SCOTTISH HOSPITALS INQUIRY

Hearings Commencing
21 August 2024

Day 3
21 August 2024
Matthew Lambert

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10:03

THE CHAIR: Good morning, everyone, both in the hearing room in Edinburgh and watching us on YouTube. This morning, Craig Connal KC, Counsel to the Inquiry, will be leading the evidence of, I think, just one witness today, and that is Mr Lambert.

I have to apologise for two technical matters. First of all, we will be unable to display in the room and to those following on YouTube the documents. Now, this is a technical problem which is in the process of being fixed but is not likely to be fixed today now. Core participants, therefore, will require to access documents which have been previously disclosed to the core participants through their own laptops. Now, I apologise for that, and it may be that the pace may have to be a little bit slower.

Now, the second technical problem is entirely my responsibility, which is I've left my notebook in my room. Now, I think that is being looked for, and we will just begin with Mr Lambert in the hope that Sylvia can identify my notebook. Good morning, Mr Lambert.

THE WITNESS: Good morning.

THE CHAIR: Please sit down.

THE WITNESS: Thanks.

THE CHAIR: Now, I understand that you would wish to make an affirmation.

THE WITNESS: Yes, please.

THE CHAIR: Sitting where you are, could I ask you to repeat after me?

Mr Matthew Lambert

Affirmed

THE CHAIR: Thank you very much, Mr Lambert. Now, you will be asked questions by Mr Connal, who is sitting opposite you. We will probably sit until about half past 11, take a break then and then sit on after a coffee break until one, and we will take a lunch break and then sit again at two o'clock. Now, that is our timing, but if at any time you want to take a break in the course of your evidence, just feel free to do so.

The final thing I would say to you is you are quite quietly spoken. Now, as you can see, I am speaking a little bit louder than I would in normal conversation. I am speaking a little bit slower. It is not necessarily easy to do, but bear in mind that we have quite a large room. You have got the assistance of the microphones and it should not be a problem, but if I could ask you to speak just a little louder than you would normally.

THE WITNESS: No problem.

THE CHAIR: Thank you. Now, Mr Connal.

Questioned by Mr Connal KC

Q Good morning, Mr Lambert, and if I can just add to that. You know more about these topics than I do, so if I ask you a question which is based on something that you know to be incorrect, please just tell me in responding to that question and we will get along fine. I am going to be asking you questions broadly in the order in which they are set out in your statement, which I think you have been provided with a copy of.

A Yes.

Q If you wish to look at your statement while I am asking about it, please feel free, or if you need more time to look at something then please also let me know. I will be referring to a number of documents, many of which you will be very familiar with, as we go along and hopefully these will then be made available for you to view in some way or another.

So, if we could-- in your statement, you do give some information about your background and experience, but just to set the scene, can you tell us very briefly what kind of things it is that you and your company do?

A We are a professional building services design consultant, so we specialise in the design of mechanical and electrical building services, so like heating systems, lighting systems, ventilation systems.

Q Right. I am just going to stop you there and say just bear in mind what his Lordship said----

A Sorry.

Q -- about speaking up, so that we can hear the whole of your answer and everybody in the room can hear it as well. So, basically, what might be called, in short, an M&E services engineer? Is that----?

A Yes. Yes.

Q Is that fair? Would that be the kind of label people would put on you?

A Yes.

Q And you were also asked whether you and your company, which is called IDS Services-- is that correct?

A Innovated Design Solutions.

Q Innovated Design Solutions?

A Yes.

Q Sorry, my correction-- have experience in the healthcare setting. Is that so?

A Yes.

Q Have you done lots of projects, or the odd one, or? What is your background?

A A lot of different healthcare projects, so boiler rooms and cold water tank replacements. A lot of health centres, so not full hospitals but various facilities within hospitals.

Q Thank you. Now, I am just looking at your statement, and obviously the statement was formulated by asking you questions and then you gave answers to the questions, and at that time not all of the documents we now know about were available, but on the second page of your statement, you are asked by the questioner at the time about your understanding of the need to appoint post holders to deal with ventilation compliance. Is that something you have come across in the course of your work?

A Authorised engineers, yes.

Q So, do you know when these authorised engineers are usually appointed?

A At design stage, I would assume. It was, like, in a newer role that was brought in.

Q Right, so you might tell me about a newer role.

A I don't think authorised engineers has been around for the last 20 years. I think it's more of a kind of a newer role.

Q Yes. Thank you very much. Now, the next couple of pages, you talk about Innovated Design Solutions, and I am not going to ask you about that again, but I want to come to when you first became involved with the-- I will just call it the new hospital. Otherwise, I will get mixed up between Queen Elizabeth and

University and so on, and that you start to deal with on page 4 of your statement. What you say there is that the initial scope of your instruction was simply to determine the viability of providing 6 air changes per hour in particular areas.

A Yes.

Q Is that really all you were asked to do initially?

A Initially, yes. It was to ascertain the existing air change rates and then determine the viability of increasing the existing air change rates to 6, and what impact that would have on the ductwork distribution.

Q Right. Well, let me ask you a couple of things, then, before we get into the details, which may help us a little bit later on with more general kind. At time to time, we see in your statement the initials CIBSE.

A The Chartered Institution of Building Services Engineers.

Q Right, and is that an organisation that issues guidance on certain issues?

A Yes.

Q Right, I see, so when you refer to that, you are referring to a professional body that you are familiar with, is that right?

A Yes. Industry design guidance.

Q Industry design guidance.

Thank you. Another set of initials. Now, I think I know what this is, but I will ask you anyway. The initials H&V crop up as a source of information. What does that refer to, H&V in capitals? Can you remember?

A It'll be heating and ventilation, I'm assuming.

Q Yes, okay. Well, let us not worry. If you cannot remember, we will pick it up later on. Can I ask you another general question, which we are going to come back to later? This is about the consequences of changing an air change rate in a room. Does that have any consequences on the ducting, or for the ducting, that is deployed in the whole system?

A Yes. Significant.

Q Well, when you say it is significant, can you just give us an idea of what we are talking about here? What happens if you need more air changes to the duct sizing?

A Your air flow rate increases. So, for instance, if you had a 30 litres a second airflow rate, you might need a 100 ml ductwork diameter, and if you increase to 90 litres a second, you might need a 200 or 250 diameter duct. You could do it with smaller ducts, but it increases velocity and pressure drop, so the more air you put down a smaller duct, the higher the pressure loss and higher

the velocity is within that duct.

Q Okay. I will probably need to get you to come back to a couple of these points, but just in terms of duct size, can this be significantly different if you are trying to avoid these issues of pressure drop and so on?

A Yes. There's other parameters, like noise as well. You'd need to take a (inaudible).

Q Right. So, the duct that you would need if you were trying to put in 6 air changes without problems of pressure drop and noise, would that be likely a different duct size to one for, say, 2½ air changes now?

A Yes.

Q Significantly different or just marginal?

A Significantly, I would imagine.

THE CHAIR: I mean, is it a linear relationship, another--? If I am following what you are saying, Mr Lambert, if we consider the difference between, let us say, 4 air changes an hour and 6 air changes an hour, if I follow you, the diameter of a duct, assuming it is circular in section, would the relationship between 4 and 6 be reflected in the relationship of the increase in size, or would it not be related in a linear way?

A Cross-sectional area.

Q Sorry?

A The cross-sectional area

would get larger.

Q Right, so it is the cross-sectional area that is the critical thing?

A Yes, yes.

Q And would that be a linear relationship or not?

A Yes.

Q It would be a linear relationship?

A Yes, more air. If you're-- You'll be trying to maintain a certain noise level within the ductwork distribution relative to where the ductwork is installed within the building, so if the ductwork was over a corridor you could run it at a higher velocity, whereas if you run it above a bedroom you try and keep the noise-- the velocity down in the duct so you don't get disturbance to the occupant.

So, you might be able to go from 4 to 6 air changes in certain sections of the ductwork, but as you increase the air volume, you would increase the ductwork size, typically.

Q Right, and one of the reasons for increasing the ductwork size is to avoid unacceptable noise?

A Yes.

Q Right. Sorry. Sorry, Mr Connal.

MR CONNAL: Yes, and the ductwork would typically be installed in a ceiling void in the kind of buildings we are looking at?

A Yes.

Q So presumably you then need space in the ceiling void for whatever size of ductwork you are talking about?

A Yes.

Q Thank you. Just while we are on noise, again, am I right in understanding, am I, that decibels, which is the usual measure of noise, although there are lots of technical versions of simple decibels, operate on what is called a logarithmic scale?

A Yes.

Q Is that something you are aware of?

A Yes.

Q So, if you see 2 decibels and 4 decibels and think, "There is not much difference in noise between them," you would be wrong. Is that right?

A Yes.

Q Is there quite a significant difference?

A Yes.

Q Okay. Now, if we can come back to your statement. The next name that crops up on page 4 of your statement is the name Zutec, which you will see in the middle of that page. Were you aware of what that was supposed to be, Zutec?

A A digital record system for the hospital.

Q Digital record system?

A Yes.

Q And were you given access to that?

A Yes.

Q In fact, was that your main source of information?

A Yes.

Q I will come back to other sources you used later, but was that where you got most of your information?

A Yes.

Q Were you provided, at that initial stage, with any material about the contract between the parties for the building of the hospital or anything of that kind?

A No.

Q Or the design process, other than what you got from Zutec?

A No.

Q Thank you. That first section also tells us who instructed you and who you were involved with, so I came to understand this: you say there you had an initial discussion with two people, Mary Anne Kane and Alan Gallacher.

A Yes.

Q Is that what you recall?

A Yes.

Q And when you say, "an initial discussion," was this a meeting, a phone call? What was it?

A I was in-- From memory, I was in the Estates office actually speaking to somebody else, and they asked me to pop through and have a chat with them after I'd finished with the other person.

Q So you think you were maybe in the Estates office for some other reason?

A Yes.

Q And you were asked to pop through and chat to these people?

A Yes.

Q Ms Kane and Mr Gallacher?

A Yes.

Q And so, what were you told?

A They were concerned that the air change rates were lower than 6, and they didn't know what they were, and they wanted to determine the viability of increasing to 6.

Q Were you given any more detail, or was that it?

A That was it.

Q Right. After that initial meeting, you recorded here that you dealt with a Mr Powrie. Is that so?

A Yes.

Q So did you communicate thereafter with Ms Kane or Mr Gallacher?

A Not from memory, apart from issuing the reports. I think I would have-- It was mainly Ian Powrie I dealt with, and Colin Purdon as well. Colin Purdon assisted me to access Zutec and help me find documents on Zutec if I couldn't find them.

Q Was that easy to do?

A No.

Q Why not?

A It was clunky. It was-- Where you'd have thought you'd find information, there wasn't information, and where you wouldn't expect to find information was the information you were looking for. That----

Q Right, so it was a database that you were-- So you would interrogate the database and expect to find X and it was not there?

A Yes.

Q But it was somewhere else?

A Sometimes.

Q Sometimes? And Mr Purdon, who presumably was familiar with it, was helping you with that. Is that right?

A Yes.

THE CHAIR: Sorry to interrupt. Your initial conversation with Mary Anne Kane and Alan Gallacher, you said in the Estates office, I take it it is on the Queen Elizabeth campus?

A Yes.

Q Right. They were concerned about air change rates not achieving 6 air changes an hour. At that stage, did they identify where they were talking about?

A Well, it was Ward 2B and Ward 2A.

Q Right. Two wards specifically? Sorry, Mr Connal.

MR CONNAL: Well, I will just follow that through. We know that the way the work was subsequently done – and we will look at these documents shortly – was that you prepared a report for Ward 2B and a report for Ward 2A. First question is, were you specifically asked to do two separate reports?

A I can't remember.

Q And is there any particular reason why 2B came before 2A in chronological date?

A It might have been because of the information I found on Zutec related to Ward 2B before I found information relating to Ward 2A.

Q But you were not specifically asked, "Please do 2B first"?

A Not that I remember, no.

Q I am going to ask you to look at that in a moment, but on page 5 of your statement, you record that, having had this initial discussion, told of a concern about air change rates not being at 6, it appears that additional items were added to the job you were asked to do.

Now, you deal with that in a general paragraph in the middle of that statement, where you say, "During the analysis process, we were asked to include additional aspects," and then you say what these were. Can I understand from you, please, how did that happen? You had been sent off to see what are the air change rates, can you get them up to 6?

That was your initial brief.

A Yes.

Q So how did it come to be that you were being asked other things? Did someone get in touch? Were you called in for meetings? How did it happen? Do you remember?

A From memory, it was by telephone as I was doing the analysis. What we discovered during the analysis raised concerns regarding the suitability of the environment.

Q Right, so were you prompting a telephone call, or was the call coming from Mr Powrie or someone else?

A I would have most likely made Mr Powrie aware. There was other things regarding the actual equipment and the ventilation systems in general that we were concerned with.

Q Yes. Well, we will try and pick up on these as we go through the reports. I am just trying to understand the process at the moment, if I can. So you have the initial brief, you start to think about other issues that concern you. So you think you got in touch with who? Would it be Mr Powrie?

A Yes, I'd imagine so.

Q And what was the result of that? Did he instruct you to do something else?

A No observations. We were also asked to have a look at not just the ductwork distribution-- from memory it was the ductwork. We were asked to look at what impact would it have on the ductwork size if you increased air change rates, and then we became concerned about the air handling units, filtration and other elements in the system, so they asked us to include them within the report also.

Q Right, so that is why you say here you were asked to comment on the impact on the systems generally----

A Yes.

Q -- as well as give an idea of what would be needed and also record any other observations that you had on the existing systems, which were things that you say you were concerned about.

A Yes.

Q Thank you. Well, let us look at-- I will come to 2A shortly, but let us-- We will get lost otherwise. Let us look at 2B first because that was the first report in strict chronological order. Just before I do that, can I ask you a question that was raised with you on page 7 of your statement? You have already told us you did not have contract documents or design documents or anything like that. You just had Zutec----

A Yes.

Q -- and you were asked a question on page 7 whether you were able to ascertain the design philosophy

that lay beneath the ventilation systems, and you were just looking at 2B and 2A, and you say there that you thought you could work out the "probable design intent." Can you just help us to understand what you mean by that phrase? What is it that you reckon you could work out from looking at the material you had?

A Low air change rates and the air cascade arrangement within the ward.

THE CHAIR: Sorry, low air change rates, and I just missed what you said after that.

A The direction of air movement.

Q Right.

A The air cascade from one space to another.

Q Air cascade?

A Yes.

Q (To Mr Connal) Do you want maybe just to tease that out a little bit?

MR CONNAL: Yes. (To the witness) I will ask you two questions about that and you tell me if I am getting this completely upside down. There is one issue that can arise, depending on the kind of ward you are looking at, which is what should the movement of air be between the single room where the patient is and the area outwith that, the corridor and so on? Now, is that what you mean by direction of movement?

A Yes.

Q And is that something – and we will no doubt come back to it in more detail -- but is that something that cropped up as you started to look into this system?

A Yes.

Q And what was the issue?

A I thought the air was going in the wrong direction: towards the patient rather than away from the patient, from the corridor.

Q Right. Why, for that group of patients, was it going in the wrong direction?

A Immunocompromised patients.

Q Right, so it was going in rather than out?

A Out.

Q Yes, and when you use the phrase "air cascade," can you just tell us what you mean by air cascade, just so we are all clear we are talking about the same thing?

A It's like a theatre. If you think about a surgical theatre, you try to put air into the theatre and then you push the air into adjacencies, so it cascades from clean to less dirty out towards the main hospital corridor, rather than pulling dirty air towards the patient.

THE CHAIR: When you were making a judgment as to air change rates and the flow of air, what are you testing that against?

A SHTM guidance.

Q Sorry?

A SHTM guidance.

Q Right, so you are applying the recommendations of SHTM-0301 and the table we find towards the end of that?

A Yes.

Q And you are contrasting that with what you are finding on site or what you are finding in the Zutec system?

A Both.

Q Both? Right. Thank you.

A But, from memory, we questioned what the Schiehallion ward utilised patient group-wise because it wasn't clear from the drawings.

Q Sorry, say that again.

A The Schiehallion ward in Ward 2A, we queried what the bedroom use was, if it was general bedrooms or if it was for (inaudible) patients.

Q Right, so you were asking these questions?

A Yes.

Q On the site?

A Once we got into the analysis. Well, further into the analysis.

Q Right, and when you talk about the analysis, you have got information on Zutec, which I take it is design drawings?

A Record drawings.

Q Record drawings?

A Yes.

Q And you are on site speaking to staff?

A Estates, yes.

Q Estates? Speaking to Estates? Can you remember who you spoke to on the ground? Was it Ian Powrie or somebody else?

A It'll be Ian Powrie and Colin Purdon as well, I'd imagine.

Q Thank you. Sorry to interrupt, Mr Connal.

MR CONNAL: No, this is helpful. Mr Lambert, apologies. This is going quite slowly at the moment. We will get through it later. Still sticking to page 7, you were asked what difficulties did you encounter in getting the information that you thought you wanted, if I can paraphrase, in order to do the job you were being asked to do. You have then listed a number or lack of definitive design because you could just get what was in Zutec. Is that right?

A Yes.

Q And you say here, "As-fitted drawings were deemed to be incomplete and inaccurate." What is the problem there?

A Well, the as-fitted record drawing is a layout of the ventilator-- Well, what I was looking for was a layout of the ventilation systems and the air flow rates and things associated with the installation on site, and the information was incomplete and inaccurate, and

some information you would expect to find on the drawings wasn't on the drawings, which made my analysis more difficult to do.

Q Right, and you say in the same paragraph you needed to "relate third-party commissioning data [now, here comes H&V] from H&V."

A They're our commissioning specialist.

Q Right. Thank you, so H&V is a company which does ventilation commissioning, is that right?

A Yes.

Q Thank you. Did you have to go and get data from them, or was it provided to you?

A It was on Zutec.

Q It was on Zutec? Right. I see, so what you are doing is piecing together the jigsaw. Is that right? You have got some information from H&V material and some information from the drawings?

A Yes.

Q Tell me if I am wrong when I am asking these questions.

A No, that's correct. Yes.

Q Yes, okay.

A That's what made it harder to do the analysis, because you had to think, how would you get the information? It's not in the drawing, so where else would you get it? So you would go and find the balancing sheets or the air handling sheets, trying to piece the puzzle together.

Q Yes. Also at the foot of that page, you talk about "discrepancies between airflow rates stated by the AHU..." That is "air handling unit"?

A Yes.

Q "... manufacturer, H&V commissioning data..." So that is what they recorded, the designer and your own calculations?

A Yeah.

Q So, should they all say the same thing or----

A Yes.

Q And what kind of discrepancies were you noting?

A They were in the report, from memory.

Q Right, okay. Well, perhaps when we come to the report, hold that thought and we will pick it up then. Then you noted, going on to page 8 of your statement, that there was not much technical literature in regard to some of the devices, and also the final comment there, that you needed to actually go to the air handling unit manufacturer at points. Is that right?

A Yes.

Q Why did you have to go to them?

A To establish what the capabilities of the equipment installed in

terms of air flow rates and pressure drops, and to determine what spare capacity and things were in the systems.

Q Yes. That was material that you did not have available to you from Zutec?

A Yes.

Q Thank you. Now, you are asked a general question on page 8, and I do not think I need dwell on that too much. I think the point is being made that you use words like "assumptions" and so on at various points in your report, but what I am interested in is what you say there. You say, "Concerns regarding the ventilation systems became more apparent." Now, whose concerns were these?

A Ours. Mine.

Q And the urgency to complete your findings and issue the reports was "duly emphasized." So, just tell us what was happening there.

A From memory, as we raised further concerns regarding the systems – the design of the systems and installation of the systems – NHS Estates became more concerned regarding what we were finding, and they wanted the reports back as quickly as possible.

Q Thank you. When you say NHS Estates, is that the same two individuals that you have mentioned, or is this different people?

A No, this would be Ian Powrie.

Q Ian Powrie?

A Yes.

Q Thank you.

THE CHAIR: Right, so if I am just picking that up, as you communicated to him-- This is before delivering your formal report, but in the course of communicating with Ian Powrie, he became more concerned by reason of what you were telling him about what you were finding?

A Yes.

Q Sorry, just so I am keeping up.

A I don't think they appreciated the extent of the problems at the time until we started doing our analysis, and then they became more worried.

Q Thank you.

MR CONNAL: Now, I am going to ask you about your Ward 2B report in a moment, which is in bundle 6, document 33. We are just pausing just before I do that, just so we get all the paperwork right. When you were being asked about these matters, you were asked about your Ward 2B report, correct, and your Ward 2A report? You then drew the attention of the questioner to the fact that you had produced later this lead consultant brief. Is that correct?

A Yes.

Q And then there was an addendum to that, which is something we

can pick up, and I think we will leave over what is in the lead consultant brief until we come and everybody can look at it at that time, if you do not mind. If you look at page 9 of your statement, where did you get the understanding of what patients were to be in Ward 2B?

A The drawings, initially, or the record drawings on Zutec.

Q You also asked what you thought the ventilation requirements for that group of patients was. That is also on page 9. What did you think was required?

A Ten air changes and positively pressurised.

Q So positively pressurised and, again, correct me if I am wrong, this is the process you discussed earlier whereby the air flows out from the patient room into the surrounding area because of the nature of the patients that are in the room.

A Yes.

Q Thank you. Now, as I say, I will come back to your consultant's brief because we need to understand where your job started and where it finished. We will come there. On page 10, you are asked what your initial thoughts were when you started to look at the ventilation rates. What was the first thing that came to your mind as an issue?

A Well, the existing air change rates were abnormally low, even for a general bedroom ward, and the air cascade was apparently going in the wrong direction.

Q Apparently going in the wrong direction?

A Yes.

Q And when you say low compared to a general ward, is that not against a figure of 10 but against a different figure?

A Six.

Q Six, and that is what you would have expected for a general ward, is that right?

A In terms of air change rates, it was low relative to a to a general ward or a single-bed room. The differential pressure's different from a neutropenic to a single room, but in a general room it can be neutral or negative, whereas in neutropenic it needs to be positive. You need to make sure the air flow is from the bedroom to the adjacency.

Q Yes. Could you work out why, in a ward dealing with, as you saw it, anyway, patients with a particular need, the ventilation system had been designed in the way it was?

A No.

Q Now, I think, in fairness to you, on page 10 and going on to page 11, you speculate as to reasons why that might have been. Are any of these statements

that you make there-- Can I just check, are they based on particular material that you had, or is it just you having a stab at it?

A I answered these queries, or these questions, and then I actually retrospectively had a look at some of the inquiry documents in more detail – not regarding my matters, regarding other documents – and I think I know the answer now: that it was signed off as a variation to the design process. I didn't know that at the time I wrote these answers.

Q Okay. I am going to put something to you later on in your evidence and allow you to comment on it then, so, with his Lordship's permission, I will simply move past that point for the moment. But, just touching briefly on the things that you are touching on there, you say that smaller air change rates can save money. Is that correct?

A Well, it's smaller ductwork, smaller fan units, smaller grilles. Everything's smaller.

Q Yes; and then you had found on the drawings reference to the purpose of these rooms, so is there anything in that that would have led you to assume that low air change rates would be provided for rooms of that kind?

A No.

Q Okay. We will come back to this when we come to Ward 2A, but just so the reference is not too obscure, at the foot of page 10, you talk about dirty extract systems being integrated within the Ward 2A system. Is that a specific issue that you found in 2A?

A Yes.

Q Right. We will come back to that when we deal with your 2A report then, please. His Lordship asked you about SHTM 03-01. Is that a document you are familiar with?

A Yes.

Q And have there been various iterations of it over the years?

A Yes.

Q I will come back to that as well. So you found low air change rates, you found air possibly moving in a direction you had not expected. At the foot of page 11, you touch for the first time in your statement on another issue, which you describe as "resilience with regard to spare capacities." Now, can you just tell us what you mean by that? The very foot of page 11, "AHU Selection."

A Well, there's a few problems with the resilience.

Q Right, well, let us take them-- Give me one first.

A There's only one air handling unit with one supply fan and one extract fan, so if one fan breaks, you don't have a supply and extract system.

Q Why is that a problem?

A Because your occupants can't open their windows for fresh air. Disregarding positive/negative air change rates, building regulations require every person in every occupied space to be afforded with 8 l/s fresh air from outside, so if your fan doesn't work or there's something wrong with your air handling kit, there's no other means of affording fresh air to the occupants.

THE CHAIR: You introduced the idea of opening a window, Mr Lambert. I think, and correct me if I am wrong, what you are saying-- I mean, you recognise that some rooms in a hospital will not have openable windows.

A Yes.

Q Because if you do have openable windows, you cannot maintain the recommended air change rate. Therefore, the mechanical ventilation system must do at least as well as the building regulation requirement.

A Yes.

Q Have I picked that up correctly?

A Yes. You'd always need to provide an occupancy level of fresh air, regardless of the facility, if you can't open the window. If you can't provide natural ventilation, regardless of the room type, the room use, classroom, any building, you'd need to provide 8 l/s fresh air per occupant.

Q You are being asked about resilience and you draw attention to the fact there is only one-- Is it one fan for supply and one for extract?

A Yes.

Q Again, if I am following you, the point is that if, for any reason, one of these fans fails, you have no supply?

A I would imagine so. You'd need to check with the manufacturer. I would imagine if your extract system doesn't work, you might still be able to run the supply, but I don't know. I'd need to check how it's controlled, but normally, that would be the case. If there's a failure, it would be a failure.

Q Right, so that is one of your resilience concerns.

A Yes.

MR CONNAL: Was there another one about spare capacity?

A Yes.

Q Just tell us what you were finding about spare capacity.

A Once we'd spoke to the air handling manufacturer, we determined that the units were designed on 100 per cent air duty, so if you needed 100 l/s supply of air, they'd selected the nearest fan suitable for 100 l/s, and by doing so it didn't take cognisance of the system becoming dirty.

Q Right. I think we just need to

work through this a little more slowly. If you do a calculation of the ability of the fan to perform its function when completely new, it produces a particular figure. Is that right?

A Yes.

Q But you were telling us about the system becoming dirty. Now, does that have an impact on what the fan can then achieve?

A Well, you design a ventilation system to provide a certain amount of air quantity coming through the air outlet and inlet, the extract, so as you operate the system, you'll get dust and debris on your grilles, on your ductwork, on the dampers used in the ductwork to control your flow rate, just general dirt accumulation on the distribution system, and as your filters are there to filter the incoming air and the outgoing air-- so, again, the deterioration to the-- It's a cross-section of area again. It'll become dirtier and it'll get clogged and that will reduce the airflow through the system, and it increases the pressure drop on the system, how hard the fan needs to push there, the resistance.

Q So what are you meant to do, then, when picking your fan?

A Well, your fan-- You would have spare capacity so that as your system gets dirtier, your fan can increase in speed, ideally automatically, so it maintains the set duty that you're looking for.

Q And did you find an issue about spare capacity----

A Yes.

Q -- when you were looking at the systems you were interrogating?

A You'd also like spare capacity for future resilience in terms of if you want to increase the number of wards, or you want to increase the air change rates, so there was no future capacity and there was inadequate capacity in terms of-- Well, it's difficult to say there was inadequate capacity in terms of the system becoming dirty. You'd need to do more analysis on that, but it could impact it further. It made your air changes less than they already were.

Q Okay. Well, I think you probably told me about two different things in the course of that answer, so let me see if I can unpick that. You have told me about building into the capacity of the kit – if I just use layman's terms for it – the ability to increase its workload if you suddenly decide to do something a little bit different or more. Is that one thing you were telling me about?

A Yes.

Q Say you wanted to increase air change rates or something of that kind, and then the second thing is you are supposed to design to reflect the fact that the system will become dirty, and I am

assuming that is even with appropriate maintenance?

A Yes.

Q Were you finding issues over these points when you were investigating Ward 2B?

A Yes.

Q Can I ask you to look, then, at page 12 of your statement? It is a point here you did not think the air terminals were going to be suitable to be used for increasing airflow rates. Then you say, "... there was dubiety with regards to the appropriateness of supply air terminals..." What are you meaning there?

A So, the air terminals didn't appear suitable to increase the amount of air going through the terminal in terms of pressure drop and noise level, and in terms of the appropriateness, I think I'd be referring to the use of an induction unit.

Q Right. Just tell us why that is an issue.

A It's got a perforated inlet for the extract path.

Q Why is that a problem?

A It'll be hard to clean.

Q Now, we will come to that, but am I right in thinking that the perforations are on the, well, what have sometimes been called chilled beam units, just for ease?

A Yes.

Q Is that right? Is that where the perforations are to be found?

A Yes.

Q We will come to them a little later, and you talk about thermal wheels, which we will come to as well, and then you said:

"H&V [so this is not your record] stated that AHU 24 fan chamber was full of water..."

It seemed an odd thing to find.

A It was a note on the commissioning sheet.

Q All right, so this is not something you found; this is something you just picked up in passing from the commissioning engineers?

A It was more to make sure that it was no longer full of water because if someone's been in there on commission to assess them, they wouldn't empty it of water. They would just record it and give it back to the contractor. It was to make sure that it's checked and picked up.

Q Right, so that is why you mentioned it in your report, so that the Estates people knew about it?

A Yes.

Q Thank you, and then you are asked again on page 12 about other guidance and you mention this CIBSE ventilation guidance, and that is all to do with your noise-generation issue,

is it?

A Yes.

Q Then DW144 Ductwork Specification, what is that?

A It's how you build the ductwork, how the ductwork's manufactured relative to different velocities and pressure classifications for ductwork. So, if it's a higher airspeed and a higher pressure drop in the system, you need to manufacture the ductwork relative to that.

Q So is there any significance? You make a point there that the ductwork was designed and installed relative to a low-pressure Class A system, and not in accordance with the pressures within the commissioning records.

A That wasn't----

Q Can you help us understand that point, please, for laypeople?

Q So, within the Zutec information, from memory, there was a note saying it's designed and installed relative to a low-class system – so under a certain pressure drop within the system – whereas the commissioning records suggested to me it should have been manufactured to a higher pressure classification.

I think, by my own opinion, they didn't realise the pressure drop in the system was going to be so high, so when it was installed, it was higher than they

initially anticipated at design stage, and that pushed it into a higher classification.

Q Why is that a problem for the system?

A If you're working under a higher classification of system, it would be different jointing methods. You might want intermediate stay bars in the ductwork to keep it rigid and things like that.

Q That has an effect on a need to create a physical structure that can cope with----

A Weight. You can think about weight in an actual building structure.

Q Right, okay.

THE CHAIR: Thank you. Could you give me that-- It is entirely my fault. Could you give me that again under relation to ductwork? Take me through it again, Mr Lambert.

A So, when you're designing a ventilation system, DW144 has-- It's a table, essentially, with velocities and pressure drops within the system.

Q Now, can I stop you there? Pressure drop is?

A Is the resistance in the system from the fan unit or, well, from the inlet----

Q Mm-hmm.

A -- through the fan, through all the equipment, to the outlet, or the furthest outlet. It's an index circuit, so if I can get air to there from the fan, I'll be

able to get air to there because then that resistance is harder for me to get to, and that's how you calculate your pressure drop.

Q Right. Pressure drop a loss of----

A Resistance within the system.

Q Mm-hmm.

A Yeah, so----

Q Every system of necessity will have a pressure drop?

A (Inaudible) pressure drop. That's how you select your fan units, so it will give you that amount of air out of that resistance.

Q Right. Now, you said they had not anticipated the pressure drop. Can you just help me on that?

A From memory, as I say-- well, for classification in A, I think, for a supply system is up to 500 Pa, so the H&V documents, the commissioning documents, will say the design flow rate and the design pressure drop.

So the design pressure drops were, say, 400 at design stage, but when the person from H&V commissioned the system, he found that it was 700 or 800 actual system resistance, so the resistance in the system was significantly higher installed than it was anticipated to be at design stage, and, again, that would impact your fan selections.

Q Right, so the fan was not

sufficiently effective, strong?

A Well, no, the ductwork. It's the ductwork. What conveys the air from the fan unit to the terminals wasn't manufactured to suit that resistance in the ductwork----

Q Right.

A -- structurally.

Q Right. Sorry, Mr Connal.

MR CONNAL: Thank you. Now, can I just make the point now that if you feel at any stage in my questions you need to look at your actual report-- I will do that at various points, but if you feel I am asking you a question that you cannot answer, please just tell us and that will be, I am sure, fine.

So, having dealt with the ductwork, you then touch on heat recovery devices. Now, that is where thermal wheels come in and other possible options, is that correct?

A Yes.

Q You are recording, at the top of page 13, what CIBSE guidance says about the risk of cross leakage with the use of a thermal wheel device.

A Yes.

Q That, as I understand it, is important because you have dirty air and clean air, and the question is, is there any chance of there being a leakage from the one to the other?

A Yes.

Q Is that correct?

A Leakage and carryover.

Q Thank you. Fine. When we look at your report, you have an executive summary on page 1 of 16, section 1.01, which will obviously summarise things that we will come back to in a little more detail, and you say that you found a discrepancy with the selection of the air handling units, and you were asked, "Well, what was the discrepancy in your statement?" You say:

> "Abnormally low air change rates. No appropriate resilience with spare capacities. "

Well, you have told us about that. You say:

> "Did not facilitate ongoing maintenance regimes without undermining patient comfort and safety."

What is that about?

A Getting into the bedrooms to clean them.

Q Is that the chilled beam units?

A Oh, no, sorry. That's terminals. In terms of the air handling unit----

Q Right.

A -- you wouldn't be able to turn off the system to be able to clean it because the occupants need 24/7 fresh air, so it's not as if you could turn it off for

a day and clean filters and clean the inside of the unit out.

Q Yes, and then you mentioned clean filters, which I have already asked you about. I will not ask you about that again. In the next section, you talk about an assumption of 125 per cent capacity and where you got that. Where did you get that from?

A From memory, it was Zutec.

Q So is that what, according to Zutec, should have been provided?

A Yes.

Q Was it provided?

A No.

Q How did you work out that there was not 125 per cent capacity?

A Using H&V commissioning data and information from the manufacturer.

Q When you say information from the manufacturer, is that information that you got, or were you provided with it?

A That I got.

Q You got? Then, at the foot of page 13, you are talking about the 100 per cent capacity, which I think we have touched on, and you are asked, just over the page on page 14, "How important is the spare capacity?" Well, how important is the spare capacity in your view, Mr Lambert, the 25 per cent over the 100 per cent?

A Very important.

Q Why is that?

A It gives you future flexibility, deterioration of the system. I would never design a system without any spare capacity in it whatsoever. If that has been offered or stated as something that I was going to give you and I didn't give you it, there's a detrimental effect into the system because you can't retrospectively add it very easily.

If your system's been designed on 100 per cent and you want to change it to 125 per cent, it's going to be very difficult to do so.

Q Right. That may be a general point. By their nature, once you put an air handling system into a building which then is occupied, is it easy to change it?

A No.

Q Is that just because of the physical works that are needed?

A Yes.

THE CHAIR: Mr Lambert, please correct me if I am wrong about this: when you talk about 25 per cent additional capacity, is it-- and let us say you are trying-- the objective is to produce a system that is producing, let us say, 10 air changes an hour.

Now, is it as simple as saying that, if the guidance requires 10 air changes an hour, you should design in order to achieve 12.5? I mean, is it as simple as that?

A Essentially, yes.

Q Right, thank you.

MR CONNAL: The 25 per cent spare capacity, you found reference to that in Zutec, did you?

A Yes.

Q Right, so that is the question I asked you earlier, so apologies for repeating it, that Zutec said it should have been 125 per cent and you did not find that?

A Correct.

Q The net result of all of this: was it going to be feasible in Ward 2B to increase the air changes to 6?

A No.

Q Did you measure the air changes in Ward 2B?

A No. I utilised H&V commissioning data.

Q What kind of figures for air changes were being recorded for Ward 2B?

A Can I refer to my report?

Q Of course. I do not need a precise----

A Two to three.

Q -- figure, just a----

A Two and a half to three----

Q About 2½?

A 2.8, from memory.

Q Right, I am going to come back to some of these later for this reason, that

in your lead consultant's brief that you subsequently prepared, did you set out what you thought there ought to be provided in a ward of that kind?

A Not in 2B.

Q Not in 2B?

A No.

Q Sorry, you are quite correct. The brief was for 2A. Is that right?

A The original brief was 6 air changes----

Q Yes.

A -- for both wards.

Q I am confusing you by reference to different documents, so we will stop doing that for the moment, but you have been asked in the course of the questioning, "Well, what do you think should have been provided?" and you say, "Well, look at my lead consultant's brief," although that was for 2A, not for 2B.

A Yes, sorry. Yes, it is 10 air changes, 10 pascals of positive pressure.

Q Yes, and you have already said that that is what you thought should have been provided for 2B.

A Yes.

Q Thank you. I think, in your report, there are a lot of figures and records of what you found and analysis of what size the ductwork was and so forth, and you will be glad to know I am not going to ask you about that, and I am not going to ask you about clean filters again because I have taken that from you, but the next topic you deal with in your statement is this question of thermal wheels. Now, the Inquiry has heard quite a lot of evidence about ventilation, but if you can just tell us briefly, what is a thermal wheel?

A It's a rotary heat recovery device that takes heat off the extract path and transfers it onto the supplier path or the fresh air going to the building.

Q And what is the point of having one?

A Energy efficiency.

Q Right. Are there other means, other than thermal wheels, of doing something similar?

A Yes.

Q On page 16 of your statement, you deal with the issue of cross-contamination. Just explain to us how that works.

A Yes, well, you can get-- It's like a brush that goes round the wheel, so you can get leakage from one-- from the extract path to the fresh air path, and it's also a membrane that's on the wheel, so you can get carryover. So it's air leakage and carryover that would be my concerns.

Q Yes. You say that the-- I mean, I think earlier you quoted the CIBSE guidance of a 1 to 10 per cent risk

of cross-leakage. You seem to have been in touch, according to page 16, with the air handling unit manufacturer about the thermal wheel.

A Yes.

Q Did you get any information about the air paths from that source?

A It wouldn't provide a complete segregation of air paths. That's what we would advise from the manufacturer.

Q Right. Now, you say, in the middle of page 16, you have come across thermal wheels before, but you tend to suggest a different device. Is that right?

A Yes.

Q What do you suggest?

A Counter-flow heat exchangers.

Q Say it again.

A A counter-flow heat exchanger.

Q A counter-flow heat exchanger? Do they have the same issue about potential leakage?

A No.

Q So you record your view, on page 16, that you would not recommend the use of a thermal wheel because of the risk of some----

A Any.

Q -- level of cross-contamination.

A Yes.

Q Is that right?

A If there's any risk of cross-contamination or carryover, that-- in my

personal opinion, I wouldn't use one, no. This was something that was discussed with the authorised engineer, by memory, when I issued my report. They were of the opinion that thermal wheels were suitable because they were noted in the SHTM 03, but I disagreed and stuck with what was in the report and said, "Well, I think it should be risk assessed relative to the use of the facility."

Q Yes. Now, I think you may be picking that point up at the top of page 17 of your statement, where you are asked whether thermal wheels comply with SHTM 03-01, and you say, "Well, maybe," but you still would not recommend them. Is that your position?

A Yes.

Q And that is because?

A I would argue that any potential risk associated with cross-contamination and ultimately patient safety should be completely mitigated wherever it's possible to do so. So, if you've got another heat exchanger, although-- albeit slightly less efficient, then it should have been considered or installed.

Q Yes, thank you. Now, we go on, in your statement at page 17, to talk about cooling devices, and I do not think I need to get into a debate with you about whether these are technically chilled beam units or comfort units, or whatever

we want to call them, but whatever the units are, they perform a similar function, is that correct?

A Yes.

Q Is that by drawing in air over a chilled water system and then pushing it out again?

A Yes, heating and cooling coils.

Q Sorry, say it again.

A Heating and cooling coils.

Q Heating and cooling coils.

A Yes.

Q You are recorded on page 17 as simply saying, "Well, what I saw was a more compact version of a chilled beam."

A Yes.

Q But, in technical terms, does it make any difference?

A Fundamentally the same operation.

Q Yes, thank you. Where were these units to be found?

A Within Ward 2A bedrooms and within Ward-- the BMT ward and Day Care, and some of the other-- I think it's in some of the other offices and consultant rooms in Ward 2B as well. I think I noted that.

Q Yes, I think you were asked that question at the top of page 18 of your statement, and you say (sic), "Where were they?" and you say, "They were in the Day Ward and Day Stay Ward of 2B and other rooms of 2B."

A Yes.

Q Now, do you know what was in the contract exchanges about the use of chilled beams?

A No.

Q Is there guidance about the use of chilled beams in SHTM 03-01?

A Yes.

Q And has that changed?

A No.

Q Why would you not recommend them?

A Cleanliness. Cleanliness.

Q Cleanliness. Now, this is your perforated sections point.

A Yes.

Q I think you also make a point on page 18 about access for cleaning.

A Yes.

THE CHAIR: Thank you.

MR CONNAL: Now, can I just ask you to look at paragraph 4.03 of your 2B report? That's on page 9 of 16. (After a pause) Have you got that?

A (After a pause) They've only got the page-- the bundle page number.

THE CHAIR: The bundle page is 666.

MR CONNAL: 666-- 686.

THE CHAIR: Well, according to what I have available, we are in bundle 6 and----

A Yes.

Q -- 4.03 is to be found on page

666.

A Right, thank you.

MR CONNAL: Thank you, (inaudible). Yes, I just wanted to ask you about this decibel point because it crops up in the second paragraph under "Supply Air Terminals", and you say:

> "At a primary air supply volume of 40l/s, module sound level is stated as being 28dB(A) ... At the upper limit of 55l/s, module sound level is 36dB(A)."

In noise terms, is that quite a big difference?

A Reasonable, yes.

THE CHAIR: Thank you.

A It'll be above-- I'm trying to just distinguish because obviously the bedroom-- the dB(A) limit within a bedroom is lower. Well, it's lower than 36 and it's above 28, so I'm assuming I'm trying to show or demonstrate that if you increase the airflow, you're going to be above the guidance limit for a bedroom noise level, so thereby it wouldn't be viable to increase the supply of air volume going through the terminal.

MR CONNAL: Apart from making more noise because you are trying to shovel more air through the same ducting, does it have any other impact if you try and increase the rate through these units in that room?

A Well, on that example, it doubles-- it almost doubles the resistance or the pressure drop through the terminal, and the impact of that would find its way back to the fan unit, so it would put another 60 pascals' resistance onto the air handling unit and thereby decrease the amount of air that it can provide or reduce the spare capacity.

Q Yes. You were asked about the cooling devices, and I do not think I need to ask you about that. You have dealt with dirty filters. Do you think the question of coping with dirty filters, which, I think, in fairness to you, you define in your statement as "dirty condition having regard to normal maintenance processes,"-- From what you saw, had that been taken into account in the design that you were looking at?

A No.

Q Thank you very much. So you have-- you recorded an air change number of 2.33, and you have been asked whether you thought that was compliant with what you would expect to see, and what was your answer to that?

A No. It'd be no for a general ward.

Q No for a general ward?

THE CHAIR: That is on the basis that a general-- you would expect 6 for a general ward.

A Yes.

MR CONNAL: And you have

already dealt with not expecting to find negative pressure. You were expecting to find positive pressure.

A Yes.

Q Thank you.

THE CHAIR: Although, I do not think you would expect to find positive pressure on a general ward----

A No.

Q -- but you would on a neutropenic ward.

A Yes.

Q Yes.

MR CONNAL: So when you were looking at 2B, you were anticipating that what you would find was positively pressurised rooms?

A Yes.

Q Thank you. Can I just ask you a slightly different topic? Can you turn to page 24 of your statement? You are talking there about supply and extract air terminals. You make a point----

THE CHAIR: Can I ask just a very basic question? I am not quite sure if I understand what an air terminal is, unless it is the grille in front of the point of supply into the room.

A Yes, that's an air terminal, supply air terminal. One on the ceiling next to the light.

Q Oh, right. Excellent, thank you.

A It's all right.

Q Sorry, Mr Connal.

MR CONNAL: So, what you are saying at that section of your report is, if you increase the amount of air going through the terminals that were there at the time you found them, it could cause discomfort and extra resistance, which is the point that you have just dealt with.

A When you size a supply, your grille, you size it for a throw, so the size of the outlet or the size of the outlets in the direction of air throw is relative to where it would be seen, the walls and things like that, so you don't want to hit the wall and it to come down and cause a downdraft and things.

Q Right.

A So, if you've sized that for a 2 m, throw that way, a 2 m, throw that way, and then I double the amount of air, it wouldn't be exactly the same, but it could go 4 m or 5 m each direction. It could cause discomfort from downdrafts and things like that.

Q Right. So, if you had sized it to go 2 m, but there was a wall just after the 2 m and you put more through it, it is going to hit the wall and do something?

A Yes.

Q I just wanted to ask you about the last section of that statement, where you say:

"Extract grilles do not appear

to have been appropriately sized.

They seem to have been selected to suit the ceiling grid size in lieu of the extraction rate."

What is the point there that you are making?

A Well, I'm assuming what they've-- They've got a 600 grid, so they've just put a 600 extract grille in, rather than sizing the extract terminal or the inlet size, the cross-sectional pre-area of the inlet relative to the air duty you're trying to extract. You'd ideally want to have a pull from your extract, so you've got a face velocity so you can suck in air, whereas it's been completely oversized, so it would have less face velocity. I've noted there that that grille size would be suitable for 500 l/s, whereas from memory it was doing 47 or something like that.

THE CHAIR: My fault, I am not quite sure I follow that. Give me that again, Mr Lambert.

A So, instead of sizing the extract grille relative to the room extract rate – which was, say, 47 – they had a ceiling tile. So, they thought, "We'll just put a ceiling tile grille in there," so that's the full ceiling tile size. It's easier to install, Quicker to install.

Q Right.

A And that was capable of doing 500 l/s rather than significantly less-- well, 10 times less air.

Q Right, so the problem is in fact the----

A Face velocity. So, it wouldn't pull-- it wouldn't pull air.

Q It is too large?

A Too large. Too much air.

Q I have got that right?

A Yes.

Q All right. Thank you.

A It'd be the same if you oversize a supply air grille. It would just dump the air straight down, rather than distribute it into the room.

Q Right.

A Essentially, we weren't sized.

Q Thank you.

MR CONNAL: Thank you. So, the way your report is structured, you have had an executive summary at the start. You have then gone to a lot of the technical detail, and then you provide a summary, although you provide the summary, I think, before then going on to various system alteration proposals. I am just wanting to make sure that we understand why the report is structured in that way. Is that answered on page 25 of your statement, when you are asked about the options at section 5 of the report, and you say, "Well, what I was setting out there were options to increase air changes to 6, but not to do anything about anything else"?

A For Ward 2B, yes.

Q For Ward 2B?

A Yes.

Q That is what you were doing when you went on to options?

A Yes.

Q You were just looking at that one issue?

A Yes.

Q And can I just ask you the general question, why were you just doing that? Because your initial brief had tended to encourage you to focus very narrowly, and then you were being told to report on other things.

A We were asked to look-- Well, during the process of the report of 2A, we were asked look at what would be required or how would we make the systems more suitable relative to use by a neutropenic patient? How would we do it, essentially, and it wasn't deemed viable to do that in Ward 2B, from memory. I think that's why we retrospectively added in the addendum to the appointment brief. That's why that got put in at the end. It was, essentially, "Leave what you've got and improve air quality and air change rates for Ward 2B," whereas Ward 2A got substantially----

Q Yes. I think we are probably jumping ahead a little bit in the chronology, Mr Lambert, but if I get you correctly, what you are saying is, you were initially asked to answer the question, "Can we increase the air change rates to 6?"

A Yes.

Q To which the answer was, "No, with the existing plan, but there are things you could do, various options."

A To improve it.

Q To improve it. I think the question might be – and you do not need to give me the detail that goes into it – you ultimately produced a brief to completely redo the system for 2A, to produce 10 air changes per hour and so on and so forth----

A Yes.

Q -- which we will look at. Were you given any explanation as to why you were not asked to do that for 2B?

A I think it was just, it wasn't deemed viable to do it for Ward 2B at the time. I can't remember the exact reason, we just-- it wasn't deemed viable from NHS's perspective. I don't know if it's a time constraint, from cost. I can't remember.

THE CHAIR: When you say not viable, are you thinking of technical reasons or other reasons?

A Both. It wasn't physically viable to-- You'd need to rip out all the ductwork, you'd need to strip the entire system out for Ward 2B, and I think that was what made it less viable.

Q So less work was required for 2A?

A No, more work.

Q Sorry?

A More work.

Q More work?

A Yes.

Q Okay, well. I was just exploring this Ward 2B. From GGC's point of view, improvement of 2B was not viable, and I was just trying to explore this, whereas, if I have picked you correctly, GGC was looking for a brief to achieve 10 air changes in 2A. Just exploring this word "not viable".

A I think it's from the functionality, from memory, of the use of the facility probably. They couldn't lose those areas within the hospital, so you'd need to shut the entire ward off to be able undertake the works. We didn't get asked to look at a main upgrade in that area. The exact reason I can't remember, but it was either cost or that you couldn't lose that area of the hospital to undertake the works.

Q You could not lose the ability to use the facility?

A Yes. It's got examination rooms and consultancy rooms and things like that as well.

Q Thank you.

MR CONNAL: Apologies, my Lord. My numberings are not matching what is

on the electronic system. Let us just try and finish your 2B report, please, Mr Lambert. At section 405, which is on bundle page 667 of the report, you set out a summary of your findings, and do we find there, essentially, the matters we have been talking about already this morning? Air change rates lower, comment about design insofar as you could find out about it, negative pressure, 100 per cent calculation for the fans, spare capacity, clean filters. So all of these are the issues, essentially, that we have been discussing this morning?

A Yes.

Q And then what you did, as we have just discussed, is you set out some possible works that could be done with particular costs and so on and so forth, and then what you did was you added a sort of, "And here are some additional points at the end". Is that right?

A Yes. They were just some other notable observations that we observed whilst we were undertaking the analysis.

Q And that is something you had been asked to do, put in your additional observations?

A Not at the start.

Q Sorry?

A Not at the start of the process.

Q Not at the start?

A That was something that we

obviously raised with Ian, and he said, “Put them into the report,” as well.

Q Right. So, when you come to section 6 of your 2B report, which is on bundle page 672, you are setting out again, in part, material that we have already looked at. You say that there is supposed to be 125 per cent capacity, but that does not seem to be what you are finding. Ductwork classification, I am not going to ask you about again. The thermal wheel, which you have identified, and you make a comment there about the majority of air handling units have thermal wheels. Where did you get that from?

A I'm sure there's an Excel sheet, or there was an Excel sheet on Zutec that identified what other areas within the hospital had air handling units and what heat exchanges were installed within those air handling units.

Q Thank you. Why did you think it was a good idea to bring that to the attention of the Board?

A So, I thought someone should risk assess the use of that heat recovery device within other areas of the hospital.

Q Thank you. First of all, a small point. The air handling unit full of water, were you ever involved in discovering what had ever happened to that unit that was full of water?

A No.

Q Thank you. Let me ask you this. This was, I think, the first report just in terms of date. It was dated 15 October. Who did you give it to?

A I can't remember.

Q You cannot remember?

A It would have gone to Mary Anne, Alan Gallacher, and Ian Powrie. It might have gone to Colin Purdon as well. I can't remember.

Q If I can put it this way, not everything in that report was particularly complimentary about what you had found.

A No.

Q Can you remember what kind of reception it got? What was the response to you handing over a report with that kind of material in it?

A They were aware of what was coming, I think, because I'd had a few discussions when I was preparing it, and then there was an urgency to get it back to them. So I think they were aware that there were significant issues.

Q Okay. Well, let me split that into two questions. Are you telling me that a number of the things that you have been telling us about, you had already indicated you were finding when you were in conversations during the preparation of the report?

A Yes.

Q So, it was not all a big surprise?

A No.

Q And when you actually produced the report, did you get any immediate response to it or anything of that kind?

A Not Ward 2B.

Q Right.

A We were completing Ward 2A. We issued Ward 2B and then Ward 2A came out. So we were just getting on with that. I think they were waiting to get Ward 2A back before they decided what they were doing, probably.

Q Right. Thank you. Now, my Lord, I am about to go on to Ward 2A and I am just looking at the time. I wonder whether this might be the appropriate moment to have a short break.

THE CHAIR: All right, let us do that. As I said, Mr Lambert, we usually take 20 minutes for coffee. So if I could ask you to be back by ten to twelve.

A No problem. Thanks.

(Short break)

THE CHAIR: Mr Lambert, I have an apology to make to you. I am told that when I asked you to affirm----

THE WITNESS: Yes.

THE CHAIR: -- I in fact spoke over you when you were asking me to repeat what I had said----

THE WITNESS: Right at the start.

THE CHAIR: -- and because, if I may say so, you began quite softly----

THE WITNESS: Sorry.

THE CHAIR: -- I did not hear that, but that is a lot to do with the fact that my hearing is not great. So, what I propose to do is we will repeat the affirmation just in case anyone feels that that is an irregularity. So, this time, I will speak clearly and try not to speak over you.

Mr Matthew Lambert

Re-affirmed

THE CHAIR: Thank you very much, Mr Lambert, and as I say, entirely my fault. Now, Mr Connal.

Questioned by Mr Connal

Q Thank you, my Lord. I can now follow one apology with another. I had asked you this morning about your witness statement, Mr Powrie-- Mr Lambert. Second-- third mistake of the day, Mr Lambert, and what I should have done before I took you to any of the details is asked you if you had seen it and you were content to adopt it as your evidence to this Inquiry, and are you happy to do that?

A Yes.

Q Thank you very much. Right.

Now, I may also ask you to look at page-- and I will quote a different number, which you can ignore, but which the technical people here should hopefully recognise as their page numbers so that we can all find the same thing at the same time – again, which is an error that I have had pointed out to me.

I think when we took the break, we had come to the point where you have delivered your-- or produced your Ward 2B report. You were saying that you thought the Estates team, with whom you were in communication, were expecting the kind of things that were in it and then you delivered it, and at that point you were then getting on with your Ward 2A report. Is that correct?

A I was doing both at the same, yes. I was struggling to find information for certain parts of 2A.

Q Right. Well, if we can look at 2A and, again, what I will do, Mr Lambert, is I will ask you about your lead consultant brief document – which is a different document – later, so we can leave aside. Now, you were asked to look at 2A and, so that we know where to get it when we get there, that report is in bundle 6, document 34, page 674, so that is the one we will look at shortly. Did you go about doing the same job as you did for 2B, i.e. finding out what patients were anticipated to be within 2A?

A Yes.

Q What did you find?

A Teenage Cancer Trust kids and bone marrow transplant.

Q Now, am I right in thinking that part of Ward 2A was excluded from the work you were asked to do?

A Yes, the bottom area.

Q How could you distinguish which bit was yours and which was not? What was on the bottom area?

A We were shown on plan by Estates, Ian Powrie.

Q Right, and what did you understand to be the part that was excluded from the request for your work?

A There was a-- I can't remember. I think it was bone marrow transplant at the bottom as well, and there was isolation suites.

Q Right.

THE CHAIR: Sorry, can I just get that? When you were asked which parts you were asked to look at, if I have noted you correctly, you said Children's Cancer Trust, is that right, and the bone marrow transplant?

A Yes, the Schiehallion Ward. It was----

Q In the Schiehallion Ward?

A Yes.

Q These are two areas within 2A, is that right?

A Yes, I called it the upper

section of 2A, before a set of double doors.

Q Okay, and when you say “upper,” I mean, it is all on the same horizontal level.

A Yes, it was on plan.

Q Right.

A The upper kind of horseshoe part.

Q Right, and the excluded part you describe as the----

A Isolation suites.

Q Anything else?

A BMT. There was a BMT space as well, I think.

Q Right, so there is bone marrow transplant rooms in the part you were asked to look at, but also bone marrow transplant rooms that you were not asked to look at?

A It was-- BMT would be noted on the plans, whereas the other rooms were SCH, numbers of the Schiehallion Ward, so they didn't say “bone marrow transplant patients,” whereas the bit we were asked not to look at did----

Q Right.

A -- if that makes any sense.

Q So, on the plan, the bit you are not asked to look at was noted as "bone marrow transplant."

A From memory, yes.

Q My fault, I am sure. I noted you to begin with by saying the part you were asked to look at included bone marrow transplant. Now, did I get that wrong?

A I didn't realise it was-- at this time, it was just "Schiehallion Wards" on the drawings.

Q Right.

A It was only until we queried what the room occupancy or room use was that we discovered it was that function as well.

Q Right, so, on the plans, the rooms were marked "SCH"----

A Yes.

Q -- but you discovered that they were being used for bone marrow transplant patients?

A Yes.

Q Right, okay.

MR CONNAL: Obliged. In terms of your brief, your initial brief, was it the same for Ward 2A as it had been for Ward 2B as you have described earlier?

A Yes.

Q Can you increase from whatever figure you find up to six?

A Yes.

Q Just for the record, what level of air change rate did you find when you started to look at 2A?

A Similar to what we found in 2B, about 2.8-ish.

Q Based on what you had been told, what air change rate would you have

expected to find in that ward, 2A?

A For a single room, 6. For an (inaudible), 10 air changes.

Q As we said, you subsequently prepared a brief for that, which I will come to, and was your source of information in relation to 2A the same as it was for 2B?

A Yes, Zutec.

Q In relation to your report on 2A, was your brief expanded, if I can use that word, as matters proceeded in light of discussions?

A Yes.

Q So you are saying yes?

A Yes. We were asked to consider what would be required relative to the use of the patients.

Q Right, so that is perhaps a slightly different issue. So, who asked you to look at what was required, given the patients that were involved?

A Ian Powrie, from memory.

Q Ian Powrie. Just so I am making sure we have got this clearly, on page 28 of your statement, which is bundle 84-- bundle page 84, you say in answer to section 74, "Refer to my previous answer." Then you say you were subsequently asked to include within the report upgrade options relative to the patient group. Is that what you are referring to?

A Yes.

Q Then you then set out what

guidance you looked at in order to do that?

A Yes.

Q Which was SHTM 03-01, and SHPN 04: Supplement 1.

A Yes.

Q Were they materials that you were familiar with?

A Yes, less so SHPN 04.

Q Thank you. Now, if we look to the next page of your statement, which is page 85 in the electronic bundle, question 77, you are asked the question, "Well, okay, so same instruction, different part of the ward, 2A now. Was there any significant difference that you found between the systems that you found in the first one to the second one?" You talk about exhaust air. Can you just explain what the point about exhaust air in 2A was?

A Well, in 2A-- It's probably notable to mention that Ward 2A ventilation system didn't just serve Ward 2A. It served Level 3, or areas in Level 3, Level 1 and other areas in the hospital.

Q Right.

A So, I was extracting the air it was pulling back to the air handling unit. It wasn't from clean areas in the hospital in those facilities. It was from dirty areas, like sluices and cleaner stores and toilets, and the clean air from the bedrooms was ducted directly to outside, whereas I

would expect to see the complete opposite.

Q Just help us understand this, if we can. Bear in mind we are not ventilation engineers yet, but we will get there. You were saying you would expect the opposite, so this is air that has been extracted from areas that you describe as dirty?

A Yes.

Q I think, in your statement, you list toilets, shower rooms, dirty utility rooms, disposal rooms and so on.

A Public areas-- general public areas within the hospital.

Q It is being routed back, you say, to the air handling unit?

A Yes.

Q What is the significance of that?

A Risk of cross-contamination.

Q So the air is being taken out of these areas and sent back to the air handling unit, which serves various areas, including 2A. What happens to it when it gets there? Does it get re-circulated?

A No, but it goes through a heat reclaim device that's got a risk of cross-contamination, in my opinion.

Q Right.

THE CHAIR: Sorry, I missed that. It----

A It's got a risk-- through the thermal wheel, it's got the risk of cross-contamination to the fresh air supply that you're bringing in. So it brings back exhaust air from the rooms, and it goes through the heat reclaim device to try and heat up the fresh air coming from outside. So, that risks a cross-contamination, whereas everywhere else in the hospital that I looked at, the extracted air from dirty areas was directly to outside without going through a heat reclaim device, whereas, for some reason, Ward 2A, the dirty areas were brought back to that air handling unit.

Q When you say the air from the dirty areas, are you including Level 1 and Level 3?

A Yes.

Q Because, just for clarification, 2A is on the second floor of the building and, as you have said, one air handling unit is serving 2A but also at least part of the third level and part of the first level.

A Yes, and, I think, from memory, part of the ground floor as well.

Q Part of the ground floor.

A Like a 24-hour walk-in ward.

Q Is dirty air being circulated?

A Dirty area.

Q Sorry?

A Dirty area, yes. Like, so it's not extract from an office or extract from a patient's own suite; it's extract from less clean environments.

Q Yes. You are correct to correct me.

A Yep.

Q When we are talking about dirty air, we mean air that is less clean than the air that would be circulated within 2A.

A Yes.

Q Right.

A That was dissimilar from other areas and other systems within the hospital, whereas that type of dirty utility room, disposal rooms wasn't brought back to the air handling units. It was served by a dedicated extract-only system.

MR CONNAL: And the effect of that would be that it was simply exhausted into the outside air, if I can use that----

A Without heat reclaim.

Q Without heat reclaim. But, for some reason, in this case, the air which had potential levels of contamination in it – we do not know what----

A Yeah.

Q -- was being brought back to an air handling unit which was then serving Ward 2A?

A Yes.

Q Were you able to work out why, in that particular situation, that had been set up in that way?

A No. It was either-- I would say it was either an error or to improve the energy efficiency of the system.

Q Thank you. So, apart from that peculiar difference, if I can call it that, was what you found in 2A similar to what you had found in 2B?

A No. 2B didn't bring back that exhaust system.

Q No, I apologise. Leave aside that particular issue, the bringing back of the dirty air in the way that you did not expect to find, put that aside for a moment.

A Yeah.

Q In other respects, did what you found in Ward 2A turn out to be similar to what you had found in 2B?

A Yes.

Q Air change rates, similar?

A Yep.

Q Thank you. Now, when you reported on this, were you concerned with what you had found?

A Yes.

Q Now, can we look at your Ward 2A report? Document 34, page-- electronic page 676, it is what you would find as page 1 of 24, which is the executive summary. Obviously, there are a lot of calculations that lie behind that that I am not going to trouble you with. You say at the very start of that executive summary, at the top of the page, that:

> "Following analysis ... [you] anticipate the original accommodation design philosophy was not intended for use by patients with immune response impairment/deficiency. On the contrary, the existing ventilation strategy would appear only likely to promote the risks associated with uncontrolled ingress of infectious aerosols into patient areas."

That is a pretty strongly-worded paragraph. Were you quite comfortable that that was what you found?

A Yes.

Q We know you only had access to Zutec and so on. Why were you able to comment on the design philosophy of that particular air handling system?

A What we found was there was-- the extract rate from the bedroom en suite was higher than the bedroom supply air, and it was supply air getting inputted into the corridor.

Q Sorry?

A So, with extract, you're pulling more air out of the toilet and there's no natural ventilation. There's only one way that air can go, and it's through the patient's bedroom.

Q Right, and is that not something you would expect to see?

A No.

Q Why not?

A Because you're putting the patient at risk from air from adjacencies, less cleanliness.

Q So, would you expect the air from the en suite to go in a different direction?

A No, you'd expect the air put into the bedroom, some of it to be removed from the toilet and the rest to go out into the corridor.

Q Right. Was that what was happening?

A No. I felt it was getting pulled through into the en suite from the corridor and the bedroom into the en suite, so it was pulling in the wrong direction.

Q So, the general result of all of this – I will come back to the detail in a minute – was you thought that air was being drawn into the place the patient was occupying rather than being kept out.

A Yes.

Q Is that correct? The peculiarity was that that was influenced by the amount of-- the way the extract in the en suite was set up.

A Yes.

Q Thank you. So, the air change rates were a similar conclusion, that you could not increase to 6 with what was there?

A Yes.

Q Were there chilled beam units in 2A?

A Yes.

Q Well, let us go down another paragraph in your executive summary. You say in paragraph 3 on that page, "The desired increase ... to achieve 6ac/hr is deemed impractical." Then, just take us through the next section. You say:

> "...in view of numerous deficiencies/inadequacies ... we consider that significant system modification/replacement will be necessary in any event."

Why did you say something as dramatic as that?

A Probably in terms of the air handling plant.

Q You are suggesting here in that paragraph that there should be a complete separation of ward-- I think, upper ward-- Ward 2A facilities from the existing system.

A Yes.

Q Why were you suggesting that?

A I didn't think it should serve other areas within the hospital, and it should be a a dedicated system with resilience and backup facilities.

Q Right. So, you thought it should be separated from the rest of the hospital – why?

A So it was a dedicated facility to

that patient group. You'd have different filtration than you'd have in sluices and other areas and----

Q Right. So, there would be different levels of filtration for that patient group from general areas. Is that right?

A Yes.

Q What kind of different filtration?

A You'd have HEPA filtration.

Q So, as you were suggesting, "Separate it so it is not connected to the hospital, it will have different filtration," and then I think you said with resilience built in.

A Backup air handling plant----

Q Backup air handling----

A -- with duplicate fans or-- So if you had a critical failure, the system could still operate and it would lend itself to being able to maintain the essentialised equipment as well.

Q Right. But-- So, what you are envisaging there is duplication?

A N+1, yep.

Q Sorry what was your----

A N+1. So it's an operation plus you've got a full redundancy, essentially.

Q And you used the phrase "N+1"?

A Yes.

Q Is that taken from somewhere else?

A That'll be in SHTM 03-01.

Q Right, so you were really

suggesting that basically if the plant broke down, there would be another one ready to operate immediately.

A Or a duplicate fan motor, so if a fan breaks, you can operate the other fan.

Q Right.

A Ideally, separate.

Q Yes. Now, on that page, you deal with the dirty air issue. You also deal with an issue I do not think was ultimately taken ahead, which was an idea of creating isolation suites within that space, which I will come onto----

THE CHAIR: Sorry, Mr Connal, my fault – which page?

MR CONNAL: We are still on the same page, the executive summary, my Lord----

THE CHAIR: Right, okay.

MR CONNAL: -- which is page 676 of the electronic bundle.

THE CHAIR: Yes, I have that. I was not sure if we were----

MR CONNAL: We are still there. At the foot of page 676, you have dealt with the dirty air issue that you have explained to us, and you have also, just prior to that, indicated numerous other inadequacies, which we will make sure we pick up later. But, in the middle of that page, there is a paragraph starting, "The viability". Was this something else that was looked at but then ultimately not proceeded with, creating dedicated isolation suites?

A I think that was during-- that was brought up during discussions with Ian Powrie and Infection Control.

Q Right.

A When we're looking at what facilities, "Should Ward 2A have 10 air changes, 10 pascals positive?" I was concerned about how would you monitor 10 pascals differential across the bedrooms? You can set it up to accommodate that pressure cascade, but how would you know if it deviates----

Q Right.

A -- and how would you alarm it and things like that if a nurse left the bedroom door open? It's-- How would you recognise there's a problem there? So, there was aspects that we introduced into the proposals that-- They came out of those meetings.

Q Right, okay. Let me go back a little bit to make sure we are getting this right. First of all, the measurement of the pressure between one place and another is expressed in pascals.

A Pascals, yeah.

Q And, for this patient cohort, I think you were talking about 10 pascals, "That was 10 pascals of positive pressure."

A From bedroom to corridor, yeah.

Q From bedroom to corridor, thank you, to make sure that there was enough pressure there to stop the ingress of anything outwith the patient bedroom into the bedroom. Is that the idea?

A With the door shut.

Q With the door shut?

A Yep.

Q You then went on in your answer to talk about the question of, "Well, if you set that up in that way, how would you know if it was working?" Is that right?

A Yep.

Q So, what were you discussing as a means of letting you know whether that protection system was operating or not?

A Pressure differential monitors that measure the pressure difference between the two spaces.

Q Pressure differential monitoring?

A Yep.

Q And how, in your experience, would that usually be done?

A Sensors. A building management system, a control system----

Q Right.

A -- and we also look for it to be linked back to the nurse station. So it would be on a panel, and it would highlight if there was a drop in pressure.

Q So, you have to have something in place that – to use a non-technical – keeps an eye on the pressure----

A Yes.

Q -- and then you have to have that linked to somewhere to alert somebody if it is not working----

A Yes.

Q -- or drops.

A Yes.

Q And were you suggesting – or maybe it was not your suggestion – into the discussions that that might be the nurse station?

A Yes.

Q Right. Again, I am just trying to get an understanding of where that comes into the sequence of events. I have been asking you to look at your report, which we know has a certain date on it. Was this discussion about pressure differentials and alarms during the preparation of your report or afterwards?

A After.

Q After, thank you. So that might be reflected in what we will come to look at in your specification for Ward 2A?

A Yep.

Q Thank you. But, otherwise, the kind of conclusions you were reaching on 2A, were they similar to the ones that you reached on 2B?

A Yes.

Q So, we have got issues about

thermal wheels and so on and so forth that we have discussed earlier, and your report sets out, I think, on successive pages, all the technical detail, again, about the ductwork and air change rates and so on, that you were able to find out, and the air terminals, correct?

A Yeah.

Q And the chilled heating and so on and so forth. Just for completeness, can we then move to the summary of your findings for 2A, which you will find in section 4.05 of the report – page 14 for your numbering, 689 for the electronic bundle. We will just wait until we get 689. (After a pause) So, on this page and on the immediate succeeding page, you are summarising what was found in this ward, some of which will be familiar. So, you start – first bullet point – 3 air changes.

Can I just ask, while we are on that, did you find, when you were looking, anything to support, in the Zutec or associated documents, the use of 3 as a figure?

A No.

Q Then, the second bullet point, there is essentially negative pressure, which is the point we have been discussing. "Air handling unit sized on 100 per cent design." Is that the same point again as for 2B?

A Yes.

Q Then, "The supply and extract fans have a limited extent of spare capacity," 15.5 and 9.5. Well, there are two questions: these are odd numbers, if it was supposed to be 125. Why do we find things like 15.5 and 9.5?

A So, I've asked the manufacturer what the fan duty is capable of providing in terms of air flow rate, and I've referenced that to the H&V commissioning documentation for the supply fan and the extract fan. So the spare capacity in the supply fan, with everything clean in the system, would be 15.5 per cent. Where there's everything in the extract system completely clean, the spare fan capacity was found to be 9.5 per cent of the air volume.

Q And do you know why these figures are the ones that emerged from your research?

A I believe the air handling manufacturer was asked to select the fan units based on these duties, supply air duties and extract air duties, at full speed with clean systems.

Q Right, so he is asked to select the kit based on these parameters and the resulting kit happens to have these capacities in them?

A Yes. That's the nearest fan selection relative to the design duty.

Q Could you just repeat that answer for me? I did not quite pick it up.

A That's the nearest fan

selection relative to the duty.

Q Right, thank you. If you were going to take what you found in Ward 2A and change the air change rates from 2.8 or 3 or whatever the figure was to 10, would that be possible with the ductwork and so on that you found?

A No.

Q And is it just the ductwork that is affected?

A You could practically do it, but you wouldn't-- in terms of noise level and things like that, no.

Q No? And what about the other parts that go together to make the air handling system? Could you just change it up to 10?

A The entire system wouldn't be suitable, essentially.

Q Thank you. If you have to change the system – let us say you were aiming to change it to 10 air changes an hour – would that, in your view, be likely to require changes to the general structure of the rooms and so on?

A It could impact the structure of the slabs, concrete, because the air handler would be significantly heavier, your ductwork would be bigger, your terminals-- you'd either more terminals or larger terminals. Everything in the system would get significantly larger.

Q Yes. Thank you.

THE CHAIR: So it could affect the

structural support required for the fan units?

A Yes. If your air handling unit was, I don't know, 250 kg to do 2½, it might be a tonne. It wouldn't go up linear, but it would be significantly heavier.

Q All right. Thank you.

MR CONNAL: I think you have already told us about the the extract from the-- Yes. Can we just look at page 36 of your report, which is electronic page 92? At the top of the page, I just want to make sure we have got this thing about the en-suite extract amounts. This is page 92 of his statement, sorry. This is the issue we were trying to make sure we were understanding earlier, Mr Lambert, so apologies for being a little slow on the uptake. It says here in one of the answers:

> "The volume of air being extracted from the en-suite was higher than that being supplied into the associated bedroom, thereby this differential in 'make-up air' must be derived from somewhere."

What is the point you are trying to make there?

A If you're extracting from a room, the air's got to come from somewhere, and if you're not putting the same amount or more air-- you're putting less air into the bedroom then you're

sucking out the toilet, so there's a differential in air quantity of the amount of air that you're pulling out. So if it's not coming from the bedroom and you can't open the window, it's got to come from somewhere.

Q And there is a risk it comes from outside the room?

A Yes.

Q Thank you. Thank you very much. One question I may not have put to you earlier about the use of air handling units designed-- Sorry, I should ask a question. Do you recall finding what capacity the air handling units in 2A were designed to operate at? Were they designed to operate at 90 per cent, 100 per cent, what?

A That was the percentages earlier, at 15.5 and----

Q Right.

A Well, that was the spare capacity.

Q Right, but they had spare capacity? I mean, operating an air handling unit towards the top end of its capacity, does it have any impact on its performance or anything else?

A You would need to speak to the manufacturers and ask that question, but it's like driving a car at full pelt; it's not a good idea, I wouldn't have thought, in my opinion.

Q Thank you. Now, I am not going to ask you about the ultimate proposal yet, but am I right in thinking that your ultimate conclusion was something pretty significant needed to be done to Ward 2A?

A Yes.

Q Am I right in thinking that the format of your Ward 2A report followed the same pattern as your 2B report? In other words, you go through the process, you say what you have found, you set out your views on it and then you add a kind of additional point section at the end.

A But 2A had an additional section in it, section 6.

Q Right. Now, you are referring us to section 6, which is on electronic 693 of this document. So this is bundle 6, document 34, page 693. This was an additional section that you had, compared to your 2B report?

A Yes.

Q And what was the purpose of this section?

A To consider what facilities would be required to appropriately serve the patient group within Ward 2A.

Q At that stage, when you were just finishing your initial investigations and handing over your report, had you reached firm conclusions as to what exactly had to be done?

A A complete replacement.

Q A complete replacement?

Okay. The question of what the complete replacement would produce in terms of air changes, pascals of pressure and so on was ultimately something you were asked to look at and put down in writing, is that right?

A Yes.

Q I will come to that in a moment, then. Just for completeness, then, section 7 of the report we are looking at, which starts on electronic page 697, contains what I was jumping ahead to, which was similar points to what we found in the 2B report, i.e. additional points, many of which we have touched on. So the first one was the dirty areas air movement you have dealt with, is that right?

A Yes.

Q And then the thermal wheels, which we have talked about. Point 3 is resilience. Now, point 4, you talk about significant irregularities with regard to the air handler unit extract air volume. Why was that worth reporting on?

A I think there was such a variance in different documents.

Q Okay. Now I am looking, for your purposes, at page 22 of 24. It is page 697 of the electronic one. You got that?

A Yes.

Q You see at the foot of page 22 of 24, page 697, you are talking about significant irregularities.

A Yes.

Q Just tell us what you are reporting on there.

A So the extract, well, that's extract air volume, so the manufacturer's literature for that air handler unit says that the unit was selected based on a design air volume of 2.5-- 2.65 metres cubed per second of air. So the volume of air was meant to be 2.65.

Q Tell us, in case we do not follow that, why is that an important figure?

A That's the amount of air. That's the volume of air in the extract system, and on the following page, I've said the H&V commissioning record----

Q Right, so on electronic page 698 now, at the top of the page. So this is the commissioning company's records?

A Yes, so it notes that the design air volume is meant to be 2.563, whereas they physically commissioned the system at 2.913.

Q And why does that matter?

A It's a significant differential in amount of air and it differed from the manufacturer. So the manufacturer's selection was based on 2.6, but the system was actually doing 2.9, which is a lot more, and that would reduce your spare capacity in your system and your air handler.

THE CHAIR: Can you take me through these steps, Mr Lambert? We are talking about, as I understand it, the capacity of an air handling unit. Is that right?

A Yes, the supply fan or the extract fan.

Q Right. You are discussing extract at this point?

A Yes, on this-- Yes, yes.

Q Right, so it is designed to extract 2.65 cubic meters per second?

A According to the air handling unit manufacturer.

Q Right. H&V is the specialised commissioning company. It thinks the design capacity is 2.53, and finds it with the commissioned air volume being 2.913. Does that involve some sort of physical testing to see what the air handling unit is in fact doing?

A Yes.

Q Now, to somebody ignorant like me, that would seem to be performing-- well, performing at a higher rate than it is designed to. Now, is that a good thing, a bad thing, or what is the significance of that?

A It will reduce the capacity of your fan selection. The fan was only selected to provide 2.65, whereas the system-- you are actually pulling 2.9.

Q Right.

A It is working a lot harder than it

was designed to.

Q Right, okay, so the system is requiring the fan to do more work than it is designed for, or is that too simple?

A No, there's more volume. There's a discrepancy in the amount of volume getting pulled from the system that doesn't relate to the fan selection or H&V's commission. In my next point I've said-- I've added that I added up the grilles and I got 2.76 meters cubed per second. So, what I picked off the as-fitted record drawings didn't relate to the manufacturer's design flow rate or the H&V flow rate design or the H&V flow rate at commissioning stage. Mine was completely different.

Q What is the significance of these discrepancies?

A Well, the fan was working a lot harder than it was designed to.

Q Right, which I take it is not a good thing?

A No.

Q Right. Mr Connal.

MR CONNAL: I am obliged. And elsewhere on that, effectively, the final page, are you picking up a number of other technical issues, many of which we have already discussed today?

A Yeah.

Q Yes. Thank you. When you delivered this report, the Ward 2A report, in which, if anything, if I can put it to you,

Mr Lambert, you're even less complimentary about the system than you were about 2B, first of all, how did you deliver the report?

A Email.

Q By email. Who to?

A Again, it would have been issued to Alan Gallacher, Mary Anne Kane and Ian Powrie.

Q And what kind of reception did you get this time?

A From memory, they wanted to know if we could look at redesigning the systems.

Q Right. So they did not come back and complain about the report. They wanted to get more help from it.

A How do you fix it?

Q I see, and am I right in thinking that you then were asked to prepare what to a layperson might look a bit like an outline of what was going to be required in order to get the process started by doing some work?

A Yeah, the appointment of another consultant to take the job further.

Q The appointment of another consultant.

A Yeah.

Q Well, perhaps we can ask you to look at another document, then, which is bundle 27, volume 1, page 43. First of all, is that the document that I just described in somewhat layman's terms?

A Yep.

Q It is a lead consultant appointment brief. So, it is dated 10 December. Now, your Ward 2A report was delivered in October, 24 October. Help us understand, then, what happens between the delivery of your 2A report and the creation of the lead consultant appointment brief.

A There'll be discussions with Ian Powrie and Infection Control reviewing documents on the SHTMs to more accurately determine what the facility should have.

Q Do you remember who you spoke to other than Mr Powrie?

A Teresa. Teresa Inkster.

Q Teresa Inkster.

A And I think we spoke to Peter Hoffman.

Q Possibly Peter Hoffman. The document we are looking at, at the moment, what is it intended to do?

A Outline what the system should include in terms of the air handling unit, pressure differentials, air change rates, filtration, redundancy, spare capacities.

Q This is for another consultant to be appointed to be involved in, presumably, work?

A Redesign the entire system, yeah.

Q What did you put in-- Sorry.

After discussion with Mr Powrie, Dr Inkster or whoever, what were you trying to do in this document? What was your objective?

A Outline what the ventilation systems should provide relative to neutropenic patients.

Q Right. So, I actually see it sits on NHS Glasgow and Clyde paper, but did you produce this?

A Yes.

Q Thank you. In the first paragraph we see:

> "The fundamental objective of the project is to ensure the upper portion [so we are still excluding some bit of it] of Ward 2A in the children's hospital is suitable for use by immunocompromised patients. It is proposed to convert existing accommodation facilities to afford enhanced positive pressure single-bed rooms with ensuite facilities, providing 10 air changes in air positive pressure within each bedroom space, and ensuring the bedrooms are at 10 [is that right] pascals relative to the adjacent corridors."

Where did that specification come from, those figures?

A SHTM 03-01.

Q Yes. Then you go on in the next paragraph to talk about needing a system to provide that regime while maintaining pressure differentials and noting that you need to ensure that plant failure doesn't influence the system operation or undermine safety and patient care. Now, is that the issue about a unit failing or something?

A Yes.

Q Right, okay. Then your point you made earlier, you envisage in paragraph 3 the works will be predominantly focused around complete replacement, together with improvements in the internal building fabric. Now, what were we talking about there, about internal building fabric improvements?

A The existing bedrooms had suspended grids, and I think we opened some of the grids up and noticed there was penetrations and leakage. So you couldn't positively pressurise a room if you could get inadvertent air escaping from a space. You need it to be sealed.

Q And presumably the higher amount of pressure you want, the more important it is.

A You'd need to put more air in to overcome the loss of air going out.

Q I think I was about to ask you whether the higher the pressure in the room, the more key it is to have the room sealed.

A Yes.

THE CHAIR: Could I just take that

from you again, Mr Lambert? You found the existing bedrooms-- Now, did I note you correctly as saying "on suspended grids"?

A Yeah, suspended ceiling grid.

Q Sorry?

A Suspended ceiling grid, the same as in here.

Q Suspended ceiling grid, right, and the point is that if you want to achieve positive pressure, you need a sealed space.

A Yes.

Q Right. Thank you.

MR CONNAL: Then you go on in the next paragraph, you say:

> "Some degree of modification or replacement with regards to other mechanical and electrical services is also anticipated."

Why were you mentioning that? What was involved in that element?

A Well, if you're taking down the ceiling, you're putting plasterboard up, you'd need to change the light, you'd need to relocate fire alarm detectors, any other fixtures and fittings. You'd need to---

Q BMS, is that building management system?

A It is. And the chilled water and the heating circuits, because you're putting in more supply air, so you'd need to heat it or cool it. You'd need to

increase the duties.

Q Then you go on to set out in this document items that are said to be of particular significance, the first one being design principles within SHTM 03-01; second, which is perhaps obvious, minimising downtime as far as possible; and taking account of impact on adjoining facilities. I see you mentioned HAI-SCRIBE there. Is that something you're familiar with?

A HAI-SCRIBE, yeah. The cleanliness.

Q What is that about? Why are you mentioning it there?

A So it doesn't undermine the other areas of the hospital.

Q Then you are talking about what is actually going to be involved in the next bullet point. You are having to basically detach this system from other areas.

A I was highlighting to the consultant that it was connected; that system within Ward 2A was connected to a wider system. So if you start cutting the ductwork away, you'd need to isolate the supply and extract to multiple flow areas.

Q Right.

A That's downtime as well, because when you're doing that, you've got a downtime to the areas in the hospital.

Q So it is not just a question of

saying, “Well, take out this unit and put in another one,” because this unit is connected, as you have illustrated, to other floors of the hospital.

A And then you’d need to rebalance. If you cut the ductwork away, you’d need to rebalance the rest of the system as well – well, the remaining sections of the system –because you’ve reduced the air flow rate and the pressure dropped, your system designs changed.

Q So, if we look on to the next page of your brief, which is 44 on the electronic page, page 2 of 7, you are talking about 100 per cent resilience, though I probably didn’t pick up your reference to 2N.

A N+1.

Q N+1, right. So are you actually talking about having two air handling units?

A Yes.

Q And the need to make sure that if you are maintaining one, the other one will click into action, if I can be a layperson about it.

A Yes.

Q Thank you.

THE CHAIR: I mean, just so that I am following this, when you say N+1, is the N whatever number of air handling units you have and the 1 is the----

A Extra one, yeah.

Q Thank you.

MR CONNAL: Then the next bullet point deals with something we have not really discussed very much today, which is HEPA filtration, but that is what you were envisaging.

A Yes, that’s in SHTM 03-01 for neutropenic patients.

Q And was your point again----

THE CHAIR: Sorry, can I just get that? Does it follow that you did not find HEPA filtration in 2A?

A Yes.

Q Right, thank you.

MR CONNAL: Thank you, my Lord. I just wanted to check, is it the same point that you are making about HEPA filters as you were making about the fans, that you have to take account of the fact that they have to operate under dirty conditions, i.e. used but maintained in an ordinary way?

A Yeah. HEPA filters have got a very high resistance relative to a normal filter.

Q Because the air has to be forced through them.

A They still maintain them. Yeah. A smaller cross-section of area, a smaller free area through the grillage, through the filter medium.

Q Yes. The next point, you are touching on heat recovery and suggesting that has to be looked at carefully. Is that really all you are saying

there?

A Yep.

Q All right. I see now that you deal with existing internal fabric in the next bullet point; suspended modular ceilings; partitions; services; services penetration. So that is where, for instance, a pipe goes through the wall.

A Yep.

Q IPS panels?

A Like a toilet system to conceal pipework in.

Q And you are suggesting that that has to be carefully sealed?

A Yep.

Q And you quote a maximum air leakage rate; presumably that is also from guidance.

A Yes.

Q Then monitoring. Now, is this the business of alarms to the nurse station that you were talking about?

A Yeah.

Q I suppose that the final bullet point on that page is probably repeating the same point that because you are getting filtered air in, you need to make sure that everything is sealed.

A Yep.

Q At the foot of that page, are you talking about entrance lobbies to the ward generally rather than to the individual rooms?

A Yes.

Q What were you suggesting?

A I think that's something that came up from Infection Control and meetings with Ian Powrie. How would you protect inadvertent air ingress into the general ward? And it was decided the best way to mitigate that was to put an entrance lobby where you open one door, enter, the door shuts, and then you can open the next lobby, and that you'd pressurise a lobby, so you don't get air ingress from the wider hospital environment.

THE CHAIR: A sort of airlock.

A Airlock.

MR CONNAL: Yes, and then when you go onto the next page, which is 3 of 7 on your document, page 45 electronically, you find some final references to monitoring. Well, that is the point we have touched on, possible changes to other things like alarm systems and so on, and then air permeability testing. Why did this crop up on your list?

A That's air leakage. That's to allow you to positively pressurise the space. So, you'd test that. You'd physically test what the air leakage is.

Q That has got to be done once you've built the new system?

A It's just-- That's so you can validate that what you've tried to do is achieved.

Q Yes. Now, I think I am right in

saying, Mr Lambert, that the remainder of this document is really focused on what-- the other conditions that the consultant will be picking up on, what his appointment will be based on, the insurance cover and so on, rather than on the technical details of the work that is to be done. Is that right?

A Yep.

Q Thank you. Were you involved with the further work on this project?

A We were asked to stay on and be involved with overseeing the lead consultant's design up to tender stage.

Q Up to tender stage?

A Yeah.

Q Were you involved in the carrying out of the works to Ward 2A?

A No. We provided a list of comments to the consultant during the design, I think at tender stage, and then I think, from memory, there was a lot of other things that came to light when they started opening up bits and pieces in the ward and it delayed things, and I think the redesign grew arms and legs, and then our remit was stopped.

Q Right. I just have one more ventilation document to ask you about. That document we have just been looking at is dated 10 December 2018. There is an addendum to that, which is bundle 27, volume 1, page 50, and this is dated 15 March 2019. So, you do your brief in

December. What happens between December and March?

A We were asked to look at improvements-- well, "What could you do to Ward 2B without removing the entire system?" from memory.

Q So, the proposed programme for 2A involved basically taking out what was there and putting something new in?

A Yep.

Q Was it explained to you why that was not to be done for 2B?

A Not from memory, no.

Q So, your remit was to come up with, as it were, an addendum which talked about improving things, but not doing what was being done for 2A?

A Essentially leaving as much of the system in as you could to try and improve it, and air cleanliness and air change rates without making large alterations to the existing system.

Q Again, just for completeness, this additional work scope appears on the NHS paper, but is it something you prepared?

A Yes.

Q Who did you discuss matters with prior to putting pen to paper for this document?

A Ian Powrie.

Q So, it is a fairly short document, single page. We see it is additional to those referenced in the

immediately preceding document. So, you say the principal objective is to ensure all air supply provisions are afforded HEPA infiltration, including the Ward 2A BMT preparation rooms specifically requested by NHSGGC Infection Control specialists. How did that come about? What was the discussion there?

A That would have been something that-- it must have been Teresa was looking for to be added in specifically for that area.

Q There was the question how you went about ensuring that everything was HEPA-filtered, all the air was HEPA-filtered.

A Yeah.

Q Something slightly different is being talked about in the next paragraph, centralised HEPA-filtration. Just help us understand how that works.

A That means the filtration is at the air handling unit rather than at the terminal. You can filter at either/or, or both.

Q Right. So, if we were talking about this room, instead of a HEPA filter going to the circular grille in the ceiling that you pointed to earlier, it would be at an earlier point of the system so that all air coming here would be HEPA-filtered?

A Yeah, it would be at the air handling unit.

Q Thank you. Was there any advantage or disadvantage to that so far as you could see?

A You wouldn't need to go into the facility and change all the individual-- you wouldn't need to put HEPA filters at every unit. You could do it centrally.

Q Right, okay. So, it is sort of works disruption that is the issue there.

A Yeah.

Q You do not need to go and take-- "Come into this room," chuck everybody out, and take that grille out, because you're doing it somewhere else.

A Yeah.

Q Right, thank you. Then the next paragraph you are talking about re-balancing again. Now, just so we are understanding what you as an M&E engineer mean about re-balancing, what are you trying to achieve here?

A I'm trying to put more supply air into the BMT areas and make sure it's cascading into the adjacent corridor.

Q But there is a qualification to that paragraph. It says, "Well, what you can achieve is going to depend on building fabric air tightness."

A Mm-hmm.

Q So, what was the problem that you were having to face?

A The same as Ward 2A. You won't be able to positively pressurise a space if it's leaking through the grid.

A My Lord, I am conscious of the time. I do not have a huge number of questions, but there are another couple of documents I might ask this witness to look at, so I am happy to continue or rise for lunch now as you prefer.

THE CHAIR: Well, it is nearly one o'clock, and I think we planned on the possibility of going into the afternoon, so we will take a lunch break now. Could I ask you to be back for two o'clock, Mr Lambert?

THE WITNESS: No problem.

THE CHAIR: Thank you.

Adjourned for a short time

MR CONNAL: My Lord, can I just take this opportunity of tendering an apology to colleagues in the gathering here who may or may not have been trying to get me by email because unfortunately my laptop decided not to work while on the train this morning and has only recently recanted from that position. So if people sent me emails this morning, I did not get them. I have been given one in hard copy since.

THE CHAIR: The theme of the day seems to be technical glitches. Let us hope that it is restricted to today, but some things are without-- outside our control. Mr Lambert. Good afternoon. Now, Mr Connal.

MR CONNAL: Thank you. Mr Lambert, just before lunch, we were looking at the final ventilation-related document that IDS prepared, and I was just wanting to finish going through that very briefly so we understand it. We had talked about air tightness of fabric and issues over penetrations that had to be dealt with. In the next paragraph, so that is two-thirds of the way down the page, a paragraph starting, “In addition to the foregoing,” you are talking about reviewing supply air volume flow rates within peripheral areas. What is the objective of doing that?

A I was looking at reducing-- or looking at the viability of reducing supply air into certain less critical areas to try and promote-- or put in more supply air into the BMD and day care unit. Primarily the BMD, I think. No, both areas, “with a view to redirecting the supply air provisions into the BMA-- the BMD and the (inaudible) workspaces”.

Q So, at that stage it is a question of looking at this to see what is possible rather than knowing what is possible. Is that right?

A Yes. You'd need to agree, as well. If you're going to reduce air change rates in other areas of the ward, you'd need-- that'd need to be discussed and agreed as well.

Q Thank you, and then your-- the

penultimate paragraph talks about impact on downtime and so on, and then the final one is just an instruction, essentially, as to what the lead consultant is going to have to do. Is that right?

Q Yes.

A Thank you. Well, I am finished with that. I am going to ask you one or two questions which, perhaps, in some ways hark back to what we have discussed today in a slightly random order. So please accept my apologies for that. You may not know the answer to this. If so, please just say so. You remember that you found a reference in one of the commissioning reports to an air handling unit which was full of water, and you thought it was appropriate that you should, as it were, repeat that note in your report. Do you have any information as to what was done about that air handling unit being full of water?

A No.

Q Do you remember having-- discussing it with Mr Powrie or anyone else?

A No.

Q Thank you very much. When we were discussing thermal wheels, we were discussing them obviously in the context of your examination of Wards 2A and 2B. In your report, you included a note, the general effect of which was to say, “I believe there are thermal wheels

elsewhere in the hospital, in various other locations.”

A Yes.

Q You remember that?

A Yes.

Q Now, did I understand you correctly to say that somewhere you had seen an Excel spreadsheet showing where all the thermal wheels were?

A Yes.

Q First of all, had you seen such a sheet?

A Yes.

Q Where did you see it?

A On Zutec.

Q Sorry?

A On Zutec.

Q On Zutec?

A Yes.

Q So, you-- and it showed, you know, whether there was a thermal wheel in ward such-and-such?

A It was an Excel sheet.

Q Right.

A And it listed the facilities.

Q Right, but you think that was in Zutec somewhere?

A Yes.

Q Thank you very much. Can I ask you this? The evidence you have given us this morning about the impact of buildup of dust and dirt on the components of an air handling system indicated that it had an impact on

performance because the air does not flow as easily. When you were examining-- Did-- Sorry. Did you examine air handling units in 2A and 2B to see how clean or dirty they were?

A No.

Q That was not something you were asked to do?

A No. It was a non-intrusive inspection.

Q Non-intrusive inspection. Thank you.

THE CHAIR: Sorry, that is what you did?

A Yes.

Q And, therefore, to have looked inside a unit would have been intrusive?

A Yes, it's just non-- it's a visual, non-intrusive we did, yes.

MR CONNAL: Am I right in thinking, in relation to that answer, that to see the extent to which some parts of the system were-- and I will just use the word “dirty” without meaning anything special by it, you might have to switch the unit off and dig around inside the machinery?

A Yes. You also got ductwork access hatches, so you could open up the ductwork and clean it with brushes and things like that. So you'd need to physically go into the ceiling voids and then into the ductwork.

Q And into the ductwork?

A Yes.

Q But these were not things you were asked to do for the purpose of your report?

A No.

Q Thank you. Another extra question, if I can, and I apologise for taking you back to the start of this story, you explained to us earlier that you were in-- you think you were in the hospital for some other reason when you were asked to go and join a meeting that you recollected to be with Mary Anne Kane and Mr Gallacher. Is that right?

A Yes.

Q We have dates for your reports. Is it possible to work out a date for that meeting?

A I honestly can't remember. Weeks. Within weeks, I would have thought.

Q The first report was delivered in, am I right in thinking, October? Yes, so both of the 2A and 2B reports were delivered on dates in October, 2A on the 24th and 2B I think on the 17th, something like that. 15th, my fault. Is it possible for you to work back from that when you think you had that very first meeting?

A Late-- I would say late September.

Q Late September?

A I would have thought so.

Q Okay. Thank you very much. Well, thank you for dealing with these

additional matters. I just want to ask you, essentially, a couple of questions probably about a quite different report that your firm was involved with, and am I understanding correctly that your company was asked to do a report on the CHP, the combined heat and power plant operation?

A That was on the energy centre, which supplies----

Q On the energy centre?

A Yes. That supplies heat to the actual adult and children's hospital.

Q I will just ask you this generally, can you remember who asked you to do that?

A Alan Gallacher.

Q Alan Gallacher. Thank you. Now, that report appears in bundle 6 at page-- Sorry, not bundle 6. Bear with me. Bundle 15. Thank you. It is document 34 and it starts at page 674 electronically. It is a very large report and you will pleased to know I am not going to ask you all about it because, as things stand, I, for present purposes, do not need to ask you about the----

MR MORRISON: (Inaudible).

MR CONNAL: Sorry, it is 1072, yes, you are quite correct. I have been corrected as to the correct page of that report. It is 1072. Whether the CHP plant was operating correctly as a CHP plant is not something I need to ask you

about today, but one of the issues that you were looking at in the course of doing the work on the energy centre was water temperatures. Am I right in thinking that you are aware of the use of water temperatures within the new hospital as part of a mechanism for controlling Legionella and other infections?

A Yes.

Q In layman's terms, that is because water between a particular lower temperature and a particular higher temperature is regarded as a good breeding ground for bacteria and the like.

A Yep.

Q Is that something you are familiar with?

A Yes.

Q Now, can you just tell me generally did anything that you found in the course of your study of the energy centre in May 2018 have an impact on the use of the water system for maintaining a disinfectant regime?

A I found the temperatures weren't in compliance with SHTM requirements, so the----

THE CHAIR: Sorry, you are allowing your voice to drop.

A Sorry, so the temperatures weren't in compliance with the SHTMs.

Q All right, thank you.

A Lower temperature or return temperature. We also found that the

system was struggling to maintain the desired set temperature through the control system.

MR CONNAL: Right.

A So, from memory, it was set to maintain 65 degrees in the storage cylinders, whereas the system wasn't maintaining that temperature. It was lower.

Q Right.

THE CHAIR: So, the system was set to 55----

A So 60-- It was-- The system was set to maintain hot water at 65 degrees----

Q 65.

A -- and it was maintaining below that, below 60, and, from memory, the return temperature was above 5 degrees, whereas it's meant to maintained within 5 degrees.

MR CONNAL: I will take you to a part of the report just in a moment, but just taking that generally, did this have an impact on what you understood to be the intended use of the water system for prevention of Legionella and the like?

A Well, the temperatures were still above what you'd need to maintain them at. There was still a reasonably hot temperature, essentially.

Q Right.

A They're outwith what they should be stored at and what they should be circulating at.

Q Sorry, just give me that again. They were outwith----

A They were above-- They were within a range of temperatures that would have stopped bacteria growth.

Q Right, but not what was----

A They were above that----

Q -- not what they were meant to be?

A No, no, significantly lower than what they should've been.

THE CHAIR: Are you taking 55 degrees as the----

A Yeah, the return.

Q -- necessary temperature to inhibit microorganisms growing?

A Well----

Q You have explained that the system was set for 65----

A Yep.

Q -- you found lower temperatures.

A Yep.

Q Can I take it from that that the temperatures that you found were above 55 or----

A Below. They were below 55, but they were----

Q They were below 55.

A -- they were above 50. They were above 50.

Q But they were above 50. Thank you.

MR CONNAL: Did you report on that issue in this report?

A Yes.

Q I wonder if we could just scroll past page 1072 to the next page, please, and we will go past the index. Right.

A Yeah.

Q Can we look on to the next page, 1075? I am looking here at the top of page 2 of the report, page 1075 of the electronic bundle. Are you reporting at the very top of that page about some change that had been made to the control system? Were you talking about modifications?

A Yes.

Q What had been done?

A The system was originally intended to have a 105°C flow temperature and a 75°C return temperature, but the operation of the system and the intended control of the system wasn't functioning correctly at installation and handover stage, so post-handover, the control engineers along with the consultants or the contractor modified the system so it wasn't operating at 10-- I found it at some point operating at around about 60°C flow temperature.

Q Instead of----

A 105.

Q That is quite a big difference.

A Yes, and it serves air handling equipment and plate heat exchangers

that serve hot water cylinders. So if that plate heat exchanger is expecting to see a 105 flow temperature and you give it 60 or 70, it's not going to be able to heat the water as quickly as it was designed to, and, thereby, the more usage you've got on your plumbing side of things can have a knock-on effect. It won't be able to recover itself as quickly----

Q Right, and----

A -- and that's when your temperature----

Q -- so if people are running a lot of hot water somewhere and it is drawing from the system, it is not starting from the correct point, so it is struggling to get water of the correct temperature?

A It can't recuperate itself as quickly as it's designed to and, thereby, your temperatures drop.

Q Yes, because somebody has taken away all the hot water and the water that is left is not as hot as it should be.

A You can't heat it up as quickly as you should or it's designed to.

Q So, at the top of that page, you see a reference to this “adversely influencing thermal comfort and increasing the risks associated with Legionella.” What point were you making about Legionella there?

A That, at that point, if your temperatures and usage drop for a

prolonged period of time, the system's not heating the water up as quickly as it should, thereby, it could stay at a lower temperature for longer.

Q And if it is a lower temperature for longer, it may not meet the desired Legionella temperatures?

A Yes.

Q Is that right?

A Within your circulation system and in your cylinders.

Q Now, I think, in fairness to you, can I ask you to look at a further section of this report? It is at page 1119 of the electronic bundle. (After a pause) Do we find on that page a fuller explanation of the point you have been trying to make to us about the water not being at the right temperature, not being able to heat up fast enough and then it is dependent on how much usage there is? Have I managed to focus on the correct part of this report? (After a pause) I see near the foot of that page, Mr Lambert, it says:

> "In particular, the domestic hot water services appear to have been originally designed on the basis of direct heating utilising ... plate heat exchangers, as to afford rapid recovery of domestic hot water temperatures, and minimise risks associated with Legionella."

Is that the point you have been

making earlier?

A Yes.

Q I suppose I took you to a summary from the start of the report, but this is in the detailed material. Is that right?

A Yes.

Q Just for completeness, can we look at 1125? Do we see on the second paragraph on that page that the descriptions you have set out earlier in the report "identify that the current operation ... is resulting in temperatures that are not in accordance with HSE Guidelines" because of Legionella?

A Or-- Yeah, it must be maintaining it below 60. HSE require you to store hot water above 60°C.

Q Yes. So, you drew that to the attention of the Board in the report, along with all the other material that was coming?

A Yeah.

Q Yes. Is it possible for you to judge how long this, let me call it a potential issue with temperatures had been operating for?

A It was difficult because the contractor and the BMS specialist were making modifications to the system post-incident or post-handover, and I was given a-- there was no definitive documentation to tell me how they were-- how it was intended, so we went to Zutec

and then we found a description of operation for the system, and when we looked at that relative to a site, it wasn't operating as that document. So when we drilled into that, we found the BMS specialist was writing up a new one that wasn't even available at that time, so they were still making changes to it.

Q Yes. So, is it then, therefore, difficult for you, doing a report, to work out what had been done, when?

A Yes.

Q There was not a record of that in Zutec?

A No.

Q Thank you. Now, I think we can leave that document. Thank you very much. I think, before we have a short break to check for other matters, my Lord, I just have one more matter to raise with Mr Lambert. Very early on in your evidence, when we were talking about the parameters for particular wards and so on and so forth and why an air change rate of 2.8 or 3 was to be found, you said that you had now looked at some more documents which gave you an understanding of that. I just want to see if you have any comments on these. Now, there are only two of them, and I can probably deal with one simply by narrating what it has said, and then I will put the other one to you.

In a document, which is bundle 16,

page 1662, which is a thing called an "M&E Clarification Log", what happens is that-- this contains a series of exchanges, and nothing particularly arises from these other than what I will tell you. The Board says, "You're showing an air change rate of 2.5 an hour. It should be 6 in accordance with SHTM" – and that is something you have already referred us to – and then the response to that is as follows, it says:

> "Brookfield [that was the contractor's name at the time] proposal as outlined within the bid submission is to incorporate chilled beams as a low energy solution to control the environment which do not rely on large volumes of treated air or variable natural ventilation. All accommodation is single bedrooms and therefore the need for dilution of airborne microbiological contamination should be reduced (rooms could also be at slightly negative pressure)"----

THE CHAIR: Sorry, Mr Connal, it is my fault, I am just not finding----

MR CONNAL: Sorry, my Lord. This is----

THE CHAIR: I have the----

MR CONNAL: The part I am reading from is on page 1664----

THE CHAIR: Ah, 1664.

MR CONNAL: -- in the second column on that page at the foot.

THE CHAIR: (After a pause) I now have that. Yes, I now have that.

MR CONNAL: If we ignore the reference to “microbiological contamination”, we can actually find, over page on 1665, a statement that, “6 air changes is energy intensive and not necessary,” and then there is a response to that.

What I would like to ask you about to see if you can assist the Inquiry at all is another document that relates to that series of exchanges in a way that I need not debate at the moment, which is the-- Where is it? It is bundle 17, page 2859. Now, Mr Lambert, you were not involved, as you confirmed right at the outset, in the design or contract exchanges for this hospital but you were brought in later to produce a report on at least part of the ventilation system, and you have now been shown a document which seeks to, I think, argue for a reduction in air change rates to a different figure from the one you might expect from SHTM 03-01. Have you had a chance to look at that?

A This document?

Q Yes.

A Yes.

Q Do you have any comments whether, in your view, that provides good, bad, or indifferent justification for moving to an air change rate of 3?

A No.

Q Sorry, is that you do not have any comment or you do not think it provides justification?

A I don't think it provides justification. It's saying here that if you put in 6 air changes, it “became excessive and likely to cause draughts to occupants, poor temperature control and increased energy consumption”, but you could put in 10 air changes in that room and not make it draughty. You just need more supply air terminals and better distribution of the air supply. You could put 20 air changes in the room. It would use more energy, because you're putting more air in.

Q So, your conclusion is that it would use more energy, which is one of the points that is being made, but there is no reason why 6 air changes could not be done?

A No.

Q Thank you very much, Mr Lambert. Now, my Lord, I have no further questions and my Lord will probably have spotted that I have picked up one or two other questions that have been suggested to me. I am content if my Lord wishes to take a short break after this matter is concluded.

THE CHAIR: We will do that, Mr Connal. If you can just give me a

moment to look at this ward ventilation design strategy. (After a pause) You have had a chance to look at this, Mr Lambert?

A Yes.

Q So, the document seems to begin by looking at the temperature required by GGC. It then says the SHTM – and I think we are speaking about SHTM 03-01 here – allows for natural ventilation of areas, including general wards. I suppose if you are thinking about natural ventilation, you have got to suppose that windows will be opened.

A Yes.

Q Therefore, if it is an area without an opening, a window that can be opened does not really apply, and under mechanical ventilation it says, "The recommended air change rate for single rooms is 6 air changes per hour." Well, that perhaps depends on the use that the rooms are being put, because you have given us the example of neutropenic wards where the recommendation is 10.

A Yes, this is referring to a single room, by the looks of things.

Q Sorry, I missed that.

A This looks like it's referring to a single room application, a typical single room.

Q Yes. That does not apply to neutropenic wards?

A No, and they seem to be

relating the air change rate to temperature, which again is not correct.

Q It concludes why the air change rate is less than the SHTM. Now, that is less even than the general single rooms. It is in compliance with Scottish Building Regulations.

A I think that's-- You need 8 l/s per person for Scottish Building Regulations. (Inaudible) will probably recommend 10 l/s per person, whereas that's for fresh air to breathe for occupancy ventilation, it's not for healthcare.

Q But of course the purpose of the SHTM is to make recommendations in relation to healthcare facilities.

A Specifically, yes.

Q Whereas the Scottish Building Regulations apply to any space.

A Any occupied space, yes.

Q All right. Thank you. Now, as Mr Connal suggests, there may be further questions. So if you could give us, perhaps, 10 minutes, I will invite Mr Fox to take you back to this room.

A All right. Thanks.

(Short break)

THE CHAIR: Now, I understand that there are further questions.

MR CONNAL: There are a small

number of further questions for this witness, my Lord. I do not think they will take very long.

THE CHAIR: Very well.

MR CONNAL: Mr Lambert, thank you for bearing with us and for returning. I just have a small number of questions for you. One is, in a sense, a follow-on from something you explained to us earlier about having a single air handling unit for a ward with lots of ill patients in it. At that point, you were explaining to us that one of the consequences was that if the air handling unit failed, or part of it, then there was no ventilation because there was no natural ventilation, and that would obviously cause practical difficulties. Can I ask you a sort of follow-up to that, which is if you have a system like that where there is a single air handling unit providing the air to a particular ward and there is no natural ventilation, how do you carry out maintenance?

A That was noted in the report.

Q I mean, how do you maintain a system where to maintain it might involve, for instance, shutting it down? Does that mean taking everybody out? I have been asked just to explore what the realities are of that.

A If you don't provide the fresh air for occupants, it shouldn't be occupied, in accordance with Scottish

building regs, irrespective of SHTM guidance. You would lose your heating and cooling facility as well, because your heating and cooling is via your supply air system. So you would have no fresh air and no control over the comfort of your environment.

Q So, let us say I had wanted to go and do some maintenance work on the air handling unit for 2A and it involved not just dusting the grilles but doing something a bit more intrusive. Would that mean switching off that air handling unit and moving everybody out?

A Theoretically, yes. A heating coil could burst in your air handler, or a cooling coil, or changing filters over, or your fan could have a critical failure.

Q So any of these are failures that might require you to switch the unit off? Is that what you are telling me?

A Yeah, it would be a prolonged downtime whilst you undertake the remedial works, and in that time there's no fresh air supply into the facility.

Q Thank you. That is very helpful. Thank you very much, Mr Lambert. The other two I do not know whether you will be able to help me as much with. I want to take you back to the start of your evidence for two reasons. One is I am looking back to that very first discussion that you are on site, you are called into a room in the Estates block,

presumably. I can understand that you come out of that room with a remit to go and look at Wards 2A and 2B and see whether it is possible to increase air changes from 3 to 6. That bit we follow, but the question, really, is were you able to understand from that conversation whether those talking to you already knew there was a problem?

A I'm assuming they were aware that it was under 6 to be able to ask me, "Could you look at the viability of increasing it to six?" I thought there must have been concern there.

Q Thank you. The final question I have for you, and thank you for your patience, is just to ask you one that I pretty much asked you beforehand, but I want to put in a slightly different way, and that is we were trying to date that initial meeting, and you thought it was probably late September, but you could not be more precise. Can you remember or can you not whether it was before Ward 2A was closed? Because at one point Ward 2A was decanted into another part of the hospital.

A I think the ward was still occupied.

THE CHAIR: Sorry, I did not----

A I think the ward was still occupied, or it was in the process of being decanted.

MR CONNAL: When you were first involved?

A When I first entered the ward, yep, which is-- I must have got the remit and then went straight to it, so it must have been within a day.

Q Right. So at the point when you had the first meeting, you think you may have gone straight to the ward to have a look. Was that what happened?

A Or within a day or so.

Q Within a day or so?

A Yep.

Q Presumably accompanied by someone from----

A From Estates.

Q From Estates.

A Yeah.

Q And you think the ward was still occupied at that time?

A Yes. I think it was being decanted at the time.

Q It was being decanted?

A They were in the process of----

Q In the process.

A Yeah.

Q Thank you very much. I have no further questions, my Lord.

THE CHAIR: All right. Can I just check with the room that Mr Connal has asked what he has been asked to ask? I think I take it that there are no further questions. Mr Lambert, thank you very much for your attendance, but also thank you very much for the work that has gone

into preparing your witness statement. I appreciate that that will have been extensive. I am grateful for that and it is very useful to the Inquiry, but you are now free to go.

THE WITNESS: Thank you very much. Cheers.

THE CHAIR: Now, as I understand it, Mr Connell, you have no further witnesses today.

MR CONNAL: That's correct.

THE CHAIR: But you hope to begin at ten o'clock tomorrow with Mr Powrie?

MR CONNAL: Yes, and Mr Powrie, as everybody in the room knows, my Lord, has a very extensive witness statement. I will not be taking him to all of it for purely practical reasons, but I will be endeavouring to uncover as many of the issues of significance as I can. He will not have the same problem as Mr Lambert of wondering how much more time we have. The question will be trying to get Mr Powrie finished in the day, but we will see.

THE CHAIR: Well, we will see each other again at ten o'clock. Until then, a good afternoon.

(Session ends)

14:55