript - Donald Inverarity - 05.03.2024 - column 178.
1069 RHCYP/DCN Critical Care Ventilation Systems Review - paragraphs 6.2.1 to 2.
1070 Transcript - Donald Inverarity - 05.03.2024 - column 21; see also Transcript - Janice MacKenzie (Part 2) - 27.02.2024 - column 83 - 4; Transcript - Darren Pike - 28.02.2024 - column 94.
1071 Transcript - Stewart McKechnie - 29.02.2024 - columns 137 to 8; Transcript - Lindsay Guthrie - 01.03.2024 - columns 149 to 150.

Other guidance publications

13.72. In addition to the Scottish Health Technical Memoranda, NHS NSS publish a wide range of guidance material. This is principally carried out by three teams within NSS:

- Assure – which is responsible for the development and maintenance of guidance related to the design, build and maintenance of acute healthcare built environments and the standards by which compliance within the healthcare built environment is measured to assure that they are free from avoidable risk and infection;[1072]
- HFS - which provides operational guidance on a range of healthcare facilities topics, as well as national operational policy, safety alerts and technical guidance;[1073] and
- ARHAI – which produces guidance and publications on infection prevention and control in the built environment, and decontamination, including literature reviews, guidance and reports as well as tools and templates for equipment and environment decontamination.[1074] ARHAI is charged with ensuring that the National Infection Prevention and Control Manual remains evidence-based or, where evidence is lacking, based on a consensus of expert opinion.[1075]

13.73. Production of appropriate guidance is an ongoing process, which seeks to keep pace with changes in treatment, new technologies and scientific research. Much of the guidance produced both during the period of the project and thereafter, while important, is not directly relevant to the work of the Inquiry. However, there are two recent publications that may be highlighted both for their relevance and by way of illustration of the ongoing work of NSS.

13.74. First, there is "NHS Scotland Assure Lessons Learned", published in December 2022.[1076] This report was published following a series of investigations into cases of infections and operational issues in a number of healthcare construction projects. It highlights common themes where there are opportunities to implement lessons learned with a view to reducing risk across NHS Scotland and its construction supply chain and covers topics that need more consideration and effort on the part of those commissioning projects. Areas for improvement are noted, including governance, auditing, stakeholder interaction, and the application of guidance and procedures before and after the facility becomes operational.[1077]

1072 NHS Scotland Assure Guidance.
1073 National Services Scotland Publications. A copy of all HFS publications can be found here: HFS Guidance Index.
1074 Guidance and publications. A list of some of the ARHAI guidance can be found here: National Infection Prevention and Control Manual: Chapter 4 - Infection Control in the Built Environment and Decontamination.
1075 National Infection Prevention and Control Manual: Responsibilities.
1076 NHS Scotland Assure Lessons Learned.
1077 NHS Scotland Assure Lessons Learned - page 3.

13.75. With particular reference to the RHCYP and DCN project, this report draws attention to:

- The importance of establishing a clear project brief that is understood by all of the stakeholders.
- The importance of the environmental matrix and the need for input to it from the full range of stakeholders, and for it to reflect the clinicians' views of patient requirements on a room-by-room basis.
- The critical importance of auditing the designs, particularly at key stage reviews.
- The importance of understanding the extant guidance, not limited to a review of reference tables, and for a rigorous scrutiny of all derogations by all stakeholders.
- The importance of the production of detailed schematics for certain services, including ventilation plant and systems network.
- The need for planning for commissioning to begin during the design phase.

13.76. In a section giving examples of lessons learned reference is made to inadequate air change rates and unclear room pressure differentials.

13.77. Second, ARHAI has produced a series of "Notes for Boards" covering infection prevention and control risks in the design of a critical care unit, level 2 and 3 care;[1078] the design of a neonatal unit;[1079] the design of haematology and oncology and bone marrow transplant units;[1080] and air sampling within operating theatres.[1081] These documents were published in April and May 2024.

13.78. Their aim is to support NHS Scotland boards by providing them with a summarised set of questions and answers which will signpost them to any applicable technical guidance documents and summarise key considerations pertaining to matters such as:

- functionality
- layout
- support spaces
- maintenance access arrangements

1078 Notes for Boards: Infection Prevention and Control (IPC) Risks in the Design of a Critical Care Unit (CCU), Level 2 and 3 Care.
1079 Notes for Boards: Infection Prevention and Control (IPC) Risks in the Design of a Neonatal Unit (NNU).
1080 Notes for boards: Infection Prevention and Control (IPC) risks in the design of haemato-oncology and bone marrow transplant (BMT) units.
1081 Notes for Boards: Air Sampling within Operating Theatres V1.

- water systems (including drainage)
- ventilation systems[1082]

13.79. A Note which is particularly relevant for present purposes is in relation to the design of a critical care unit for level 2 and 3 care. The note highlights a number of key questions for consideration in relation to a ventilation system serving such a unit. In relation to the air change rate, it provides:

> "All new build or refurbished Level 2 and Level 3 care areas must be designed to be provided with the air changes stipulated within the Scottish Health Technical Memoranda (SHTM), which will provide guidance and advice regarding ventilation for health care premises without unnecessary departure or derogation. Where departure or derogation is unavoidable as part of a refurbishment the project or design team are obliged to fully mitigate remaining infection risks to enable the safe delivery of care within the unit.
>
> SHTM 03-01, interim v 2.0, 2022 stipulates this is a supply of 10 air changes per hour (Ach/hr) at 10 pascals (Pa) positive pressure within the main unit and an extract of 10 Ach/hr at -5 Pa for any isolation room/suite intended for infectious diseases."[1083]

13.80. Similarly, in response to the question "What pressure differentials should be applied to a Level 2 or Level 3 care area?", the Note provides:

> "All new build or refurbished Level 2 or Level 3 care units must be provided with the pressure differentials stipulated within the current SHTM. SHTM 03-01 stipulates this is 10 Pa positive pressure."[1084]

Implementation of Grant Thornton Report

13.81. NHSL commissioned Grant Thornton, as NHSL's external auditors, to produce a report based on its review of governance and internal controls in relation to the RHCYP and DCN project in October 2019.[1085] The report was considered by NHSL's Audit and Risk Committee at its meeting on 31 July 2020,[1086] and by the NHSL Board on 12 August 2020.[1087] The report is one of a number into the project commissioned after the decision to delay the opening, including a NHS NSS review of the water, ventilation, drainage and plumbing systems;[1088] a report by KPMG

1082 Notes for Boards: Infection Prevention and Control (IPC) Risks in the Design of a Critical Care Unit (CCU), Level 2 and 3 Care.
1083 Notes for Boards: Infection Prevention and Control (IPC) Risks in the Design of a Critical Care Unit (CCU), Level 2 and 3 Care. - page 10.
1084 Notes for Boards: Infection Prevention and Control (IPC) Risks in the Design of a Critical Care Unit (CCU), Level 2 and 3 Care. - page 11.
1085 A32512442 - Grant Thornton Report - HC2024.B10 - page 4.
1086 A33887865 - Minutes of the Audit and Risk Committee - 31 July 2020.
1087 A34978959 - Private Board Minutes.
1088 A41213257 - NHS NSS Phase 1 Report: review of water, ventilation, drainage and plumbing systems, September 2019 - HC2024.B7.V3 - page 373.

titled “Independent Assessment of Governance Arrangements”;[1089] and a report by the Auditor General for Scotland titled “The 2018/19 audit of NHS Lothian - Delay to the opening of the Royal Hospital for Children and Young People.”[1090] However, the Grant Thornton report was the only report that contained a list of recommendations that were of wider application than simply to the particular project.[1091]

13.82. As its title suggests, the Grant Thornton report focuses on governance and internal controls in relation to the project. It is not concerned with identification of the reasons why the ventilation issues arose, though the interaction between governance and those issues is noted.[1092] It was commissioned in order that the Board itself could learn lessons from the project, particularly on the Board’s systems of control.[1093]

13.83. The Grant Thornton report made a number of recommendations grouped under the following headings:

- The preparation of a road map, approved from the outset, outlining management activity and assurance activity
- Clarity in relation to responsibility for making and approving decisions
- Clinical engagement
- External advisers
- The role, remit and involvement in project boards
- The NHSL framework for decision making.[1094]

13.84. NHSL provided a management response to each of the recommendations. Thus, for example, in response to the recommendation for a project route map, NHSL indicated that it would develop a framework for decision making for capital projects. In response to other recommendations, NHSL undertook to develop a process for agreeing and documenting technical changes/ derogations, a framework for clinical engagement, and a review of the procurement of technical advisers. All proposed management responses had a projected timescale of implementation by December 2020, and all were owned by the Director of Finance with the exception of the recommendations relating to the role, remit and involvement in project boards, which was owned by the Director of Capital. In substance, NHSL agreed with the findings and recommendations of the report.[1095]

1089 A32512397 - KPMG Report 2019 - HC2024.B13.V3 - page 1153.
1090 Report by the Auditor General of Scotland.
1091 The NSS report made a number of findings and recommended a number of corresponding actions, but these were specific to the issues that the report identified. See NHS NSS Report.
1092 See for example, A32512442 - Grant Thornton Report - HC2024.B10 - page 60.
1093 Transcript - Susan Goldsmith - 06.03.2024 - column 123.
1094 A32512442 - Grant Thornton Report - HC2024.B10 - page 39 - chapter 6.
1095 Witness statement - Tim Davison - 08.03.2024 - paragraph 158; Witness statement - Malcolm Wright - 07.03.2024 - paragraph 98; Transcript - Susan Goldsmith - 06.03.2024 - column 126.

13.85. NHSL's Audit and Risk Committee sought assurance on the status of NHSL's management responses to the recommendations at its meeting held on 26 April 2021. The minutes for that meeting record:

> "10.1 Ms Goldsmith presented the report. She explained that the agreed deadline for the implementation of the management response was December 2020 and she acknowledged that the timescale had not been met. This was due to the extent of the work involved in addressing the recommendations.[1096]
>
> 10.2 The committee noted the exercise that would bring a document outlining progress against the recommendation, bringing a clear way forward with key milestones. This will clearly outline the process to be followed, highlighting and identifying how each recommendation sits against national guidance and strategic direction.
>
> 10.3 Mr Marriott [NHSL Deputy Director of Finance] explained that NHS Assure was in its infancy and NHS Lothian would need to see how it links into its own internal processes. The committee agreed that a fuller discussion with examples to be worked through should be brought back to a future meeting of the Audit and Risk Committee. The Chair would take advice from Ms Goldsmith and Mr Payne [NHSL Head of Corporate Governance] on the timeline for the report. …
>
> 10.8 The committee accepted the report as a source of moderate assurance that management have started to take appropriate action on the recommendations and that some progress has been made.
>
> 10.9 The committee accepted that due to resource constraints the full completion of the management actions will not be completed until December 2021.
>
> 10.10 The committee noted that the development of the NHS Assure may have an influence on the development of the framework."[1097]

13.86. The development of the relevant documentation and processes in fact took somewhat longer than had been anticipated at that meeting. A report was provided to the Finance & Resources Committee by the Director of Finance for its meeting on 20 April 2022.[1098] This report noted that "An overall assurance framework has been developed previously, providing a comprehensive approach to assurance in Capital Projects together with key suggestions as to how assurance can be sought. From this a draft "checklist" has been developed detailing milestones throughout the whole of the project lifecycle and the suggested evidence to provide quality assurance." It suggested that the new approach be tested in relation to two projects that were then underway. The report also gave a response against each of the recommendations made in the Grant Thornton report, explaining what steps had been taken by NHSL to implement them.

1096 To this could be added the impact of the COVID-19 pandemic: Transcript - Susan Goldsmith - 06.03.2024 - column 126.
1097 A33887865 - Minutes of the Audit and Risk Committee, 26 April 2021.
1098 A47476184 -F&R Committee 20 April 2022 - HC2024.B13.V11 - page 93.

13.87. An update to this report was provided to the same Committee in October 2022.[1099] The documents prepared by NHSL continued to evolve and recruitment of a full complement of programme directors was noted to "bring a different perspective and positive challenge to the initial draft Assurance Framework documents." A further three projects had been identified as suitable for continuing to test the new approach, and it was noted that the fundamental principle being applied "is to ensure that projects are guided to best practice and efficiently present the assurance in the most effective way."

13.88. The Inquiry was provided with the documentation that currently constitutes NHSL's Assurance Framework.[1100] It is clear that the material continues to evolve.[1101] They are "ever changing" and a "live document" and NHSL "continuously develop it".[1102] It was however noted that because of the pause in capital projects NHSL have started to test the new processes and structures in a "real, live situation", but have been unable to finish such an exercise.

13.89. As noted in chapter 11, the lack of systematic knowledge transfer arrangements meant that lessons learned from the RHCYP and DCN project were not made available to other health boards.

End of NPD and introduction of the Mutual Investment Model

13.90. From September 2014 onward, the rules under which public private partnership projects had to be accounted for changed. This led to reconsideration of the NPD model and its use for public sector infrastructure projects.[1103] In short, the changes meant that the full capital costs of the project had to be accounted for in a public authority's capital budget rather than the revenue budget, with this having a significant impact on the public authority's finances. As a result of this change the Scottish Government stopped using the NPD model, with the final NPD contract signed in 2017.[1104]

13.91. The Mutual Investment Model (MIM) replaces the NPD model. It is described as "the current model for private finance projects" in Scotland[1105] and has been subject to an options appraisal by SFT.[1106]

1099 A47476187 - F&R Committee 26 October 2022 - HC2024.B13.V11 - page 96.
1100 For example: A47475948 - Assurance framework August 2023 - HC2024.B13.V11 - page 4. See also Appendices in same bundle.
1101 Transcript - John Connaghan - 07.03.2024 - column 160.
1102 Transcript - John Connaghan - 07.03.2024 - column 161 to 162.
1103 For background, see Audit Scotland, ESA 10: Classification of Privately Funded Capital Projects Briefing Paper.
1104 A33586569 - Audit Scotland - Privately Financed Infrastructure Investment - page 8.
1105 Infrastructure Investment Plan 2021-22 to 2025-26: progress report 2022 to 2023.
1106 Scottish Futures Trust - An Options Appraisal To Examine Profit Sharing Finance Schemes

13.92. The MIM was developed by the Welsh Government and introduced in 2017. It is a Public Private Partnership model that has strong similarities to NPD. The underlying contractual and financial structure of the Welsh model remains similar to that utilised in earlier examples of Private Finance Initiatives. As the Users Guide for the standard form project agreement has it:

> "The key principles embodied in the MIM Standard Form Project Agreements will be familiar to those who operate in the UK 'PPP' market. The MIM Standard Form Project Agreements are based on various UK precedent and standard project agreements, updated in order to accommodate the specific needs of the Welsh Government's infrastructure programme and Welsh Government policy."[1107]

13.93. The Guide goes on to explain that (unlike NPD) there are no controls or vetoes on the operations of the Project Company on the part of the public authority. MIM does not seek to cap the amount of profit that the private sector may make from a project. However, the cap is replaced with "profit sharing", effectively achieved through the public sector taking a risk capital investment of up to 20% in project companies (the relevant figure being 15% in Wales).[1108] The option favoured by SFT reflects the Welsh model.[1109] As yet, MIM has not been used for any healthcare project in Scotland, and the Inquiry heard that there are no immediate plans to do so.[1110]

1107 Welsh Government's Mutual Investment Model (MIM) Standard Form Project Agreements User Guide - page 2.
1108 Scottish Futures Trust - An Options Appraisal To Examine Profit Sharing Finance Schemes - page 5, section 1.3 and page 11 - section 1.7; Transcript - Peter Reekie - 19.05.2022 - column 40.
1109 Scottish Futures Trust - An Options Appraisal To Examine Profit Sharing Finance Schemes - page 5 - section 1.3.
1110 Witness Statement - Alan Morrison - 1 of 2 - 16.05.2022 - paragraph 5.

Chapter 14

Findings of fact

Chapter 14

Findings of fact

The Remit and Terms of Reference of the Inquiry require me to make certain determinations of matters of fact. Here I summarise my findings insofar as they relate to the RHCYP and DCN.

Remit

14.1. The overarching aim of the part of the Inquiry dealing with the RHCYP and DCN is to consider the planning, design, construction, commissioning and, where appropriate, maintenance of that hospital. Because of issues potentially adversely impacting on patient safety and care, the Cabinet Secretary for Health decided, on 4 July 2019, that the opening of the hospital, that had been planned for 9 July 2019, should be postponed. Following remedial works the hospital was only fully opened on 23 March 2021.

14.2. The issues which led the Cabinet Secretary to postpone opening of the RHCYP and DCN related principally to the design of the ventilation system of the critical care department of the new hospital and, in particular, the pressure differentials and air change rates that that system was capable of achieving. No relevant issues concerning maintenance were identified in the course of the Inquiry's investigations. The condition of building systems other than ventilation having the potential adversely to impact on patient safety and care, has been examined. In no instance was the condition of these systems such as to prevent the hospital opening on 9 July 2019.

14.3. In contrast, the ventilation system for the critical care department of the RHCYP and DCN, as originally installed and commissioned, was not adequate and had the potential adversely to impact on patient safety and care. That judgement reflects the particular vulnerability of the patient population which it is to be anticipated will be accommodated and treated in a critical care department, and the available guidance on what levels of air change rates and pressure differentials are appropriate sufficiently to control the risk which air-borne pathogens present to vulnerable patients.

14.4. The evidence before the Inquiry indicated that safety is not a binary issue. Rather, there is a sliding scale of risk from safe to unsafe, which can be influenced by many factors. Scottish Health Technical Memorandum 03-01 (SHTM 03-01) sets out recommended parameters for the outputs of ventilation systems reflecting a consensus about what is appropriate to create an acceptable level of patient safety. These are consistent with parameters set in other countries. A departure from such

recommendations, taken in isolation, has the potential to increase risk. However, other control measures can be introduced to make a space that does not have ventilation which is compliant with SHTM 03-01 sufficiently safe such that patients can be treated there. For example, the Royal Hospital for Sick Children (the Sick Kids) at Sciennes Road had no mechanical ventilation but the other control measures which were in place ensured that it was a safe environment in which to treat patients.

14.5. The available evidence indicated that achieving only 4 air changes per hour when 10 are recommended creates an unacceptable level of risk to the safety of patients unless other sufficient control measures are introduced. This was the evidence of Professor Hilary Humphreys, the Inquiry's instructed expert. His view was that achieving less than 50% of the air changes specified in guidance would create an unacceptable risk to patient safety. Dr Inverarity gave evidence indicating that achieving less than 6 air changes per hour gave rise to a real risk to the safety of staff.

14.6. The shortcomings in the ventilation system at the RHCYP and DCN were only identified a matter of days before the hospital was due to open. Those shortcomings could have been prevented if a clear brief had been agreed before conclusion of the Project Agreement for the construction of the hospital (otherwise Financial Close).

14.7. The decision not to open the hospital as planned had a significant impact on patients and families. Patients and families were shocked, scared and deeply disappointed that long-promised new facilities were not to be available for the treatment, in some cases, of children suffering from very serious conditions. They were provided with only limited information as to why the hospital was not opening as planned.

14.8. In relation to the RHCYP, care required to continue in the suboptimal Victorian building housing the Sick Kids hospital. Safe care could however be provided there. There is no indication of adverse clinical outcomes having been experienced by patients, in the period up to the RHCYP opening, arising from the built environment of the Sick Kids. The issues were more acute for the DCN. It had problems with the water system, including contamination with *Pseudomonas* bacteria. There was a reduction in capacity for operations. There were therefore risks associated with its continued use.

14.9. Significant remedial works were carried out to the ventilation system at the RHCYP and DCN to remedy non-compliance with SHTM 03-01. This involved extensive works to replace the ventilation system for the relevant areas.

14.10. The results of independent testing, and the expert evidence heard by the Inquiry, indicates that the remedial works have been successful. The ventilation system in the hospital now fully complies with published guidance, including SHTM 03-01. The hospital environment is suitable for the delivery of safe, effective person-centred care. No evidence is available to the Inquiry indicating any contrary position.

Term of Reference 1

14.11. Term of Reference 1 defines “defective” as:

> A. Not achieving the outcomes or being capable of the function or purpose for which they were intended
>
> B. Not conforming to relevant statutory regulation and other applicable recommendations, guidance and good practice

14.12. The ventilation system in the critical care department was defective in the sense that in the period from its installation until the remedial works were completed it did not conform to the recommendations made in the relevant guidance. This is not a finding that the ventilation system was necessarily in breach of the terms of the Project Agreement, but, rather, that it did not fully comply with SHTM 03-01 as NHSL had intended that it should.

14.13. The key deficiency was with air changes per hour and pressure differential. The ventilation system in critical care provided fewer than half the recommended air changes per hour in certain rooms. The level of the pressure differential did not conform to the guidance in SHTM 03-01 but the pressure gradient had been risk assessed and found to be preferable for the proposed clinical functions.

14.14. The ventilation system was replaced. The ventilation system is now entirely adequate. It is capable of the function for which it was intended. It conforms to applicable recommendations, guidance and good practice. In particular, it complies with the guidance in SHTM 03-01.

14.15. In a report published by NHS National Services Scotland (NSS) on 9 September 2019, the following comments were made on the state of the scientific evidence base for the current guidance as to the outputs to be achieved by ventilation systems:

> “From an infection prevention and control perspective, there is low-quality to no evidence from outbreak reports and current guidance, respectively, to support minimum ventilation requirements. Therefore, it is not possible to make conclusive statements regarding the individual minimum ventilation parameters for inpatient care areas. A rapid review of the literature found limited clinical evidence to directly implicate air change rates alone in having a direct impact on the development of an outbreak or incidence of infection. Therefore, it is reasonable that, in the absence of evidence, healthcare design teams should continue to adhere to current national guidance. In the event of a deviation from the current recommended ventilation parameters, design teams should ensure that air changes per hour are maintained as close as possible to the recommended air changes per hour without compromising other aspects of the ventilation system requirements. In addition a full assessment of the services and patient population should be carried out and mechanisms for monitoring established. Caution is advised in relying on air change rates alone to provide adequate protection from infection; this is only one part of a multifactorial

process involved in creating the appropriate airflow patterns with appropriate mixing and dilution of contaminants. Nationally, further research is required to look beyond air change rates to examine the effects that other factors such as supply and exhaust location, door position and motion, spatial orientation, surface composition, temperature, humidity, and air distribution patterns have on particle migration in clinical areas."[1111]

14.16. This passage in the NHS NSS report addresses what is known about the relationship between the outputs of ventilation systems and patient safety and care. The evidence heard by the Inquiry was consistent with what appears in that report. The scientific basis for the current recommendations as to particular ventilation parameters is very limited and to a significant extent depends on work published in the early 1970s when hospital environments and other aspects of medical care were very different from what would be expected today. It is however generally accepted that a ventilation system that maintains changes of air within spaces in a hospital and pressure differentials between certain adjacent spaces has an important contribution to make, together with other available measures, to reducing the risk of healthcare associated infections. This is particularly so in the case of patients who are especially vulnerable to infection by reason, for example, of their compromised immune systems. Accordingly, for the present, there is a strong consensus that the recommendations in current guidance are appropriate and that material deviations from these recommendations will be likely to increase the risk of infection, albeit that the increase is unquantifiable and will be dependent on what other control measures are in place.

14.17. As at July 2019 there were outstanding issues relating to the state of completion and condition of other aspects of the hospital ventilation systems and of aspects of other building systems. These are detailed in the report in chapter 4. I am satisfied on the evidence that these would not have prevented the opening of the RHCYP and DCN on 9 July 2019. They have been remedied.

Term of Reference 2

14.18. The overall contractual structure adopted for the financing and construction of the building (the NPD contract) did not directly contribute to the relevant defects that arose.

14.19. However there were, among the arrangements for the strategic definition, preparation and brief, and concept design, features which did contribute to the issues and defects that arose in relation to the ventilation system for the RHCYP and DCN. There was a lack of clarity in the brief for the ventilation system provided to tenderers during the procurement exercise. This remained the case as at the conclusion of the Project Agreement.

14.20. NHSL was subject to an instruction from the Scottish Government to prepare Room Data Sheets using the Activity Data Base (ADB) or an equivalent, in order, for example, to brief prospective tenderers as to what it required as ventilation

1111 Contained in A40933361 - Oversight Board Papers - HC2024.B3 - page 199 - paragraph 4.2.6.

outputs for the various rooms of the new hospital. Room data sheets (RDS) are the commonly used briefing tool for hospital projects. In the Inquiry's expert's opinion, using RDS is the only way for a client to inform the design team of their requirements.

14.21. NHSL initially intended to produce RDS for the project. However a decision was made instead to require bidders and, later, the preferred bidder to produce its own RDS. An environmental matrix (EM) was provided to bidders to assist in the preparation of room data sheets. This was the same EM included with a draft of the Board's Construction Requirements.

14.22. There was a lack of clarity in relation to whether tenderers required fully to comply with published guidance (including SHTM 03-01) or whether the EM was a derogation from published guidance. In short, NHSL failed to provide a clear brief, whether by means of preparing and issuing room data sheets or otherwise, which specified the environmental outputs required from the ventilation systems serving the various rooms within the new hospital.

14.23. In the absence of such a clear brief, Project Co understood the EM, which was issued both with procurement documentation and the Project Agreement, to be a statement of the ventilation outputs required by NHSL for the rooms in the hospital. That EM contained an error in relation to the parameters for certain critical care rooms. It was unintended. It arose from a mistake in the transcription of information into the relevant cells of the spreadsheet in which the ventilation requirements for each room in the hospital were set out. Had this error not been present, the issues with the ventilation system are unlikely to have arisen.

14.24. The potential for the error in the EM to give rise to the issues and defects which were to emerge was exacerbated by the decision that the Reference Design Team (including the engineers that designed the EM) would be ring-fenced from the procurement exercise. They had no involvement in the procurement exercise and did not know how the EM would be used during the procurement exercise. Bidders had no opportunity to discuss matters with the engineers who produced the EM. Had they been able to do so, the engineers would have been available to explain that the EM was not a fixed client brief. In the absence of the engineers who had produced the EM, there was no scope for prospective bidders to discuss whether the values set out in it which did not comply with SHTM 03-01 were deliberate or a mistake.

14.25. A further feature of the arrangements that contributed to the issues with the strategic definition and brief was the lack of input from clinicians into the EM. The engineers who produced the EM decided to include a "Room Function Reference Sheet". Once a room function was ascribed to an area, the ventilation parameters for that room function were used regardless of the department in the hospital in which a particular room was situated. This judgment as to room function was made by an engineer with no input from an infection prevention and control specialist or other clinician. Had clinician input been obtained through the medium of dialogue with the relevant engineer, it is unlikely that inappropriate room functions would have been ascribed to rooms in critical care.

14.26. There was a lack of direct contact between clinicians and bidders during the procurement exercise. This was described as highly unusual for a project of this nature. Had there been more of such contact, again by way of dialogue between engineers and clinicians, there is a chance that the issues could have been identified.

14.27. There was, however, no overarching problem with the procurement procedure chosen by NHSL. Competitive dialogue was entirely suitable for the procurement of the Project but there were ambiguities and inconsistences in the Invitation to Participate in Dialogue (ITPD) and the Invitation to Submit a Final Tender ISFT which had the potential to mislead prospective bidders, and which, according to the successful bidder, IHSL, did mislead it. It was not clear from the procurement documentation whether the EM was a fixed client brief or a document on which no reliance could be placed. Had the status of the document been made clearer, the issues are unlikely to have occurred.

14.28. Tenderers effectively self-certified compliance with the Board's Construction Requirements. A more intense review of tenders might have identified the issues with the EM. However, this would have required a significant amount of extra work and, on the evidence, I have not been persuaded that such work would have been proportionate at the tender assessment stage.

14.29. NHSL went through the procurement process and concluded the Project Agreement without providing a clear and robust ventilation brief to prospective bidders and then the preferred bidder. This led to a continued lack of clarity as to what were NHSL's requirements for the ventilation system.

Term of Reference 3

14.30. NHSL put in place governance procedures to oversee the project. These were in line with the procedures set out in the Scottish Capital Investment Manual. Similarly, NHSL provided an operational management structure. It appointed technical advisers. I heard nothing to suggest that these structures were not adequate.

14.31. The project was overseen at key milestones. However, in a number of instances what may be regarded as either a governance process or an aspect of operational management was ineffectively implemented.

14.32. The risks of using the EM from the capital funded phase for the revenue funded phase were inadequately assessed or mitigated. No risk assessment was conducted around the inclusion of the EM in the ITPD. The EM was provided to tenderers with insufficient assessment as to whether it would be useful, or whether, in the context in which it was presented, it could be misunderstood. The lack of a suitable risk assessment is the genesis of many of the problems that arose on the project.

14.33. In resolving the issues which were the subject of Settlement Agreement 1 (SA1), NHSL agreed to a solution which, in relation to bedrooms in the critical care department, resulted in a built environment which was not appropriately safe for patients.

14.34. The project team determined that the proposed technical solutions set out in SA1 were acceptable to NHSL. The governance bodies were told the technical solutions were appropriate. There was however no vouching provided by the project team to support this view. In particular, no report from the Infection Prevention and Control team (IPCT), engineers or technical advisers was provided. The technical advisers had declined to sign off on the appropriateness of the solution as they were not designers and did not wish to take on design responsibility. This absence of assurance does not appear to have been reported to the governance bodies, including the Finance and Resources Committee and the Board of NHSL. There was a misunderstanding on the part of NHSL as to what assurance could be taken from the advice provided by technical advisers.

14.35. As a matter of generality, decision makers did seek and obtain appropriate advice. Input was provided by clinicians, IPC specialists, estates officers and technical experts. However, not all relevant disciplines were always involved at the correct times. In particular, there appears to have been no IPC input to the decision to accept the technical solution set out in SA1. Moreover, NHSL staff with the requisite knowledge did not always combine that knowledge to reach the correct conclusion. NHSL's project clinical director and commissioning manager between them knew enough about the clinical context, the proposed technical solution, and the SHTM guidance, to identify the departure from guidance consequent on SA1, but did not identify that departure because each lacked information that the other had.

14.36. There is no evidence indicating that there were issues with organisational culture that discouraged staff from raising concerns. There were formal policies in place in relation to raising concerns and whistleblowing in particular.

14.37. Staff did raise concerns during the project. By way of example, Dr Inverarity raised concerns in relation to the lack of a suitable validation report. This led to a suitable inspection and report being instructed and the detection of the ventilation problems before patients were transferred to the hospital.

Term of Reference 4

14.38. There is no evidence indicating any deliberate concealment or failure to disclose wrongdoing of failures in performance or inadequacies of systems. NHSL had in place policies and procedures intended to encourage disclosure and reporting of any such instances.

14.39. NHSL had whistleblowing policies in place during the project and there were a variety of channels through which concerns could be raised.

14.40. From September 2005, NHSL had in place a “Freedom of Speech Policy and Procedure”. This policy was for staff to raise concerns at work and where the NHSL grievance procedure and wider polices such as race equality and equal opportunities would not be appropriate.

14.41. In 2016, this was replaced with the “Whistleblowing Policy and Procedure”. The purpose of this policy “is to ensure employees have a proper and widely publicised procedure for voicing whistleblowing concerns.”

14.42. In 2019, NHSL introduced “Speak Up”, an initiative designed to encourage staff to feel safe and supported in raising concerns. This was introduced so that staff who had a concern could discuss this confidentially and receive advice and guidance on what to do next to address the issue.

14.43. NHSL had in place Incident/Adverse Event Management Policies throughout the period of the project which provided another avenue through which concerns could be raised.

Term of Reference 5

14.44. The Scottish Government, and the Cabinet Secretary in particular, had ultimate responsibility for the promotion in Scotland of a comprehensive and integrated health service. However, the responsibility for delivering the RHCYP and DCN project lay with NHSL.

14.45. The Scottish Government had a financial and performance oversight role. Once the funding had been put in place, national oversight was relatively limited. The Scottish Government would only have further involvement if the project experienced problems.

14.46. A degree of national oversight was provided in relation to SA1, which required the submission of a business case to Scottish Government. SA1 involved an agreement between NHSL and IHSL of a list of resolutions to a number of technical issues. This included agreed resolutions for ventilation for four-bedded rooms, single bedrooms and neutropenic patient areas. Statements made to the Scottish Government on the suitability of the technical solutions set out in SA1 were taken at face value without any supporting material. For example, no view was sought from HFS and no report from a qualified expert was provided to confirm that the works were necessary and appropriate.

14.47. However, unless a full audit of the proposed technical solution had been instructed, it is difficult to see how the issues could have been detected. It is not clear that HFS had the internal capacity to undertake such an audit, and procuring an audit would have caused delay and incurred additional cost. It was appropriate for the Scottish Government to rely on the assurances provided to it on technical matters. It would not have been proportionate for the Scottish Government to conduct a technical audit.

14.48. Ms Freeman nevertheless identified gaps in how the Scottish Government obtains assurance and provides support on technical matters. Significant and substantial steps have been taken to address them. Further assurance would now be provided within the health board through its Ventilation Safety Group, with additional oversight and support external to the health board from NHS Scotland Assure.

14.49. There was very substantial national oversight from 2 July 2019 when the Cabinet Secretary took control of key decision-making. Ms Freeman was only prepared to allow the hospital to open when she received assurances that it fully complied with the relevant published guidance. Regular briefings were provided to the Cabinet Secretary on the progress being made in rectifying the issues with the ventilation system. There was also additional national oversight and support through use of the "NHS Board Performance Escalation Framework". NHSL was escalated to Stage 3 and then Stage 4 of the Framework during the project.

14.50. National oversight and support for the project also came from SFT. This involved assistance for NHSL in preparing the project for procurement under an NPD structure and in carrying out Key Stage Reviews at important stages in the procurement process. SFT's focus, consistent with the nature of its expertise, was on the commercial and financial aspects of the project. This included an interest in design and the terms of the Project Agreement insofar as they impacted upon those aspects. It was not part of SFT's role to consider compliance with technical guidance or to detect errors at the level of detailed parameters in an environmental matrix of which the Board and its advisers were unaware.

14.51. The available evidence indicates that there were effective communications between NHSL and the Scottish Government in the period up to 4 July 2019. Updates were provided to the Scottish Government on the progress of the project, and the Scottish Government provided and sought information as was necessary.

Term of Reference 6

14.52. The commissioning of the ventilation systems and the certification of practical completion of the works were conducted in line with the contractual requirements. The system was not tested against the requirements of SHTM 03-01 until independent validation by IOM in June 2019. The Project Agreement contained no requirement for commissioning and validation to be undertaken in accordance with SHTM 03-01. The Project Agreement contained provisions relating to quality control and commissioning, and made provision for an Independent Tester who would provide a certificate confirming the hospital was complete in accordance with completion criteria. These completion criteria included the provision of commissioning data demonstrating compliance with the environmental matrix.

14.53. At the stage of practical completion, as certified by the Independent Tester, NHSL considered that the system had been designed to fully comply with SHTM 03-01 with the exception of known derogations for the neutropenic ward, and from 6 to 4 air changes in single bedrooms. Otherwise, NHSL did not understand there to be any difference between the contractual requirements and the requirements set out in the relevant guidance.

14.54. SHTM 03-01 (2014) made provision for commissioning and, separately, validation. At the end of the validation process, a validation report was to be produced. There was uncertainty on the part of NHSL as to how the ventilation system would be validated. Ronnie Henderson (NHSL's commissioning manager) explained in his evidence that complications arose due to the NPD model. NHSL had responsibility for providing healthcare at the hospital. However, it did not own the building. The building was owned by IHSL. Mr Henderson was therefore unclear as to what reports should have been instructed or obtained by NHSL as opposed to IHSL.

14.55. Documentation as to commissioning was provided by IHSL to NHSL. Mr Henderson was initially content with this. However, the NHSL IPC team were not content with the available information which required an interpretation of raw data, and wished to see a report that complied with the guidance set out in SHTM 03-01. In particular, they wished to see a clear statement that there was performance to the standard specified by SHTM 03-01 and that only routine maintenance would be required. The project team agreed to additional testing as they wished IPC to be wholly satisfied with the technical performance of the ventilation system. IOM was instructed to carry out an independent validation of the system.

14.56. The testing conducted by IOM identified that for certain spaces in the hospital the pressure regime and air changes did not conform to the guidance set out in SHTM 03-01.

14.57. No issues have been identified as to the adequacy of the information and training provided on the operation and maintenance of key building systems.

Term of Reference 7

14.58. To remedy the defects, the critical care ventilation system was effectively replaced. On 8 August 2019, the Oversight Board agreed in principle that:

> "…if a technical solution was designed that would allow 10 air changes per hour in the required rooms in the critical care area, which complied with the relevant SHTM standard, and was properly implemented, then the critical care area would be fit for use."[1112]

14.59. Imtech and Hoare Lea were engaged to design and install a ventilation system that provided positive pressure and 10 air changes per hour.

14.60. The revised specification for the ventilation system is set out in HVC 107 and Settlement Agreement 2. These documents set out that NHSL wished to amend the critical care ventilation system from 4 ac/h to 10 ac/h with an associated change to the pressure regime.

14.61. In accordance with clause 33 of the Project Agreement and schedule part 16 of the Project Agreement, NHSL issued IHSL with a Board Change Notice in respect of the required works.

1112 A40933361 - Oversight Board Papers - HC2024.B3 - page 44.

14.62. HFS was involved in relation to reviewing NHSL's proposed permanent solution for the ventilation system and the "…contracting, design, installation, commissioning and setting to work processes as well as assurance around the appropriate advice on infection control." All topics were to be reviewed from Estates and IPC perspectives and an assessment made against the published guidance.

14.63. John Rayner, Authorising Engineer, issued a design assurance statement on 17 May 2020. He stated that, following a review of the design, he was satisfied that it met NHSL's performance requirements. HFS was content with the proposed solution albeit HFS was not taking design responsibility itself. MML confirmed that it had identified no "red flags" in relation to the proposed solution albeit it did not provide design assurance.

14.64. The works were carried out and testing was undertaken by IOM. IOM confirmed that the ventilation system met the requirements of SHTM 03-01. Mr Maddocks provided the Inquiry with an expert report confirming that the system is designed, and operating, in conformity with SHTM 03-01.

14.65. Mr Henderson, Paul Jameson of IOM and John Rayner (Authorising Engineer) were content that air handling units were acceptable to the client because, at the time of validation, they were considered fit for purpose and would only require routine maintenance in order to remain so for their projected life.

14.66. All of the evidence before the Inquiry indicates that the remedial works were adequate and effective. No witness has expressed any concerns about the safety of any key building system at the RHCYP and DCN since the hospital opened.

Term of Reference 8

14.67. The physical, emotional and other effects on patients and families were the subject of evidence led at the first of the hearings held by the Inquiry. That evidence indicated that patients and families were shocked and extremely concerned by the decision to cancel the opening of the hospital. In relation to the RHCYP, children required to be treated in a suboptimal Victorian building. In relation to the DCN, there was a known risk of harm to patients due to the problems with the water system which NHSL required to manage to seek to reduce the risk of harm to patients.

14.68. A large number of patients, and appointments for medical treatment, were impacted by the decision not to open the new hospital. Approximately 2255 appointments required to be rescheduled immediately. Of these, 1586 related to paediatric patients and 669 to DCN patients.

14.69. No formal complaints were received by NHSL or the Scottish Government in relation to the decision not to open the hospital.

14.70. The evidence indicates that NHSL informed all patients of the fact that appointments would not be taking place at the RHCYP and DCN as planned. A strategy was put in place to seek to ensure that patients and families knew where to attend for treatment. No evidence was led of any adverse issues surrounding that communication.

14.71. Neither NHSL nor the Scottish Government provided patients and families with a direct explanation for the reasons the RHCYP and DCN did not open as planned. The Cabinet Secretary sent two letters to staff providing an explanation of the situation. However, no similar letters were sent to patients and families. Tim Davison (Chief Executive, NHSL) and Ms Freeman agreed that the communication to patients and families was unsatisfactory in this regard. Ms Freeman acknowledged that if a similar problem was to arise in the future, letters explaining the situation should be sent to patients and families.

Term of Reference 9

14.72. This is not applicable to the RHCYP and DCN.

Term of Reference 10

14.73. The choice of site was appropriate. It allowed the hospitals to be situated beside the existing Royal Infirmary of Edinburgh. There is no evidence available to the Inquiry indicating that the choice of site gave rise to an increased risk to patients of environmental organisms causing infection.

Term of Reference 11

14.74. There were no systematic knowledge transfer arrangements in place to learn lessons from healthcare construction projects in the period prior to the creation of Assure.

14.75. The Scottish Government did write to health boards in relation to certain discrete issues that arose on the QEUH. However, the evidence before the Inquiry indicates that there was no centralised system for capturing and recording learnings from healthcare construction projects. Therefore, any board faced with a new build hospital project would not have been able to readily access learning from previous projects.

14.76. The landscape for projects has changed with the creation of Assure. It is a specialist body which is intended to gather knowledge and experience about healthcare building projects, and make it available to boards undertaking new projects. This should allow lessons to be learned on an ongoing basis.

Term of Reference 12

14.77. NHSL had some opportunities to learn lessons from the experience of issues in relation to ventilation and water at the QEUH, albeit that the information available at the relevant time was limited.

14.78. The Scottish Government wrote to all health boards in relation to the risk of cryptococcus following issues emerging at the QEUH. This prompted NHSL to seek assurances in relation to the design of the hospital. An assurance was provided by IHSL that there was full compliance with SHTM 03-01 as required.

14.79. There were wider opportunities to learn from experiences at the QEUH. For example, there was contact between Dr Inverarity and Dr Inkster in relation to emerging issues at the QEUH and Dr Inverarity knew, in 2018, that issues had arisen with the ventilation system at the QEUH that needed significant remedial works to be carried out. He sought to avoid similar issues occurring at the QEUH.

14.80. The more difficult question is whether such opportunities as there were to learn from the experiences at the QEUH arose at a point in time when knowledge about them might have avoided similar issues at the RHCYP and DCN. The key dispute in relation to the RHCYP and DCN came to a head in 2018. Agreement was reached and the works to the ventilation system were carried out in 2018, albeit the agreement was not formally approved and documented until February 2019. Over this period of time, there was little concrete evidence available to NHSL about the problems with the QEUH ventilation system. Therefore, learning opportunities were limited. The Inquiry has yet to hear detailed evidence about the issues relating to ventilation at the QEUH. The point as to whether NHSL had the opportunity to learn from experience of issues in relation to ventilation at the QEUH will, therefore, be kept under review until this evidence is heard.

Chapter 15

Recommendations

Chapter 15

Recommendations

Introduction

15.1. Following the conclusion of the evidence specific to the RHCYP and DCN project I invited Counsel to the Inquiry and the legal representatives of Core Participants to make closing statements. Included in the closing statement by Counsel were proposed recommendations that I might make in fulfilment of Term of Reference 13. Counsel distinguished between recommendations which might be made in this interim report and those which might better be made in a final report in light not only of the evidence led so far but also the further evidence to be led which is specific to the issues relating to the Queen Elizabeth University Hospital and Royal Hospital for Children, Glasgow.

15.2. The responses from the Core Participants who took the opportunity to comment on Counsels' proposals were, in large part, in agreement with what he had put forward. That substantial consensus is reflected in the recommendations which follow.

15.3. In presenting the recommendations I acknowledge that there have been a number of developments since 2019 and the Cabinet Secretary's announcement of the public inquiry. Some of them can be taken to have been in response to issues discussed in this interim report. They include the establishment of NHS Scotland Assure and the inauguration of its workstreams, and the updating of Parts A and B of SHTM 03-01 in the interim version of 2022 (and with that updating, provision for the establishment of a Ventilation Safety Group) which it is anticipated will shortly be superseded by the further versions of Parts A and B currently under preparation.

A communication strategy for patients and their families

15.4. Patients and families were not provided with a direct explanation for the reasons the RHCYP and DCN did not open as planned, by either NHSL or the Scottish Government. Neither the Scottish Government nor NHSL engaged with the Family Council, whose role was to "represent the patients and families and engage with those running the hospital", on matters relating to the delay. Communication with patients and families was unsatisfactory in this regard.

15.5. There is a cohort of young patients who are very seriously ill and spend a significant portion of their time, sometimes much of their lives, in hospital. They are supported by family members or guardians. The hospital becomes, for these patients and their families or guardians alike, their second home.

15.6. The impact of unclear or poor communication on the wellbeing of patients and their families during what may already be a very difficult, emotional, and uncertain period in their lives, is not to be underestimated.

15.7. Health boards must ensure that in the event of any adverse situation that could affect the wellbeing of patients and their families, there is a communication strategy in place to liaise with this crucially important group. The Scottish Government should ensure that this liaison is supported in any overarching communication strategy it may wish to introduce.

Risk assessment if there is a change in the arrangements for funding a project

15.8. The RHCYP and DCN project demonstrates that risks can arise if design or specification-related material generated in the context of one funding model is then used, without proper assessment of the risks of doing so, after the funding model has been materially changed. An environmental matrix developed during the capital funded phase of the project was used after a change to a revenue funded model without any or any sufficient assessment of why this was being done and how doing so might impact on parties' understanding of its significance and on their contractual relationship.

15.9. Accordingly, in situations where the funding model or procurement route changes mid project, a risk assessment should be conducted to assess whether work done on the project up to that point is suitable for the revised project. The rationale for decisions taken in this regard should be formally recorded.

15.10. The party carrying out the risk assessment should be the party on whom the potential risk falls and which is in a position to mitigate the risk, unless there are sound reasons why this should not be the case. In the case of the RHCYP and DCN project that party was NHS Lothian, notwithstanding that it was Scottish Government that made the decision to change the funding route, and consequentially, the contractual model.

Clarity in the brief for the construction or refurbishment of a healthcare facility

15.11. It is critical that a health board formulates and then presents its requirements for the key building systems in a proposed healthcare facility (its "brief") in terms which are full, clear, and unambiguous, and that that brief is finalised before a contract is signed and Financial Close is achieved. While development of the design can be carried over to a later phase, clarification of the health board's brief should not be.

15.12. The health board, in consultation with relevant stakeholders and its clinical and technical advisers, is best placed to identify which output parameters of key building systems are required for the particular clinical uses it intends for the facility and its constituent parts (and how these uses may change and develop). These should be specified by the board as part of its brief and not left to the judgment of the project company and its subcontractors during the design phase. Identification of environmental output parameters should not be regarded as a matter of design; design should address how previously determined environmental parameters are to be achieved, not whether they should be achieved. In determining what the specified environmental parameters should be, the board should follow the recommendations in Scottish Health Technical Memoranda, including SHTM 03-01, in their most recent versions (which can and should be regarded as statements of current good practice), subject to any derogations agreed in writing by, in respect of ventilation, the board's Ventilation Safety Group (VSG). In the event of a derogation being proposed, the relevant recommendation should be specifically identified, and the derogation should only be agreed where there is convincing evidence that the proposal will provide a degree of safety no less than if the recommendation had been followed. If a proposed derogation is agreed, the reasons for it and any limitations on its application should be recorded, all as is currently required by SHTM 03-01 Part A Interim Version (February 2022) paragraph 4.10.

15.13. While a health board should follow the recommendations of the relevant current Scottish Health Technical Memoranda (subject to duly agreed derogations) in formulating its brief, and it may, separately, choose to include a general obligation on the contractor to comply with Scottish Health Technical Memoranda, it should never rely on reference to such a general obligation as a substitute for presentation of the brief in the manner set out below.

15.14. The purpose of the brief is to ensure that the facility and its building systems meet the clinical requirements of the board. Accordingly, the brief should include, as a minimum, a clinical output based specification for departments or other areas having a clinical function, setting out the patient cohorts and activities which these areas are intended to accommodate, together with a schedule of accommodation identifying how areas are to be laid out and their adjacency to other areas. In addition, the brief should include documentation identifying the environmental parameters of all spaces within such areas, including the ventilation parameters. There should be precisely specified references to air change rates, pressure differentials, levels of air filtration and temperature, the specifications being set out either in room data sheets or in an environmental matrix which comprehensively and exactly identifies every space within the proposed building.

15.15. While, as a matter of contract, design responsibility may lie with the Project Company, ensuring that the health board's requirements are met should be regarded as a joint objective of parties to be arrived at collaboratively. Accordingly, the procurement process should accommodate a gateway meeting prior to Financial Close at which a common understanding of the health board's brief is agreed and recorded.

Requirement for a standard form for derogations from guidance

15.16. As is noted above, the most recent version of SHTM 03-01 now requires the Ventilation Safety Group to scrutinise and agree in writing any decision to depart from guidance. The current version of SHTM 03-01 also requires that the reason for the derogation or alternative design strategy, and the limits to its application, should be recorded, and that designers proposing a derogation or alternative design strategy should be able to supply a body of evidence showing that their proposal will provide a degree of safety no less than if the guidance in SHTM 03-01 had been followed. However, there is no method designated for how this should be done.

15.17. The evidence before the Inquiry from the public sector (including NHSL), and industry, indicated that a standard form of derogation for use throughout the NHS in Scotland would be beneficial. This would ensure that derogations are captured and recorded in a uniform way. This would result in consistent and uniform practices. It would also bring clarity to how and why a derogation is agreed and ensure that the approval of all parties is recorded in an appropriate and familiar way. I would accordingly recommend that NHS Scotland Assure, in exercise of its guidance function, prepare and issue a suitable standard form for a derogation to be used by healthcare organisations throughout Scotland.

15.18. The precise structure of such a standard form would be for NHS Scotland Assure to determine, following consultation with stakeholders but, having regard to the evidence available in the report dated 10 June 2024 by the Inquiry's expert, Andrew Poplett, my expectation would be that it would be of the nature of a template for a readily accessible document held in a database or other digital file which records: the facility or operation which is the subject of the derogation and its current application; the provision being derogated from; the precise extent of the derogation; the reasons for the derogation; the predictable consequences of the derogation; and the mitigation put in place to ensure a degree of safety no less than if the relevant guidance had been followed.

15.19. The standard form might incorporate or otherwise include a decision-making algorithm such as the questionsets prescribed for the HAI-SCRIBE process under SHFN 30.

Duplication of procedures

15.20. A range of procedures now exists to help ensure health board projects meet appropriate standards. One is the NHS Scotland Design Assessment Process ("NDAP"). There is also a Sustainable Design and Construction Procedure ("SDAC"). In addition, there is the NHS Scotland Assure Key Stage Assurance Review (KSAR) procedure. These can be time-consuming and demanding to complete. There is a risk that they become unduly bureaucratic and focused on process rather than substance. It is important that they be streamlined, and potentially merged, to ensure they are thorough and robust whilst avoiding duplication and unnecessary delay and

cost. They must be genuinely helpful to boards and cognisant of the commercial and other pressures likely to affect projects.

15.21. Consideration should also be given to how complimentary procedures - such as aspects of the HAI-SCRIBE process set out in SHFN 30 - can potentially be streamlined to avoid duplication with other processes.

Information about common errors

15.22. SHFN 30 (2007) included a list of common errors occurring in the design and construction of projects. These included incorrect air turnover and airflow patterns. This was removed from the most recent version of SHFN 30 (2014), but the RHCYP and DCN project demonstrates that the risk persists. NSS explained to the Inquiry that the expansion of the questions within HAI-SCRIBE was intended proactively to facilitate discussions on risks, which would reduce the risk of common errors being repeated.

15.23. It is important that common project errors are not repeated. One helpful step is to ensure health boards undertaking projects have information about such common errors, and that this information is clearly communicated to them. This would ensure that health boards are aware of such errors and thereby better equipped to avoid them. The information should be updated as new, significant errors are identified. It should be drafted to be genuinely useful, so should focus on material errors which, if repeated, would have a material impact, and for which there are identified solutions which are capable of being readily implemented.

15.24. I understand NSS to be conscious of the value of making information on common project errors generally and readily available to health boards, and that it has in hand means of doing so. On 13 December 2022 NSS published a paper on its website which identifies lessons learned by HFS and ARHAI from significant healthcare construction projects, titled “NHS Scotland Assure Lessons Learned: Overview for the Interim Review Service”. The Inquiry was advised that work is underway both to update this publication and to refine the mechanisms for sharing lessons learned. Assure has a programme of learning network events intended to allow health boards to assist Assure in identifying how it can better support other health boards about to go through the same process. Escalation of any immediate risks identified through the KSAR process is intended to take place through either Incident Reporting and Investigation Centre alerts, Scottish Government, or the National Strategic Groups.

15.25. I recognise that NSS is engaged in proactively applying the lessons learned from projects to develop its own guidance and processes, and that this learning is shared with health boards. While I commend this approach, I would recommend that Assure should consider, in consultation with relevant stakeholders, whether and how to provide health boards with more detailed information about common errors and issues experienced with projects than is currently provided. For example, while I acknowledge that the 2022 paper is currently being updated and that it may be intended for a quick and preliminary reference online, I would

observe that the examples of lessons learned listed there are referred to in very brief terms indeed. While I understand that brevity is desirable, a list of problems identified by short bullet points provides little by way of learning as to why it was that the problems came about, how they could have been avoided and whether and how they were resolved. NHS Scotland Assure could develop its documentation on learning from common errors in these directions.

Validation for revenue funded projects

15.26. It is clearly desirable that a health board has the assurance prior to the handover of a new or refurbished healthcare facility that the facility's specialised ventilation systems have been independently validated by an Authorising Engineer as fit for purpose and capable of achieving the operating performance originally specified.

15.27. I accordingly recommend that, whatever the method adopted for funding, contracts for the construction of new hospitals should permit independent validation by an Authorising Engineer, appropriately witnessed and with safeguards for all parties. The independent validation should be undertaken on behalf of the health board in accordance with the guidance contained in SHTM 03-01 (2022) with a view to a report or reports being sent to the health board's lead project manager.

15.28. In making this recommendation I acknowledge that simply to permit a healthcare provider to carry out independent validation, does not necessarily bring with it any contractual consequences in the event of failure to meet requisite standards; it is merely a way of providing the client with information. As a further step, I see merit in consideration being given as to whether the standard form of contract for revenue-funded projects requires more radical revision. Such revision would be with a view to strengthening the healthcare provider's power to ensure that the completed facility is fit for purpose and constructed in accordance with the healthcare provider's requirements, before the provider accepts handover.

Role specifications

15.29. There are two aspects to this: (1) role specifications within the NHS; and (2) the role of advisers to NHS bodies responsible for construction contracts.

15.30. Within NHS Scotland, there is clear guidance that there should be a partnership approach to new-build hospital contracts, with all relevant disciplines (clinicians, infection prevention and control teams, estates personnel and engineers) being involved. Examples of that can be seen in SHFN 30 (2014) and SHTM 03-01 (2022). However, SHFN 30 and SHTM 03-01 do not make clear just what are the tasks that each discipline should undertake. This risks undermining the partnership model as there is scope for different disciplines to consider that a specific issue or decision is not within their sphere of knowledge, and/or that it is not for them to be actively involved in that issue or decision. There is also a risk that disciplines are involved at some stages where this is not necessary or beneficial. This risks wasting limited resources. For example, there may be an expectation for clinicians and Infection Prevention and Control (IPC) professionals to be involved in highly

technical meetings about engineering issues that they have no experience in and can contribute nothing to; or where well-established guidance can be applied without giving rise to any clinical or infection control issues on which their expertise is needed.

15.31. All the evidence before the Inquiry spoke to the soundness of the proposition set out in SHFN 30 (2014): that for HAIs to be reduced, it is imperative that Infection Prevention and Control (IPC) measures are "designed-in" and IPC risks are "designed-out" at the very outset of the planning and design stages of a healthcare facility and that input continues up to, into and beyond the final building stage. Similarly, there is no question but for that to be achieved, decision-making in relation to the design and construction of hospital buildings requires to be informed by the expertise of IPC practitioners, both doctors and nurses. However, the demands placed on these practitioners to apply their expertise to construction and refurbishment projects, to which have recently been added the demands associated with the Assure KSR process, cannot help but be at the cost of diverting them from their core clinical duties. The Inquiry also heard evidence that the precise nature of these demands can seem to practitioners to be unreasonable. Some IPC practitioners believe that they are being forced into the role of building or quality control officers, a role they do not find congenial or for which they consider themselves well-equipped. They can feel that they are being put under pressure to "sign off" technical aspects of the design of key building systems for which they have no relevant expertise.

15.32. I accordingly recommend that priority be given to protecting scarce IPC resources. With that objective in view, what is expected of consideration and advice from individual disciplines at various stages of a project should be made clear. Job and role specifications for various disciplines, particularly IPC should be similarly identified. I acknowledge that work which may achieve these objectives is already underway. NHS NSS is currently in the early stages of producing a replacement for Frameworks Scotland 3, the primary procurement vehicle for major capital projects, and expects to further consider roles and responsibilities as part of this work, in collaboration with stakeholders. The Inquiry heard evidence that NHS National Education Scotland is working on a knowledge and skills framework for the built environment. The Chief Nursing Officer advised that it is proposed to produce a role specification for IPC teams. I recognise too that at a project level, it is the responsibility of the senior responsible owner, project director and project board, committee or steering group to define the specific roles, responsibilities and project governance. This should be done when setting up procedures such as the Project Initiation Document and Project Execution Plan.

15.33. More generally, consideration should also be given to whether there are sufficient IPC professionals to resource the current system. It is less than satisfactory to impose further duties on a service which is already over-stretched. Several witnesses raised concern about there being insufficient IPC staff to implement the procedures introduced by Assure. As is obvious, if there are insufficient personnel to resource the system, it will not work effectively.

15.34. A similar issue as to role definition and the tasks which particular professional persons should be expected to take on, arises in relation to advisers. The evidence before the Inquiry indicated that there was a lack of clarity in relation to what advice and assurance (if any) MML were providing.

15.35. There was an associated absence of contemporaneous documentation demonstrating when technical advice was sought and when technical advice was provided. This was contrasted with the role of the solicitors engaged on the project. When legal advice was sought, there tended to be a very clear instruction with a very clear statement of the advice provided in response.

15.36. I accordingly recommend that a similar procedure should be considered when technical advisers (particularly engineers) are providing specific technical advice in relation to a project such as the RHCYP and DCN. There should be a clear record of the advice requested, and the advice tendered. This should ensure that there is clarity around what expert input advisers are providing in circumstances where such input is required. This is particularly important where, as on the RHCYP and DCN project, the technical advisers work closely day-to-day with the health board's project team and are engaged in commenting on design or construction proposals. Such arrangements can lead to informality and a lack of clarity about the scope and role of the advice, and the reliance which can be placed upon it. In contrast, the approach I recommend should be such as to generate a sufficient body of evidence to support and document relevant decisions. This should contribute to more robust governance and oversight of decision making.

15.37. This issue was highlighted in the Grant Thornton report where similar recommendations are made to what is set out above. NHSL has taken steps to address the issue. However, it is not clear from the available evidence that any such changes have taken place more widely within the NHS. I accordingly recommend that a uniform policy or procedure should be adopted for health boards undertaking new build hospital projects in relation to obtaining, and recording, technical advice on key issues.

Training

15.38. Good decision-making about building engineering systems and their role in infection control depends upon contributions from a number of distinct professional disciplines, in particular engineers, infection prevention and control (IPC) professionals and clinicians. Their decisions are likely to be improved if each has a basic understanding of the way in which the various disciplines overlap in ensuring patient safety and care.

15.39. Healthcare engineering does not feature in the mandatory training for microbiologists or IPC professionals. The evidence indicates that there is the potential for individuals with little or no training, or practical experience of the key building systems in a hospital (for example, water and ventilation), to be asked to undertake key roles on projects.

15.40. I would recommend that IPC professionals should receive some basic training on the recommendations made by the NHS's own guidance for engineering systems, insofar as they are made in the interests of patient safety and care, before they are recruited to work on large scale hospital projects.

15.41. Similarly, engineers would benefit from basic training on infection control principles and clinical requirements before embarking on new build hospital projects.

15.42. Clinicians involved in projects would also benefit from basic training in the recommended output parameters of building engineering systems which have a direct bearing on the safety and care of patients in their departments.

Appendix 1

Dramatis personae

Appendix 1

Dramatis personae

Hulley & Kirkwood

Michael O'Donnell: Chartered Engineer (Mechanical and Electrical Services).

IHS Lothian, Multiplex, TÜV SÜD/Wallace Whittle and Hoare Lea

John Ballantyne: Bid Leader and Project Director, Multiplex.

Liane Edwards-Scott: Design Manager, Multiplex.

Ken Hall: Mechanical and Electrical Design Manager, Multiplex.

Stewart McKechnie: Mechanical Engineer and Director, TÜV SÜD/Wallace Whittle.

Darren Pike: Project Director, Multiplex.

Paul Serkis: Commercial Director, Multiplex.

Paul Winning: Director, Hoare Lea.

Matt Templeton: Consultant 2018 to 2019, Director of IHSL from January 2019.

Mott MacDonald Limited

Richard Cantlay: Lead Technical Adviser; Lead NPD Procurement Adviser, 2011.

Graeme Greer: Project Manager and Lead Technical Adviser.

Colin Macrae: Senior Building Services Engineer.

Willie Stevenson: Technical Adviser.

David Stillie: Design Manager and Architect Lead.

NHS Lothian

Jim Crombie: Deputy Chief Executive; Acting Chief Executive July 2016 to January 2017 and April 2018 to August 2018; Senior Responsible Officer for RHCYP and DCN project from February 2015.

Brian Currie: Project Director of the RHCYP and DCN project from August 2009.

Timothy (Tim) Davison: Chief Executive from May 2012 to August 2020.

Tracey Gillies: Executive Medical Director since February 2017.

Susan Goldsmith: Finance Director from November 2008 to May 2022; Senior Responsible Officer for the RHCYP and DCN project from July 2012 to February 2015.

Iain Graham: Director of Capital Planning and Projects since June 2009.

Lindsay Guthrie: Associate Director IPC since January 2021; Acting Head of Service IPC October 2019 to March 2020; Lead Infection Prevention and Control Nurse since 2015.

Ronald (Ronnie) Henderson: Senior Capital Programme Manager since May 2021; Commissioning Manager, Hard Facilities Management, Project Team, June 2016 to May 2021.

Brian Houston: Chairman of the Lothian Health Board, 2013 to 2020.

Donald Inverarity: Consultant medical microbiologist and Lead Infection Prevention and Control Doctor.

Janice Mackenzie: Clinical Director, Project Team, 2012 to 2019.

Alexander McMahon: Executive Director for Nursing, Midwifery and Allied Health Professionals, 2016 to 2021.

Jacqueline (Jackie) Sansbury: Head of Commissioning, Project Team, 2012 to 2019; Project Sponsor and Director of Strategic Planning until July 2010.

Sarah Jane Sutherland: HAI-SCRIBE Advisor, December 2018 to June 2022; Infection Prevention and Control Nurse, 2014 to 2018.

NHS National Services Scotland

Julie Critchley: Director, NHS Scotland Assure.

Susan Grant: Principal Architect, Health Facilities Scotland.

Edward (Eddie) McLaughlan: Assistant Director, Engineering, Environment and Decontamination, Health Facilities Scotland.

Mary Morgan: Chief Executive, since April 2021; Director of Strategy, Performance and Service Transformation, October 2018 to April 2021; Senior Programme Director for the RHCYP and DCN project, September 2019 to April 2021.

Thomas Rodger: Chief Engineer, NHS Scotland Assure.

Other individuals consulted

Peter Hoffman: Public Health England.

Teresa Inkster: Consultant microbiologist, Queen Elizabeth University Hospital, NHS Greater Glasgow and Clyde.

Paul W Jameson: Authorising Engineer, IOM.

John Rayner: Authorising Engineer for ventilation, Turner Pes.

Malcolm Thomas: Consulting Engineer.

Scottish Futures Trust

Peter Reekie: Chief Executive Officer, Scottish Futures Trust.

Scottish Government

Mike Baxter: Deputy Director, Health Finance Directorate, February 2009 to December 2014.

John Connaghan: NHS Scotland Chief Performance Officer, January 2019 to March 2020; NHS Scotland Chief Executive since March 2020.

Jeane Freeman: Cabinet Secretary for Health and Sport, June 2018 to May 2021.

Christine McLaughlin: Director of Health Finance and Chief Finance Officer.

Alexander McMahon: Chief Nursing Officer since 2021.

Fiona McQueen: Chief Nursing Officer November, 2014 to April 2021.

Alan Morrison: Deputy Director of Health Infrastructure and Sustainability since March 2020; Capital Accounting and Policy Manager for Health Infrastructure, January 2015 to March 2020.

Malcolm Wright: Director General for Health and Social Care and NHS Scotland Chief Executive, 2019 to July 2020.

Appendix 2

List of witnesses

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List of witnesses

Participants at the Inquiry's hearing on the impact to patients and their families, held from September to November 2021:

Abishek Behl

Mark Bisset

Lesley King

Haley Winter

Participants at the Inquiry's Edinburgh I hearings held in May 2022:

Michael Baxter, Scottish Government

Richard Cantlay, Mott MacDonald Limited

Sorrel Cosens, NHS Lothian

Brian Currie, NHS Lothian

Shaun Fitzgerald, Inquiry Expert

Susan Goldsmith, NHS Lothian

Iain Graham, NHS Lothian

Hilary Humphreys, Inquiry Expert

Janice MacKenzie, NHS Lothian

Stephen Maddocks, Inquiry Expert

Edward McLaughlan, HFS

Alan Morrison, Scottish Government

Michael O'Donnell, Hulley & Kirkwood

Andrew Poplett, Inquiry Expert

Peter Reekie, Scottish Futures Trust

Jackie Sansbury, NHS Lothian

Participants at the Inquiry's Edinburgh II hearings held in April and May 2023:

John Ballantyne, Multiplex Construction Europe Limited
Richard Cantlay, Mott MacDonald Limited
Paul Cooper, Wallace Whittle / TÜV SÜD
Liane Edwards-Scott, Multiplex Construction Europe Limited
Susan Goldsmith, NHS Lothian
Graeme Greer, Mott MacDonald Limited
Ken Hall, Multiplex Construction Europe Limited
Janice MacKenzie, NHS Lothian
Colin Macrae, Mott MacDonald Limited
Stewart McKechnie, Wallace Whittle / TÜV SÜD
Peter Reekie, Scottish Futures Trust
Paul Serkis, Multiplex Construction Europe Limited
Donna Stevenson, Scottish Futures Trust
Willie Stevenson, Mott MacDonald Limited
David Stillie, Mott MacDonald Limited

Participants at the Inquiry's Edinburgh III hearings held in February and March 2024:

John Connaghan, Scottish Government
Julie Critchley, NHS Scotland Assure
Tim Davison, NHS Lothian
Jeane Freeman, Scottish Government
Tracey Gillies, NHS Lothian
Susan Goldsmith, NHS Lothian
Graeme Greer, Mott MacDonald Limited
Lindsay Guthrie, NHS Lothian
Ken Hall, Multiplex Construction Europe Limited
Ronnie Henderson, NHS Lothian
Donald Inverarity, NHS Lothian
Janice MacKenzie, NHS Lothian
Stephen Maddocks, Inquiry Expert
Stewart McKechnie, Wallace Whittle / TÜV SÜD
Alexander McMahon, NHS Lothian
Fiona McQueen, Scottish Government

Mary Morgan, NHS Lothian

Alan Morrison, Scottish Government

Darren Pike, Multiplex Construction Europe Limited

Thomas Rodger, NHS Scotland Assure

Sarah Jane Sutherland, NHS Lothian

Matt Templeton, IHSL

Malcolm Wright, Scottish Government

Participants who provided evidence to the Inquiry by way of written statement only:

Darren Forbes, Dalkia Engineering Limited (previously “Imtech Engineering Services Central Limited”)

Susan Grant, NHS NSS

Peter Henderson, Hoare Lea

Robert O’Donovan, Mercury Engineering

Paul Winning, Hoare Lea

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