

<p>1 Monday, 26 November 2018</p> <p>2 (10.00 am)</p> <p>3 SIR MARTIN MOORE-BICK: Good morning, everyone. Welcome to</p> <p>4 today's hearing.</p> <p>5 We are going to continue this morning with the</p> <p>6 evidence of Dr Lane.</p> <p>7 MS GRANGE: Yes.</p> <p>8 SIR MARTIN MOORE-BICK: Could you ask Dr Lane to come back</p> <p>9 in, please. Thank you.</p> <p>10 DR BARBARA LANE (continued)</p> <p>11 Questions by MS GRANGE (continued)</p> <p>12 SIR MARTIN MOORE-BICK: All right, ready to carry on?</p> <p>13 THE WITNESS: Yes.</p> <p>14 SIR MARTIN MOORE-BICK: Good, thank you very much.</p> <p>15 Yes, Ms Grange.</p> <p>16 MS GRANGE: Thank you.</p> <p>17 Just to signpost what we're going to be dealing with</p> <p>18 today, I want to focus today on the active and passive</p> <p>19 fire safety measures inside the building, and the extent</p> <p>20 to which they failed to control the spread of fire and</p> <p>21 smoke and contributed to the speed at which the fire</p> <p>22 spread.</p> <p>23 In general, we're going to be looking at certain</p> <p>24 passive measures first, including the flat and stair</p> <p>25 doors, and then looking at the active systems later in</p> <p>Page 1</p>	<p>1 The word "flammability" threw me because it's not</p> <p>2 a defined term in reaction to fire tests or in general;</p> <p>3 it's a word I won't use as a fire safety engineer.</p> <p>4 I think if the person meant sustained flaming, if</p> <p>5 sustained flaming is part of assessing combustible and</p> <p>6 non-combustible materials, the answer is yes, with zero</p> <p>7 required for a non-combustible material, and then</p> <p>8 different quantities of sustained flaming. Remember we</p> <p>9 talked about the B down to F then for other materials.</p> <p>10 So it's a very technical point but I just felt quite</p> <p>11 bad I didn't answer it on Thursday.</p> <p>12 SIR MARTIN MOORE-BICK: That's helpful, thank you.</p> <p>13 MS GRANGE: Thank you.</p> <p>14 Yes, so just before we consider flat doors</p> <p>15 specifically, I just want to start by considering the</p> <p>16 overall consequences once we have a multi-storey fire in</p> <p>17 existence.</p> <p>18 Once that was the case, so we have this external</p> <p>19 fire spread, what fire safety features of the building</p> <p>20 do you think became most critical inside the building?</p> <p>21 A. Okay, so I haven't given an order of contribution yet,</p> <p>22 as you know, so I wouldn't mind actually talking about</p> <p>23 that for just a little while.</p> <p>24 So once the cladding fire had become a multi-storey</p> <p>25 fire, then, over time, internal fires also commenced,</p> <p>Page 3</p>
<p>1 the day, including the fire main, the lift and the smoke</p> <p>2 control system.</p> <p>3 Mr Chairman, I want to just give a very minor</p> <p>4 trigger warning at this stage on the basis that, during</p> <p>5 the next two sections dealing with doors, we will look</p> <p>6 at some images of fire doors in Grenfell Tower,</p> <p>7 including some images of the doors when tested with</p> <p>8 smoke and flame around them. So it's just a minor</p> <p>9 trigger warning now in case anyone would find those</p> <p>10 images distressing.</p> <p>11 Before we start, I understand, Dr Lane, that there</p> <p>12 is one point of clarification that you would like to</p> <p>13 provide in relation to your evidence from last Thursday.</p> <p>14 A. Yes, there is.</p> <p>15 I think it was just before lunch, there was quite</p> <p>16 a rapid series of questions about non-combustible,</p> <p>17 combustible and flammability.</p> <p>18 SIR MARTIN MOORE-BICK: Yes.</p> <p>19 A. So I just want to speak very briefly about that.</p> <p>20 The question about non-combustible was, I think: did</p> <p>21 I agree it dealt with calorific content only? My answer</p> <p>22 is no, because sustained flaming, mass loss and</p> <p>23 temperature difference must also be measured and, within</p> <p>24 limits, that's what becomes the definition of</p> <p>25 a non-combustible material.</p> <p>Page 2</p>	<p>1 and so we now, over time, had a multi-storey internal</p> <p>2 fire condition.</p> <p>3 So it's two multi-storey events, if you will, one</p> <p>4 caused by the other.</p> <p>5 I also made clear on Thursday that in the next phase</p> <p>6 of my work I'm going to be looking at intrinsic risk and</p> <p>7 risk assessments. And this is important, because</p> <p>8 a non-compliant system will either play a role or not in</p> <p>9 terms of a hazard posed to an individual, or a grouping</p> <p>10 of individuals, as a function of the fire hazard in that</p> <p>11 location.</p> <p>12 So, giving a theoretical example, a non-compliant</p> <p>13 fire door may have a substantial contribution to the</p> <p>14 severe consequences in one location for a grouping of</p> <p>15 people, and it may have had no contribution in another</p> <p>16 location where the consequences were not extreme.</p> <p>17 So the non-compliance status is important, and we'll</p> <p>18 be talking a lot about that today and in terms of health</p> <p>19 and safety duties.</p> <p>20 But the next thing, then, is the overall assessment</p> <p>21 of risk, understanding the hazards to the people who</p> <p>22 lost their lives particularly in those locations, and</p> <p>23 how each active and passive fire safety measure</p> <p>24 contributed to what's called "severe harm".</p> <p>25 I've put in section 2 of my report a document I want</p> <p>Page 4</p>

<p>1 to make you aware of. It's called PAS 79. That sets 2 out a fire risk assessment methodology. And risk is 3 a function of probability of occurrence and consequences 4 of failure, and where there is multiple loss of life, 5 that's defined as "severe harm".</p> <p>6 So we know the consequences and we know the 7 probability, and the next step, then, is to analyse, for 8 each grouping of people who lost their lives, how each 9 one of the active and passive measures contributed.</p> <p>10 So I can't pick one more than the other for all 11 conditions, because the fire hazard is different as 12 a function of one's location.</p> <p>13 SIR MARTIN MOORE-BICK: Yes.</p> <p>14 MS GRANGE: Just in terms of particular features that are 15 critical, would you agree that the protected stairs and 16 the lobbies are two particularly important spaces?</p> <p>17 A. Yes. So in Grenfell Tower, there was only one staircase 18 and, when a resident was in a flat, one lobby leading to 19 one staircase. So once the fire had spread through the 20 cladding on multiple floors, there was only one way to 21 leave the building, and so the staircase, but 22 particularly the lobby, immediately became the most 23 important protection measure for those persons when they 24 were evacuating.</p> <p>25 For people who stayed, various active and passive</p> <p style="text-align: center;">Page 5</p>	<p>1 important, in my opinion.</p> <p>2 Q. Just one more question before we get specifically to 3 flat doors.</p> <p>4 In terms of the active and passive safety systems in 5 the building, I think your evidence is that the greater 6 number of layers of safety which fail, the greater the 7 likelihood of a major incident; is that correct?</p> <p>8 A. Yes, that's correct, and that's not, let's say, you 9 know, an opinion I formulated on my own; it's kind of 10 classic disaster or catastrophe theory, where the more 11 layers -- just as the statutory guidance builds in 12 layers and multiple layers, we spoke a lot about cavity 13 barriers on Thursday, there's at least three, for 14 example, between one window and the next.</p> <p>15 So the more layers that are defective or entirely 16 defective, the higher the risk and the more severe the 17 consequences.</p> <p>18 Q. So turning, then, to specifically look at flat doors, 19 it's really chapter 15 and it's particularly 20 chapter 15.5 and appendix I that are going to be 21 relevant here, if you want to make sure you have those 22 to hand.</p> <p>23 A. Yes.</p> <p>24 Q. Picking up on that theme about flat doors and their 25 importance, in the LGA guide on purpose-built blocks of</p> <p style="text-align: center;">Page 7</p>
<p>1 fire protection measures were needed or relied upon by 2 them to make that staying put safe in that context.</p> <p>3 Okay?</p> <p>4 So the stairs and the lobby become very important, 5 but the compartmentation to the flats was exceptionally 6 important for people who did not walk down the stairs of 7 their own accord, within particularly the first 8 40 minutes.</p> <p>9 I've gone into considerable detail on this subject 10 in section 14 particularly.</p> <p>11 Q. I just wanted to get you to give an overview at this 12 stage, and what you're saying there is that flat doors 13 and stair doors, which we're going to come to in 14 a moment, become particularly important?</p> <p>15 A. They become particularly important, but there are other 16 openings in the lobby that are a potential for fire and 17 smoke spread. So any riser breaking through the lobby, 18 such as the smoke control riser, when it's shut, must 19 also prevent fire and smoke spread.</p> <p>20 There were multiple other services in the lobby 21 built as part of the primary refurbishment, and they too 22 needed to prevent fire and smoke spread.</p> <p>23 But in terms of the immediate line between a person 24 in a flat and the conditions in the lobby and the 25 conditions in the stairs, the doors are particularly</p> <p style="text-align: center;">Page 6</p>	<p>1 flats, it says that flat doors are critical to the 2 safety of the common parts. Would you agree with that?</p> <p>3 A. Yes, I do.</p> <p>4 Q. In terms of the relevant legal framework, and what 5 happened at Grenfell Tower, we know that there was 6 a significant flat door replacement in 2011 --</p> <p>7 A. Yes.</p> <p>8 Q. -- in Grenfell Tower.</p> <p>9 At that time, 106 flat doors were replaced. You 10 give the figures in your report. That's 58 unglazed 11 flat doors --</p> <p>12 A. Yes.</p> <p>13 Q. -- and 48 glazed.</p> <p>14 Both types of door were Masterdord Suredoor doors.</p> <p>15 A. That's correct.</p> <p>16 Q. Is that correct?</p> <p>17 In addition, there were 14 doors that were not 18 replaced at that time which you believe may have been 12 19 leaseholder doors and two tenanted doors; is that 20 correct?</p> <p>21 A. Yes.</p> <p>22 Q. We should perhaps note at this point that you've noted 23 that in certain chronologies produced to the inquiry, 24 there's some reference to flat door replacement works in 25 or about 1985. But is it right that we don't have any</p> <p style="text-align: center;">Page 8</p>

<p>1 documentation at this stage to assist us in what</p> <p>2 would've been the scope of those works?</p> <p>3 A. That's correct.</p> <p>4 Q. As we've already discussed, back last Thursday, your</p> <p>5 view is that Grenfell Tower was originally constructed</p> <p>6 in accordance with the guidance set out in CP3 1971, and</p> <p>7 you've explained to us what the CP3 1971 guidance</p> <p>8 would've been for doors.</p> <p>9 You've said the recommended performance</p> <p>10 specification was for something called a type 3</p> <p>11 fire-resisting door.</p> <p>12 A. Yes.</p> <p>13 Q. Is that correct?</p> <p>14 A. Yes.</p> <p>15 Q. You've explained in your report that that meant they</p> <p>16 must have freedom from collapse for at least 30 minutes,</p> <p>17 resistance to passage of flame for at least 20 minutes</p> <p>18 and fitted with automatic self-closing devices; is that</p> <p>19 correct?</p> <p>20 A. That's correct.</p> <p>21 Q. Building up towards the 2011 flat door replacement, you</p> <p>22 note that there was some DCLG guidance in 2006, "Fire</p> <p>23 safety risk assessments: sleeping accommodation", often</p> <p>24 referred to as the DCLG sleeping guide, and that that</p> <p>25 was available and in force at the time the 2011 door</p> <p style="text-align: center;">Page 9</p>	<p>1 the LGA guide.</p> <p>2 If we could blow up that table at the bottom, that's</p> <p>3 great.</p> <p>4 Can you see that okay?</p> <p>5 A. Yes. Actually, it's probably worth saying, nothing has</p> <p>6 been made available to me, and I would've thought it</p> <p>7 should have been by now, as to what the performance spec</p> <p>8 for those works actually were, and so what document was</p> <p>9 actually relied upon or considered.</p> <p>10 Q. Yes.</p> <p>11 SIR MARTIN MOORE-BICK: All right.</p> <p>12 MS GRANGE: That's helpful.</p> <p>13 What I'm going to do is look at the LGA guide now,</p> <p>14 and then we'll look at the relevant parts of ADB which</p> <p>15 you've summarised.</p> <p>16 Sticking with this, the LGA guide, this is giving</p> <p>17 benchmarks for existing blocks of flats.</p> <p>18 A. Yes.</p> <p>19 Q. What it's saying is if you've got different travel</p> <p>20 distances, you may be advised to do different things</p> <p>21 with your doors; is that correct?</p> <p>22 A. That's correct.</p> <p>23 Q. At Grenfell Tower -- we'll come back to your diagram in</p> <p>24 a moment -- you've measured travel distance in the lobby</p> <p>25 as up to 10.5 metres.</p> <p style="text-align: center;">Page 11</p>
<p>1 replacement was being considered; is that correct?</p> <p>2 A. Yes.</p> <p>3 Q. You say that that assisted in any risk assessment</p> <p>4 relating to doors; is that correct?</p> <p>5 A. It should do.</p> <p>6 Q. You say that a key point that is made in that DCLG</p> <p>7 guidance was that all doors onto a protected corridor</p> <p>8 should have a self-closing device; is that correct?</p> <p>9 A. Yes.</p> <p>10 Q. You also note that from July 2011, there was the Local</p> <p>11 Government Association, LGA, guide on purpose-built</p> <p>12 blocks of flats --</p> <p>13 A. Yes.</p> <p>14 Q. -- which also applied to doors in Grenfell Tower; is</p> <p>15 that correct?</p> <p>16 A. Correct.</p> <p>17 Q. Is it right that this represents guidance to assist</p> <p>18 responsible persons to discharge their duties under the</p> <p>19 Fire Safety Order 2005?</p> <p>20 A. Yes, it is.</p> <p>21 Q. I just want to look at a few potentially relevant parts</p> <p>22 of that guidance.</p> <p>23 A. Okay.</p> <p>24 Q. So if we can pull that up. If we can go to</p> <p>25 CTAR00000033, at page 98, this is internal page 95 of</p> <p style="text-align: center;">Page 10</p>	<p>1 A. Yes.</p> <p>2 Q. Which means -- are we on the second-to-last bullet point</p> <p>3 here?</p> <p>4 A. Exactly. So if one agrees with the LGA guide, it says</p> <p>5 that for a travel distance between 10 to 15 metres, in</p> <p>6 an existing building, as a minimum the existing doors</p> <p>7 should be upgraded as opposed to being replaced with</p> <p>8 a new door.</p> <p>9 Q. Yes.</p> <p>10 So just to read that:</p> <p>11 "• In ventilated lobbies and corridors, travel</p> <p>12 distances of ten to 15m may be acceptable, providing all</p> <p>13 doors to the common corridor or lobby are at least</p> <p>14 'upgraded FD30S' doors ... and the smoke ventilation</p> <p>15 comprises PVs or AOVs."</p> <p>16 A. That's correct. So it's travel distance and ventilation</p> <p>17 provision.</p> <p>18 Q. Just to be clear what PV or AOV means --</p> <p>19 A. Permanent vent and automatically openable vent, yes.</p> <p>20 Q. Thank you.</p> <p>21 If we can then stay with this LGA guide for a moment</p> <p>22 and go to paragraph 62.17, that's on internal page 101.</p> <p>23 A. Yes.</p> <p>24 Q. So here, what it's saying is it's not going to be</p> <p>25 practicable to test existing doors to confirm their</p> <p style="text-align: center;">Page 12</p>

<p>1 actual fire resistance; therefore, various options exist</p> <p>2 in relation to doors.</p> <p>3 A. Yes.</p> <p>4 Q. So this is saying you can either accept the door as it</p> <p>5 is, upgrade the door or replace the door; is that</p> <p>6 correct?</p> <p>7 A. Well, it's the view of this guide that it's not</p> <p>8 practicable to test existing doors, and so it offers you</p> <p>9 some other approaches to consider.</p> <p>10 Q. Yes.</p> <p>11 A. Do you want me to explain?</p> <p>12 Q. And one of those is replacement of the door.</p> <p>13 A. Yes, it is indeed.</p> <p>14 Q. Exactly.</p> <p>15 It might be helpful at this point, because this is</p> <p>16 going to come up in relation to doors generally, where</p> <p>17 we have upgrading of the door, it talks about fitting</p> <p>18 intumescent strips and smoke seals.</p> <p>19 Could you just explain to the chairman what the</p> <p>20 difference is between an intumescent strip and a smoke</p> <p>21 seal?</p> <p>22 A. Yes, I can.</p> <p>23 So an intumescent strip operates under heat, and</p> <p>24 it's intended to prevent the passage of flame as well as</p> <p>25 the gaseous products of combustion.</p> <p style="text-align: right;">Page 13</p>	<p>1 class or the European class.</p> <p>2 Q. Thank you.</p> <p>3 Just before we come on to Approved Document B, we</p> <p>4 talked about travel distances and your assessment of</p> <p>5 travel distances.</p> <p>6 You've put a very clear figure in your addendum to</p> <p>7 your report, BLAS0000037 on page 24, figure 15.5. If we</p> <p>8 could bring that up.</p> <p>9 (Pause)</p> <p>10 It's within that same addendum, and it's figure</p> <p>11 15.5.</p> <p>12 (Pause)</p> <p>13 A. I'm not sure the figure can really do --</p> <p>14 Q. If you want to explain --</p> <p>15 A. Be as powerful as it might be looking at the moment.</p> <p>16 SIR MARTIN MOORE-BICK: You tell us what you want to tell</p> <p>17 us.</p> <p>18 A. I think on the drawing I marked up the travel distance</p> <p>19 from each door, and it's quite striking, actually, when</p> <p>20 you think about consequences later, the difference in</p> <p>21 terms of journey distance as a function of what flat you</p> <p>22 lived in. And in terms of the LGA guide, that the</p> <p>23 travel distances are exceeded.</p> <p>24 I don't know if you wanted to cover anything else --</p> <p>25 Q. We can come back to that in bit. We'll check we have</p> <p style="text-align: right;">Page 15</p>
<p>1 A smoke seal is intended to prevent the passage of</p> <p>2 gaseous products of combustion only. It's also called</p> <p>3 a cold smoke seal.</p> <p>4 Q. Again, just sticking with this guide for the moment, can</p> <p>5 we go to page 102 and look at 62.20.</p> <p>6 So is it right that that is making clear:</p> <p>7 "62.20. The fitting of suitable self-closing</p> <p>8 devices - whether to replace rising butt hinges</p> <p>9 (pictured below) or because the doors are not fitted</p> <p>10 with self-closing devices - must be undertaking the</p> <p>11 short term as a matter of priority.</p> <p>12 So in this guide, it is very clear that you must fit</p> <p>13 self-closing devices as a priority; is that correct?</p> <p>14 A. Absolutely, which aligns with the statutory guidance.</p> <p>15 Q. Which we're going to come to next.</p> <p>16 Can we also look at paragraph 62.22 of the LGA</p> <p>17 guide. That's at the bottom there.</p> <p>18 Is it right that that makes clear that:</p> <p>19 "62.22. Any new or replacement doors within</p> <p>20 an existing block of flats should meet current standards</p> <p>21 for fire-resisting doors ..."</p> <p>22 So if you choose to put in a new door, you need to</p> <p>23 put it in in accordance with current standards?</p> <p>24 A. Yes, that's correct, and so one would be expected to</p> <p>25 have the relevant test evidence to either the national</p> <p style="text-align: right;">Page 14</p>	<p>1 the right diagram.</p> <p>2 A. So, for example, flat 1s --</p> <p>3 Q. Page 25.</p> <p>4 A. -- the travel distance is only 4.5 metres, it's a very</p> <p>5 short distance, but for other flats it's in excess of</p> <p>6 10 metres. That's why this situation about the hazard</p> <p>7 experienced in specific locations is going to become so</p> <p>8 important.</p> <p>9 Q. Yes, that's it. If we can zoom in on that middle</p> <p>10 figure, blow that up.</p> <p>11 A. Yes.</p> <p>12 Q. So does that illustrate your --</p> <p>13 A. Yes.</p> <p>14 Q. -- travel distances?</p> <p>15 A. Yes.</p> <p>16 So you can see occupants of flat 4 have to travel</p> <p>17 over double that of, say, somebody living in flat 1.</p> <p>18 Q. I now want to go to your summary of the requirements of</p> <p>19 the relevant part of Approved Document B, and this is</p> <p>20 table I3 of your report, if we could bring that up on</p> <p>21 the screen. That's BLAS0000030 at 36.</p> <p>22 Thank you.</p> <p>23 You've explained in your report that at the time of</p> <p>24 the flat door replacement work in 2011, Approved</p> <p>25 Document B 2010 would've been in place; is that correct?</p> <p style="text-align: right;">Page 16</p>

<p>1 A. That's correct.</p> <p>2 Q. What you've sought to do in this table, which I think</p> <p>3 appears in A3 landscape in your report, is to summarise</p> <p>4 the key performance requirements that are there in</p> <p>5 Approved Document B 2010; is that correct?</p> <p>6 A. That's correct.</p> <p>7 Q. I just want to pick out some of the key ones at this</p> <p>8 stage?</p> <p>9 A. Mm.</p> <p>10 Q. So if we go the fourth column along, you have "Fire</p> <p>11 resistance", and there you have no integrity failure up</p> <p>12 to 30 minutes when tested to the relevant British</p> <p>13 Standards; is that correct?</p> <p>14 A. That's correct.</p> <p>15 Q. That's 30 minutes' integrity.</p> <p>16 A. 30-minute door, yes.</p> <p>17 Q. Just remind us what integrity is.</p> <p>18 A. It's a measure of preventing flame and temperature</p> <p>19 coming through cracks. That's a very simplistic</p> <p>20 definition. There's certain ways of measuring it during</p> <p>21 the test, but it's basically to make sure there's no</p> <p>22 cracks and no flames protruding.</p> <p>23 Q. Yes.</p> <p>24 In the next column you have "Smoke leakage</p> <p>25 performance standard", and you refer to -- they have to</p> <p style="text-align: right;">Page 17</p>	<p>1 "Must close door from any angle and against any</p> <p>2 latch ..."</p> <p>3 Is that correct?</p> <p>4 A. That's correct.</p> <p>5 Q. That's what you were emphasising earlier, that this</p> <p>6 statutory guidance, the LGA guide, the DCLG sleeping</p> <p>7 guide, they're all clear about self-closing devices.</p> <p>8 A. They're all entirely aligned about the provision of</p> <p>9 self-closers, and the guidance since the 1970s has been</p> <p>10 very clear about what the role of a self-closer is and</p> <p>11 why it is so important.</p> <p>12 Q. Do you want to just explain why it's so important?</p> <p>13 I mean, it may sound obvious, but --</p> <p>14 A. To shut the door. To shut the door after a person, to</p> <p>15 make sure the door can close.</p> <p>16 Q. Yes.</p> <p>17 A. I can't say anything else.</p> <p>18 SIR MARTIN MOORE-BICK: To make sure it does close, really.</p> <p>19 A. Did I say make sure it doesn't close?</p> <p>20 SIR MARTIN MOORE-BICK: No, no, you said "can".</p> <p>21 A. No, to make sure it does close, yes. Yes.</p> <p>22 MS GRANGE: I now want to run through your conclusions about</p> <p>23 the performance of the flat doors based on your</p> <p>24 investigations.</p> <p>25 A. Yes.</p> <p style="text-align: right;">Page 19</p>
<p>1 have a leakage rate not exceeding 3 cubic metres per</p> <p>2 metre per hour when tested in certain ways; is that</p> <p>3 correct?</p> <p>4 A. Yes, that's correct, and measuring that leakage is</p> <p>5 deemed to represent the smoke leakage condition.</p> <p>6 Q. Yes.</p> <p>7 Two other points on this table.</p> <p>8 "Glazing", in the sixth column, it makes it clear:</p> <p>9 "No glazing unless the glazing as per table A4</p> <p>10 unless the glazing has been demonstrated to achieve</p> <p>11 an insulation performance equivalent to the required</p> <p>12 integrity performance."</p> <p>13 Is that correct? That's saying your glazing has not</p> <p>14 got to be a weak point; is that correct?</p> <p>15 A. That's correct. So on escape routes, the glazing</p> <p>16 basically has to be detailed up to not be a weak spot</p> <p>17 and not allow heat transfer through the glass. So</p> <p>18 insulation performance is about preventing -- detailing</p> <p>19 to prevent temperature rise on the unheated side. So</p> <p>20 it's protecting the person walking past the closed door</p> <p>21 if the fire's behind that door.</p> <p>22 Q. The point you made earlier about self-closing device is</p> <p>23 in the very next column, self-closer performance</p> <p>24 standard. So that makes it clear that it is required,</p> <p>25 under Approved Document B 2010:</p> <p style="text-align: right;">Page 18</p>	<p>1 Q. Primarily we're looking at the 106 Masterdor doors that</p> <p>2 were replaced.</p> <p>3 A. Yes.</p> <p>4 Q. You say in your report that you surveyed eight of these</p> <p>5 Masterdor doors during your site visit; is that correct?</p> <p>6 A. Yes.</p> <p>7 Q. You've noted a large number of problems with these</p> <p>8 doors.</p> <p>9 A. Yes.</p> <p>10 Q. I just want to pick up on some of the key ones. There's</p> <p>11 a lot of detail in appendix I --</p> <p>12 A. Yes.</p> <p>13 Q. -- but I want to focus on some of the key points you</p> <p>14 seem to be making.</p> <p>15 You say that the 106 doors were not tested for</p> <p>16 30 minutes' integrity from both sides of the door and,</p> <p>17 therefore, were not compliant with the requirements of</p> <p>18 Approved Document B; is that correct?</p> <p>19 A. Yes. So there's the door installed in Grenfell Tower</p> <p>20 and then there's the door that was tested and used as</p> <p>21 the relevant test evidence. So the test door was tested</p> <p>22 from one side only. But as you know, the test door type</p> <p>23 isn't what was installed at Grenfell Tower.</p> <p>24 Q. I understand.</p> <p>25 A. Okay? So the door was tested from one side only.</p> <p style="text-align: right;">Page 20</p>

<p>1 Q. Yes.</p> <p>2 A. Yes.</p> <p>3 Q. It's worthwhile, I think, at this point, noting that you</p> <p>4 have referred to the BRE global test report that the MPS</p> <p>5 obtained on one of these doors.</p> <p>6 A. Yes.</p> <p>7 Q. They tested one of these doors on 13 February 2018 for</p> <p>8 fire integrity.</p> <p>9 A. Yes.</p> <p>10 Q. The door achieved just 15 minutes integrity; is that</p> <p>11 correct?</p> <p>12 A. That's correct, and with the glazing panel in it.</p> <p>13 Q. I'd like to look at that test report because I think</p> <p>14 that's useful. If we can bring that up, there we go,</p> <p>15 this is the test report MET00019996.</p> <p>16 If we go to internal page 25 of this test report, if</p> <p>17 you can perhaps zoom in on that image.</p> <p>18 Here we have the door, and it says in the label:</p> <p>19 "Exposed face of specimen at time of first integrity</p> <p>20 failure (15 minutes)."</p> <p>21 Can you talk us through what we're seeing in that</p> <p>22 picture?</p> <p>23 A. Well, I mean, it's a bit blurry. So what I see is flame</p> <p>24 coming out presumably where the glazed area is in that</p> <p>25 door.</p> <p style="text-align: right;">Page 21</p>	<p>1 A. Yes.</p> <p>2 Q. In those circumstances, how representative do you think</p> <p>3 this test result to be of the those doors' performance?</p> <p>4 A. I think it was nearly half the doors had glazing in</p> <p>5 them.</p> <p>6 Q. Yes.</p> <p>7 A. Yes.</p> <p>8 Q. Where there's a glazed door, you consider this test</p> <p>9 evidence to be relevant?</p> <p>10 A. Yes. Well, my understanding is this is the door that</p> <p>11 was installed at Grenfell Tower, but the BRE and the</p> <p>12 police would need to just confirm all of that. But my</p> <p>13 understanding is that is one of the doors.</p> <p>14 Q. Yes.</p> <p>15 A. And so it is representative.</p> <p>16 Q. On glazing, that's another one of the issues you've</p> <p>17 identified in your report, you've noted that the glazed</p> <p>18 test specimen used for the original fire test report in</p> <p>19 support of those flat doors used a different</p> <p>20 specification of glass to that which was actually used</p> <p>21 in the 2011 upgrade; is that correct?</p> <p>22 A. That's correct, they're not described the same way, and</p> <p>23 obviously if we wanted to proceed with that further, it</p> <p>24 would be useful to understand exactly the exact</p> <p>25 technical specification that was proposed and what was</p> <p style="text-align: right;">Page 23</p>
<p>1 Q. Yes.</p> <p>2 A. That's around here (Indicates).</p> <p>3 Q. Is it potentially significant that we're also seeing</p> <p>4 smoke coming from the sides of the door?</p> <p>5 A. Yes, so that's a bit complicated, actually, because if</p> <p>6 that smoke isn't hot enough, by definition, in the test,</p> <p>7 it doesn't matter that that smoke is coming around the</p> <p>8 door. And I have to be honest that I also witnessed</p> <p>9 some other doors being tested, and it really struck me</p> <p>10 during those tests that that was deemed to be</p> <p>11 acceptable.</p> <p>12 Q. If we then go just one page on at page 26, that is the</p> <p>13 door at 28 minutes, is that right, at the end of the</p> <p>14 test?</p> <p>15 A. Yes.</p> <p>16 Q. I wanted to kind of --</p> <p>17 A. Yes.</p> <p>18 Q. So we can see the difference between --</p> <p>19 A. So total failure of the door.</p> <p>20 Q. Yes.</p> <p>21 You note that this is a retrospective test of a door</p> <p>22 taken from Grenfell Tower.</p> <p>23 A. Yes.</p> <p>24 Q. And it's obviously a glazed specimen that we're looking</p> <p>25 at here.</p> <p style="text-align: right;">Page 22</p>	<p>1 installed in the tower. But I personally don't need</p> <p>2 that level of detail because I'm clear the door failed</p> <p>3 in the test.</p> <p>4 Q. You say for that reason that that test evidence that</p> <p>5 came with the doors is not relevant test evidence in</p> <p>6 circumstances where the glazing is different.</p> <p>7 A. Exactly. So it's made very clear in the statutory</p> <p>8 guidance document the importance of taking care with the</p> <p>9 glass, and so when one is offering a door with glazing</p> <p>10 for installation in a residential building, it's</p> <p>11 important to make sure that glazed element is a glazed</p> <p>12 element that's been tested satisfactorily, and will</p> <p>13 allow the door to perform to the required standard.</p> <p>14 Q. You've also concluded that the flat doors don't comply</p> <p>15 with certain cold smoke leakage requirements --</p> <p>16 A. Yes.</p> <p>17 Q. -- in ADB, table B1. What you've the said is there's no</p> <p>18 information in the test report about cold smoke leakage</p> <p>19 performance.</p> <p>20 A. Exactly. So there's two points here.</p> <p>21 So in terms of works, there is no technical</p> <p>22 specification for the works, so I don't know who asked</p> <p>23 for what type of door. I have to rely on a spreadsheet</p> <p>24 from Masterdor, and they are for FD30 doors with no S</p> <p>25 stated. The test report I have is also FD30 with no S</p> <p style="text-align: right;">Page 24</p>

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<p>1 test done.</p> <p>2 So you could say they match, but I don't understand</p> <p>3 why an FD30 door was installed, when an FD30S door</p> <p>4 should have been installed.</p> <p>5 So it's two separate points.</p> <p>6 S doesn't appear to have been called for, and S was</p> <p>7 not provided.</p> <p>8 Q. S is about cold smoke leakage; yes?</p> <p>9 A. Yes, it is.</p> <p>10 Q. Again, can you just explain to us what cold smoke</p> <p>11 leakage is referring to, in simple terms?</p> <p>12 A. So the door in its final form, with any fixtures and</p> <p>13 fittings, any intumescent, anything at all needed for</p> <p>14 fire resistance, is put under pressure and the leakage</p> <p>15 measured. It has to be lower than a defined value, and</p> <p>16 that represents what the door would do when smoke is</p> <p>17 attempting to pass through it.</p> <p>18 Q. You've also concluded that the doors contained different</p> <p>19 hardware, including locks, hinges, letter plates, letter</p> <p>20 boxes, than in the test reports.</p> <p>21 A. That's correct.</p> <p>22 Q. Can you explain why that is potentially so significant,</p> <p>23 different hardware in doors?</p> <p>24 A. Yes. Well, the statutory guidance document, Approved</p> <p>25 Document B, makes that clear, and the test reports for</p> <p style="text-align: right;">Page 25</p>	<p>1 Q. -- you've noted that the door-closers which were</p> <p>2 specified for the refurbishment were not the same as the</p> <p>3 door-closer in the one specimen that was tested; is that</p> <p>4 correct?</p> <p>5 A. That is correct. It was an overhead closer, that</p> <p>6 classic arm closer, in the test, and most of the doors</p> <p>7 I saw had that internal closing device using the chain.</p> <p>8 But you'll see in the detail in my report, for</p> <p>9 example, there's photos from London Fire Brigade after</p> <p>10 the fire where they did observe a door, one door, with</p> <p>11 an overhead closing device. But I don't know why that</p> <p>12 was there, because the chain-closing mechanism appears</p> <p>13 to have been the one specified during the door</p> <p>14 replacement works.</p> <p>15 Q. You've highlighted in your report several instances of</p> <p>16 door-closers malfunctioning or breaking based on the</p> <p>17 written evidence you've seen.</p> <p>18 Do you agree that we've heard more examples of that</p> <p>19 in the oral evidence from the BSRs during the course of</p> <p>20 the BSRs' evidence?</p> <p>21 A. Yes, I do.</p> <p>22 Q. You've also noted, in terms of frequency of inspections,</p> <p>23 in your report that the LGA guide suggests six-monthly</p> <p>24 inspections and preventative maintenance for</p> <p>25 fire-resisting doors.</p> <p style="text-align: right;">Page 27</p>
<p>1 fire doors makes that clear.</p> <p>2 It seems to be because, if you want to use the</p> <p>3 phrase, getting the door through the test, it's</p> <p>4 a sensitive business. So any piece of metal, any gap,</p> <p>5 you know, so locks or letter boxes, may act as a heat</p> <p>6 transfer route, as a flame spread route or a hot smoke</p> <p>7 spread route, and so would cause the door to fail.</p> <p>8 So a door, when sold, can be detailed up to perform</p> <p>9 perfectly satisfactorily, but then it must be installed</p> <p>10 that way too because of those sensitivities. And</p> <p>11 I consider those sensitivities to be very well</p> <p>12 documented as an issue.</p> <p>13 Q. In terms of intumescent seals, in your report you've</p> <p>14 compared the intumescent seals that were specified for</p> <p>15 the 109 replacement doors with those included in the</p> <p>16 test specimens.</p> <p>17 A. Yes.</p> <p>18 Q. Again, you found that none were specified with the same</p> <p>19 intumescent seals as the test report.</p> <p>20 A. So some of the seals near the locks and the hinges were,</p> <p>21 but the main seals around the leaf were not. So the</p> <p>22 majority of the seals were not as communicated in the</p> <p>23 test report provided as being relevant.</p> <p>24 Q. In terms of self-closing mechanisms --</p> <p>25 A. Yes.</p> <p style="text-align: right;">Page 26</p>	<p>1 A. Yes, that's correct.</p> <p>2 Q. Aimed at identifying defects such as missing or</p> <p>3 ineffective closing devices; is that correct?</p> <p>4 A. That's correct.</p> <p>5 Q. You also note that there's a relevant British Standard,</p> <p>6 BS 8412 2008, which recommended six-monthly checks of</p> <p>7 the door-closers.</p> <p>8 A. Yes.</p> <p>9 Q. You also say the DCLG guidance suggested more</p> <p>10 frequently; perhaps monthly checks.</p> <p>11 A. Yes. I think they're more making sure, I would consider</p> <p>12 when you're doing a monthly inspection, if the door is</p> <p>13 able to close, and the six-monthly inspection would be</p> <p>14 a careful review of the door.</p> <p>15 Q. You've noted that the TMO policy was for fire risk</p> <p>16 assessments on an annual or two-yearly basis; is that</p> <p>17 correct?</p> <p>18 A. Apparently so.</p> <p>19 Q. So if that -- and we'll have to look at the evidence on</p> <p>20 this in Phase 2 -- was the only time the door-closers</p> <p>21 were checked, for example, hypothetically, what you're</p> <p>22 drawing attention to is that there's other guidance that</p> <p>23 suggests more frequent inspections.</p> <p>24 A. Yes. So I haven't dealt with maintenance yet. So, yes,</p> <p>25 the frequency seems to be different, but in Phase 2 I'll</p> <p style="text-align: right;">Page 28</p>

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<p>1 be more interested in the quality of the inspection and</p> <p>2 the maintenance that occurred in the tower.</p> <p>3 Q. Before we come on to the impact of these issues on the</p> <p>4 events of the night, just on the 14 doors that were not</p> <p>5 replaced --</p> <p>6 A. Yes.</p> <p>7 Q. -- in 2011, that's 12 leaseholder doors and two tenanted</p> <p>8 doors, you say in your report you can't confirm the</p> <p>9 specification of the original 1970s installation or any</p> <p>10 subsequent replacement of the doors because they've now</p> <p>11 been lost in the fire.</p> <p>12 Is that correct?</p> <p>13 A. Yes. So I couldn't inspect the doors because they're</p> <p>14 all gone, and no relevant paperwork has been made</p> <p>15 available to me about them.</p> <p>16 The only thing I know was what the risk assessor</p> <p>17 said to the TMO, which is in my report, and he</p> <p>18 considered those doors to be fire retardant, which isn't</p> <p>19 a relevant term regarding fire-resisting doors.</p> <p>20 Q. You've said in your report that the compliance of these</p> <p>21 doors cannot be determined at this time, and that</p> <p>22 because the doors have been lost, their compliance will</p> <p>23 not be able to be determined. Is that your position?</p> <p>24 A. Unless the TMO or other parties produce the paperwork</p> <p>25 and information they relied upon when they decided the</p> <p style="text-align: right;">Page 29</p>	<p>1 "b) Failure of the fire door to resist the spread of</p> <p>2 fire and smoke from a flashover fire within an apartment</p> <p>3 due to the presence of multiple untested components</p> <p>4 within the doors ..."</p> <p>5 A. Yes.</p> <p>6 Q. That would include hardware, glazing, et cetera; is that</p> <p>7 correct?</p> <p>8 A. That's correct. So once a severe fire happened near</p> <p>9 a door or there was a flashover in an apartment or any</p> <p>10 kind of localised heating condition, failure of the door</p> <p>11 would be expected in theory, and obviously it's</p> <p>12 supported by witness evidence.</p> <p>13 Q. Yes.</p> <p>14 At c) you've got:</p> <p>15 "c) Failure of the fire door to resist the spread of</p> <p>16 fire and smoke from a flashover fire within the</p> <p>17 apartment due to the presence of glazing ..."</p> <p>18 Expected, you say, to cause early failure based on</p> <p>19 the test evidence.</p> <p>20 A. That's correct, yes.</p> <p>21 Q. At d) we have:</p> <p>22 "d) Failure of an unknown number of doors to</p> <p>23 self-close after an occupant escape."</p> <p>24 Is that correct?</p> <p>25 A. That's correct. Yes.</p> <p style="text-align: right;">Page 31</p>
<p>1 performance of those doors.</p> <p>2 Q. I now want to look at the impact of those issues that</p> <p>3 you've identified on the events of the night.</p> <p>4 You summarise the potential contribution that these</p> <p>5 issues may have caused in your report at</p> <p>6 paragraph 19.5.28. Can we go to that. That's</p> <p>7 BLAS0000019 at page 20.</p> <p>8 You have crystallised for us here what you say are</p> <p>9 a number of ways in which the flat entrance doors failed</p> <p>10 to control the spread of smoke and fire to the</p> <p>11 lobbies --</p> <p>12 A. Yes.</p> <p>13 Q. -- in these paragraphs. I just want to take you through</p> <p>14 them and just summarise.</p> <p>15 A. Okay.</p> <p>16 Q. So you say in a):</p> <p>17 "a) Failure to prevent the spread of smoke and flame</p> <p>18 by leakage through gaps between the door leaf and door</p> <p>19 frame."</p> <p>20 Is that correct?</p> <p>21 A. That's correct, and that's important in the early stages</p> <p>22 of a fire, or if one is waiting some time in a flat</p> <p>23 remote from a hazard and smoke is spreading from the</p> <p>24 lobby.</p> <p>25 Q. In b) what you're drawing attention to there I think is:</p> <p style="text-align: right;">Page 30</p>	<p>1 Q. You also say in the next paragraph, if we could go to</p> <p>2 the next page at the top of your report:</p> <p>3 "19.5.29. The fire doors also failed in a second</p> <p>4 way; to resist the spread of fire and smoke from the</p> <p>5 lobby — given that fire doors are required to perform in</p> <p>6 both directions."</p> <p>7 A. That's correct.</p> <p>8 Q. Is that the key point you're making there?</p> <p>9 A. Again, I'm back to this issue of: what is the hazard in</p> <p>10 a specific location and at a specific time? That's very</p> <p>11 important.</p> <p>12 So in the event that one was in a flat with no fire</p> <p>13 within it, it may be there was a hazard in the lobby</p> <p>14 that you required protection from.</p> <p>15 Q. Do you have a current view as to which of those are</p> <p>16 potentially the most significant on the night?</p> <p>17 A. I want to look at the hazard in a specific location</p> <p>18 before I give a final opinion. I do consider the fire</p> <p>19 doors to be a very significant fire safety measure in</p> <p>20 general, and I think, therefore, their contribution to</p> <p>21 the events on the night require very careful review.</p> <p>22 Q. What would you say to the point which can be made that</p> <p>23 the doors, even if compliant, would've only had</p> <p>24 30 minutes' integrity?</p> <p>25 A. That's correct, yes. So it's not 60 minutes, it's not</p> <p style="text-align: right;">Page 32</p>

<p>1 120 minutes, it is 30 minutes.</p> <p>2 Q. Given that such doors are not intended to provide</p> <p>3 indefinite protection, isn't it inevitable that they're</p> <p>4 going to fail at some point?</p> <p>5 A. It is indeed inevitable that they're going to fail at</p> <p>6 some point, but the important point is what happens</p> <p>7 before that failure occurs.</p> <p>8 So I don't think it's acceptable to consider,</p> <p>9 because they might fail anyway, it doesn't really matter</p> <p>10 what happens in the time period before that. I think</p> <p>11 that's very important, particularly for people who are</p> <p>12 waiting in flats.</p> <p>13 Q. I've been asked to put to you the following proposition:</p> <p>14 to the extent the flat entrance doors were</p> <p>15 non-compliant, that had at most only a limited effect on</p> <p>16 the spread of fire and smoke and the outcome of fire.</p> <p>17 Would you agree with that?</p> <p>18 A. I don't agree with that at all.</p> <p>19 Q. Do you agree that --</p> <p>20 SIR MARTIN MOORE-BICK: Would you like to explain why?</p> <p>21 A. I think that those fire doors were needed for so many</p> <p>22 different reasons as a function of where one was living</p> <p>23 or waiting for rescue in the tower. So we have</p> <p>24 conditions where -- you know, protection from fire or</p> <p>25 protection from smoke, either in one's own apartment, in</p> <p style="text-align: center;">Page 33</p>	<p>1 A. I'm very interested in those areas.</p> <p>2 Q. I'm not going to go through them all now, but there are</p> <p>3 a number of examples from the BSRs' oral evidence.</p> <p>4 A. Yes, there are, and that's why, again, I don't want to</p> <p>5 give any kind of overall opinion on one measure.</p> <p>6 I think there's a really important piece of analysis per</p> <p>7 flat, per lobby, required to give a fair view on what</p> <p>8 those systems did.</p> <p>9 Q. Because would you accept that there are some examples of</p> <p>10 flat doors appearing to fair well on the night -- for</p> <p>11 example, Antonio Roncolato[sic], who was there for</p> <p>12 a very long time, who was the last person rescued --</p> <p>13 A. I think that's a really good example, actually. So the</p> <p>14 hazard in that flat was entirely different to, for</p> <p>15 example, flat 1 up at level 23. So when I'm looking at</p> <p>16 the doors in that context, I will explain the hazard in</p> <p>17 that flat and why it was so different to the hazard in,</p> <p>18 for example, flat 1 at level 23, and so explain the</p> <p>19 relevance of the non-compliant fire doors.</p> <p>20 Q. Does it often come down to a matter of timing in terms</p> <p>21 of, as you said before, people staying in their flats</p> <p>22 and waiting in accordance with the stay-put instruction,</p> <p>23 and the length of time that that door is protecting them</p> <p>24 from hazards?</p> <p>25 A. That's quite a general question and I would not want to</p> <p style="text-align: center;">Page 35</p>
<p>1 a lobby, and, say, from another flat on the floor.</p> <p>2 So wherever you're located, there may be nearby fire</p> <p>3 or remote fire, and you are relying on those lines to</p> <p>4 prevent those products eventually reaching your</p> <p>5 location.</p> <p>6 I'm not avoiding the answer, that's why I emphasised</p> <p>7 at the start today the location of the flat and the</p> <p>8 location of the person is so important in terms of what</p> <p>9 that fire protection measure was needed for. And doors</p> <p>10 protect against fire and smoke, and so I would give</p> <p>11 a view, therefore, on how those doors performed, in the</p> <p>12 lobbies, for the lobbies, for the flats, when I carry</p> <p>13 out my risk assessment in Phase 2. Okay?</p> <p>14 So it's not appropriate, therefore, either to simply</p> <p>15 say they all failed, they all have the same</p> <p>16 contribution. It's relevant to location, and the hazard</p> <p>17 they were required to protect a person from.</p> <p>18 MS GRANGE: So will it be relevant to your analysis at</p> <p>19 Phase 2 that we can see examples from the BSRs' evidence</p> <p>20 of some residents where they are talking about smoke</p> <p>21 coming in through the front door, whether underneath the</p> <p>22 bottom, around the sides, a couple of clear examples</p> <p>23 through the letterbox?</p> <p>24 A. That's correct.</p> <p>25 Q. Those are all areas you're interested in?</p> <p style="text-align: center;">Page 34</p>	<p>1 answer it generally. I don't think it would be</p> <p>2 appropriate. It's all about specific hazards and</p> <p>3 specific protection needed.</p> <p>4 Q. Would it be possible to estimate how much smoke might</p> <p>5 seep out from a representative, closed, non-compliant</p> <p>6 door, as compared with a compliant door? Would it be</p> <p>7 possible to do that exercise --</p> <p>8 A. I'm sure there's somebody clever somewhere who can run</p> <p>9 a CFD analysis and work that out, if it was important.</p> <p>10 Q. Do you think that exercise would be a useful one?</p> <p>11 A. At the moment, I don't have any plans to do that, but</p> <p>12 I'll let you know if I change my mind in Phase 2.</p> <p>13 Q. I think you've answered this, but in terms of doing</p> <p>14 a flat-by-flat analysis, of the impact, for example of</p> <p>15 no self-closing device or inadequate self-closing</p> <p>16 device, whether the door nevertheless shut or was shut</p> <p>17 behind, is that the kind of analysis you're flagging for</p> <p>18 Phase 2?</p> <p>19 A. Exactly, exactly.</p> <p>20 Q. Would you agree that the presence of smoke in the</p> <p>21 lobbies is most likely to have been caused by</p> <p>22 a combination of factors which may have also included</p> <p>23 flat entrance doors being held open or propped open,</p> <p>24 flat entrance doors being broken down by firefighters to</p> <p>25 fight fires? Would you agree that all of those factors</p> <p style="text-align: center;">Page 36</p>

<p>1 are going to be relevant in terms of the presence of</p> <p>2 smoke on lobbies?</p> <p>3 A. All those factors will be relevant, but I don't think we</p> <p>4 should overstate those other features in terms of</p> <p>5 quantity of location that actually occurred. So saying</p> <p>6 the Fire Brigade broke down doors, you know, it sounds</p> <p>7 as if that was happening -- I think it's a bit of</p> <p>8 a sweeping statement, isn't it? So there's very</p> <p>9 specific activity on specific floors and I will look at</p> <p>10 the doors carefully in that regard.</p> <p>11 In terms of smoke in the lobby, I've made clear</p> <p>12 there are other and there may be more contributory</p> <p>13 features also, and I will take each measure in turn.</p> <p>14 Q. Just in terms of the early presence of smoke on the</p> <p>15 lobbies, some firefighters say they were very surprised</p> <p>16 to find smoke in lobbies at a very early stage in the</p> <p>17 fire. We get the evidence of, for example, Badillo, who</p> <p>18 is going up, and Firefighter Secrett similarly.</p> <p>19 Do you have any view at this stage about what</p> <p>20 factors might have been important in terms of explaining</p> <p>21 that early presence of smoke in some lobbies or would</p> <p>22 you give the same answer?</p> <p>23 A. Well, I mean, again, I want to do the</p> <p>24 location-by-location review, but there was a trend in</p> <p>25 terms of the location of the external flame front and</p> <p style="text-align: right;">Page 37</p>	<p>1 A. I think I'm okay, thank you.</p> <p>2 Q. Turning to the stair doors, therefore, in your revised</p> <p>3 report, you've done a considerable amount of work to try</p> <p>4 and ascertain the history of the stair doors at</p> <p>5 Grenfell Tower, including whether they were compliant</p> <p>6 with relevant standards over time, including looking at</p> <p>7 their original installation at Grenfell Tower; is that</p> <p>8 correct?</p> <p>9 A. Yes. So I just probably wouldn't mind being able to say</p> <p>10 that I have been contented since I wrote my report about</p> <p>11 the CP3 requirements for stair doors, but I know that</p> <p>12 other people had a lot of concern with my view, so</p> <p>13 that's why I did that extra work to try and explain with</p> <p>14 a lot of detail the performance of historic fire doors,</p> <p>15 and I've done that work. But my position remains about</p> <p>16 the CP3 requirements for those doors, because doors and</p> <p>17 ventilation together protect a lobby or protect the</p> <p>18 stair.</p> <p>19 Q. Prior to asking you some more detailed questions about</p> <p>20 that and about the stair doors in detail, can we just</p> <p>21 look at your conclusion at paragraph 19.7.27 of your</p> <p>22 report BLAS0000019 at page 45.</p> <p>23 Could I ask you to read that paragraph to yourself</p> <p>24 for a moment.</p> <p>25 A. Yes, so this is the failure to prevent smoke spread.</p> <p style="text-align: right;">Page 39</p>
<p>1 the progression of early smoke in the lobbies.</p> <p>2 So clearly there was a smoke spread route from the</p> <p>3 cladding fire out to the lobby.</p> <p>4 Q. Will part of your analysis look at the flat 6s and</p> <p>5 specific --</p> <p>6 A. Yes.</p> <p>7 Q. -- importance of the flat 6s and their self-closing</p> <p>8 device or their door --</p> <p>9 A. Yes.</p> <p>10 Q. -- in the fire?</p> <p>11 A. Yes, because remember, the whole point about having</p> <p>12 a self-closer is that when a person evacuates, they</p> <p>13 don't cause harm. I don't like to -- you know, that's</p> <p>14 not a nice way of putting it, but the whole point of</p> <p>15 having a self-closer is the door closes behind the</p> <p>16 person who has evacuated and, therefore, the protection</p> <p>17 is maintained. That's why they are so incredibly</p> <p>18 important.</p> <p>19 Q. I'm now going to turn to a different but related topic</p> <p>20 of the stair doors.</p> <p>21 A. Yes.</p> <p>22 Q. For this purpose, it's really chapter 16 and</p> <p>23 appendices I and a little bit of M, but mainly I, that</p> <p>24 is relevant, if you want to make sure you have those to</p> <p>25 hand.</p> <p style="text-align: right;">Page 38</p>	<p>1 Q. Into the stairs; is that correct?</p> <p>2 A. Into the stair, yes:</p> <p>3 "The stair doors appear to be the primary route of</p> <p>4 spread of smoke and heat to the stair."</p> <p>5 Because I didn't find any other opening:</p> <p>6 "No other significant failures in the construction</p> <p>7 separating the stair from the lobby or flats has been</p> <p>8 observed."</p> <p>9 Q. Yes, and then I want to focus on the next stage. You</p> <p>10 say:</p> <p>11 "At this stage the stair doors being opened, or held</p> <p>12 open, by either fire-fighting equipment or other objects</p> <p>13 appears to be the primary failure."</p> <p>14 A. Yes, that's correct, because I didn't observe in the</p> <p>15 tower severe damage to the concrete in the staircase.</p> <p>16 Q. Yes.</p> <p>17 A. I would expect to see severe damage in the staircase,</p> <p>18 for example, if the door had entirely failed, so</p> <p>19 collapsed in some form. I haven't seen that, so I can't</p> <p>20 say they failed that way.</p> <p>21 So I have to assume, therefore, that any heating</p> <p>22 effects I observed in the staircase, or the smoke</p> <p>23 observed in the staircase, came through the activity of</p> <p>24 the doors.</p> <p>25 Q. Would you agree we need to bear that in mind when it</p> <p style="text-align: right;">Page 40</p>

<p>1 comes to any potential problems in terms of the</p> <p>2 performance of these stair doors, your conclusion there?</p> <p>3 A. I don't know what you mean.</p> <p>4 Q. You are saying you think the primary failure appears to</p> <p>5 have been open doors. Do we need to bear that in mind</p> <p>6 when we then come and look at your detailed analysis?</p> <p>7 A. Oh, yes. I think I've been quite clear on that, yes.</p> <p>8 Q. Just in general, can you explain the importance of stair</p> <p>9 doors in a building like Grenfell Tower with a single</p> <p>10 staircase?</p> <p>11 A. Yes. So they have two roles: to prevent smoke from the</p> <p>12 fire flat, which may have entered the lobby, entering</p> <p>13 the staircase, and so preventing escape from above the</p> <p>14 fire.</p> <p>15 The second role is -- and that's why it's to</p> <p>16 a higher standard, actually -- again to prevent smoke</p> <p>17 entering the staircase, to protect firefighters who are</p> <p>18 moving up and down in that staircase, carrying out their</p> <p>19 various duties.</p> <p>20 Q. As you say, because of that dual role, it has</p> <p>21 a particularly protected status, that staircase.</p> <p>22 A. Yes, it does, yes.</p> <p>23 Q. Does that make it all the more important as a safety</p> <p>24 feature?</p> <p>25 A. All the more important -- I think it's important, yes,</p> <p style="text-align: right;">Page 41</p>	<p>1 THE WITNESS: Yes.</p> <p>2 SIR MARTIN MOORE-BICK: Yes, Ms Grange.</p> <p>3 MS GRANGE: Thank you.</p> <p>4 I just have a small correction to make to the</p> <p>5 transcript and an apology.</p> <p>6 At page 35 of the transcript I'm recorded as saying</p> <p>7 Antonio Roncolato was the last person to be rescued. In</p> <p>8 fact, that's not correct; it was Elpidio Bonifacio from</p> <p>9 flat 83 who was the last person rescued. I ought to</p> <p>10 correct that and apologise. Thank you.</p> <p>11 SIR MARTIN MOORE-BICK: Thank you.</p> <p>12 MS GRANGE: So in terms of the stair doors.</p> <p>13 A. Yes.</p> <p>14 Q. You have concluded that all 20 doors on levels 4 to 23</p> <p>15 are original 1972 construction doors; is that correct?</p> <p>16 A. That's correct.</p> <p>17 Q. Can we just look at a couple of pictures of those doors,</p> <p>18 just to remind ourselves what they look like.</p> <p>19 A. Yes.</p> <p>20 Q. You've got two pictures that are helpful in your report,</p> <p>21 BLAS0000030 at page 78, figure I.25.</p> <p>22 If we can zoom in on that.</p> <p>23 So this is a level 6 stair door; is that correct?</p> <p>24 A. Yes, it is.</p> <p>25 Q. If we can look at the figure at the bottom, figure I.26,</p> <p style="text-align: right;">Page 43</p>
<p>1 I think it's important. I'm probably not ready to say</p> <p>2 "all the more important" about anything just yet.</p> <p>3 MS GRANGE: I'm about to go to a more detailed passage. I'm</p> <p>4 happy to stop now or carry on in terms of a break.</p> <p>5 SIR MARTIN MOORE-BICK: Would you like a break at this</p> <p>6 point?</p> <p>7 THE WITNESS: I'm okay, but would it be another three hours</p> <p>8 if you don't have a break or 20 minutes?</p> <p>9 SIR MARTIN MOORE-BICK: I would suggest we have a break now.</p> <p>10 THE WITNESS: Okay.</p> <p>11 SIR MARTIN MOORE-BICK: And maybe have another one in about</p> <p>12 an hour's time.</p> <p>13 THE WITNESS: Okay, perfect.</p> <p>14 SIR MARTIN MOORE-BICK: So you go with the usher. Don't</p> <p>15 talk to anyone about your evidence while you're out of</p> <p>16 the room.</p> <p>17 THE WITNESS: Thank you very much.</p> <p>18 SIR MARTIN MOORE-BICK: We'll come back at 11.05.</p> <p>19 All right, 11.05, then, please.</p> <p>20 (11.00 am)</p> <p>21 (A short break)</p> <p>22 (11.10 am)</p> <p>23 SIR MARTIN MOORE-BICK: All right?</p> <p>24 THE WITNESS: Yes.</p> <p>25 SIR MARTIN MOORE-BICK: Happy to go on?</p> <p style="text-align: right;">Page 42</p>	<p>1 we're going to come back to this picture and look in</p> <p>2 a moment, but there we see what the edge looks like of</p> <p>3 those doors. You say brush seal present.</p> <p>4 I'm not going to ask you questions about that right</p> <p>5 now, but this is just to remind ourselves what those</p> <p>6 doors look like. So that's the door on level 6.</p> <p>7 Can we also look at the level 19 stair door. That's</p> <p>8 BLAS0000030 at page 82, figure I.30.</p> <p>9 So this is the level 19 stair door after the fire.</p> <p>10 A. Yes.</p> <p>11 Q. So we can see the single vision panel, the same as we</p> <p>12 saw on level 6.</p> <p>13 A. Yes.</p> <p>14 Q. And you've drawn attention to the rail -- is that a kind</p> <p>15 of horizontal supporting --</p> <p>16 A. Exactly, yes.</p> <p>17 Q. The stile, is that a kind of vertical --</p> <p>18 A. Yes.</p> <p>19 Q. And then we can also see a little bit of what the edge</p> <p>20 looked like.</p> <p>21 A. Yes.</p> <p>22 Q. So that's the level 19 stair door.</p> <p>23 Now --</p> <p>24 A. And --</p> <p>25 Q. -- as we discussed previously --</p> <p style="text-align: right;">Page 44</p>

<p>1 SIR MARTIN MOORE-BICK: Sorry, you --</p> <p>2 A. Yes, sorry. Just also, actually, because of what you</p> <p>3 asked me earlier, if you just have a look around the</p> <p>4 door on the concrete, you can't see any spalling</p> <p>5 effects, but you can see the significant charring of the</p> <p>6 stair door.</p> <p>7 You were asking me earlier about why I had chosen</p> <p>8 opening rather than a total failure.</p> <p>9 So it's the conditions around the door on the stair</p> <p>10 side are very important in understanding that. Just</p> <p>11 that picture is a good one.</p> <p>12 MS GRANGE: Yes, that's helpful.</p> <p>13 SIR MARTIN MOORE-BICK: We don't have a picture of the other</p> <p>14 side of that door, do we?</p> <p>15 A. We do in my report, yes, and they are very interesting</p> <p>16 too if you look at them in sequence on every level.</p> <p>17 SIR MARTIN MOORE-BICK: Yes.</p> <p>18 MS GRANGE: Yes, I think that's in your appendix of</p> <p>19 photographs.</p> <p>20 SIR MARTIN MOORE-BICK: And they suggest that the doors</p> <p>21 actually responded well?</p> <p>22 A. So the doors remained stable, they haven't collapsed.</p> <p>23 They have undergone significant charring due to heat,</p> <p>24 and you can see, very unfortunately, the condition of</p> <p>25 the lobby. This is level 19, I think.</p> <p style="text-align: right;">Page 45</p>	<p>1 a 25-millimetre rebate rather than a testing condition;</p> <p>2 is that correct?</p> <p>3 A. I don't understand the question, I'm really sorry.</p> <p>4 Q. You're saying that to comply with the type 2 door, it</p> <p>5 needed to have a 25-millimetre rebate; is that correct?</p> <p>6 A. Yes, it did, yes.</p> <p>7 Q. Just --</p> <p>8 A. I'm sorry, I understand now.</p> <p>9 Yes, it did, and test evidence that exists from the</p> <p>10 time supports the reason why that number is written into</p> <p>11 the 1971 guidance, yes.</p> <p>12 Q. In general, can you just explain, first of all, what</p> <p>13 a rebate is, just so everybody's clear --</p> <p>14 A. Yes.</p> <p>15 Q. -- and what the effect is of a rebate on, for example,</p> <p>16 freedom from collapse and passage of flame.</p> <p>17 A. Oh, okay.</p> <p>18 So a rebate is -- I think they used to call them</p> <p>19 like door-stops or smoke-stops in the old days, and it's</p> <p>20 just a cut in a piece of timber. So when you push the</p> <p>21 door, it can't get through the frame at that part. So</p> <p>22 there's a little slot -- I'm trying to see if there's</p> <p>23 something to help me.</p> <p>24 SIR MARTIN MOORE-BICK: Are we talking about the depth of</p> <p>25 what one might call the doorjamb? How far into the</p> <p style="text-align: right;">Page 47</p>
<p>1 Q. Yes.</p> <p>2 A. Okay? So that door has remained in place, despite those</p> <p>3 conditions.</p> <p>4 SIR MARTIN MOORE-BICK: Thank you.</p> <p>5 MS GRANGE: Yes.</p> <p>6 As we discussed previously, you consider that the</p> <p>7 design basis for Grenfell Tower was CP3 1971, and you've</p> <p>8 explained in your report that the CP3 1971 requirement</p> <p>9 for access to the main stairway was for something called</p> <p>10 type 2 doors; is that correct?</p> <p>11 A. That's correct.</p> <p>12 Q. Can we just look at that definition. If we go within</p> <p>13 your report to BLAS0000030 at page 67, under I5.2.5.</p> <p>14 A. Yes.</p> <p>15 Q. And if we can zoom in on the type 2 door definition.</p> <p>16 Thank you.</p> <p>17 A. Yes.</p> <p>18 Q. You've concluded that the type 2 door must have</p> <p>19 a 25-millimetre rebate; is that correct?</p> <p>20 A. Yes, so that's pasted directly in from CP3, and for</p> <p>21 a type 2 door, it has the 30-minute performance</p> <p>22 requirement for collapse and passage of flame, and</p> <p>23 a rebate is listed there also of 25 millimetres. And,</p> <p>24 again, the self-closing device.</p> <p>25 Q. You understand that that's a requirement of</p> <p style="text-align: right;">Page 46</p>	<p>1 setting the door will go?</p> <p>2 A. It's how far into the setting, how far in --</p> <p>3 SIR MARTIN MOORE-BICK: Yes.</p> <p>4 A. -- and how wide the setting is. So it's got two --</p> <p>5 SIR MARTIN MOORE-BICK: Yes, all right.</p> <p>6 A. It's an L shape, okay? And I know there's been huge</p> <p>7 interest in rebates. There are drawings in my report</p> <p>8 with all that I mentioned through all the different</p> <p>9 types of doors.</p> <p>10 But it's dimensioned and so the door can't move any</p> <p>11 further, if you will.</p> <p>12 MS GRANGE: Yes, yes.</p> <p>13 That return on the rebate is potentially important,</p> <p>14 is it, in terms of the freedom from collapse and the</p> <p>15 passage of flame or smoke through the door, the L-shape</p> <p>16 and the width of that L-shape?</p> <p>17 A. Yes. So I refer to -- actually, I brought them -- tests</p> <p>18 done in the 1970s by Morris, and it's referenced in my</p> <p>19 report so people can read it, and he tested a whole</p> <p>20 series of doors with the same leaf as appears to have</p> <p>21 been installed in Grenfell Tower with different rebates,</p> <p>22 and he found the dimensions to be very important. He</p> <p>23 actually concluded, particularly on the 12.5-millimetre</p> <p>24 rebate, it prevented the ability for a door to achieve,</p> <p>25 in his testing regime, anything more than 12 minutes'</p> <p style="text-align: right;">Page 48</p>

<p>1 fire resistance.</p> <p>2 Q. Yes.</p> <p>3 A. Back then.</p> <p>4 Q. We'll come back to that in a moment.</p> <p>5 Just sticking for a moment with the type 2 doors</p> <p>6 under CP 371, that also makes clear that it has to have</p> <p>7 a self-closer; is that correct?</p> <p>8 A. That's correct.</p> <p>9 Q. So, again, we see self-closers there, right back from</p> <p>10 the 1970s.</p> <p>11 You also note in your report that the DCLG sleeping</p> <p>12 guide is again relevant, which requires such doors to be</p> <p>13 self-closing; is that correct?</p> <p>14 A. Yes.</p> <p>15 Q. You've also mentioned in your report the LGA guidance</p> <p>16 which we looked at before in purpose-built blocks of</p> <p>17 flats.</p> <p>18 We can go back to that if you like, but as we noted</p> <p>19 earlier, that required at least upgraded FD30S doors; is</p> <p>20 that correct?</p> <p>21 A. Yes.</p> <p>22 Q. Shall we look at that again?</p> <p>23 A. Sorry, it's actually not clear on stair doors. Sorry,</p> <p>24 nearly said the wrong thing. It's not clear at all on</p> <p>25 the replacement or the upgrade of stair doors. It's</p> <p style="text-align: right;">Page 49</p>	<p>1 Here what you're referring to is bullet point 1, you</p> <p>2 can:</p> <p>3 "• accept the door as it is, provided it is a good</p> <p>4 fit in its frame and that it satisfied the standard</p> <p>5 applicable to fire-resisting doors at the time of</p> <p>6 construction of the building or manufacture of the door</p> <p>7 ('notional FD30' door)."</p> <p>8 Is that correct?</p> <p>9 A. Yes, it is, yes.</p> <p>10 Q. Again, it's just worth looking at the definition of</p> <p>11 an upgraded FD30S door. That's page 182 within this</p> <p>12 document.</p> <p>13 A. Yes.</p> <p>14 Q. I think it's right at the very top.</p> <p>15 A. Yes, it is.</p> <p>16 Q. The notional FD fire-resisting door is:</p> <p>17 "A door assembly that satisfied the current</p> <p>18 specification, or fire resistance test, for 30 minutes</p> <p>19 at the time of construction of a block of flats or</p> <p>20 manufacture of the door."</p> <p>21 That's the definition of that; is that correct?</p> <p>22 A. Yes, that's correct.</p> <p>23 Q. Let's then look at what you saw when you inspected the</p> <p>24 doors.</p> <p>25 You say in your report that you inspected one door</p> <p style="text-align: right;">Page 51</p>
<p>1 very clear on flat entrance doors.</p> <p>2 Q. Yes. Let's have a look at that, let's go to</p> <p>3 CTAR00000033, page 98.</p> <p>4 So if we zoom in on the table again, and we're on</p> <p>5 the second-to-last-bullet point:</p> <p>6 "• In ventilated lobbies and corridors, travel</p> <p>7 distances of ten to 15m may be acceptable, providing all</p> <p>8 doors to the common corridor or lobby are at least</p> <p>9 'upgraded FD30S' doors ... and the smoke ventilation</p> <p>10 comprises PVs or AOVs."</p> <p>11 I think you say in your report that on one reading</p> <p>12 of that, "all doors to the common corridor or lobby"</p> <p>13 could be interpreted as all doors including the stair</p> <p>14 door.</p> <p>15 A. In my opinion, it should include the stair door.</p> <p>16 Q. You've noted that the LGA guidance only recommends</p> <p>17 upgrading the door so that it's classed as an upgraded</p> <p>18 door, FD30S door, where the existing door satisfied the</p> <p>19 specification at the time of construction and was</p> <p>20 therefore something called a notional FD30 door.</p> <p>21 A. Yes.</p> <p>22 Q. Let's look at that in the guidance. So if we go to</p> <p>23 page 101 within this document, paragraph 62.17.</p> <p>24 Here it's said in this guidance that it's not</p> <p>25 practical to test existing doors. Three options exist.</p> <p style="text-align: right;">Page 50</p>	<p>1 on level 6 but you consider that door to be</p> <p>2 representative; is that right?</p> <p>3 A. Yes, that's correct, based on photographic evidence.</p> <p>4 Q. So it does appear from what we've seen that all those</p> <p>5 doors between levels 4 and 23 were of the same make and</p> <p>6 construction; is that correct?</p> <p>7 A. It appears to be the case, yes. There's no</p> <p>8 documentation available.</p> <p>9 Q. What you've noted is that the stair doors had a rebate</p> <p>10 depth of 12 millimetres; is that correct?</p> <p>11 A. That's correct.</p> <p>12 Q. I think we have a picture of that we can look at</p> <p>13 BLAS0000016 at page 23.</p> <p>14 I think this picture might help us in terms of --</p> <p>15 does that show the rebate?</p> <p>16 A. Not really, sorry.</p> <p>17 Q. Does that help us -- sorry -- on showing the rebate?</p> <p>18 A. No.</p> <p>19 Q. No. You can see the rebate when you open the door?</p> <p>20 A. Yes. When you open the door, you can look in, you see</p> <p>21 the edge of the door, where you push the door.</p> <p>22 Q. Yes.</p> <p>23 A. On the frame on the left there --</p> <p>24 Q. Yes.</p> <p>25 A. -- you'll just see the little stop made of timber.</p> <p style="text-align: right;">Page 52</p>

<p>1 Q. You say in your report that that rebate depth of 2 12 millimetres is too small to comply with the 3 requirement for type 2 doors under CP3 1971; is that 4 correct? 5 A. That's correct. 6 Q. But what you've said is, following your investigations, 7 the stair doors appear to have been constructed 8 potentially as a class A door, a number 3 class A door, 9 under the London constructional amending bylaws; is that 10 correct? 11 A. That's correct. 12 Q. Right at the beginning of your evidence, we looked at 13 the different regimes that were in place. 14 A. Yes. 15 Q. There were these London constructional bylaws under the 16 relevant London Building Acts. 17 A. Yes. 18 Q. That defines something called a class A door. 19 A. A type A. 20 Q. A type A 21 A. A type A door, yes. 22 Q. I apologise, a type A door. 23 A. Yes. 24 Q. What you've concluded is that that 12-millimetre rebate 25 would satisfy that standard?</p> <p style="text-align: right;">Page 53</p>	<p>1 we have at Grenfell Tower, and was very carefully 2 fitted, you could get that door up to a 30-minute -- 3 30/20 standard. 4 Q. So as you say, that was only if what you refer to as 5 tolerances of fit were controlled to less than 6 1.5 millimetres. 7 A. Exactly. 8 Q. Can you help us, what are tolerances of fit? 9 A. So he observed on the test that unless the door to frame 10 the gaps around the door leaf were very tiny -- the 11 paper is very interesting to read -- unless they were 12 literally down at 1 millimetre or 2, coupled with 13 a 12.5-millimetre rebate, and even with the 14 25-millimetre rebate, with that type of door leaf, the 15 rail and stile leaf, it really altered their fire 16 performance. 17 Q. What you say is you've carefully examined the door and 18 they do seem very similar to these half-hour fire check 19 doors referred to in a British Standard from 1951; is 20 that correct? 21 A. That's correct. So the door leaf with the rail and 22 stile type, so the timbers, if you will, as to how the 23 leaf is made, are the same as something called 24 a British Standard fire check door. They were 25 considered to offer some performance, but not full fire</p> <p style="text-align: right;">Page 55</p>
<p>1 A. Yes. So the London constructional bylaws provide four 2 forms of type A door. The performance resistance is 3 actually 30 minutes, which is the same as a type 2 door 4 in CP3. Okay? So the bylaw door and, let's say, the 5 CP3 door, the performance resistance is written on paper 6 the same way. 7 The issue with the type doors, so the bylaw doors, 8 is it also gives examples of construction forms one can 9 select to comply with the type A requirements, and all 10 of them are stated as being allowed to have a rebate of 11 12.5 millimetres. 12 Q. In your report, you go on to say -- and this is what you 13 were touching on earlier about the Morris research in 14 the 1970s -- that based on certain research you've done, 15 that you've identified from the early 1970s, you've 16 concluded that, in fact, this door may only achieve 17 20 minutes' integrity and 30 minutes' stability to the 18 standard applicable at the time of construction; is that 19 correct? 20 A. Yes, so he discovered -- so doors with that rebate were 21 commonly available, let's say, and in his tests he 22 discovered that once the rebate was 12.5 millimetres, 23 the resistance could drop as low as 12 minutes. 24 If the rebate was increased to 25 millimetres and 25 intumescent strips were also provided to the door leaf</p> <p style="text-align: right;">Page 54</p>	<p>1 resistance performance. 2 So for a 30-minute door, full fire resistance was 3 30 minutes, preventing collapse for 30 minutes, 4 integrity for 30 minutes. A fire check door, the 5 collapse regime of 30 minutes was retained, but you 6 couldn't get the integrity at 30 and so a fire check 7 door was 20 minutes instead. 8 So they were considered to act as a fire door but 9 with a lower performance. 10 Q. Yes. 11 A. With that rail and stile leaf. 12 Q. So is it on that basis that you consider the performance 13 of that door, the class A door, doesn't satisfy the same 14 stability and integrity requirements of a type 2 door 15 under CP3 1971? 16 A. That's correct. 17 Q. You've highlighted in your report that you consider it 18 might be worth thinking about an amendment to the 19 relevant guidance, including the LGA guide, because you 20 think it might have to flag up that there may be 21 an entire category of doors still present in tower 22 blocks today -- 23 A. Yes. 24 Q. -- which would've met these lower London constructional 25 bylaw standards --</p> <p style="text-align: right;">Page 56</p>

<p>1 A. That's correct.</p> <p>2 Q. -- but which in fact have a proven lower performance</p> <p>3 standard than other doors installed in the 1970s.</p> <p>4 A. Exactly.</p> <p>5 Q. I think you make clear that even if you upgrade these</p> <p>6 doors, so you put in smoke seals, intumescent strips,</p> <p>7 the performance is potentially still concerning --</p> <p>8 A. Exactly.</p> <p>9 Q. -- because of those original issues --</p> <p>10 A. Exactly, to do with the closeness of fit and whatever</p> <p>11 rebate is installed in that building or this building.</p> <p>12 That's very well documented in various papers. I've</p> <p>13 given the publications in my report.</p> <p>14 Q. Let's just go back and look at figure I.26 on</p> <p>15 BLAS0000030, at page 78, and look at what we see in --</p> <p>16 yes, if we could blow up figure I.26.</p> <p>17 A. Yes.</p> <p>18 Q. It's right, isn't it, that you've done certain detective</p> <p>19 work in terms of looking really carefully at these doors</p> <p>20 and trying to work out what may have happened to them --</p> <p>21 A. Yes.</p> <p>22 Q. -- over time?</p> <p>23 A. Yes, I have, yes.</p> <p>24 Q. You note here in the label below, you say:</p> <p>25 "... (brush seal present, unknown if intumescent</p> <p style="text-align: right;">Page 57</p>	<p>1 evidence at this stage as to whether cold smoke seals,</p> <p>2 possibly combined with an intumescent seal, could've</p> <p>3 been retrospectively installed in order to upgrade these</p> <p>4 stair doors; is that correct?</p> <p>5 A. That's correct</p> <p>6 Q. Again, the difference between a cold smoke seal and</p> <p>7 intumescent seal -- what's the difference between those</p> <p>8 two things?</p> <p>9 A. Okay, so I think there's conflicting evidence about if</p> <p>10 works were done to the stair door, and if the works</p> <p>11 consisted of installing something as we can see here on</p> <p>12 the leaf, what exactly those works were. Okay? It's</p> <p>13 not just about if it was a cold seal or an intumescent</p> <p>14 seal.</p> <p>15 Q. Yes.</p> <p>16 A. So different parties have provided different evidence</p> <p>17 regarding whether works have been done to the stair door</p> <p>18 or not since the tower was constructed.</p> <p>19 Q. Yes.</p> <p>20 A. In reviewing photos from the time of the primary</p> <p>21 refurbishment showing seals being installed on one or</p> <p>22 two doors, I still cannot conclude what the seal was for</p> <p>23 and how many doors it was installed on or not.</p> <p>24 Q. So although, as you note, some photos have been provided</p> <p>25 by Mr Stokes that show a seal in some doors that's</p> <p style="text-align: right;">Page 59</p>
<p>1 seal present below the brush seal)." </p> <p>2 A. Yes.</p> <p>3 Q. Can you just explain to us what a brush seal is?</p> <p>4 A. Well, it can be to stop draughts, or it could be for the</p> <p>5 purposes of cold smoke.</p> <p>6 I don't know what's underneath it, I haven't done</p> <p>7 a destructive test of the door, and if, therefore,</p> <p>8 there's intumescent hidden behind it, which would act in</p> <p>9 the event of a fire to seal up the door for fire</p> <p>10 resistance purposes.</p> <p>11 Q. So just to be clear, the intumescent seal would be</p> <p>12 different to a brush --</p> <p>13 A. I think so. It would be underneath it. I showed some</p> <p>14 pictures of standard products in my report. It should</p> <p>15 be underneath there, as I understand it.</p> <p>16 Q. That's what you've said in your report; you say it's</p> <p>17 unclear whether there may be an intumescent seal</p> <p>18 underneath the brush seal.</p> <p>19 A. Yes.</p> <p>20 Q. And that only if we did a destructive analysis could we</p> <p>21 be able to definitively confirm that; is that correct?</p> <p>22 A. Yes, you'd just need to take it out of the door and have</p> <p>23 a look, yes.</p> <p>24 Q. You've also noted, based on the documents you've seen so</p> <p>25 far, that there's potentially inconsistent factual</p> <p style="text-align: right;">Page 58</p>	<p>1 visually similar to a combined cold smoke and</p> <p>2 intumescent seal --</p> <p>3 A. Yes.</p> <p>4 Q. -- you're not clear whether work was done to all the</p> <p>5 doors or just some of the doors --</p> <p>6 A. No.</p> <p>7 Q. -- at this stage; is that correct?</p> <p>8 A. That's correct, and I've provided a series of</p> <p>9 photographs in my report to explain why. I can see</p> <p>10 a combined seal in a photo, but I can't see that it has</p> <p>11 been consistently installed, and there's a conflict in</p> <p>12 whether works were done at all, as I've explained in my</p> <p>13 report.</p> <p>14 Q. So at this stage, can we draw any conclusions as to</p> <p>15 whether or not --</p> <p>16 A. I won't draw a conclusion about what works were done,</p> <p>17 but I acknowledge that there is a brush seal installed</p> <p>18 on some doors.</p> <p>19 Q. Yes.</p> <p>20 A. I don't know what it's for, who put it there or why.</p> <p>21 Q. Is this something that could be looked at further at</p> <p>22 Phase 2, investigated further as necessary?</p> <p>23 A. Yes. I hope the relevant information will be provided</p> <p>24 to me so I can close that out, and I intend to do</p> <p>25 a destructive test of the door myself.</p> <p style="text-align: right;">Page 60</p>

<p>1 Q. You do intend to do that now?</p> <p>2 A. Yes, yes, I do.</p> <p>3 Q. You note that the BRE has carried out testing --</p> <p>4 A. Yes.</p> <p>5 Q. -- to a stair door. That was found -- we are going to</p> <p>6 look at the test report in a second -- to have just</p> <p>7 16 minutes' integrity and 3 minutes' insulation.</p> <p>8 A. Yes.</p> <p>9 Q. If we just pull up the test report, that's MET00021780.</p> <p>10 That's the test report dated September 2018. If we can</p> <p>11 go to internal page 22 of this test report, and if we</p> <p>12 could just zoom in on that a little.</p> <p>13 A. Yes.</p> <p>14 Q. So this is the condition of the door after 16 minutes;</p> <p>15 is that correct?</p> <p>16 A. That's correct, as recorded by the BRE, yes.</p> <p>17 Q. I mean, this is one of the stair doors from</p> <p>18 Grenfell Tower?</p> <p>19 A. Yes, it is.</p> <p>20 Q. Is that correct?</p> <p>21 A. Yes.</p> <p>22 Q. We see the glazing unit, and then we can see a little</p> <p>23 bit of flame at the top.</p> <p>24 A. Exactly.</p> <p>25 Q. And smoke around the edges; is that correct?</p> <p style="text-align: center;">Page 61</p>	<p>1 A. At the time -- that's correct, yes.</p> <p>2 Q. Is that right?</p> <p>3 A. Yes. It's a more difficult test to pass, if you will,</p> <p>4 because they introduced a pressure differential. It was</p> <p>5 in the 1970s. Yes.</p> <p>6 Q. So a positive pressure --</p> <p>7 A. Yes.</p> <p>8 Q. -- against the door.</p> <p>9 A. Exactly, and it's more likely the products of combustion</p> <p>10 would pass through it.</p> <p>11 Q. So we need to bear that in mind when we're looking at</p> <p>12 that test report?</p> <p>13 A. Yes, we do.</p> <p>14 Q. Just to clarify, that was one of the stair doors from</p> <p>15 Grenfell Tower.</p> <p>16 Do you think that that is representative of the</p> <p>17 stair doors we're concerned with between levels 4 and</p> <p>18 23, as far as you're aware?</p> <p>19 A. So in the BRE test report, I couldn't find information</p> <p>20 on the seal to the door they tested, and that would be</p> <p>21 useful to know. And then, coupled with hopefully more</p> <p>22 information from relevant parties, we could close out</p> <p>23 the matter of what seal was there or not, and I could</p> <p>24 make a more final conclusion on the actual fire</p> <p>25 resistance of the stair door, noting that I haven't</p> <p style="text-align: center;">Page 63</p>
<p>1 A. Yes.</p> <p>2 Q. The 3 minutes' insulation is recorded at page 13 of 23.</p> <p>3 A. Yes.</p> <p>4 Q. If we go back into page 13. There we see --</p> <p>5 A. Yes.</p> <p>6 Q. -- again, can you just remind us of the difference</p> <p>7 between integrity and insulation?</p> <p>8 A. So you typically don't have to provide insulation on</p> <p>9 a fire door because it can open and, ideally, there</p> <p>10 isn't storage of combustibles up against the door, and</p> <p>11 insulation is to do with preventing heat transfer onto</p> <p>12 the cold side, the unheated side. Integrity is about</p> <p>13 preventing flames through cracks.</p> <p>14 So I'd imagine that when there's a cotton pad, when</p> <p>15 they put that near the flame up on the top left-hand</p> <p>16 corner, that's why they recorded failure.</p> <p>17 Q. To be fair, you note that the testing standard that was</p> <p>18 applied by the BRE is a more recent -- you say it's</p> <p>19 a 1987 version of BS 476 --</p> <p>20 A. Yes.</p> <p>21 Q. -- than would've been applicable at the time of</p> <p>22 construction of Grenfell Tower?</p> <p>23 A. Yes.</p> <p>24 Q. So you say it's not directly comparable with the</p> <p>25 30-minute requirement at the time of construction.</p> <p style="text-align: center;">Page 62</p>	<p>1 observed a failure caused by the door in the staircase</p> <p>2 with respect to that damage I mentioned.</p> <p>3 So these are technical matters rather than something</p> <p>4 that might substantially change my opinion.</p> <p>5 Q. Again, is it potentially relevant that we see varying</p> <p>6 damage of the stair doors still in situ in</p> <p>7 Grenfell Tower, with some of them only marginally</p> <p>8 damaged and perhaps seem to have held up reasonably</p> <p>9 well?</p> <p>10 A. Yes.</p> <p>11 Q. Is that correct?</p> <p>12 A. That's correct, and we're back again to this situation</p> <p>13 of the hazard in a location, the conditions in that</p> <p>14 location, and so what was imposed upon that door over</p> <p>15 time.</p> <p>16 Q. Finally on this subtopic, you've highlighted in your</p> <p>17 report that if you compare these stair doors with the</p> <p>18 current guidance in ADB 2013, current standards require</p> <p>19 a stair door to achieve FD 60 minutes integrity; is that</p> <p>20 correct?</p> <p>21 A. That's correct, for firefighting stair protection.</p> <p>22 Q. So that's strictly the modern standard and doesn't take</p> <p>23 into account any non-worsening principle or</p> <p>24 non-worsening in relation to the stair doors?</p> <p>25 A. I'm not giving any view on non-worsening at the moment,</p> <p style="text-align: center;">Page 64</p>

<p>1 but the statutory guidance at this time is for</p> <p>2 a 60-minute door to a firefighting shaft.</p> <p>3 Q. Again, some similar questions about stair doors to flat</p> <p>4 doors.</p> <p>5 Would you agree that they're never going to provide</p> <p>6 indefinite protection against fire; they're only ever</p> <p>7 going to last for, if they were upgraded doors,</p> <p>8 30 minutes, and even if they're ADB doors, 60 minutes,</p> <p>9 and that they would generally be expected to fail at</p> <p>10 some point? Do you think that that's something we need</p> <p>11 to bear in mind and --</p> <p>12 A. I'm not sure, because I don't know what -- you know, I'd</p> <p>13 have to say: what is the definition of "indefinite</p> <p>14 protection"? There is a performance required for</p> <p>15 specific reasons.</p> <p>16 This issue of not replacing doors and simply</p> <p>17 upgrading them without having to contemplate anything</p> <p>18 else, I don't understand, so that guidance in the LGA.</p> <p>19 I typically don't recommend, myself, notional fire</p> <p>20 doors, for example, in my own work.</p> <p>21 So in my mind, I understand in a major flashover</p> <p>22 fire, at some point the door may fail, but it's actually</p> <p>23 of considerable importance for the time before that very</p> <p>24 severe heating occurs, hence the S rating, the</p> <p>25 door-closer and everything else about a fire door. It's</p> <p style="text-align: right;">Page 65</p>	<p>1 Q. There's a number of examples of that that we had in some</p> <p>2 of the oral and written evidence?</p> <p>3 A. Yes.</p> <p>4 Q. Do you think that that evidence is potentially</p> <p>5 significant when we consider the importance of any</p> <p>6 performance non-compliances that you found in the doors?</p> <p>7 A. Yes, exactly.</p> <p>8 So there's non-compliance and then there is</p> <p>9 performance during a hazard. And, yes, that must be</p> <p>10 considered, and that's why I keep saying what happens in</p> <p>11 each location will become very important.</p> <p>12 Q. A slightly different topic now: the refuse chute doors.</p> <p>13 I just want to ask some very brief questions about the</p> <p>14 refuse chute doors.</p> <p>15 So on each of the lobbies, next to the stair door,</p> <p>16 along from the stair door to the other side of the</p> <p>17 service riser cupboard, is a door that goes onto</p> <p>18 a refuse chute that residents could use; is that</p> <p>19 correct?</p> <p>20 A. That's correct.</p> <p>21 Q. You note that CP3 1971 set no standard for any refuse</p> <p>22 chute doors. You note that in your report.</p> <p>23 A. For the door itself, just for its location and the</p> <p>24 location of the chute itself not being in an escape</p> <p>25 route, and the requirement for permanent ventilation.</p> <p style="text-align: right;">Page 67</p>
<p>1 about its function in the early, middle and late stages</p> <p>2 of the fire.</p> <p>3 Q. Again, do you think it would be possible to estimate how</p> <p>4 much smoke might seep through a closed non-compliant</p> <p>5 door as compared with a door which was compliant by the</p> <p>6 original standards or modern standards, and would that</p> <p>7 exercise be relevant and helpful?</p> <p>8 A. Yes. So there are very clever smoke modelling people</p> <p>9 out there; I am not one of them. That is a numerical</p> <p>10 analysis that could be carried out if a person thought</p> <p>11 it would be relevant, yes.</p> <p>12 SIR MARTIN MOORE-BICK: You'd have to know the manner in</p> <p>13 which the door was not compliant, though, wouldn't you?</p> <p>14 A. You certainly would, and you'd have to understand the</p> <p>15 hazard posed to that door over time.</p> <p>16 SIR MARTIN MOORE-BICK: Mm.</p> <p>17 MS GRANGE: Is that something you consider would be useful</p> <p>18 for your work going forward?</p> <p>19 A. I don't feel the need to do that at this time.</p> <p>20 Q. Finally on this topic -- I think you, yourself,</p> <p>21 mentioned it -- there is some firefighter evidence from</p> <p>22 the night that some of the stair doors, when shut, were</p> <p>23 fairly effective at preventing smoke from entering the</p> <p>24 stairs.</p> <p>25 A. Yes.</p> <p style="text-align: right;">Page 66</p>	<p>1 But not for the door, yes.</p> <p>2 Q. Do you agree that, based on your inspections of the</p> <p>3 tower, those wooden refuse chute doors appear to have</p> <p>4 fared better than the stair doors?</p> <p>5 A. They do appear to, because in the tower, during my</p> <p>6 inspections, I observed the cleanliness and lack of fire</p> <p>7 and smoke damage in nearly every refuse chute area. It</p> <p>8 was very striking.</p> <p>9 Q. Do you think those refuse chute rooms could potentially</p> <p>10 have been used as safe places for residents waiting to</p> <p>11 be rescued?</p> <p>12 A. I understand -- you know, one has those thoughts, I did</p> <p>13 have such thoughts myself on site, but the reality is</p> <p>14 knowing where they are, making a decision about them</p> <p>15 being safe or not -- I just don't know how anyone</p> <p>16 could've made that decision during the fire.</p> <p>17 I understand that they appear to have been safe</p> <p>18 because of their post-fire condition, but I couldn't</p> <p>19 honestly say that it's something that would've been</p> <p>20 reasonable to consider.</p> <p>21 Also, one or two of them actually are -- well,</p> <p>22 particularly at level 7, there was one that was very</p> <p>23 severely damaged.</p> <p>24 The other important thing about that area is there</p> <p>25 is actually mechanical ventilation apparently provided</p> <p style="text-align: right;">Page 68</p>

<p>1 to that room. I don't have enough information on it</p> <p>2 yet, but I will be looking at the effect that had in</p> <p>3 terms of smoke in the lobby also.</p> <p>4 But I couldn't say that it should have been</p> <p>5 considered or that it should be considered, no.</p> <p>6 Q. A new topic now: gas.</p> <p>7 Your appendix K is serving as effectively a briefing</p> <p>8 document for the specialist gas expert that the inquiry</p> <p>9 has appointed, Mr Rodney Hancox; is that correct?</p> <p>10 A. That's correct.</p> <p>11 Q. On that basis, I have just a few questions for you on</p> <p>12 this topic because this is going to be addressed in much</p> <p>13 more detail by Mr Hancox when he opines in his written</p> <p>14 report.</p> <p>15 A. Yes.</p> <p>16 Q. But one of the topics I want to ask you about is about</p> <p>17 penetrations that may be relevant to the gasworks at the</p> <p>18 tower, in particular about the penetration between the</p> <p>19 stairs and the lobbies which you've identified as</p> <p>20 potential routes of smoke spread between levels during</p> <p>21 the fire.</p> <p>22 A. Yes.</p> <p>23 Q. Is it right that you've concluded that the wall of the</p> <p>24 stairwell -- which, as you've explained, is a protected</p> <p>25 shaft, the stairs --</p> <p style="text-align: right;">Page 69</p>	<p>1 staircase. Those works hadn't taken place by the time</p> <p>2 the fire occurred; they were due around that time.</p> <p>3 What I don't know is if there's a fire-stopping</p> <p>4 material at the back of this hole in the wall or not,</p> <p>5 and I will need to work very closely with the gas expert</p> <p>6 and review his survey data to understand if that hole</p> <p>7 there was sealed.</p> <p>8 Now, that wouldn't impact the stair because the</p> <p>9 stair is boxed in. I don't know if we can --</p> <p>10 Q. I was about to take you to a photo of that.</p> <p>11 A. Maybe show that.</p> <p>12 What it does affect is that actually acts as a link</p> <p>13 from lobby to lobby, because at the next pipe run above</p> <p>14 on the next nearest floor, if the same hole is there,</p> <p>15 smoke from one lobby could travel up and out to the next</p> <p>16 lobby.</p> <p>17 But I don't know that and I need that information</p> <p>18 about the fire-stopping on the stair wall to lobby line.</p> <p>19 So the staircase seems clear. The lobby requires</p> <p>20 further attention.</p> <p>21 Q. Just before we leave this photo -- we will go to the one</p> <p>22 on the stair side in a moment.</p> <p>23 A. Yes.</p> <p>24 Q. So these were penetrations --</p> <p>25 A. Yes.</p> <p style="text-align: right;">Page 71</p>
<p>1 A. Yes.</p> <p>2 Q. -- was breached on 13 floors between the 4th and the</p> <p>3 21st floor; is that correct?</p> <p>4 A. Yes. Are we able to show a photo?</p> <p>5 Q. Yes, that's my next -- exactly. If we can look at your</p> <p>6 figure K.23. That's BLAS0000032, page 24.</p> <p>7 If we zoom in on K.23, which is at the top of that</p> <p>8 page.</p> <p>9 A. Okay. So --</p> <p>10 Q. You explain what we're seeing in this photo.</p> <p>11 A. So this is on the lobby side. So you mentioned there on</p> <p>12 the stair side a protected shaft was built. There is no</p> <p>13 information on how it was built and its fire</p> <p>14 performance, and that would be useful to have.</p> <p>15 That appears, though, as I've said in my report, to</p> <p>16 have performed effectively, in the sense, again, there</p> <p>17 is no significant heat damage or, you know, damage to</p> <p>18 the concrete enclosure to the staircase in that area at</p> <p>19 the moment.</p> <p>20 Separately, on the lobby side, where this gas pipe</p> <p>21 leaves the staircase enclosure, it breaks through the</p> <p>22 concrete here (Indicates), and now we're out on a lobby</p> <p>23 near flat 1 and 2. Yes.</p> <p>24 What I don't know is -- Cadent have said they were</p> <p>25 going to box this in the same way they boxed in the</p> <p style="text-align: right;">Page 70</p>	<p>1 Q. -- through the wall to accommodate pipes referred to as</p> <p>2 laterals; is that correct?</p> <p>3 A. Laterals, yes. They're just running out, yes.</p> <p>4 Q. This was all part of the new gas riser installation for</p> <p>5 riser number 2.</p> <p>6 A. Yes.</p> <p>7 Q. So there were, I think, five risers coming up, and one</p> <p>8 of those risers was being replaced for the flat 2s.</p> <p>9 A. Yes, there were six coming up, and this was the</p> <p>10 replacement riser, and it was run through the staircase</p> <p>11 and brought out through the wall of the staircase, out</p> <p>12 onto the lobbies that required a gas supply. It looks</p> <p>13 like that (Indicates).</p> <p>14 Then you can see it entering the flat here at the</p> <p>15 wall there. Again, I don't know what that seal there is</p> <p>16 either.</p> <p>17 Q. So let's look at what it looks like from the other side.</p> <p>18 Figure K.22, I think, on page 23.</p> <p>19 A. Yes.</p> <p>20 Q. So you've highlighted these, I think. This is level 13</p> <p>21 and level 21.</p> <p>22 A. Yes.</p> <p>23 Q. Is it right what we can see is the boxing-in on the</p> <p>24 stair side.</p> <p>25 A. Yes.</p> <p style="text-align: right;">Page 72</p>

<p>1 Q. I think on the right-hand picture you can see the 2 vertical boxing-in down the side and then the boxing in 3 at the top of the wall; is that correct?</p> <p>4 A. Yes, that's correct. So here's the vertical gas run 5 boxed in, and here, because this is a floor where it's 6 going to come out onto the lobby, it comes across and 7 then it goes out onto the lobby side.</p> <p>8 Q. So what we were seeing in the other photograph was 9 what's going on on the other side, on the lobby side?</p> <p>10 A. Yes.</p> <p>11 Q. You've highlighted these two photographs in particular 12 because what you say is there are missing panels at the 13 end of these.</p> <p>14 A. Yes, that's correct.</p> <p>15 Q. But to be fair, what you say in your report is they 16 could've been taken off by somebody after the fire.</p> <p>17 A. Yes.</p> <p>18 Q. You're not clear at the moment.</p> <p>19 A. Yes, it could be as part of some work by the police that 20 samples of materials have been taken by the time I got 21 to site.</p> <p>22 Q. Yes.</p> <p>23 A. It is a hole in the protection, but if you just look 24 again, it's about looking at the damage around it. You 25 can see here at level 13, yes, the light is damaged, but</p> <p style="text-align: right;">Page 73</p>	<p>1 staircase, but it could flow through the box --</p> <p>2 SIR MARTIN MOORE-BICK: I understand that.</p> <p>3 A. -- back out to another floor.</p> <p>4 MS GRANGE: Yes.</p> <p>5 I know you have said you want to do further 6 investigations; are you able to give any opinion at this 7 stage about the significance of this breach of 8 compartmentation in terms of smoke spread on the night?</p> <p>9 A. So with regards to the fire-stopping on the lobby line, 10 if it was not there, I would be very concerned about it 11 as a route for fire and smoke spread.</p> <p>12 But I very much want to get proper information about 13 the fire-stopping at that line before I stray into that 14 territory.</p> <p>15 Q. I understand.</p> <p>16 Just on another topic linked to this question of 17 breaches of compartmentation, then we might have another 18 break: ventilation ducts in the bathrooms.</p> <p>19 A. Oh, yes.</p> <p>20 Q. It's been suggested that there appear -- I'm afraid 21 I don't have any photographs -- to have been ventilation 22 ducts in each of the six bathrooms on each floor.</p> <p>23 A. That's correct.</p> <p>24 Q. Is that correct?</p> <p>25 A. That is correct.</p> <p style="text-align: right;">Page 75</p>
<p>1 I explain that later on with regards to the door. At 2 21, you can see there's no severe damage, for example, 3 to the concrete.</p> <p>4 So at the moment I've no reason to believe they were 5 particularly relevant, but it will be very helpful to 6 get a proper explanation of those works.</p> <p>7 Q. The significance, just to be absolutely clear, is that 8 potentially, otherwise, there's a compromising of the 9 stair compartment by virtue of these holes?</p> <p>10 A. Those holes.</p> <p>11 Q. Lobby to lobby, is what you're saying?</p> <p>12 A. But the ones I showed earlier, it's about smoke being 13 able to flow from one lobby to the next through the 14 breaches on the stair wall.</p> <p>15 SIR MARTIN MOORE-BICK: Through the trunking we see on the 16 stairs? What's the route for the --</p> <p>17 A. It's a pity we don't have a sealed one, actually. If 18 this was one of the sealed trunkings, if there is fire 19 and smoke in the lobby, and that fire-stopping isn't 20 there on the line, smoke can enter this space, and all 21 of this is connected on every floor within the box.</p> <p>22 SIR MARTIN MOORE-BICK: When you say "this space", you mean 23 the boxing?</p> <p>24 A. Within the box. It's connected then at every floor 25 within the box. So it mightn't break out onto the</p> <p style="text-align: right;">Page 74</p>	<p>1 Q. Is it right that they run in pairs vertically through 2 the building?</p> <p>3 A. Yes, that is correct. Yes, I think in pairs. Yes.</p> <p>4 Q. It's been suggested that from level 9, the boxing-in of 5 those vertical risers appears to have been destroyed by 6 fire; is that correct?</p> <p>7 A. I observed significant damage during my time on site, 8 yes.</p> <p>9 Q. Have you conducted any detailed inspection of those?</p> <p>10 A. Me and my team actually tracked those risers, and it's 11 something that I will go to look at in the next stage of 12 my work. Because like every other riser, they connect 13 every floor, and my understanding, from the limited 14 information made available to me, is there may have been 15 some new ventilation provided through those risers also.</p> <p>16 Q. So do you think this is something that's important to 17 investigate in terms of the spread of smoke throughout 18 the building?</p> <p>19 A. Yes, I do.</p> <p>20 MS GRANGE: Great, thank you.</p> <p>21 Mr Chairman, that's probably a good point for 22 another break.</p> <p>23 SIR MARTIN MOORE-BICK: Is that a good point?</p> <p>24 MS GRANGE: Yes. Thank you.</p> <p>25 SIR MARTIN MOORE-BICK: All right. Well, we'll have another</p> <p style="text-align: right;">Page 76</p>

<p>1 break now. Is that all right?</p> <p>2 THE WITNESS: Okay, thank you.</p> <p>3 SIR MARTIN MOORE-BICK: Same as before. Off with the usher,</p> <p>4 and we'll come back at 12.10.</p> <p>5 MS GRANGE: Yes, that's great.</p> <p>6 SIR MARTIN MOORE-BICK: Right, 12.10, please.</p> <p>7 (11.55 am)</p> <p>8 (A short break)</p> <p>9 (12.10 pm)</p> <p>10 SIR MARTIN MOORE-BICK: All right, Dr Lane, happy to go on?</p> <p>11 THE WITNESS: Yes.</p> <p>12 Actually, I thought I should probably clarify</p> <p>13 something. You asked me why the laterals and verticals,</p> <p>14 how they connect within the staircase --</p> <p>15 SIR MARTIN MOORE-BICK: What I wanted to make sure</p> <p>16 I understood was that the route of smoke transfer</p> <p>17 between lobbies on different floors was through the</p> <p>18 boxing and the trunking.</p> <p>19 THE WITNESS: Exactly.</p> <p>20 SIR MARTIN MOORE-BICK: I thought that was the route, but</p> <p>21 I wanted to clarify that. Thank you.</p> <p>22 THE WITNESS: And the reason why it could happen is there's</p> <p>23 a statutory duty to ventilate that boxing and to provide</p> <p>24 ventilation to it in the relevant gas legislation, and</p> <p>25 it's considered so important that the fire safety</p> <p style="text-align: right;">Page 77</p>	<p>1 correct?</p> <p>2 A. Yes.</p> <p>3 Q. Where you say you think temperatures may have got above</p> <p>4 150 degrees Celsius; is that correct?</p> <p>5 A. Yes, that's correct.</p> <p>6 Q. In your revised report, and having heard the factual</p> <p>7 evidence that you've heard, you've highlighted</p> <p>8 a particular rescue operation described by</p> <p>9 Firefighter Desforges around levels 10/11 with the stair</p> <p>10 door being held open after 2.00 am, 2.10 am, possibly.</p> <p>11 A. Yes.</p> <p>12 Q. You've also noted some resident witness statements which</p> <p>13 indicate a lot of firefighter activity around level 14</p> <p>14 at around the same time; is that correct?</p> <p>15 A. That's correct.</p> <p>16 Q. You've said at this stage in your report that the</p> <p>17 strongest evidence of the cause of the plastic light</p> <p>18 damage in this hot-spot is smoke and heat entering the</p> <p>19 stairs from open doors, possibly due to this firefighter</p> <p>20 activity; is that correct?</p> <p>21 A. Yes that's correct.</p> <p>22 Q. Does that remain your view, based on what you've heard</p> <p>23 so far?</p> <p>24 A. At this stage, yes, it is.</p> <p>25 Q. Is it also possible that the reason why there's</p> <p style="text-align: right;">Page 79</p>
<p>1 legislation also makes that clear, and the only way the</p> <p>2 laterals and the verticals can be ventilated is if</p> <p>3 they're fully open to each other.</p> <p>4 So it would be useful to understand the detailing</p> <p>5 around that.</p> <p>6 SIR MARTIN MOORE-BICK: Thank you, that's helpful.</p> <p>7 Yes, Ms Grange.</p> <p>8 MS GRANGE: Thank you.</p> <p>9 Just a few questions about the hot zone or hot-spot</p> <p>10 that you identified in your report.</p> <p>11 So in your first report you found evidence that the</p> <p>12 plastic stair lights on levels 13, 14 and also the half</p> <p>13 levels on 13 and 14 had been fully destroyed --</p> <p>14 A. Yes.</p> <p>15 Q. -- whereas the plastic stair lights above that on levels</p> <p>16 15, the half level of level 15 and 16 you say were</p> <p>17 deformed or just partially melted; is that correct?</p> <p>18 A. Yes, that's correct.</p> <p>19 Q. You also found significant evidence of damage to the</p> <p>20 lobbies and the stair doors on those levels as well,</p> <p>21 where the lights were completely deformed?</p> <p>22 A. Yes, yes, I did.</p> <p>23 Q. You consider that this was potentially significant</p> <p>24 evidence in terms of a hot zone or hot-spot in the</p> <p>25 middle of the stairs at around levels 13 to 16; is that</p> <p style="text-align: right;">Page 78</p>	<p>1 a hot-spot or hot zone might be explained, for example,</p> <p>2 by gas fires burning later in the piece? Do you think</p> <p>3 that's potentially another source of those hot zones or</p> <p>4 hot-spots?</p> <p>5 A. So I presume what that's meant to mean is causing</p> <p>6 a heating beside the stair door so extreme, it can</p> <p>7 radiate through the materials and melt the lights.</p> <p>8 I have no evidence available to me that that is possible</p> <p>9 as a function of how I understand the location of the</p> <p>10 gas risers in the flats.</p> <p>11 Q. So you think at the moment it's much more likely this is</p> <p>12 due to firefighter actions in that part of the building?</p> <p>13 A. Yes, and I think in my April report, I put the timing</p> <p>14 after the change in stay-put advice, but careful</p> <p>15 analysis of resident evacuations shows that there's</p> <p>16 a period of time between about 01.45 and 02.25 where no</p> <p>17 one exited the tower from above that zone.</p> <p>18 Q. Yes.</p> <p>19 A. But later on, then, evacuation from that zone and above</p> <p>20 occurs.</p> <p>21 Q. Yes.</p> <p>22 A. At the moment, that's how I've honed in on the time.</p> <p>23 Q. Yes. That's very helpful.</p> <p>24 I'm now going to turn to consider some of the active</p> <p>25 fire safety systems in the building.</p> <p style="text-align: right;">Page 80</p>

<p>1 In general, I think, is it right here we're looking 2 at requirements B1 and B5, means of warning and escape, 3 and facilities to assist the firefighters to save life 4 and allow for fire engine access? Those are the key 5 parts of the Building Regulations, the functional 6 requirements?</p> <p>7 A. That's correct.</p> <p>8 Q. I want to start with some brief questions about the 9 interface between fire detection and alarms.</p> <p>10 You have concluded in your report that there is no 11 requirement to have a centralised alarm system, is that 12 correct, in a building like Grenfell Tower?</p> <p>13 A. That's correct. There's no requirement to provide 14 an alarm sound or voice message in one or all of the 15 parts. That's correct.</p> <p>16 Q. What you've said in your report is that there's a useful 17 explanation in BS 5588-1:1990 on the reason why there's 18 no statutory requirement for a common alarm system. Can 19 we just look at that.</p> <p>20 A. Yes.</p> <p>21 Q. So that's BLAS0000015 at page 15, at the top of the 22 page.</p> <p>23 So here it says:</p> <p>24 "There is no statutory requirement for a common 25 fire alarm system to be provided in a building solely</p> <p style="text-align: right;">Page 81</p>	<p>1 kind of all-out function hasn't been provided to date in 2 residential buildings.</p> <p>3 Q. You say in this context that it's important to 4 understand what alternatives there are available for 5 raising the alarm throughout the whole building, which 6 brings us to chapter 18 of your report, which is about 7 communication with residents; is that correct?</p> <p>8 A. Yes.</p> <p>9 Q. I'm going to ask you some questions about that chapter. 10 Not very many, but just some questions.</p> <p>11 A. Yes.</p> <p>12 Q. So in that chapter of your report, you consider the 13 possible means available to the London Fire Brigade of 14 communicating with residents during the fire and once 15 the stay-put strategy was formally changed; is that 16 correct?</p> <p>17 A. Yes, that's correct.</p> <p>18 Q. First I want to ask you about loudhailers. You note 19 that this is part of the LFB inventory equipment, but 20 you consider it impractical due to other background 21 noise at the fire ground and the height and proportions 22 of Grenfell Tower; is that correct?</p> <p>23 A. Yes, that's correct.</p> <p>24 Q. I think you note that loudhailers were used, but for 25 very specific reasons; for example, if there were</p> <p style="text-align: right;">Page 83</p>
<p>1 containing flats and/or maisonettes and, in buildings 2 designed and constructed in accordance with this code, 3 it is generally unnecessary and undesirable for a fire 4 alarm system to be provided. A common fire alarm system 5 ought to be provided only in a building in which some 6 control can be achieved over the occupants so that a 7 pre-determined response leading to the evacuation of the 8 building can be triggered.</p> <p>9 "In flats and maisonettes in normal use this kind 10 of response cannot be achieved, nor is it necessarily 11 desirable that evacuation should take place from areas 12 remote from the fire, unless these areas themselves 13 become threatened by fire.'</p> <p>14 A. That's correct.</p> <p>15 Q. You've obviously thought it was important in your report 16 to highlight these particular features of that British 17 standard in terms of why an all-out alarm is not 18 necessary; is that right?</p> <p>19 A. Yes.</p> <p>20 Q. Is there anything more you want to say on that?</p> <p>21 A. No, I think it's that concept about either accidental or 22 malicious false alarms or, you know, people would have 23 said before, if someone burns their toast in one flat, 24 you don't want the whole building having to evacuate. 25 That would've been the kind of general view and why that</p> <p style="text-align: right;">Page 82</p>	<p>1 concerns about people --</p> <p>2 A. People's safety.</p> <p>3 Q. People's safety, jumping or --</p> <p>4 A. Yes. Sorry, I just would really like to say that I've 5 looked into these features, because the building design, 6 you know, the provisions with the building itself, 7 provides nothing at all for communication, and so I was 8 trying to find other methods instead. But I want to 9 emphasise the absence of any form of communication 10 device, not just a sounder, in the building itself. 11 Yes.</p> <p>12 Q. Firefighters knocking on doors.</p> <p>13 A. Yes.</p> <p>14 Q. That's another thing that you've considered. You note 15 the difficulty with doing this if done for the whole 16 tower block, and I think you note that you would require 17 significant resources and significant numbers of 18 firefighters to be deployed to all floors.</p> <p>19 A. Yes, that's correct.</p> <p>20 Q. And also logistical issues: whether you break in if 21 there's no answer -- there may be all sorts of 22 logistical difficulties you sought to highlight; is that 23 correct?</p> <p>24 A. Exactly, to do it methodically in such circumstances.</p> <p>25 Q. You've concluded that this issue of communication with</p> <p style="text-align: right;">Page 84</p>

<p>1 residents and available methods should be explored</p> <p>2 further given the number of other buildings with</p> <p>3 a stay-put policy; is that correct?</p> <p>4 A. Yes. So the number of other buildings with a stay-put</p> <p>5 policy, and an external wall that supports the spread of</p> <p>6 fire.</p> <p>7 Q. I want to ask you about the option on the night for the</p> <p>8 LFB to use the door intercom system, as Fatima Alves</p> <p>9 appears to have done, to communicate with other</p> <p>10 residents.</p> <p>11 I think it's right that you've now considered that</p> <p>12 question in detail at section 18.8 of your report,</p> <p>13 pages 21 to 24.</p> <p>14 A. Yes.</p> <p>15 Q. In particular, is it right you've sought to draw</p> <p>16 attention to the functionality of the intercom system,</p> <p>17 in terms of what it could and couldn't do?</p> <p>18 A. Yes.</p> <p>19 Q. Which you think is relevant to this; is that right?</p> <p>20 A. Yes, that's correct. So, I mean, my understanding, from</p> <p>21 the information I have about the intercom system, it</p> <p>22 wasn't installed as a life safety feature; a life safety</p> <p>23 feature requires backup power and other more resilient</p> <p>24 features to make sure it will work during a fire. But</p> <p>25 in terms of using it on an ad hoc basis, I've looked</p> <p style="text-align: right;">Page 85</p>	<p>1 "There are also other ways that use of such a system</p> <p>2 would not be effective, such as if the communications</p> <p>3 cable serving the intercoms was affected by the fire."</p> <p>4 A. Yes, that's correct. Also, there are other timings</p> <p>5 programmed into the system, in terms of how long it will</p> <p>6 ring the flat for, how long one is allowed to speak on</p> <p>7 the phone and all sorts of other functions.</p> <p>8 Again, we don't have that information at the moment,</p> <p>9 but all of that contributes to it not necessarily being</p> <p>10 a robust means of contacting every single flat</p> <p>11 methodically.</p> <p>12 Q. So based on what you know at the moment, do you think</p> <p>13 that was a practical option for use on the night?</p> <p>14 A. I understand that it's something that could be done. In</p> <p>15 the circumstances at Grenfell Tower, I don't know how</p> <p>16 one would go about using it effectively as was required</p> <p>17 that night with the number of people waiting for rescue.</p> <p>18 Q. You've also expressed concerns in that chapter as to how</p> <p>19 the limitations on communications would affect those who</p> <p>20 require assistance to escape in the event of fire; is</p> <p>21 that correct?</p> <p>22 A. That's correct. That's something I'm actually very</p> <p>23 concerned about.</p> <p>24 Q. Can you just briefly explain your concerns?</p> <p>25 A. Well, the issue for any person who isn't fully mobile</p> <p style="text-align: right;">Page 87</p>
<p>1 into what the system could potentially do.</p> <p>2 I think the list on --</p> <p>3 Q. I was going to take you to paragraph 18.8.6.</p> <p>4 A. Yes.</p> <p>5 Q. That's BLAS0000018, page 23.</p> <p>6 A. Yes.</p> <p>7 Q. Yes, so I think that this is your summary here:</p> <p>8 "... the intercom was not installed with the</p> <p>9 necessary robustness to make it a formal life safety</p> <p>10 system, if firefighters wished to use the intercom as an</p> <p>11 ad-hoc means to communicate with residents, a flat</p> <p>12 number would need to be dialled and the firefighter</p> <p>13 would need to wait until a resident answered."</p> <p>14 A. That's correct.</p> <p>15 Q. "If a resident did not answer from a flat, the fire</p> <p>16 fighter would have no way of knowing if the flat was</p> <p>17 empty, if the resident was incapacitated or otherwise</p> <p>18 unable to come to the intercom, or if the system had</p> <p>19 been muted for the night."</p> <p>20 A. That's correct.</p> <p>21 Q. Again, have you noted that you can mute the system?</p> <p>22 A. Yes, exactly. There is a muting function that you can</p> <p>23 programme in and I have no information about how that</p> <p>24 operated at Grenfell Tower at this time.</p> <p>25 Q. The last point that you've made is:</p> <p style="text-align: right;">Page 86</p>	<p>1 for whatever reason, there will be a category of person</p> <p>2 who lived at Grenfell Tower who could never use the</p> <p>3 staircase or could only use the staircase with</p> <p>4 difficulty. I think we might talk about lifts later.</p> <p>5 There was no proper firefighting lift for evacuation.</p> <p>6 So when it came to rescue not being possible, and</p> <p>7 self-evacuation was the only means to leave the tower,</p> <p>8 that left that category of person in a very hazardous</p> <p>9 condition, as I've been mentioning earlier.</p> <p>10 There is no statutory duty at this time to provide</p> <p>11 such means explicitly set out in the design guidance,</p> <p>12 and I find that very concerning to say the least.</p> <p>13 Q. Emergency lighting and signage. You dealt with that in</p> <p>14 chapter 15 of your report. Just a few questions on</p> <p>15 this.</p> <p>16 A. Yes.</p> <p>17 Q. You say on lighting that you're not able to tell whether</p> <p>18 the system complied with Approved Document B 2010</p> <p>19 because the lighting is now damaged and you can't</p> <p>20 determine if it complied with the relevant three-hour</p> <p>21 requirement for emergency lighting in sleeping</p> <p>22 accommodation that would be required in that guidance;</p> <p>23 is that correct?</p> <p>24 A. Yes, I don't have any drawings, actually, or</p> <p>25 specification.</p> <p style="text-align: right;">Page 88</p>

<p>1 I think it's probably worth explaining, emergency 2 lighting only switches on if there is a power failure. 3 Artificial lighting is required at all times on the 4 escape route. So there's adequate lighting on the 5 escape route, and then, in the event of a power failure, 6 that a certain number of lights can switch on and 7 maintain adequate lighting to the escape route. 8 I'm not aware at the moment that there was 9 necessarily a power failure, and I need more information 10 to be able to explain if an adequate quantity of 11 lighting was provided on the escape route to give a view 12 on its compliance. 13 So it's two things: power failure, but without power 14 failure, an adequate quantity of lights or luminaires. 15 Q. There is some evidence of failure of lobby emergency 16 lighting. 17 A. Yes. 18 Q. You note that once the lobbies filled with black smoke, 19 the lighting would've been of little use, but would it 20 potentially have been significant if the lights had 21 failed earlier than they should have? 22 A. Yes. So if the lobby was filled with black smoke, it 23 might be that the light was on but, because of its 24 relative illuminance with the smoke particles, quite 25 simply one can't see it, rather than it had failed off,</p> <p>Page 89</p>	<p>1 So I think that is something that should be 2 considered: adequate lighting, with proper orientation 3 information, so firefighters can be clear about where 4 they are. 5 Q. I want to turn now to some questions about the fire main 6 at Grenfell Tower. 7 You've dealt with this in chapter 2 and then 14 and 8 15 of your report, if you want to make sure you have 9 those to hand. 10 A. Yes. It's okay, keep going, I'll be fine. Yes. I just 11 have too many papers on my desk. 12 SIR MARTIN MOORE-BICK: Do you want a moment to sort them 13 out? 14 A. No, no, I'll be okay. I'll tell you if I get stuck. 15 MS GRANGE: You explain in your report that in modern design 16 codes, the regulations require provisions only for 17 internal firefighting in high-rise buildings? 18 A. That's correct. 19 Q. You've looked first at CP3 1971, the design guidance you 20 think applied when Grenfell was constructed, and you've 21 concluded that the risers were non-compliant because 22 there should've been provision for a wet riser, given 23 the height of the building; is that correct? 24 A. That's correct. 25 Q. So Grenfell Tower is more than 60 metres; it was</p> <p>Page 91</p>
<p>1 or the lighting in that lobby in themselves may have 2 failed during the fire. 3 Q. Given the difficulties that were experienced by the 4 firefighters in reading the floor numbers -- 5 A. Oh, yes. 6 Q. -- which were placed directly beneath the lighting on 7 the stairs, are you able to comment on the lighting and 8 the floor numbering? In particular do you think the 9 floor numbers should've been more clearly marked than 10 they were? 11 A. Yes. So, actually, I've observed that on some parts of 12 the stair, the emergency lighting actually covers over 13 the number, and in other parts of the stair, the number 14 is present. I didn't actually check if the number was 15 correct when I was at the tower. 16 Q. Is there anything in any of the statutory guidance or 17 other relevant guidance -- 18 A. No, that's what I was going to say. So it's interesting 19 that if you think about this adequate lighting on 20 an escape route, the absence of guidance on adequate 21 lighting on, say, a floor number sign for orientating 22 oneself as a firefighter, that's not something that's 23 a duty at this time. But there is evidence from other 24 fires too that that orientation of the firefighters can 25 be very difficult.</p> <p>Page 90</p>	<p>1 measured at 65.49, using the relevant height criteria 2 under CP 371; is that correct? 3 A. That's correct. 4 Q. What we have at Grenfell Tower is dry risers. 5 A. Yes. 6 Q. Can we just look -- again, just to orientate ourselves 7 as to what we're talking about here -- at some of the 8 pictures of those dry risers that you have at 9 Grenfell Tower in your report. 10 If you go to BLAS0000014, page 117, figure 14.56. 11 So there we have examples of the dry risers, and 12 we're going to come to this in a minute, but these are 13 in the lobbies, aren't they? 14 A. Yes. 15 Q. Basically, these are places where the firefighters plug 16 in their hoses to conduct the firefighting. 17 A. That's correct. 18 Q. So it looks like the particular type may have slightly 19 kind of -- the particular details in different bits of 20 the tower; is that correct? 21 A. Well, I think this picture is a little bit confusing 22 because it shows the newer inlet provided -- 23 Q. Ah, I see -- 24 A. -- for the new works -- 25 Q. So we see -- yes -- the level 2 outlets, level 3 --</p> <p>Page 92</p>

<p>1 A. -- rather consistently at level 4 to level 23. So maybe 2 just look at -- 3 Q. So the ones at the bottom, level 4 looks like that. 4 A. Yes. 5 Q. Level 9 looks like that. 6 A. Yes. 7 Q. You have said that under modern design guidance -- 8 that's Approved Document B 2013 -- a wet riser was also 9 required. 10 Can you just briefly explain for us the difference 11 between a wet riser and a dry riser? 12 A. Yes, so a dry riser is empty in normal use. The Fire 13 Brigade arrive and pump the water from -- I call it the 14 town mains or the area water supply, through pumping 15 equipment, into the riser. It pumps the water up 16 through the riser and makes it then available for use on 17 any floor. 18 A wet rising main is what's called permanently 19 charged by means of tanks and pumps in the building, and 20 so the only action for the Fire Brigade is to go to the 21 floor and operate the system on the floor that it's 22 needed. 23 SIR MARTIN MOORE-BICK: And presumably top up the tanks from 24 time to time, if necessary? 25 A. The tanks are connected to the town main.</p> <p style="text-align: center;">Page 93</p>	<p>1 this is chapter 2. 2 A. Yes. 3 Q. If we look at BLAS0000002 at page 66. 4 It's paragraphs 2.23.24, and 2.23.25, those two. 5 Yes, if we can make those big. 6 So you say there: 7 "2.23.24. In a wet riser, the system would already 8 have been charged with a pump connected when LFB 9 arrived. There would have been no operations required 10 by LFB to find external hydrants, connect to their 11 pumping appliance and connect to the riser inlet. 12 Therefore, the provision of a dry main would have 13 contributed to increasing the time required by the LFB 14 to get water to the initial fire event in Flat 16. 15 "2.23.25. Therefore, a wet fire main could have 16 enabled a faster initial response time to the fire in 17 Flat 16 which might have increased the chances of 18 extinguishing the fire before it spread externally. 19 However, it cannot be asserted it would have absolutely 20 achieved this." 21 A. That's correct. 22 Q. I want to ask you some questions about this speed of 23 set-up topic. 24 A. Okay, yes. 25 Q. That is potentially consistent with what Watch Manager</p> <p style="text-align: center;">Page 95</p>
<p>1 SIR MARTIN MOORE-BICK: Oh, are they? 2 A. That's the idea. That's the idea. And so they should 3 be replenished if they're emptied or being used. That's 4 the idea. 5 SIR MARTIN MOORE-BICK: Right. 6 MS GRANGE: I just want to look at what you've said in your 7 report at paragraph 15.8.17. That's BLAS0000015, 8 page 37 of chapter 15. 9 If we could zoom in on 15.8.17, you say that this 10 relevant design standard, BS 9990:2006 gives us some 11 reasons why you have taller buildings requiring wet fire 12 mains. 13 A. Yes. 14 Q. So what it says there: 15 "wet fire mains should be installed owing to the 16 pressures required to provide adequate fire-fighting 17 water supplies at the landing valves at upper floors and 18 also to ensure that water is immediately available at 19 all floor levels." 20 A. Yes, that's correct. Because in a dry rising main, the 21 taller the floor, the more difficult, if you will, it is 22 to pump the water there. It's entirely possible, but it 23 becomes more difficult with height. 24 Q. I now want to go to what you say -- and this is 25 crystallised in your summary and conclusions chapter,</p> <p style="text-align: center;">Page 94</p>	<p>1 Dowden said in his evidence. On Day 3, on 27 June, he 2 said [page 3, lines 18 to 20]: 3 "But generally, as a rule of thumb, it will increase 4 our timing -- decrease the time to make a compartment 5 entry, yes." 6 A. Yes. 7 Q. However, do you agree that the chairman will also need 8 to consider the factual evidence more broadly about 9 whether firefighters in fact had to wait to use the dry 10 riser? 11 A. Yes, I do agree, yes. 12 Q. And that he will have to look at whether there's 13 evidence as to whether they actually had to wait for the 14 water and whether they were ready to go in any event? 15 A. Yes, that's not something I've analysed at all. Yes. 16 Q. Just on this, do you accept that the activity of 17 connecting a supply to the dry riser, and also the fire 18 crews setting up at the bridgehead, are likely to be 19 simultaneous activities? 20 A. That's a matter for a firefighting expert to give a view 21 on. 22 Q. Another topic on this is about the use of a wet main to 23 cool the lobbies. 24 A. Yes. 25 Q. If we go back again within chapter 2 of your report to</p> <p style="text-align: center;">Page 96</p>

<p>1 2.23.26 -- that's chapter 2, BLAS0000002, page 66, the 2 same page we were just on. 3 If we can zoom in on that paragraph, 2.23.26. 4 A. Yes. 5 Q. So you've said this there: 6 "2.23.26. A wet fire main, could have enabled 7 greater water pressure for fire-fighting on the upper 8 floors of Grenfell Tower, which may have allowed LFB to 9 use water to cool lobbies and stair and therefore 10 provide more assistance to people trying to escape." 11 A. Yes. So this is something I'm very interested in in 12 terms of understanding hazards to people in specific 13 locations, because the design condition is to have a wet 14 rising main which can cope with two hoses operating at 15 the same time. 16 I just would like to hear some more about, if that 17 condition was present at Grenfell Tower, how it could 18 have been used in the context of rescue. The two hoses 19 are very important, because that's about protecting 20 crews. And in the beginning it should be about 21 extinguishing the fire and protecting the crew, but 22 I would like to understand later on, if that provision 23 had been available, a wet rising main with two 24 functioning hoses, and it could've been applied that 25 way, with two functioning hoses, how that might have</p> <p style="text-align: right;">Page 97</p>	<p>1 flow rate (l/s) and pressure of water (bar) to the 2 design requirements for a wet fire main system. In 3 summary, I have found that assuming two hoses operating 4 in the building, one each at Levels 22 & 23, the 5 pressure at the outlet would be 2.57bar. This is 32% of 6 the pressure required by ADB 2013 for a wet rising main 7 (8 bar)." 8 Is that correct? 9 A. Yes, it's a simple theoretical analysis where all the 10 water conditions are the same outside the tower, and it 11 was just for the purposes of comparing a dry and wet 12 riser in that context, to try and illustrate how it's 13 different and how it would be potentially different in 14 a building the height of Grenfell Tower. 15 Q. You go on to say: 16 "15.8.23. Similarly, to deliver the equivalent 17 pressure to a wet fire main on the highest floors, the 18 pressure required at Ground Level would be 15.5bar. 19 This is over 50% more than the maximum operating 20 pressure that dry fire mains are designed for (10 bar)." 21 Is that correct? 22 A. Yes, that's correct. 23 Q. So I think you've accepted -- and you did, I think, make 24 this point in your original report -- that even with 25 a wet main, pumps and water supplies are not designed</p> <p style="text-align: right;">Page 99</p>
<p>1 assisted protecting crews and dealing with localised 2 conditions in the lobby. 3 I would like to hear about that from a firefighting 4 expert or a firefighter. 5 SIR MARTIN MOORE-BICK: When you talk about two functioning 6 hoses, what exactly do you have in mind? 7 A. So the water supply is meant to be sufficient through 8 the wet rising main to allow the full operation of two 9 hoses simultaneously. 10 SIR MARTIN MOORE-BICK: Right. 11 A. So I accept entirely that if you've multiple hoses at 12 the same time, even with the wet riser, the situation 13 changes. But if one used it as it was designed, if it 14 had been provided, how can that assist protecting crews 15 and dealing with localised firefighting to aid rescue 16 only? I can't take that off the table as such. 17 MS GRANGE: Okay. 18 Can we just look at paragraphs 15.8.22 and 15.8.23 19 within the body of your report. That's BLAS0000015 at 20 38. 21 A. Yes. 22 Q. And here you give some comparison calculations you say: 23 "15.8.22. To compare the performance of wet and dry 24 fire main systems, I have calculated ... whether the dry 25 fire main in Grenfell Tower could provide an equivalent</p> <p style="text-align: right;">Page 98</p>	<p>1 for multiple fire streams; is that correct? 2 A. Beyond two. 3 Q. Yes. 4 A. But I think understanding how two could have been used 5 is important. 6 Q. So at Grenfell Tower, would any shortcomings which are 7 encountered in respect of the water pressure for the dry 8 riser potentially also have been encountered for the wet 9 riser due to the number of hydrants which were in use? 10 A. Eventually, but there's proper expert detail required to 11 understand the impact of the firefighting on the town 12 main and I wouldn't like to stray there. 13 But, yes, the more water that was used externally, 14 in just very simple terms, I presume it impacted the 15 water available for internal firefighting, and that 16 proper analysis of network flows needs to be done. 17 Q. And that's going to be done by probably Ivan Stoianov, 18 who has been appointed as the water expert -- 19 A. Yes. 20 Q. -- and potentially, presumably, Steve McGuirk, the 21 firefighting expert may need to look at that as well. 22 A. Yes. So I accept, because of all the ad hoc 23 firefighting that became required outside the building, 24 even though that's not what's meant to be required, will 25 now have to be reviewed in the context of the remaining</p> <p style="text-align: right;">Page 100</p>

<p>1 water internally. But the evidence shows the</p> <p>2 effectiveness of the external firefighting at the levels</p> <p>3 it was possible, as I've explained in my report.</p> <p>4 Q. So on this basis, once the fire has spread to multiple</p> <p>5 floors, and they're doing firefighting in a large number</p> <p>6 of locations, would you accept that the wet riser may</p> <p>7 not have made a material difference?</p> <p>8 A. Once it went beyond two hoses, as I said.</p> <p>9 Q. Just moving to a slightly different point, you've said</p> <p>10 that under Approved Document B 2013, the risers,</p> <p>11 according to those current standards, have to be located</p> <p>12 within the stair enclosure --</p> <p>13 A. Yes.</p> <p>14 Q. -- and not within the lobbies.</p> <p>15 A. That's the recommendation yes.</p> <p>16 Q. That's if the current standards apply.</p> <p>17 A. Yes, it is, yes.</p> <p>18 Q. Do you consider that the siting of the outlets in the</p> <p>19 lobbies rather than the protected stairwell may have</p> <p>20 affected the firefighting effort within Grenfell Tower?</p> <p>21 A. Well, I observe in the evidence available to us that</p> <p>22 trying to get that distance to the dry riser, and in the</p> <p>23 shape of the lobby as it was, it did pose difficulties</p> <p>24 to London Fire Brigade as they have said themselves.</p> <p>25 Q. Yes.</p> <p style="text-align: center;">Page 101</p>	<p>1 Q. Just looking --</p> <p>2 SIR MARTIN MOORE-BICK: At that point, if you have a wet</p> <p>3 riser, you've got to draw water from the local mains.</p> <p>4 A. Yes.</p> <p>5 SIR MARTIN MOORE-BICK: And if you have a dry riser, you're</p> <p>6 drawing water from the local mains.</p> <p>7 A. Eventually, exactly.</p> <p>8 SIR MARTIN MOORE-BICK: So the difference is going to lie in</p> <p>9 the pumping capacity of the fixed pumps for the wet</p> <p>10 riser and the Fire Brigade's engines for the other?</p> <p>11 A. Absolutely, and not exceeding -- I keep saying two</p> <p>12 hoses -- the design basis of the wet rising system,</p> <p>13 which isn't 10 hoses, 20 hoses; it's two hoses.</p> <p>14 That's -- exactly, the pumping equipment and staying</p> <p>15 within the design limits of the system.</p> <p>16 SIR MARTIN MOORE-BICK: Yes.</p> <p>17 A. How one would do that systematically in an extreme</p> <p>18 event, that's the kind of information an expert in</p> <p>19 firefighting would need to bring.</p> <p>20 SIR MARTIN MOORE-BICK: Thank you.</p> <p>21 MS GRANGE: Just one set of questions on this topic now.</p> <p>22 Take the dry riser as a dry riser. Have you seen</p> <p>23 any evidence that suggests it didn't perform adequately</p> <p>24 as a dry riser, as in do you have any evidence that it</p> <p>25 didn't achieve the pressure that you would expect a dry</p> <p style="text-align: center;">Page 103</p>
<p>1 A. And because of the conditions in the Grenfell Tower</p> <p>2 fire, the lobbies became a hazardous area, whereas if</p> <p>3 the dry riser was in the staircase in those extreme</p> <p>4 circumstances, that's something to contemplate.</p> <p>5 Q. Do you think that using a wet riser reduces the risk of</p> <p>6 compromise of the water supply caused by falling debris?</p> <p>7 A. I couldn't answer that question, sorry. Yes.</p> <p>8 Q. In terms of fire spread on the external wall --</p> <p>9 A. Yes.</p> <p>10 Q. -- do you think that the presence of a dry riser rather</p> <p>11 than a wet riser made any difference in terms of the</p> <p>12 firefighters' abilities to fight that external wall</p> <p>13 fire?</p> <p>14 A. Again, I actually don't understand that question,</p> <p>15 because the cladding fire was dealt with from outside</p> <p>16 the building for several hours, yes. Not with the dry</p> <p>17 riser. So I don't understand the question.</p> <p>18 Q. Would you accept that in an extended incident, such as</p> <p>19 that which was encountered at Grenfell Tower, had wet</p> <p>20 risers been used, the capacity of the tanks may have</p> <p>21 been exceeded early on in the fire?</p> <p>22 A. Indeed, and I think the analysis of the network supply</p> <p>23 in the area and around the building, therefore, is</p> <p>24 a useful exercise to understand what impact that might</p> <p>25 have had to replenishing those tanks.</p> <p style="text-align: center;">Page 102</p>	<p>1 riser to achieve?</p> <p>2 A. Oh, I'm sorry. I was about to say, well, a dry riser is</p> <p>3 a dry riser.</p> <p>4 No, the evidence from early firefighting is that it</p> <p>5 performed effectively in their opinion.</p> <p>6 There is evidence of an incident at level 20 -- very</p> <p>7 unfortunately, I just can't bring the time to my mind</p> <p>8 right now, it wasn't late in the fire -- where the water</p> <p>9 pressure and flow rate at level 20 was less, if that's</p> <p>10 what you mean.</p> <p>11 SIR MARTIN MOORE-BICK: But the functioning of the dry riser</p> <p>12 is going to be related to the functioning of the Fire</p> <p>13 Brigade's pumping equipment --</p> <p>14 A. Correct.</p> <p>15 SIR MARTIN MOORE-BICK: -- and the supply of water to that</p> <p>16 equipment.</p> <p>17 A. Correct.</p> <p>18 SIR MARTIN MOORE-BICK: There's nothing intrinsic to the dry</p> <p>19 riser that you're aware of that compromised its --</p> <p>20 A. That's why I don't quite understand the question,</p> <p>21 because the dry riser is an empty pipe and it exists as</p> <p>22 an empty pipe in itself.</p> <p>23 SIR MARTIN MOORE-BICK: Well, you could've had a problem,</p> <p>24 for example, where you couldn't get the cap off or the</p> <p>25 valve didn't work or something like that.</p> <p style="text-align: center;">Page 104</p>

<p>1 A. Oh, I see, yes. I'm not aware that detailing of the 2 physical infrastructure was a problem. 3 SIR MARTIN MOORE-BICK: Right. 4 MS GRANGE: This might help a little bit, but it's said that 5 the dry riser did achieve the 10-bar pressure that you 6 were referring to earlier, do you remember, a comparison 7 between the pressure of a wet riser, 15.5, and the dry 8 riser, 10-bar was the requirement. 9 A. Yes. 10 Q. It's suggested that it did, when tested, achieve that 11 10-bar requirement. Have you considered that test 12 evidence? 13 A. No, I have not. 14 Q. No. 15 A. I'm not aware that it did. 16 Q. But it would be appropriate for probably another inquiry 17 expert to consider -- 18 A. Absolutely. 19 Q. -- any testing of the dry riser that was done? 20 A. Yes, and how it's done, replicating the exact 21 circumstances of the external firefighting, and 22 condition of the water network, around the tower on that 23 night, particularly. 24 MS GRANGE: Yes. 25 Mr Chairman, I have no more questions on that topic,</p> <p style="text-align: right;">Page 105</p>	<p>1 MS GRANGE: Thank you. 2 I now want to ask you some questions about the fire 3 lift at Grenfell Tower, for which purpose we will mainly 4 be in appendix L of your report. 5 As you explained in your presentation in June of 6 this year, the lifts at Grenfell Tower were renovated in 7 2005. 8 A. That's correct. 9 Q. That work was carried out by Apex as contractor against 10 a Butler & Young specification. 11 A. Correct. 12 Q. You say in your report that at that time, it was 13 Approved Document B 2000 that was the relevant statutory 14 guidance under the Building Regulations. 15 A. That's correct. 16 Q. You say that Approved Document B 2000 required 17 conformity to a particular British Standard, that's 18 BS 55885:1991, which was the relevant standard at the 19 time of those lift replacement works. 20 A. Yes. 21 Q. You say in your report that the Butler & Young 22 specification did not provide for a full firefighting 23 lift. We're going to look at the difference between 24 that and a fire lift in a moment, but I just want to be 25 clear. So it was not specified to be a full</p> <p style="text-align: right;">Page 107</p>
<p>1 and I'm about to move to a bigger topic, which is about 2 the lift. 3 SIR MARTIN MOORE-BICK: Would you like to break at that 4 point? 5 MS GRANGE: I think that would be an appropriate moment for 6 a break, and I would be happy to come back at 2.00. 7 SIR MARTIN MOORE-BICK: Are you sure? 8 MS GRANGE: I'm sure. 9 SIR MARTIN MOORE-BICK: There you are. Ms Grange thinks 10 it's safe to have an extra 10 minutes for lunch. 11 We're going to break at that point, then, and we 12 will resume at 2 o'clock. 13 THE WITNESS: Okay. 14 SIR MARTIN MOORE-BICK: If you would like to go with the 15 usher, and I have to remind you not to talk about your 16 evidence. 17 Good, thank you. 18 Right, 2 o'clock, then, please. Thank you. 19 (12.50 pm) 20 (The short adjournment) 21 (2.00 pm) 22 SIR MARTIN MOORE-BICK: All right? Ready to go on? 23 THE WITNESS: Yes. 24 SIR MARTIN MOORE-BICK: Thank you very much. 25 Yes, Ms Grange.</p> <p style="text-align: right;">Page 106</p>	<p>1 firefighting lift; is that right? 2 A. That's correct, based on the evidence provided to me. 3 Q. Nor did it specify compliance with that British Standard 4 I just referred to. You make that point in your report 5 as well. 6 A. Yes, I make that point. 7 Q. You note that despite the TMO's policy that, when the 8 lift are being refurbished, the reinstalled lift should 9 be upgraded to a firefighter lift, the lift was not 10 upgraded to that standard, but was replaced with another 11 fire lift; is that correct? 12 A. That's correct. 13 Q. Can we just go back to CP3 1971 and just look at what 14 a fire lift was required to have under that standard. 15 A. Yes. 16 Q. So if we go to figure L.2 in your report, BLAS0000033, 17 at page 10. 18 So here you've given the basic fire lift 19 requirements as per that standard in 1971. 20 A. Yes. 21 Q. And you've got them in labels here. 22 A. Yes, that's correct. 23 Q. So we've got an independent power supply, various things 24 about cabling, serving every residential level. 25 A. Yes.</p> <p style="text-align: right;">Page 108</p>

<p>1 Q. Then a fire switch at access level; is that right?</p> <p>2 A. That's correct, yes.</p> <p>3 Q. That was a fire switch to enable it to be taken into</p> <p>4 firefighter control; is that correct?</p> <p>5 A. That's correct.</p> <p>6 Q. And we have a minimum lift car area. That's a basic</p> <p>7 fire life; is that correct?</p> <p>8 A. Basic fire -- well --</p> <p>9 Q. What we see there --</p> <p>10 A. Their dimensions are made clear, yes. And also it</p> <p>11 should serve every residential level, and then there's</p> <p>12 a walking distance to the door of the lift.</p> <p>13 Q. You've put the features of a full firefighting lift in</p> <p>14 a figure L.1 of your report, where we see those in</p> <p>15 diagram form. That's on page 7 within chapter 33.</p> <p>16 A. Yes.</p> <p>17 Q. Perhaps if we can pull that up.</p> <p>18 Again, you went through a number of these features</p> <p>19 in your presentation in June.</p> <p>20 A. Yes, I did.</p> <p>21 Q. This is just to remind ourselves of what a full</p> <p>22 firefighting lift requires.</p> <p>23 A. Yes, so it --</p> <p>24 Q. So --</p> <p>25 A. Oh, sorry.</p> <p style="text-align: right;">Page 109</p>	<p>1 that that doesn't replicate the provisions of any design</p> <p>2 standard that you're aware of.</p> <p>3 A. As I read it. I don't know the basis for their</p> <p>4 definition.</p> <p>5 Q. What you said is, even looking at the lower fire lift</p> <p>6 standards, you've seen no evidence that in 2005 both</p> <p>7 lifts were connected to fire control switches; is that</p> <p>8 correct?</p> <p>9 A. In 2005?</p> <p>10 Q. Yes.</p> <p>11 A. Or to the 2005 standard?</p> <p>12 Q. Yes. In 2005, you say you found no evidence that the</p> <p>13 lifts were connected to fire control switches. You say</p> <p>14 the Butler & Young specification did not specify the</p> <p>15 provision of a fireman's control to any specific code or</p> <p>16 guidance; is that correct?</p> <p>17 A. Yes, that's correct. Not that I didn't find physical</p> <p>18 evidence of --</p> <p>19 Q. Sorry.</p> <p>20 A. Sorry, I misunderstood.</p> <p>21 Q. Yes, I think it's my question.</p> <p>22 A. Yes.</p> <p>23 Q. You've also noted that the relevant British Standard,</p> <p>24 the one we referred to earlier BS 55885:1991, required</p> <p>25 some very particular features for the firefighting</p> <p style="text-align: right;">Page 111</p>
<p>1 Q. Yes, I mean, take it from the top: an independent</p> <p>2 primary and secondary power supply, that is a key</p> <p>3 feature.</p> <p>4 A. Yes, it's a key feature to ensure operation in</p> <p>5 an emergency.</p> <p>6 Q. Water ingress protection, the fourth label down.</p> <p>7 A. Yes, on the left.</p> <p>8 Q. I'm just highlighting some of the key features. We have</p> <p>9 them all in labels here.</p> <p>10 The provision of an escape hatch within the lift</p> <p>11 car.</p> <p>12 A. Yes, for the Fire Brigade and others, yes.</p> <p>13 Q. A compliant intercom system. So you talk about</p> <p>14 a two-way intercom from the lift car to the machine room</p> <p>15 and access level?</p> <p>16 A. Exactly, so you can communicate with someone outside the</p> <p>17 lift or for other reasons up at the machine room.</p> <p>18 Q. Again, we see the fire switch at access level.</p> <p>19 A. Yes, and fire-resisting landing doors, yes.</p> <p>20 Q. So those are all the features if you were to do</p> <p>21 a firefighting lift.</p> <p>22 A. Yes. I mean, that's a summary of, you know, a longer</p> <p>23 British Standard, so yes.</p> <p>24 Q. You've also noted in your report that the TMO has its</p> <p>25 own definition of a firefighting lift. What you say is</p> <p style="text-align: right;">Page 110</p>	<p>1 switch operation; is that correct?</p> <p>2 A. Yes, it did.</p> <p>3 Q. You've set these out at paragraph L3.3.6 and following</p> <p>4 of your report.</p> <p>5 A. Yes.</p> <p>6 Q. Perhaps we can bring that up on screen. We don't need</p> <p>7 to go through all the details of it, but it's at</p> <p>8 BLAS0000033, pages 12 and then on to 13. If we do</p> <p>9 page 12 first.</p> <p>10 So I think at the bottom of that page, you've</p> <p>11 included all the different --</p> <p>12 A. Yes, it's the next page.</p> <p>13 Q. -- requirements for a firefighting lift switch -- yes,</p> <p>14 it goes on to the next page.</p> <p>15 A. Yes, this list here.</p> <p>16 Q. So there's a long list here, but if I can just try and</p> <p>17 understand in summary what you're saying this shows.</p> <p>18 In essence, is it right that such a switch should</p> <p>19 enable the firefighters to bring the lift back to their</p> <p>20 access level, and then take control of the lifts?</p> <p>21 A. Yes, and prevent its use by any other person from</p> <p>22 a lobby.</p> <p>23 Q. Exactly. So it's taken out of all normal operation.</p> <p>24 A. Exactly.</p> <p>25 Q. So if you're a resident on floor 10 and you press the</p> <p style="text-align: right;">Page 112</p>

<p>1 switch, it shouldn't respond to that.</p> <p>2 A. Exactly, and if you happened to have pressed the switch</p> <p>3 and you're waiting, and the lift was taken under control</p> <p>4 whilst you were waiting, again, it wouldn't respond to</p> <p>5 your earlier call.</p> <p>6 Q. The way in which the firefighters control the lift, is</p> <p>7 it by putting pressure on certain switches within the</p> <p>8 lift car itself?</p> <p>9 A. Yes. So in that standard, it comes to where the fire</p> <p>10 control point is, and then the Fire Brigade can enter</p> <p>11 that lift and use the buttons inside the lift car to go</p> <p>12 to a floor and open the door slowly on that floor.</p> <p>13 Q. So it's basically under complete, sole firefighter</p> <p>14 control --</p> <p>15 A. Yes.</p> <p>16 Q. -- if that lift switch works?</p> <p>17 A. Yes, that's correct.</p> <p>18 Q. You've noted in your inspections at Grenfell Tower, as</p> <p>19 it existed at the time of the fire, that there are two</p> <p>20 firemen's control switches.</p> <p>21 A. Yes, I did.</p> <p>22 Q. There's one at ground floor.</p> <p>23 A. Yes, and one at level 2.</p> <p>24 Q. Yes. Let's just go to photographs of those. This is</p> <p>25 figure L.11, BLAS0000033, page 25.</p> <p style="text-align: center;">Page 113</p>	<p>1 if one was added during the primary refurbishment, or if</p> <p>2 they both existed before 2005, or they were both new or</p> <p>3 both old -- apologies for rambling, but it's a ramibly</p> <p>4 subject.</p> <p>5 So, in short, I have no idea when each switch was</p> <p>6 installed at any stage.</p> <p>7 Q. We're going to come back to these switches in a moment,</p> <p>8 but in the principal refurbishment, you've ascertained</p> <p>9 that the extent of the work that was carried out to the</p> <p>10 lifts was basically two new landing doors to the lift</p> <p>11 shafts on levels 1 and 2 --</p> <p>12 A. Yes.</p> <p>13 Q. -- because of the new flats that were being converted in</p> <p>14 terms of change of use at that time.</p> <p>15 A. Exactly, works to allow the lifts to stop at every</p> <p>16 floor.</p> <p>17 Q. You've mentioned, L4.3.8 of your report, what the extent</p> <p>18 of that work was, and you say that the scope of work did</p> <p>19 not include fire control switches at this time in terms</p> <p>20 of what you can ascertain; is that correct?</p> <p>21 A. Based on the evidence provided to me, yes.</p> <p>22 Q. In terms of the lifts' performance on the night, what</p> <p>23 you've concluded is that the basic fire lift function,</p> <p>24 the override switch we were just looking at, did not</p> <p>25 work on the night; is that correct?</p> <p style="text-align: center;">Page 115</p>
<p>1 So there we can see the switch that was present on</p> <p>2 ground level; yes?</p> <p>3 A. Yes.</p> <p>4 Q. And the switch at level 2.</p> <p>5 A. That's correct.</p> <p>6 Q. They've both got "Fire control" written on them,</p> <p>7 although slightly --</p> <p>8 A. They're different shapes.</p> <p>9 Q. -- different shapes.</p> <p>10 A. Yes.</p> <p>11 Q. What you've said in your report -- is this right? -- is</p> <p>12 that you don't know if one or both of the switches at</p> <p>13 ground and level 2 were kept in 2005 or if they were</p> <p>14 new --</p> <p>15 A. Exactly.</p> <p>16 Q. -- or if there was a change during the refurbishment.</p> <p>17 You're a little bit unclear about the history of these</p> <p>18 switches?</p> <p>19 A. Exactly. So there should only be one because there's no</p> <p>20 way of understanding which -- there's not meant to be</p> <p>21 two, and if there is two, which one takes priority,</p> <p>22 okay? I've reviewed all sorts of documentation, so when</p> <p>23 I say I don't know, it's not for want of trying to find</p> <p>24 the information, as such.</p> <p>25 I don't know which switch was installed in 2005, or</p> <p style="text-align: center;">Page 114</p>	<p>1 A. Yes. So when I wrote my first draft of this report, the</p> <p>2 evidence from the firefighters was a key was placed at</p> <p>3 the ground floor fire control key point, and they</p> <p>4 considered that nothing happened.</p> <p>5 Q. Yes. Again, we're going to come to this.</p> <p>6 Just in terms of the switch on the ground floor, as</p> <p>7 you've just said, we know that Firefighter Secrett tried</p> <p>8 to use a drop key to activate it --</p> <p>9 A. Yes.</p> <p>10 Q. -- but couldn't get the lift to return to ground when he</p> <p>11 attempted to operate the override switch.</p> <p>12 We can see an image of that if we go in your report,</p> <p>13 BLAS0000033, page 39, figure L.20.</p> <p>14 A. Yes.</p> <p>15 Q. If we blow that figure up, there we see Firefighter</p> <p>16 Secrett, and he has put a key into the switch.</p> <p>17 A. Yes.</p> <p>18 Q. Is that what we can see? That's what you're referring</p> <p>19 to in your report?</p> <p>20 A. Yes, I am. Then his evidence that nothing happened.</p> <p>21 Q. You also note that the lift remained in general</p> <p>22 operation and was used by residents during the fire.</p> <p>23 A. Yes, based on the evidence from the night.</p> <p>24 Q. Again, we'll come back to that.</p> <p>25 You now have, and you had at the time of writing</p> <p style="text-align: center;">Page 116</p>

<p>1 your revised report, the benefit of a report from WSP --</p> <p>2 A. Yes.</p> <p>3 Q. -- which was prepared for the Metropolitan Police</p> <p>4 Service.</p> <p>5 A. That's correct.</p> <p>6 Q. We'll look at some aspects of that report in a moment,</p> <p>7 but just to summarise, that report first of all shows</p> <p>8 that the level 2 override switch had no wires connected</p> <p>9 to the firemen's switch.</p> <p>10 A. That's correct.</p> <p>11 Q. So that level 2 switch, which is still there, doesn't</p> <p>12 look like it was connected.</p> <p>13 A. Exactly, and if it was not connected, as an absolute</p> <p>14 minimum, notification should've been present in that</p> <p>15 location for the Fire Brigade, but far more preferably,</p> <p>16 that switch should've been removed.</p> <p>17 Q. WSP also state in the report that they tried to activate</p> <p>18 the fireman's switch on the ground floor and it was</p> <p>19 "difficult to operate".</p> <p>20 A. That's correct.</p> <p>21 Q. So is your understanding that they did try and operate</p> <p>22 it as part of their investigation?</p> <p>23 A. Yes, they did. I've read their activities. They tried</p> <p>24 to place the drop key in it in the wall and they also</p> <p>25 removed the box mechanism from the wall and made further</p> <p style="text-align: right;">Page 117</p>	<p>1 Q. Do you think that that's consistent with the evidence of</p> <p>2 Firefighter Secrett as to the problems he encountered</p> <p>3 with activating the switch on the night?</p> <p>4 A. I very much do, yes.</p> <p>5 Q. Do you think it signifies a potential maintenance</p> <p>6 failure with the switch in terms of maintaining it?</p> <p>7 A. There is a duty to test those switches, a duty to</p> <p>8 understand if they're connected or not, and so, yes,</p> <p>9 there is a duty to maintain life safety equipment at all</p> <p>10 times in any building.</p> <p>11 Q. Do you think it's possible that the reason</p> <p>12 Firefighter Secrett could not operate the switch is that</p> <p>13 he was using a drop key which didn't have a pin across</p> <p>14 it to stop the pin going too far into the access point?</p> <p>15 A. No, I do not.</p> <p>16 Q. Can you just explain why you don't? Is that because of</p> <p>17 other evidence you've seen?</p> <p>18 A. Other evidence has been provided to me, and when the</p> <p>19 drop key is in the correct position in a mechanism the</p> <p>20 same as Grenfell Tower, there is no need for the key to</p> <p>21 be pushed as far as hitting off that split pin. So it's</p> <p>22 in the correct position, and then there is a gap and</p> <p>23 then there is the split pin. So you can't push it</p> <p>24 further.</p> <p>25 Therefore, I don't understand the relevance of the</p> <p style="text-align: right;">Page 119</p>
<p>1 attempts there.</p> <p>2 Q. Yes.</p> <p>3 A. And neither were successful because the mechanism is</p> <p>4 jammed or seized. It can't be moved.</p> <p>5 Q. We can go to that in the report.</p> <p>6 A. Yes.</p> <p>7 Q. So they removed the faceplate, so they did a destructive</p> <p>8 examination.</p> <p>9 A. Yes, they went and looked at the innards of it all.</p> <p>10 Q. They said they discovered the mechanism was seized and</p> <p>11 damaged/deformed.</p> <p>12 A. Yes.</p> <p>13 Q. Can we look at that. So that's figure L.18,</p> <p>14 BLAS0000033, pages 31 to 32.</p> <p>15 So the left here is the level 2 switch --</p> <p>16 A. Yes.</p> <p>17 Q. -- with the faceplate removed, where they found the</p> <p>18 wires were not connected; is that correct?</p> <p>19 A. Yes, that's correct.</p> <p>20 Q. The right is the ground level switch with the faceplate</p> <p>21 removed.</p> <p>22 A. Yes, and the mechanisms at the back there hanging down.</p> <p>23 Q. And they found that to be deformed and damaged.</p> <p>24 A. Yes, I'll have to rely on their physical activity on</p> <p>25 site, which I'm happy to do so, yes.</p> <p style="text-align: right;">Page 118</p>	<p>1 split pin in that evidence sent in.</p> <p>2 Q. You've also said in your report that it remains unclear</p> <p>3 to you whether that ground floor override switch, which</p> <p>4 does seem to have been wired at that point --</p> <p>5 A. Yes.</p> <p>6 Q. -- was in fact interfaced with the lift controllers in</p> <p>7 the lift plant room and, if interfaced, whether it was</p> <p>8 operable?</p> <p>9 A. So, again, WSP have various findings from site and, as</p> <p>10 a result of their observations, I actually don't know</p> <p>11 now if both lifts or one lift is a fire lift, which one</p> <p>12 was connected to the key switch, and therefore how</p> <p>13 everything was meant to work, both and one, and if it</p> <p>14 was one, which one was it?</p> <p>15 SIR MARTIN MOORE-BICK: The drop key has a mechanical</p> <p>16 operation, does it? It doesn't have anything --</p> <p>17 A. It's in itself mechanical, but my understanding is it</p> <p>18 forms some kind of circuit, and that should then be</p> <p>19 connected to an interface somewhere else which would</p> <p>20 send a signal. Electrical engineering, absolutely</p> <p>21 outside my area of expertise.</p> <p>22 SIR MARTIN MOORE-BICK: I couldn't help noticing in one of</p> <p>23 the earlier pictures someone seemed to be holding what</p> <p>24 might be a drop key. Would you recognise one if you saw</p> <p>25 it?</p> <p style="text-align: right;">Page 120</p>

30 (Pages 117 to 120)

<p>1 A. Oh, I would, yes. I brought a brochure for you.</p> <p>2 MS GRANGE: Go to figure L.11, BLAS0000033 at page 25.</p> <p>3 A. Yes. So every lift expert in the country will be cross</p> <p>4 when I describe it this way, but --</p> <p>5 SIR MARTIN MOORE-BICK: It's all right, do your best.</p> <p>6 A. That's a drop key for the old-style control.</p> <p>7 SIR MARTIN MOORE-BICK: Right.</p> <p>8 A. And you can see -- sorry -- that's because this portion</p> <p>9 drops (Indicates). You push it in on the horizontal and</p> <p>10 it drops down once it gets to the right part for it to</p> <p>11 drop down in behind this plate. That's the old style</p> <p>12 express key they're called as well.</p> <p>13 SIR MARTIN MOORE-BICK: Thank you.</p> <p>14 A. Well illustrated in the WSP report.</p> <p>15 MS GRANGE: That point about the interfacing and whether</p> <p>16 this switch was interfaced with the lift controllers, is</p> <p>17 that something you think could be investigated further?</p> <p>18 A. I think it very much needs to be investigated to</p> <p>19 a considerable detail.</p> <p>20 Q. This is probably a good point to note, isn't it, that</p> <p>21 you have recommended in your latest report that the</p> <p>22 inquiry should appoint a specialist lift expert to look</p> <p>23 at this.</p> <p>24 A. Yes, I do, because we're getting into the complex</p> <p>25 question of what's connected where, how, why, and WSP</p> <p style="text-align: center;">Page 121</p>	<p>1 Q. That's there in that guidance.</p> <p>2 A. It is, and that's a common means of providing</p> <p>3 assistance, using the firefighting lift, with all the</p> <p>4 additional protection measures, whilst it's available.</p> <p>5 Q. But you note that in the event, the lifts could not be</p> <p>6 used for that purpose because they were not these</p> <p>7 upgraded firefighter lifts.</p> <p>8 A. Exactly. They don't have the right emergency power</p> <p>9 sources and other protection measures to make them safe</p> <p>10 enough to be used to transport people around the tower,</p> <p>11 that's correct.</p> <p>12 Q. You are aware of some of the issues which arose on the</p> <p>13 night, given that the operation of the lifts stayed in</p> <p>14 normal mode.</p> <p>15 A. Yes.</p> <p>16 Q. Firefighter Badillo talks about getting stuck on the</p> <p>17 15th when trying to go to the 20th.</p> <p>18 A. Yes.</p> <p>19 Q. We've also had evidence from Nadia Jafari about what</p> <p>20 happened to her father in relation to the lift.</p> <p>21 A. Yes, that's correct.</p> <p>22 Q. Do you think that given that the lift couldn't be used</p> <p>23 as a firefighter lift, or even a fire lift, on the</p> <p>24 night, it should've been disabled in the early stages of</p> <p>25 the fire to avoid the consequences of it being in normal</p> <p style="text-align: center;">Page 123</p>
<p>1 also found some curious connections where it may have</p> <p>2 been connected to the detection system, linked to the</p> <p>3 smoke control panel, which I don't understand at all.</p> <p>4 So those interfaces from the lift are very important</p> <p>5 to understand now.</p> <p>6 Q. Just a couple of questions about the lift as a mode of</p> <p>7 evacuation for those with mobility problems.</p> <p>8 A. Yes.</p> <p>9 Q. You consider that Grenfell Tower was non-compliant with</p> <p>10 the B1 means of escape provision. In particular, you</p> <p>11 say that Approved Document B does not make specific</p> <p>12 requirements, but that you think B1 would require</p> <p>13 an adequate means of escape for those who have mobility</p> <p>14 problems; is that correct?</p> <p>15 A. Yes. So the functional requirement is clear that</p> <p>16 everyone can evacuate the building independently without</p> <p>17 assistance. The statutory guidance then doesn't make</p> <p>18 any specific provision in residential buildings for</p> <p>19 those that require assistance.</p> <p>20 Q. You've noted in your report that Approved Document B</p> <p>21 2010 states that those in wheelchairs will need</p> <p>22 evacuation by lifts and, in particular, paragraph 5.39</p> <p>23 of ADB allows for a firefighter lift to be used to</p> <p>24 evacuate those with mobility problems.</p> <p>25 A. That's correct.</p> <p style="text-align: center;">Page 122</p>	<p>1 operation?</p> <p>2 A. Disabled by whom and how?</p> <p>3 Q. That's the question. Yes. I mean, possibly --</p> <p>4 A. Oh, sorry, I'm not allowed to ask you a question.</p> <p>5 Should it have been disabled? Well, frankly, if</p> <p>6 I may say, it shouldn't have been provided in that</p> <p>7 condition in the first place and that should have been</p> <p>8 known.</p> <p>9 Q. I take that point, but in terms of on the night, do you</p> <p>10 think it might have been possible to, say, block the</p> <p>11 doors with firefighting equipment and take it out of</p> <p>12 operation? Is that something that could've happened?</p> <p>13 A. I've never tried to block a lift with firefighting</p> <p>14 equipment. I did observe it being done in the early</p> <p>15 stages. You can see that in the CCTV.</p> <p>16 As to the practicalities of the Fire Brigade</p> <p>17 attempting to do that with equipment in the middle of</p> <p>18 an event like this, I think others should comment.</p> <p>19 But for me, the primary duty was not to provide</p> <p>20 lifts in that condition in the first place.</p> <p>21 SIR MARTIN MOORE-BICK: Can I take it that you're not</p> <p>22 yourself aware of any way in which the lift could've</p> <p>23 been put out of operation by having the power</p> <p>24 disconnected or any other way and that would be</p> <p>25 reasonably accessible?</p> <p style="text-align: center;">Page 124</p>

<p>1 A. I would prefer you to ask a lift expert that question, 2 and then it's who do you phone, what do they do, how do 3 they get there? A very interesting concept. A proper 4 lift expert could answer all those questions. 5 SIR MARTIN MOORE-BICK: Thank you. 6 MS GRANGE: In terms of the use of the lifts in the very 7 early stages to fight the fire in flat 16, you say in 8 your report that the fact that it was not a firefighter 9 lift may have caused a short delay in arriving at 10 flat 16. However, you've also noted in your report that 11 given that firefighters did actually use the lifts in 12 the event to transport equipment up to the bridgehead in 13 normal mode, you don't think this caused a delay to the 14 initial firefighting response. 15 A. It doesn't seem to have been significant, no, in times 16 of time, as they relay events. 17 Q. Yes. Just one final set of questions on this topic. 18 Do you agree that, when considering whether the fact 19 that the lifts were not firefighting lifts made 20 a difference on the night, it may be relevant, for 21 example, that the LFB policy was that the bridgehead is 22 set up two floors below the fire floor, and that the 23 policy is that lifts should not be used above the 24 bridgehead in a high-rise incident? 25 Do you think those are potentially relevant in terms</p> <p style="text-align: right;">Page 125</p>	<p>1 discussing, do you agree that the fact that the lifts 2 were not firefighting lifts made no difference or no 3 material difference to the development of the fire in 4 terms of the ability of the firefighters to carry out 5 firefighting? 6 A. In the early stages of the fire, or any stage? 7 Q. At any stage. 8 A. I wouldn't want to try and answer that question. 9 Q. I then want to turn to the smoke ventilation system. 10 A. Okay. 11 Q. At this point, it's going to be appendix J, which is 12 worth having. 13 What I'd like to do -- this is potentially quite 14 a complex topic -- is to start by looking back at some 15 of the slides from your presentation back on 18 June, 16 just to give a very overall picture of how the system 17 was configured. 18 So if we look at BLAS00005481, and go to page 19 page 173 of that presentation. 20 A. Yes. 21 Q. So here what you've given, I think, is a schematic which 22 shows the operation of the original smoke control 23 system. That's original as in from the 1970s when 24 Grenfell Tower was built. 25 A. Yes.</p> <p style="text-align: right;">Page 127</p>
<p>1 of the impact not having a firefighter lift had? 2 A. Yes, I do. Yes, I do. 3 Q. The lifts appear to fill with smoke at a fairly early 4 stage when they are opened with lobbies. 5 A. Yes. 6 Q. Does that mean that using it for firefighting on the 7 night may have been compromised? 8 A. Yes, it is, and I've been thinking about that, actually. 9 I think the overall flow of smoke through the building, 10 when that's being considered, there is an interesting 11 sudden change in state in the lifts when you look at the 12 CCTV, and I would love to understand that to a much more 13 substantial level of detail than I do at the moment. 14 It's a very sudden change in state and I'd like to 15 understand what caused that. Was there some kind of 16 pressure or flow situation going on in the building 17 caused by other matters? I think that would be a very 18 interesting and useful study to do. 19 Q. Yes. 20 A. Just to point out, remember, that the lift shaft should 21 also be provided with a supply of clean air in 22 a standard pressurisation system, so we'll get on to 23 that. So it's all interconnected where the smoke was 24 flowing in terms of the lifts also. 25 Q. In the light of those points that we've just been</p> <p style="text-align: right;">Page 126</p>	<p>1 Q. Can you just explain very briefly how that original 2 system was intended to work? 3 A. Yes. So in the event of a fire in a flat, once that 4 flat door was opened, smoke would enter the lobby and 5 will be extracted up to the roof by the shafts on the 6 north side of the lobby, and fresh air was supplied into 7 the south side of the lobby. 8 Q. So it's a simple kind of flow of air -- 9 A. Yes, it's a very simple extract system. 10 Q. Yes. 11 A. It's important to note that the original system was 12 a natural system first. 13 Q. Yes. 14 A. So the vents opened and the smoke moved by buoyancy 15 first. Then there was a control for the Fire Brigade to 16 use where they could switch it to being a mechanical 17 system then, and then the fans would operate and extract 18 the smoke. 19 Q. Yes. 20 A. So it was natural ventilation until the Fire Brigade 21 switched on a mechanical extract system. 22 Q. Is that what is termed a corridor smoke dispersal 23 system? 24 A. Dispersal -- yes, exactly, a dispersal system means you 25 have a means of, I suppose, dispersing the smoke from</p> <p style="text-align: right;">Page 128</p>

<p>1 the lobby.</p> <p>2 Q. It was designed to work on one floor only at that point.</p> <p>3 A. Yes, that's correct.</p> <p>4 Q. Yes.</p> <p>5 If we then go within this presentation to page 179,</p> <p>6 you make it clear here -- so what we have, and we'll</p> <p>7 follow this through in a moment, is now in</p> <p>8 Grenfell Tower, at the time of the fire, there was</p> <p>9 a combined lobby environmental system and a smoke</p> <p>10 control system?</p> <p>11 A. Yes, that's correct.</p> <p>12 Q. Is that correct?</p> <p>13 A. So, there became a need for environmental air control</p> <p>14 because of the new services placed through the lobby</p> <p>15 which could cause a build-up of heat in normal</p> <p>16 conditions, and so a decision was made to make the</p> <p>17 existing system a combined environmental and smoke</p> <p>18 extract system.</p> <p>19 So day to day, the system was used to deal with</p> <p>20 temperature build-up in the lobbies, and then in</p> <p>21 an emergency it was to switch over and become a means of</p> <p>22 smoke control only.</p> <p>23 Q. Again, it's designed to work on one floor only --</p> <p>24 A. That's correct.</p> <p>25 Q. -- in smoke control mode.</p> <p style="text-align: right;">Page 129</p>	<p>1 What you've done here in this section of your report</p> <p>2 is to explain all the new features that came in at the</p> <p>3 time that the smoke vent system was refurbished.</p> <p>4 A. Yes. So the existing -- they're called builders' ducts.</p> <p>5 Instead of being metal, they're formed with blocks or</p> <p>6 concrete. The existing builders' ducts were maintained,</p> <p>7 two on either side of the lobby, north side and south</p> <p>8 side.</p> <p>9 And then new equipment was installed into the tower.</p> <p>10 So you've got the four automatically openable vents or</p> <p>11 fire dampers, the dampers, at every lobby; there was</p> <p>12 a new extract fan combined with the environmental fan</p> <p>13 placed up at the roof level; and then there was new</p> <p>14 extract fans and new environmental fan down at level 2.</p> <p>15 Then down at those lower levels, a series of dampers</p> <p>16 also, to allow environmental mode and smoke mode to be</p> <p>17 fully -- it was meant to be fully separated at level 2.</p> <p>18 There was a need for some new ductwork at level 2</p> <p>19 also to bring the system out to the external wall.</p> <p>20 Q. Then I think as you go on and explain over the page,</p> <p>21 there were a number of other things, including new</p> <p>22 controls, control panels, detectors, which we will come</p> <p>23 back to?</p> <p>24 A. Yes.</p> <p>25 Q. So a whole lot of new --</p> <p style="text-align: right;">Page 131</p>
<p>1 A. Yes.</p> <p>2 Q. Can you just, very briefly -- again, because we'll get</p> <p>3 into this -- in the environmental mode, how was it meant</p> <p>4 to work?</p> <p>5 A. In environmental mode, there is a supply of fresh air in</p> <p>6 at level 2 that comes up and out on the vents on the</p> <p>7 south side. And then the heat is removed -- so that is</p> <p>8 supplying fresh air, and then the heat is removed by</p> <p>9 means of an environmental fan at the roof, up through</p> <p>10 the north side vents.</p> <p>11 Q. Then in smoke control mode, just in overview --</p> <p>12 A. Yes.</p> <p>13 Q. -- in contrast, how is it supposed to work in smoke</p> <p>14 control mode?</p> <p>15 A. So that mode of operation has to switch off, and then</p> <p>16 you extract smoke in two directions: down and out at</p> <p>17 level 2, and up and out at the roof.</p> <p>18 Q. Is it right that during the refurbishment -- 2012 to</p> <p>19 2016 -- new features were introduced to the existing</p> <p>20 smoke ventilation system?</p> <p>21 A. Yes, that's correct, so new fans, new dampers.</p> <p>22 Q. You've listed all to those out. Let's just look at that</p> <p>23 at J6.5.2 at BLAS0000031, pages 52 to 53.</p> <p>24 So, again, we don't need to go to all of these, but</p> <p>25 I wanted to pull out some of the features.</p> <p style="text-align: right;">Page 130</p>	<p>1 A. Yes.</p> <p>2 Q. -- electronic control panels that were introduced.</p> <p>3 A. Exactly. It's called a human-machine interface panel</p> <p>4 out in the main lobby, which allows day-to-day or</p> <p>5 emergency interaction with the system, and then a more</p> <p>6 complex control panel in -- I think it's the hub room,</p> <p>7 it's called, yes.</p> <p>8 Q. Yes.</p> <p>9 A. Yes.</p> <p>10 Q. Is it right that both the original system that was there</p> <p>11 in the 1970s and the refurbished system with all this</p> <p>12 new work were bespoke systems?</p> <p>13 A. Okay, so the original system had a smaller area of vents</p> <p>14 for natural ventilation than CP3 called for.</p> <p>15 Q. I am coming to that, yes.</p> <p>16 A. Oh, was I meant to just say "yes"? Sorry, yes, just ask</p> <p>17 me the question again --</p> <p>18 Q. Were they both bespoke systems?</p> <p>19 A. Yes, but there's a lot of caveats there. I can't quite</p> <p>20 say yes. So, yes, nearly they were.</p> <p>21 Q. In terms of combining that environmental system and the</p> <p>22 smoke extract system is it common for both systems to be</p> <p>23 combined? Do we see that in other buildings?</p> <p>24 A. You can see it in other buildings, but I'm relying on</p> <p>25 Max Fordham, who said it was unusual in their paperwork.</p> <p style="text-align: right;">Page 132</p>

<p>1 But it would be a lie to say it's never been done 2 before; it is done. 3 Q. Is it common that both systems can share the same 4 shafts? Is that common? 5 A. It's not very common. 6 SIR MARTIN MOORE-BICK: Can I make sure I've understood what 7 is going on here? 8 A. Yes. 9 SIR MARTIN MOORE-BICK: The north side vents and trunking 10 was essentially always there? 11 A. Was always there, yes. 12 SIR MARTIN MOORE-BICK: And it was always an exhaust system 13 to the roof? 14 A. Yes. 15 SIR MARTIN MOORE-BICK: The south side started life as 16 an inflow system and had to be changed as a result of 17 the refurbishment -- 18 A. Indeed. 19 SIR MARTIN MOORE-BICK: -- to an outflow system? 20 A. Yes, it had to do two things after the refurbishment. 21 SIR MARTIN MOORE-BICK: So when the system was operating 22 in -- what do you call it? -- ventilation or -- 23 A. Environmental mode. 24 SIR MARTIN MOORE-BICK: Environmental mode. 25 A. Yes.</p> <p style="text-align: center;">Page 133</p>	<p>1 SIR MARTIN MOORE-BICK: In which the extract fan is 2 operating. 3 A. That's correct. 4 SIR MARTIN MOORE-BICK: Right. 5 A. They shared a lot of that. There is a good drawing in 6 my report -- I don't know if you want to look at it -- 7 but they did share some of the ductwork there and the 8 dampers were placed to separate the the two fans. 9 SIR MARTIN MOORE-BICK: I think I understand the basic. 10 A. But, in essence, it's meant to separate, and then the 11 extract fan and ductwork are safely used to extract 12 smoke, or that switches off and you go back to opening 13 up the right piece of ductwork for the supply fan and 14 operate in environmental mode. 15 SIR MARTIN MOORE-BICK: Thank you very much. 16 MS GRANGE: I think we're going to come to that diagram in 17 a moment. 18 Just going back to the original system -- I think 19 you've just said this -- you've said the key reason why 20 you think the original system didn't comply with CP 371 21 was that there was an inadequate aggregate area of the 22 smoke shafts. You've said that the aggregate area was 23 significantly lower than the area recommended; it was 24 only about 0.48 metres squared, whereas it should've 25 been 1.5 metres squared; is that correct?</p> <p style="text-align: center;">Page 135</p>
<p>1 SIR MARTIN MOORE-BICK: What was the south system doing? 2 A. It was supplying -- there was a supply fan at level 2 3 taking air from outside the building, pushing it up -- 4 if you imagine pushing that pressure up -- 5 SIR MARTIN MOORE-BICK: So it was doing the same job as it 6 was before, it was feeding air into the system? 7 A. Yes, but for environmental reasons only. 8 SIR MARTIN MOORE-BICK: Sure, sure. 9 A. Correct, yes. 10 SIR MARTIN MOORE-BICK: I probably ought to know the answer 11 to this but I don't off the top of my head: when it 12 changed into smoke extract system -- 13 A. Yes. 14 SIR MARTIN MOORE-BICK: -- did the fan on the south side 15 simply turn the other way, or was there a second fan 16 that -- 17 A. There was a second fan. 18 SIR MARTIN MOORE-BICK: Right. 19 A. So the environmental fan switches off, the dampers go 20 into a specific arrangement to seal that part of the 21 system, and then your extract fan goes on, the dampers 22 open, and now you can pull the smoke down. 23 SIR MARTIN MOORE-BICK: And you've presumably got a second 24 line of trunking between, at some point -- 25 A. At some point.</p> <p style="text-align: center;">Page 134</p>	<p>1 A. That's correct. 2 Q. Could that makes a difference to the operation of the 3 system when you don't have the right aggregate area? 4 A. Yes, there's less -- I suppose the best way of putting 5 it is that there is less room for the smoke to flow out 6 under buoyancy and get to the top of the building. 7 Q. So then let's come to the newly-refurbished smoke 8 control system. 9 You have in your appendix J assessed that system in 10 accordance with the guidance in Approved Document B 11 2013. 12 A. Yes, I have. 13 Q. Do you agree that the design basis assumed in Approved 14 Document B for a smoke control system is on the basis of 15 a fire starting in a single location and being contained 16 within a single apartment? 17 A. Yes, I do. 18 Q. So, consequently, a smoke control system designed in 19 accordance with that guidance would only be required to 20 disperse smoke from a single common lobby, not in 21 multiple lobbies on multiple levels? 22 A. That's correct. 23 Q. Section 2.27 of Approved Document B 2013 gives us 24 an alternative to the natural ventilation route to 25 compliance, a mechanical option using pressure</p> <p style="text-align: center;">Page 136</p>

<p>1 differentials; is that correct?</p> <p>2 A. Yes, so there's natural, there's mechanical and there's</p> <p>3 pressure differentials, which is a form of mechanical.</p> <p>4 There are other mechanical types.</p> <p>5 Q. We're going to look at the differences between those in</p> <p>6 a moment.</p> <p>7 Can we look at Approved Document B 2013, that's</p> <p>8 CLG00000224 on page 28.</p> <p>9 Yes, I just want to start by looking at the bottom</p> <p>10 right-hand column, "Smoke control of common escape</p> <p>11 routes", 2.25, right at the very bottom.</p> <p>12 A. Yes.</p> <p>13 Q. So this, I think, tells you the purpose of providing</p> <p>14 smoke control. So it says:</p> <p>15 "Despite the provisions described in this Approved</p> <p>16 Document, it is probable that some smoke will get into a</p> <p>17 common corridor or lobby from a fire in a flat, if only</p> <p>18 because the entrance door will be opened when the</p> <p>19 occupants escape."</p> <p>20 A. That's correct.</p> <p>21 Q. If we can go on to the next page, if we can highlight</p> <p>22 the top of that page to start with, it says:</p> <p>23 "There should therefore be some means of ventilating</p> <p>24 the common corridors/lobbies to control smoke and so</p> <p>25 protect the common stairs. This offers additional</p> <p style="text-align: right;">Page 137</p>	<p>1 between a natural ventilation and mechanical ventilation</p> <p>2 system?</p> <p>3 A. Okay. So just in very, very simplistic terms -- again,</p> <p>4 these things are explained in substantially more detail</p> <p>5 in various British Standards -- a natural smoke extract</p> <p>6 system is providing an opening so smoke can leave the</p> <p>7 space by means of its own natural buoyancy while it's</p> <p>8 hot.</p> <p>9 A mechanical system is using fans to extract smoke</p> <p>10 from the fire zone.</p> <p>11 A pressure differential system is somewhat</p> <p>12 different. It does use mechanical devices, but it isn't</p> <p>13 to extract smoke from the fire zone; it's to stop the</p> <p>14 smoke from leaving the fire zone.</p> <p>15 So it's really important that I make it clear that</p> <p>16 there is a difference between a mechanical system and</p> <p>17 a pressure differential system and what they're trying</p> <p>18 to do.</p> <p>19 So when you provide fans and other devices for</p> <p>20 a pressure differential system, your goal only is to</p> <p>21 stop the smoke leaving the fire zone. It isn't to</p> <p>22 remove the smoke from the fire zone.</p> <p>23 SIR MARTIN MOORE-BICK: So you're, what, raising the</p> <p>24 pressure in the lobby in this case?</p> <p>25 A. Well, I'm afraid I can't say that here, but --</p> <p style="text-align: right;">Page 139</p>
<p>1 protection to that provided by the fire doors to the</p> <p>2 stair."</p> <p>3 And then we see this:</p> <p>4 "This can be achieved by either natural means in</p> <p>5 accordance with paragraph 2.26 or by means of mechanical</p> <p>6 ventilation as described in paragraph 2.27."</p> <p>7 A. That's correct.</p> <p>8 Q. If we can then look at paragraph 2.27, on that same</p> <p>9 page. There it says:</p> <p>10 "2.27. As an alternative to the natural ventilation</p> <p>11 provisions in paragraph 2.26, mechanical ventilation to</p> <p>12 the stair and/or corridor/lobby may be provided to</p> <p>13 protect the stair(s) from smoke. Guidance on the design</p> <p>14 of smoke control systems using pressure differentials is</p> <p>15 available in BS EN 12101-6:2005."</p> <p>16 A. That's correct.</p> <p>17 Q. So those are the key parts of Approved Document B; is</p> <p>18 that correct?</p> <p>19 A. Yes, they are.</p> <p>20 Q. So it's directing the reader to the guidance in that</p> <p>21 British Standard for pressure differential systems?</p> <p>22 A. If one is going to design based on pressure</p> <p>23 differentials.</p> <p>24 Q. Just pausing there -- and I know you were just touching</p> <p>25 on it -- can you just first explain the difference</p> <p style="text-align: right;">Page 138</p>	<p>1 SIR MARTIN MOORE-BICK: No, no, just to get the concept.</p> <p>2 A. The concept is you raise the pressure in a protected</p> <p>3 zone to stop the smoke leaving the fire zone.</p> <p>4 SIR MARTIN MOORE-BICK: And effectively, if there's</p> <p>5 leakages, it's going to be of clean air into the fire</p> <p>6 zone?</p> <p>7 A. It's -- yes. Yes.</p> <p>8 SIR MARTIN MOORE-BICK: So you wouldn't have the sort of</p> <p>9 grilles and trunking that we've got on the north side,</p> <p>10 which is simply letting air escape to the outside?</p> <p>11 A. Can I answer that question a little bit later? Just ...</p> <p>12 MS GRANGE: Yes, I think some of the diagrams we're about to</p> <p>13 come to can help.</p> <p>14 A. Yes. So there is Grenfell Tower and then there is</p> <p>15 a pressurisation and depressurisation system as it</p> <p>16 should be done, yes.</p> <p>17 SIR MARTIN MOORE-BICK: A very simple -- well, it may not be</p> <p>18 simple. I've come across this in the context of</p> <p>19 laboratories, for example, handling dangerous materials.</p> <p>20 A. Yes.</p> <p>21 SIR MARTIN MOORE-BICK: So you pressurise the laboratory to</p> <p>22 keep the air out.</p> <p>23 A. Exactly. Exactly. That's what should happen. So the</p> <p>24 location of your equipment must be in the right place to</p> <p>25 allow you to pressurise the right zone, to prevent the</p> <p style="text-align: right;">Page 140</p>

<p>1 products of combustion leaving the fire zone. Exactly.</p> <p>2 MS GRANGE: So just to be clear, a pressurised system, that</p> <p>3 could be pressurisation of the stair and the lobby and</p> <p>4 the lift shaft, that's the protected space is</p> <p>5 pressurised relative to the fire zone or flats; is that</p> <p>6 right?</p> <p>7 A. Yes. So there's two types of pressure differential</p> <p>8 system, one where you pressurise and one where you</p> <p>9 depressurise, and I'd really love to be able to refer to</p> <p>10 some diagrams while I explain this.</p> <p>11 Q. Is this the point where you want to refer to your</p> <p>12 sketches?</p> <p>13 A. I would like to, because I do think it's fiendishly</p> <p>14 complex to understand.</p> <p>15 Q. If we go to BLAS0000038, I think what you've done is,</p> <p>16 for the purposes of your oral evidence, you've prepared</p> <p>17 some very basic cartoons or sketches --</p> <p>18 A. Yes.</p> <p>19 Q. -- to try and help you explain this; is that correct?</p> <p>20 A. Yes.</p> <p>21 Q. BLAS0000038.</p> <p>22 A. Yes.</p> <p>23 Q. So can you talk us through this slide?</p> <p>24 A. So a pressure differential system comes in two</p> <p>25 forms: a pressurisation system and a depressurisation</p> <p style="text-align: center;">Page 141</p>	<p>1 zone and going out to the lobby.</p> <p>2 SIR MARTIN MOORE-BICK: Thank you.</p> <p>3 MS GRANGE: I think it's worth sticking with these. Do you</p> <p>4 want to go through your next slide?</p> <p>5 A. Okay, if I can see the next one.</p> <p>6 Q. Can you just explain, this is the Grenfell smoke</p> <p>7 ventilation system --</p> <p>8 A. Yes, okay.</p> <p>9 Q. -- is that right, that you're trying to illustrate?</p> <p>10 A. Yes. So here I'm trying to explain that, at</p> <p>11 Grenfell Tower, we appear to have a depressurisation</p> <p>12 system, but it isn't installed to deal with the fire</p> <p>13 zone; instead, it is installed to deal with the lobby.</p> <p>14 Okay?</p> <p>15 What that means, because of that pressure</p> <p>16 differential and the focus being the lobby, once you</p> <p>17 open the fire zone door, the products of combustion are</p> <p>18 attracted out to the location of where the equipment is</p> <p>19 extracting from the lobby.</p> <p>20 SIR MARTIN MOORE-BICK: Yes.</p> <p>21 A. Okay?</p> <p>22 MS GRANGE: And I think there's another slide that completes</p> <p>23 this run.</p> <p>24 A. Yes.</p> <p>25 Q. It's not the next page because the next page is blank,</p> <p style="text-align: center;">Page 143</p>
<p>1 system.</p> <p>2 In a pressurisation system, air is supplied into the</p> <p>3 lift, it's supplied into the lobby and it's supplied</p> <p>4 into the stair. Okay? The idea, then, is when you open</p> <p>5 the fire zone door, the products of combustion are</p> <p>6 prevented from leaving. Okay? So that's a</p> <p>7 pressurisation system.</p> <p>8 If I'm able to look at the next one. Okay.</p> <p>9 So it's important to understand that</p> <p>10 a depressurisation system in the British Standard is</p> <p>11 typically recommended for basements only, where the fire</p> <p>12 zone is sealed. There, the idea is you extract the</p> <p>13 products of combustion from the fire zone, at a rate</p> <p>14 that, when you open this door, because of air supply in</p> <p>15 the protected space, again, the products of combustion</p> <p>16 cannot leave the fire zone.</p> <p>17 So you have your pressure differential, but the</p> <p>18 extract rates and design here are not to remove the</p> <p>19 products of combustion completely from the fire zone;</p> <p>20 it's at enough of a rate, with the pressure</p> <p>21 differential, to prevent the smoke flowing out onto the</p> <p>22 lobby, mainly. Okay?</p> <p>23 So pressurisation, all the equipment focuses on the</p> <p>24 protected escape route; depressurisation is meant to</p> <p>25 focus on the fire zone to prevent smoke leaving the fire</p> <p style="text-align: center;">Page 142</p>	<p>1 I think.</p> <p>2 A. That's fine.</p> <p>3 Q. That slide.</p> <p>4 A. Actually, can we just go back to the other slide?</p> <p>5 Sorry.</p> <p>6 So at Grenfell, the system is designed that there is</p> <p>7 an extract rate from the lobby, and the system is</p> <p>8 balanced such that when you open this one stair door,</p> <p>9 the idea is the airflow across that door should prevent</p> <p>10 smoke moving from the lobby to the stair. But it</p> <p>11 assumes every other door was closed in making the</p> <p>12 calculations for that.</p> <p>13 When we go to the next slide, once you open a second</p> <p>14 door, the area of opening, if you like, increases, and</p> <p>15 so you can't maintain the necessary airflow across one</p> <p>16 door because now you've got two doors open.</p> <p>17 Also, the extract is pulling the smoke from the fire</p> <p>18 zone out.</p> <p>19 So it causes two things: attracting the smoke out,</p> <p>20 and reducing the ability to maintain the required</p> <p>21 airflow at that door, because a second door has been</p> <p>22 open.</p> <p>23 SIR MARTIN MOORE-BICK: Right.</p> <p>24 MS GRANGE: Just a few questions to build up to your</p> <p>25 preliminary views about this.</p> <p style="text-align: center;">Page 144</p>

<p>1 A. Yes.</p> <p>2 Q. So is it right that in all types of smoke control</p> <p>3 system, vents on the fire floor are opened and vents on</p> <p>4 all other floors are closed in order to allow the full</p> <p>5 capacity of the smoke control system to be directed at</p> <p>6 a single floor?</p> <p>7 A. Typically, yes.</p> <p>8 Q. Can you explain for us why it is that you've assessed</p> <p>9 the compliance of the system at this stage against the</p> <p>10 requirements of BS EN 12101-6:2005, the British Standard</p> <p>11 we saw in ADB?</p> <p>12 A. Yes, because in the PSB documentation, it refers to some</p> <p>13 specific criteria from the pressure differential</p> <p>14 standard.</p> <p>15 Q. So in the documentation you've seen, it's referring to</p> <p>16 some of the --</p> <p>17 A. Yes, it does.</p> <p>18 Q. -- criteria that are in that British Standard?</p> <p>19 A. Yes, it does.</p> <p>20 Q. That's a British Standard for pressure differential</p> <p>21 systems?</p> <p>22 A. Yes. But it wasn't called a depressurisation system in</p> <p>23 the documentation dated from before the fire.</p> <p>24 Q. That's what I was coming onto. So it's clearly not</p> <p>25 a pressurisation system; do you think it was</p> <p style="text-align: center;">Page 145</p>	<p>1 page 34, where you've set out a key part of that</p> <p>2 standard, if we just zoom in on that.</p> <p>3 A. Oh, that's a different part. Yes, yes.</p> <p>4 Q. Is it right that it gives an example -- we see that in</p> <p>5 the second line --</p> <p>6 A. Yes.</p> <p>7 Q. -- of a basement. So it says:</p> <p>8 "The objective of a depressurization system is to</p> <p>9 achieve the same protection at a doorway between the</p> <p>10 depressurized space (e.g. a basement) and the protected</p> <p>11 space ..."</p> <p>12 Is that right?</p> <p>13 A. Yes.</p> <p>14 Q. In the very last part of this extract from the</p> <p>15 British Standard, it says, the last sentence:</p> <p>16 "The most appropriate use of depressurization</p> <p>17 systems is likely to be in basement spaces, see</p> <p>18 Figure 18 ..."</p> <p>19 A. Yes.</p> <p>20 Q. Is that why you said most frequently used in basements,</p> <p>21 but you don't think it's only confined to basements?</p> <p>22 A. Yes, and I think that's got to do with the earlier</p> <p>23 sentence "bounded on all sides by fire-resisting</p> <p>24 constructions". Just slightly up there:</p> <p>25 "To be effective, each depressurized space shall be</p> <p style="text-align: center;">Page 147</p>
<p>1 a depressurisation system?</p> <p>2 A. In the sense that there is extract from a zone relative</p> <p>3 to the fire zone, and a stated attempt in the</p> <p>4 documentation to provide a pressure differential across</p> <p>5 a particular door and provide a flow rate across the</p> <p>6 stair door, and looking at the ability to open a door.</p> <p>7 And they're all features of the design basis using</p> <p>8 pressure differentials.</p> <p>9 Q. Is it right that that pressure differential between the</p> <p>10 stairs and the lobby that you were just talking about</p> <p>11 was -25 Pa; is that right?</p> <p>12 A. That's stated in the documentation.</p> <p>13 Q. Yes. What does PA stand for?</p> <p>14 A. Pascals.</p> <p>15 Q. Yes.</p> <p>16 A. Yes, Pascals.</p> <p>17 Q. Is that a unit used to measure pressure equal to</p> <p>18 1 Newton per meter squared?</p> <p>19 A. Yes, yes.</p> <p>20 Q. Back to that British Standard, and you mentioned</p> <p>21 basements before, do you think that the British Standard</p> <p>22 only applies to depressurisation systems in basements?</p> <p>23 A. No, it says "typically" rather than "always", yes.</p> <p>24 Q. We can perhaps look at what it actually says at</p> <p>25 paragraph J5.2.22 of your report. That's BLAS0000031,</p> <p style="text-align: center;">Page 146</p>	<p>1 bounded on all sides by fire-resisting constructions,</p> <p>2 because any loss of integrity would result in</p> <p>3 equalization of pressure between the depressurization</p> <p>4 zone and external air."</p> <p>5 To cut a very long story short, if a window can</p> <p>6 break, the balancing of your system is lost, and that's</p> <p>7 why in a basement space, you know that risk isn't there.</p> <p>8 Q. Yes.</p> <p>9 A. Okay?</p> <p>10 Q. Is that why it's so important to know what you're doing</p> <p>11 about doors being opened?</p> <p>12 A. Absolutely.</p> <p>13 Q. Which we'll come on to in a moment.</p> <p>14 A. Absolutely.</p> <p>15 Q. So if you open more doors, it's going to affect your</p> <p>16 calculations.</p> <p>17 A. Exactly. The purpose of all your design decisions are</p> <p>18 to create what I would call a balanced system with the</p> <p>19 correct openings allowed for.</p> <p>20 Q. Is your position that that British Standard that we're</p> <p>21 just reading from could be viewed as setting out</p> <p>22 functional objectives or measurable performance</p> <p>23 requirements which could be used to assess the adequacy</p> <p>24 of a pressure differential system as against the</p> <p>25 Building Regulations? Is that one way you could use it,</p> <p style="text-align: center;">Page 148</p>

<p>1 ie not strictly following every letter of it, but</p> <p>2 looking at functional objectives or performance</p> <p>3 requirements that it's setting?</p> <p>4 A. Yes, I do. It actually is very clear on functional</p> <p>5 objectives, particularly when it gets to explaining</p> <p>6 where the smoke should not go, in terms of a single</p> <p>7 stair and lobby used for firefighting.</p> <p>8 So I think that British Standard is very clear on</p> <p>9 functional objectives, and then it gives additional</p> <p>10 guidance on how to achieve them.</p> <p>11 Q. Is it right that you've said in your latest report that</p> <p>12 you'd like to be provided with evidence from the design</p> <p>13 team at Phase 2 about what route to compliance they</p> <p>14 thought they were adopting, and that you will review any</p> <p>15 such evidence before you reach any final view on</p> <p>16 compliance of the system?</p> <p>17 A. That's correct.</p> <p>18 Q. I think you've already accepted that the Building</p> <p>19 Regulations required the system to be no worse than the</p> <p>20 original smoke vent system.</p> <p>21 A. I don't accept that, no.</p> <p>22 Q. But you haven't considered anything to do with the</p> <p>23 non-worsening principle yet.</p> <p>24 A. I haven't done that, and it will be interesting to see</p> <p>25 the calculations as to what the original mechanical</p> <p style="text-align: right;">Page 149</p>	<p>1 A. I don't want to answer that question at the moment.</p> <p>2 Q. Because you don't have enough information?</p> <p>3 A. I don't have enough information, and I haven't done</p> <p>4 a proper comparison of those systems to give my view.</p> <p>5 I'm happy to do so.</p> <p>6 Q. Could such systems comply with the functional</p> <p>7 requirements of the Building Regulations in principle?</p> <p>8 A. If they were designed and installed appropriately.</p> <p>9 MS GRANGE: What I'm going to do is just turn to your</p> <p>10 current assessment of the system and just look in</p> <p>11 general at that.</p> <p>12 Before we get to smoke dampers, we might take</p> <p>13 a break. If I can just do a few more questions before</p> <p>14 that.</p> <p>15 SIR MARTIN MOORE-BICK: Yes, all right.</p> <p>16 MS GRANGE: So what you have concluded -- is this right? --</p> <p>17 is that the system appears to have been intended to</p> <p>18 comply with one aspect of that British standard, namely</p> <p>19 the airflow performance of a class B pressure</p> <p>20 differential system as defined in that spec.</p> <p>21 A. Yes, it refers to the airflow across the stair to lobby</p> <p>22 door, and it also refers to the correct force to allow</p> <p>23 one to open that door.</p> <p>24 Q. But as I understand your evidence, you consider that</p> <p>25 there are five key requirements for a class B system,</p> <p style="text-align: right;">Page 151</p>
<p>1 extract system could do relative to this version now.</p> <p>2 Q. Would you agree that a smoke ventilation system using</p> <p>3 pressure differential principles is not the only type of</p> <p>4 mechanical ventilation system which could be considered</p> <p>5 acceptable to comply with the Building Regulations?</p> <p>6 A. Yes, I do.</p> <p>7 Q. Do you agree that tailor-made solutions can be</p> <p>8 appropriate?</p> <p>9 A. Tailor-made solutions that deliver on the required life</p> <p>10 safety objectives and fire safety objectives, yes, and</p> <p>11 this British Standard is very clear that the stair and</p> <p>12 lobby are to be kept safe for firefighting purposes when</p> <p>13 the flat door is open and multiple other doors are open</p> <p>14 at the same time.</p> <p>15 Q. Would you agree that most smoke ventilation systems are</p> <p>16 usually bespoke and that they don't use natural</p> <p>17 ventilation or pressurisation or depressurised</p> <p>18 principles?</p> <p>19 A. No, I would not.</p> <p>20 Q. Would you agree that there are known alternatives to</p> <p>21 such systems, such as the BRE shaft system or the</p> <p>22 ColtShaft system?</p> <p>23 A. I'm aware that they exist.</p> <p>24 Q. Are either of those similar to what was installed at</p> <p>25 Grenfell Tower?</p> <p style="text-align: right;">Page 150</p>	<p>1 not just that airflow performance, and that includes</p> <p>2 a pressure differential criterion; is that correct?</p> <p>3 A. Yes.</p> <p>4 Q. We can see those five key requirements listed out in</p> <p>5 your paragraph J5.2.16, if we could just bring that up.</p> <p>6 That's BLAS0000031, at page 33.</p> <p>7 So you've listed them out.</p> <p>8 A. Yes, that's easier.</p> <p>9 So a class B pressure differential system is for the</p> <p>10 purposes of protecting a firefighting stair and lobby.</p> <p>11 So it requires the designer to consider the flat door</p> <p>12 being open, the stair door on that lobby being open, as</p> <p>13 well as the stair door below, and also there's</p> <p>14 requirements for the lift.</p> <p>15 So there's rules for providing the right pressures,</p> <p>16 and they're multiple requirements; the right airflow,</p> <p>17 and they're multiple requirements; also air supply and</p> <p>18 various other things.</p> <p>19 So all together, they provide a balanced system that</p> <p>20 keeps smoke away from the lobby and stair as a result of</p> <p>21 it flowing out of the flats.</p> <p>22 Q. Can we go to your figure J.50. I think this is where we</p> <p>23 see a good diagram that you've marked up of the</p> <p>24 refurbished system.</p> <p>25 That's it, yes. If we can blow that up.</p> <p style="text-align: right;">Page 152</p>

1 So there, this is your attempt to try and explain
 2 the programmed operation of the smoke control system is
 3 that correct?
 4 **A. Yes, that it operates on one floor.**
 5 Q. Yes.
 6 **A. And the smoke is extracted down the south shaft and up**
 7 **the north shaft.**
 8 Q. So we see it going out of the south shaft --
 9 **A. Yes.**
 10 Q. -- up and out of the north shaft --
 11 **A. At the roof, yes.**
 12 Q. -- removal of the air from the lobby --
 13 **A. Yes.**
 14 Q. -- and you say design intent 2 metres per square through
 15 the one open stair door; yes?
 16 **A. Yes, exactly. So that airflow was designed for with the**
 17 **stair door open, that the system would cause that**
 18 **airflow at that door and prevent the smoke flowing into**
 19 **the stair. But in this design, no other door being open**
 20 **was provided for. So everything was shut, except the**
 21 **stair door.**
 22 **SIR MARTIN MOORE-BICK: If the system is operating, it's**
 23 **taking air out of the lobby --**
 24 **A. Yes.**
 25 **SIR MARTIN MOORE-BICK: -- in two different directions.**

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1 **A. Yes. Yes.**
 2 **SIR MARTIN MOORE-BICK: To that extent, it's exerting some**
 3 **degree of pressure on the stair door to keep it closed.**
 4 **A. Yes.**
 5 **SIR MARTIN MOORE-BICK: The stair door ought to be fitted**
 6 **with smoke seals.**
 7 **A. Yes.**
 8 **SIR MARTIN MOORE-BICK: But it still lets enough air in,**
 9 **does it, to compensate for the loss of pressure in the**
 10 **lobby?**
 11 **A. One has to make that decision during design, how you are**
 12 **going to allow that release of pressure so you can open**
 13 **the door.**
 14 **SIR MARTIN MOORE-BICK: In layman's terms, you've got to get**
 15 **air from somewhere?**
 16 **A. You certainly do.**
 17 **SIR MARTIN MOORE-BICK: It could come from the flats**
 18 **surrounding the lobby, whose doors won't be airtight.**
 19 **A. Correct.**
 20 **SIR MARTIN MOORE-BICK: But should be smoke-tight.**
 21 **A. Should be, same with the stair door, or you might**
 22 **provide air release -- you might provide something**
 23 **specifically in the lobby to allow that air release.**
 24 **SIR MARTIN MOORE-BICK: Okay.**
 25 **A. Okay?**

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1 **SIR MARTIN MOORE-BICK: But as soon as you open the door to**
 2 **the flat where the fire is --**
 3 **A. Yes.**
 4 **SIR MARTIN MOORE-BICK: -- you are inevitably -- again, in**
 5 **layman's terms -- sucking combustion products out of**
 6 **that flat?**
 7 **A. That's correct, yes.**
 8 **SIR MARTIN MOORE-BICK: Yes, all right, thank you.**
 9 **A. Yes.**
 10 MS GRANGE: Just back to how this was meant to work, as you
 11 explained earlier, the environmental system was to
 12 deactivate, shutting down and isolating the
 13 environmental fans at lower level.
 14 **A. Yes.**
 15 Q. And then the automatic opening vents on the fire floor
 16 only were to open --
 17 **A. That's correct.**
 18 Q. -- and all other floors, the automatic opening vents
 19 were meant to stay shut.
 20 **A. They were to shut if they were open or stay shut.**
 21 Q. The role of those dampers -- we're going to come back to
 22 those in a little bit of time -- they are to stop the
 23 flow of air through a duct. Is that what a damper does?
 24 **A. So --**
 25 Q. We have dampers all the way up, don't we, on the AOVs,

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1 behind the AOVs?
 2 **A. Yes. So those dampers shut to seal that riser. It's**
 3 **almost like closing the compartment. So it prevents**
 4 **anything leaving the duct, ideally, as it's moving down**
 5 **to the south, up to the north. That's one reason why**
 6 **it's sealed. And it's also acting as the wall, if you**
 7 **will, to prevent fire and smoke products from other**
 8 **floors.**
 9 **So dampers are -- it's like a door sealing**
 10 **a compartment, again. You're closing a hole in**
 11 **a protected riser.**
 12 Q. In this diagram, you've identified some concerns you
 13 have about the way the system was set up to run at the
 14 bottom in little red boxes.
 15 **A. Yes.**
 16 Q. Are any of those likely to have made a difference on the
 17 night, given that --
 18 **A. So I don't know, and I've made clear in my report what**
 19 **I need to know. It's either just a paperwork error, so**
 20 **the papers I have aren't up to date -- but at the**
 21 **moment, based on the programming in the panel, it**
 22 **doesn't appear that there is a proper power supply in**
 23 **and out of those dampers. But that's what I've asked**
 24 **for documentation to confirm either way.**
 25 Q. I just want to try and summarise your current views

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39 (Pages 153 to 156)

<p>1 about the design of the system based on what you've seen</p> <p>2 to date.</p> <p>3 A. Yes.</p> <p>4 Q. So you said that at Grenfell Tower it was a system</p> <p>5 whereby each flat should have been a depressurised zone,</p> <p>6 but in fact it was a system which depressurised the</p> <p>7 lobbies relative to the flats and the stairs, and that's</p> <p>8 not a system envisaged by the British Standard.</p> <p>9 A. Not as I understand it.</p> <p>10 Q. You say that the airflow criterion in the British</p> <p>11 Standard is a minimum airflow of 2 metres per second</p> <p>12 through the open door between the lobby and the fire</p> <p>13 flat must exist.</p> <p>14 A. Yes.</p> <p>15 Q. But is it right that the design at Grenfell was such</p> <p>16 that the system was said to provide an average open-door</p> <p>17 velocity, with no other open-door conditions?</p> <p>18 A. That's correct, as I read the technical specification,</p> <p>19 yes.</p> <p>20 Q. So you have a concern at the moment that there may have</p> <p>21 been no allowance for the fact that both the flat door</p> <p>22 and the stair door might have to be open during</p> <p>23 firefighting operations and the system should still be</p> <p>24 able to deal with that and cope with that.</p> <p>25 A. Yes, that's the whole functional point of a class B</p> <p style="text-align: right;">Page 157</p>	<p>1 A. Yes.</p> <p>2 Q. Is the concern that this might draw smoke into the lobby</p> <p>3 both from the flats and also the stair?</p> <p>4 A. Yes.</p> <p>5 Q. And that's your --</p> <p>6 A. Particularly the flats, yes.</p> <p>7 Q. What about if other flat doors were open onto the lobby?</p> <p>8 Is that something that also should have been thought</p> <p>9 about?</p> <p>10 A. Well, because of depressurising that zone, the more</p> <p>11 doors you open, the more the zone is impacted.</p> <p>12 Q. Yes.</p> <p>13 SIR MARTIN MOORE-BICK: But the other flat doors which are</p> <p>14 not affected by fire will simply give you a better</p> <p>15 airflow, won't they?</p> <p>16 A. It's not just about airflow; it's about pressure balance</p> <p>17 as well, and the fans are connected to pressure sensors.</p> <p>18 So everything changes all the time in a pressure</p> <p>19 differential system.</p> <p>20 SIR MARTIN MOORE-BICK: Right.</p> <p>21 MS GRANGE: Yes.</p> <p>22 A. So it isn't just that there's good airflow coming</p> <p>23 through the flat door.</p> <p>24 SIR MARTIN MOORE-BICK: Mm, all right.</p> <p>25 A. It's how the pressure balance is then impacted and what</p> <p style="text-align: right;">Page 159</p>
<p>1 system, which is to aid firefighting.</p> <p>2 Q. You've also referred to the fact that it provides for</p> <p>3 a single pressure differential of -25 Pascals, which was</p> <p>4 not referred to in the British Standard.</p> <p>5 A. That's correct.</p> <p>6 Q. That referred to pressure differential requirements at</p> <p>7 three different locations.</p> <p>8 A. Yes, it did.</p> <p>9 Q. And that the British Standard required four more</p> <p>10 performance requirements for a class B system --</p> <p>11 A. Yes.</p> <p>12 Q. -- which we just looked at.</p> <p>13 A. That's correct.</p> <p>14 Q. You also say, since it was based on depressurisation</p> <p>15 principles, there were ten separate additional</p> <p>16 requirements which you've looked for and you've not</p> <p>17 found.</p> <p>18 A. Yes, no, I haven't.</p> <p>19 Q. Only one you think may have been met at this stage.</p> <p>20 A. Yes, that's correct.</p> <p>21 Q. Is it right that your fundamental concern is that, in</p> <p>22 a depressurisation system, the flats should be</p> <p>23 depressurised relative to the stair and the lobby, but</p> <p>24 at Grenfell Tower the lobby was depressurised relative</p> <p>25 to the flats and the stair?</p> <p style="text-align: right;">Page 158</p>	<p>1 other resulting flows are near the stair. Yes.</p> <p>2 Q. Just to be clear, you've not formed any final view on</p> <p>3 compliance in relation to this and you would like to</p> <p>4 hear from the design team --</p> <p>5 A. Yes, I would.</p> <p>6 Q. -- at Phase 2 so you can understand --</p> <p>7 A. Understand all --</p> <p>8 Q. -- how the system was meant to work --</p> <p>9 A. Exactly, yes.</p> <p>10 Q. -- and how they were complying with the functional</p> <p>11 requirements of the Building Regulations.</p> <p>12 A. Yes, because as I read it now, I don't understand how at</p> <p>13 all it could be a class B system.</p> <p>14 MS GRANGE: Thank you.</p> <p>15 Mr Chairman, I think that's a good time for a break</p> <p>16 because I'm moving on to another subtopic within this,</p> <p>17 but I think we're still in good shape to finish.</p> <p>18 SIR MARTIN MOORE-BICK: We're going to either have</p> <p>19 a slightly shorter break or a longer break.</p> <p>20 MS GRANGE: I suggest we have a slightly longer break, and</p> <p>21 I aim to then finish -- oh, we will have to have another</p> <p>22 break.</p> <p>23 SIR MARTIN MOORE-BICK: No, no, I don't think we need</p> <p>24 another one after that.</p> <p>25 MS GRANGE: Well, I'll have to mop up any questions.</p> <p style="text-align: right;">Page 160</p>

<p>1 SIR MARTIN MOORE-BICK: Oh, that one doesn't count.</p> <p>2 I think we'll have a slightly longer break,</p> <p>3 otherwise it will be very short. I'm going to stop for</p> <p>4 just over 10 minutes.</p> <p>5 MS GRANGE: 3.25.</p> <p>6 SIR MARTIN MOORE-BICK: 3.25, exactly. All right? Thank</p> <p>7 you very much.</p> <p>8 Good, thank you. 3.25, please, thank you.</p> <p>9 (3.10 pm)</p> <p>10 (A short break)</p> <p>11 (3.25 pm)</p> <p>12 SIR MARTIN MOORE-BICK: Yes, now ...</p> <p>13 THE WITNESS: Yes.</p> <p>14 SIR MARTIN MOORE-BICK: Ready?</p> <p>15 THE WITNESS: Yes.</p> <p>16 SIR MARTIN MOORE-BICK: Good.</p> <p>17 MS GRANGE: Yes, thank you.</p> <p>18 A. Could I just add to something from earlier? It's good</p> <p>19 to have a coffee break sometimes.</p> <p>20 So I think I should be clear that when a system</p> <p>21 based on pressure differentials is being allowed for,</p> <p>22 the S requirement for fire doors is not provided. So</p> <p>23 the smoke seals. Okay?</p> <p>24 SIR MARTIN MOORE-BICK: Oh, right.</p> <p>25 A. In a new building.</p> <p style="text-align: right;">Page 161</p>	<p>1 they're dampers, sorry, yes.</p> <p>2 Q. I'm trying to get the principle of what a damper is.</p> <p>3 A. Yes.</p> <p>4 Q. If you can just explain to us.</p> <p>5 A. So it's a metal mechanical device that can be controlled</p> <p>6 into the shut position on the right.</p> <p>7 Q. Yes. So open on the left and the shut on the right.</p> <p>8 A. Yes.</p> <p>9 Q. It's meant to then provide a seal so that the smoke</p> <p>10 going behind it doesn't leak through; is that correct?</p> <p>11 A. Where a seal is required.</p> <p>12 Q. Yes.</p> <p>13 A. And so -- yes, because in other buildings, a seal may</p> <p>14 not be required.</p> <p>15 Q. I see, yes.</p> <p>16 A. Yes.</p> <p>17 Q. You've explained in detail in your report that because</p> <p>18 the smoke extract system was a powered pressure</p> <p>19 differential system, these dampers were required to meet</p> <p>20 certain enhanced standards for smoke control dampers to</p> <p>21 ensure that they achieved a 60-minute rating for</p> <p>22 integrity and smoke leakage; is that correct?</p> <p>23 A. Yes, because they're in a lobby in a residential</p> <p>24 building.</p> <p>25 Q. Yes.</p> <p style="text-align: right;">Page 163</p>
<p>1 SIR MARTIN MOORE-BICK: Yes.</p> <p>2 A. The second thing I should have said is the fans are</p> <p>3 connected to a pressure sensor, which is monitoring the</p> <p>4 pressure difference between the stair and the lobby all</p> <p>5 the time, and so the fans -- you could say they're</p> <p>6 changing. You asked about what happens if X, Y door</p> <p>7 start to open. So all the time it's monitoring that</p> <p>8 pressure difference. So it's not a steady state system.</p> <p>9 SIR MARTIN MOORE-BICK: It's much more sophisticated than</p> <p>10 I gave it credit for.</p> <p>11 A. Potentially, yes. It's much more complex, anyway. Yes.</p> <p>12 SIR MARTIN MOORE-BICK: All right. Thank you.</p> <p>13 Yes, Ms Grange.</p> <p>14 MS GRANGE: Thank you.</p> <p>15 I want to move to the topic of smoke dampers now,</p> <p>16 because you've raised some concerns about those in your</p> <p>17 report.</p> <p>18 A. Yes.</p> <p>19 Q. Can we just look at a picture of what we're talking</p> <p>20 about. I think there's a good one in your presentation</p> <p>21 of the 18 of June, if we go to page 176 of that. That's</p> <p>22 BLAS00005481, page 176.</p> <p>23 Have I got this right? So you've got them as</p> <p>24 rotating blades here. Can we see the dampers on here?</p> <p>25 A. Yes, I can. I think they're from the new floors, but</p> <p style="text-align: right;">Page 162</p>	<p>1 A. Yes.</p> <p>2 Q. I understand.</p> <p>3 You've explained in your report that the smoke</p> <p>4 dampers in the north and south shafts were series 54</p> <p>5 smoke dampers manufactured by a company called Gilberts</p> <p>6 and supplied to Rydon's subcontractor, PSB; is that</p> <p>7 correct?</p> <p>8 A. Correct.</p> <p>9 Q. You've identified some evidence in your most recent work</p> <p>10 which would suggest that these dampers weren't tested to</p> <p>11 the relevant enhanced standards for smoke control</p> <p>12 dampers. Indeed, it would appear that they weren't</p> <p>13 properly tested to certain lower standards; is that</p> <p>14 correct?</p> <p>15 A. Yes, they've actually failed the smoke leakage test, and</p> <p>16 they were not tested in the proper I would say position</p> <p>17 in the fire damper tests.</p> <p>18 Q. Is it right that in order to satisfy the requirements of</p> <p>19 that lower standard, they had to be tested from the open</p> <p>20 position, and if they take a certain amount of time, or</p> <p>21 in excess of 2 minutes, to close, the test is failed?</p> <p>22 A. That's correct. It has to show it can do its opening</p> <p>23 and closing action in the test.</p> <p>24 Q. Was the ability of a damper to close effectively on all</p> <p>25 floors away from the fire, on being subjected to heat</p> <p style="text-align: right;">Page 164</p>

<p>1 and smoke, fundamental to the performance of the smoke 2 control system at Grenfell Tower?</p> <p>3 A. It was fundamental to the function of the builders' 4 ducts acting as an adequate compartment.</p> <p>5 Q. So these are the shafts -- the builders' ducts that have 6 been used are the shafts --</p> <p>7 A. Yes.</p> <p>8 Q. Particularly the north shaft, to extract the smoke away 9 from the lobby.</p> <p>10 A. Yes.</p> <p>11 Q. These are what protects --</p> <p>12 A. Yes.</p> <p>13 Q. -- the lobby on all floors.</p> <p>14 A. On all floors, exactly.</p> <p>15 Q. On the fire floor where it's working, it opens.</p> <p>16 A. It opens, and that's absolutely fine. The products of 17 combustion can enter, but then those products have to be 18 kept within that protected riser. They cannot exit on 19 any floor.</p> <p>20 Q. Is it right that you have picked up that there is some 21 evidence from the BSRs which would suggest that smoke 22 was entering the lobbies via these kind of smoke 23 vents --</p> <p>24 A. Yes.</p> <p>25 Q. -- on particular floors?</p> <p style="text-align: right;">Page 165</p>	<p>1 potential smoke leakage onto the lobbies through these 2 dampers, and he said this [Transcript of 20 November, 3 page 192, lines 7 to 11]:</p> <p>4 "Answer: Well, the evidence is that the system is 5 performing poorly because it's bringing smoke into the 6 lobbies. Now, that could have been because of the 7 non-compliances, but it could also have been because the 8 system was designed to basically deal with one floor."</p> <p>9 I think what he was implying is that if you've got 10 a fire and multi-storey fire across the building, 11 potentially that system is dealing with a quantity of 12 smoke that it wouldn't have otherwise dealt with.</p> <p>13 The question for you is: would you have expected the 14 system, particularly in terms of leakage through those 15 dampers, to have coped with those smoke levels?</p> <p>16 A. Okay, so can we just break that down a bit? 17 So the system isn't dealing with a fire on multiple 18 floors, in the sense it's not meant to be open on 19 multiple floors, okay?</p> <p>20 Q. Yes.</p> <p>21 A. So at the moment, therefore, I don't understand 22 Professor Torero's issue about smoke quantities. 23 The system as a protected riser is required to 24 provide compartmentation, yes, for a certain period in 25 every lobby.</p> <p style="text-align: right;">Page 167</p>
<p>1 A. There is some evidence on some floors that smoke was 2 observed to leak from the location of the builders' 3 ducts, yes.</p> <p>4 Q. We had oral evidence from Farhad Neda in particular in 5 relation to that; is that correct?</p> <p>6 A. Yes, we did.</p> <p>7 Q. Do you think that that evidence is potentially important 8 in the context of the problems that you have identified 9 with the dampers?</p> <p>10 A. Yes, yes, I do.</p> <p>11 Q. Could this potentially indicate a failure to comply with 12 compartmentation rules for protected shafts?</p> <p>13 A. Yes, it could.</p> <p>14 Q. Do you think there are any other potential explanations 15 that you're aware of at this stage for what Mr Neda says 16 he witnessed on his floor? Could it have been anything 17 to do, for example, with the firefighters operating the 18 HMI panel? I mean, is that possible?</p> <p>19 A. Oh, so this is a recent piece of evidence for me, and 20 I have set out in appendix J all the things I now want 21 to look at.</p> <p>22 I don't have any evidence, remember, that the 23 firefighters actively opened or shut dampers on any 24 floor.</p> <p>25 Q. Professor Torero in his evidence was asked about the</p> <p style="text-align: right;">Page 166</p>	<p>1 Q. That's 60 minutes?</p> <p>2 A. Yes, it is.</p> <p>3 Q. Yes.</p> <p>4 A. Yes. There are other pressure imbalances that might 5 cause flowing of smoke out at level 23 particularly, but 6 as I've said, there's all sorts of different things 7 I must consider before I offer up any kind of opinion on 8 why the smoke leaked on certain floors.</p> <p>9 I am clear in my own mind about the damper 10 performance, but there are other things that I must 11 consider too.</p> <p>12 Q. There's potentially some other written evidence. For 13 example, Daniel Griffin, in a witness statement that was 14 read out to the inquiry, refers to smoke spread via the 15 vents into the 6th floor lobby.</p> <p>16 A. Yes.</p> <p>17 Q. Is that something that you will want to look into?</p> <p>18 A. I have been thinking -- yes, I am considering that.</p> <p>19 Q. So in terms of those smoke shafts on the north and the 20 south side, you've also highlighted some potential 21 issues around those shafts.</p> <p>22 They were retained in the refurbishment. They were 23 originally builders' work shafts, serving the north and 24 south sides of the lobbies; is that right?</p> <p>25 A. That's correct.</p> <p style="text-align: right;">Page 168</p>

<p>1 Q. You've examined them. Can we look at figure J.16 of 2 your report, BLAS0000031 at page 56. 3 A. Yes. 4 Q. I think what we see -- I just want to look at a number 5 of these figures -- is you have concluded that neither 6 shaft was rendered, nor was it metal-lined. 7 Let's stick with rendering. 8 A. Yes. 9 Q. Does that mean cemented to make it a smooth surface? 10 A. Yes. So when someone like me wants to rely on 11 a builders' work shaft for a smoke control system, both 12 the British Standard and, actually, the Smoke Control 13 Association guidance makes clear (a) that's perfectly 14 appropriate, but (b) there's certain checks you have to 15 do. So it's about making it as smooth as possible, and 16 also checking if it leaks just by nature of its current 17 condition. 18 Q. If this was leaking, this shaft, what are the potential 19 candidates in terms of where it leaks to? 20 A. Oh, okay. Well, I would need to show you on a plan, but 21 the walls here that we're looking at for the builders' 22 duct are in the flats. 23 Q. They're in the flats? 24 A. Yes, they are, near -- well, it depends which flat, but 25 they're near the front door, yes.</p> <p style="text-align: center;">Page 169</p>	<p>1 this condition? 2 A. On the inside, I would like to understand how the lining 3 of the builders' work duct and its leakage was 4 considered by the design team and factored in to the 5 final design condition they provided. 6 Q. Because you say at the moment you've not seen currently 7 on what you've had any evidence that it was checked or 8 tested during the refurbishment. 9 A. That's correct, based on the papers given to me. 10 Q. Let's finish off. If we look at J.18 and then J.19. 11 A. Yes. I mean, it's the same thing again. 12 Q. It's the same points. 13 A. Just trying to show what is there so people can have 14 that transparency. 15 Q. Those builders' works ducts should've had a one-hour 16 fire resistance, I think you say. 17 A. Well, as an extension of the lobby, it should be two 18 hours, but the dampers are one hour for the 19 floor-to-floor separation. 20 Q. Yes. 21 A. Yes. 22 Q. In terms of the contribution of these kind of issues, 23 ie with the dampers and the shafts -- let's just think 24 about them -- and the contribution they potentially 25 might have played to smoke spread in the building, given</p> <p style="text-align: center;">Page 171</p>
<p>1 Q. You've noted it wasn't metal-lined either. Is that 2 something you sometimes see in a smoke shaft like 3 this -- 4 A. Yes. 5 Q. -- that you will metal-line the whole thing? 6 A. So if you can't apply a smooth finish, it might be that 7 a designer would choose to provide a lining instead. 8 But it has to be contemplated, is the point I'm making, 9 in terms of then preventing so much friction when the 10 fans switch on. Okay? It's trying to get the smoke up 11 easily. 12 Q. You've drawn attention in this particular photograph to 13 mortar joints between blocks, which you say are visible, 14 and then you've got the same diagonal line pattern as 15 exhibited on the outside of shaft. 16 A. I was trying to say that it's not been covered with 17 something else from what I can see. 18 The mortar joint is a good thing in the sense that 19 that means it is sealed. 20 Q. Can we look at a couple of other photographs after this. 21 J.17, which is on the next page. 22 A. Yes. So, again, just trying to say that I can see 23 an external surface rather than a surface that's been 24 covered with something else. 25 Q. So, to you, is this concerning that you're seeing it in</p> <p style="text-align: center;">Page 170</p>	<p>1 the scale of the fire and the fact that we know that 2 numerous flat front doors did not have functioning 3 door-closers or the doors were left open, isn't the most 4 likely source of smoke in the lobbies due to the failure 5 of the doors as people escaped into the lobbies, rather 6 than these kind of compartmentation failings? 7 A. So I have to say what I said this morning: it depends 8 which lobby it is. There may have been lobbies where 9 the doors were not left open, or opening very 10 frequently, and smoke spread by other means is relevant. 11 Q. Commissioning. 12 You have looked at the available commissioning 13 documentation that you've seen to date for the system. 14 A. Yes. 15 Q. Your view is, I think, that the Building Regulations 16 require the works to have been carried out such that 17 they can adequately perform the functions for which 18 they're designed. Does that mean, in your view, that 19 such systems need to be properly commissioned so as to 20 demonstrate the adequate performance? 21 A. Yes, to comply with regulation 7. 22 Q. On the basis of commissioning documents you've seen to 23 date, is it right that you have concerns about the 24 commissioning process that was followed? 25 A. Yes, I have.</p> <p style="text-align: center;">Page 172</p>

<p>1 Q. The detail is in your report, but in summary, is it</p> <p>2 right that you've looked at relevant guidance for</p> <p>3 commissioning, including the Smoke Control Association</p> <p>4 guidance, and you can't see evidence that all the</p> <p>5 relevant checks were carried out when commissioning the</p> <p>6 system?</p> <p>7 A. Yes, that's correct.</p> <p>8 Q. In terms of the evidence of its operation, both before</p> <p>9 and on the night, and whether the system was operating</p> <p>10 properly, you have said in your latest report that you</p> <p>11 want to revisit this in Phase 2, given the wealth of</p> <p>12 evidence that you've heard from firefighters and BSRs</p> <p>13 about the operation on the night.</p> <p>14 A. That's correct.</p> <p>15 Q. I'm therefore not going to put any points in detail</p> <p>16 about this, except to just look at a few points on the</p> <p>17 extent of what you have examined.</p> <p>18 You say that you know that the system worked in some</p> <p>19 way on the 4th floor because the building management</p> <p>20 system triggered an alert to Tunstall, that's the remote</p> <p>21 monitoring platform, at 00.54; is that right?</p> <p>22 A. That's correct. So we know that happened and I assume</p> <p>23 it was because of smoke at level 4 because of the time</p> <p>24 that that signal was sent. But, yes, I don't have any</p> <p>25 information, remember, about how that whole remote</p> <p style="text-align: right;">Page 173</p>	<p>1 a single fire condition, and if the system operated as</p> <p>2 intended.</p> <p>3 Q. You say in your report you've been able to look at the</p> <p>4 programming for the smoke control system.</p> <p>5 A. Yes.</p> <p>6 Q. You say that it does appear to have been correctly</p> <p>7 programmed to respond appropriately to the detection of</p> <p>8 smoke on level 4; is that correct?</p> <p>9 A. That's correct.</p> <p>10 Q. But you're unable to say on the night precisely which</p> <p>11 pieces of equipment activated as the system activation</p> <p>12 log in the HMI panel was overwritten by events after</p> <p>13 14 June before it was seized --</p> <p>14 A. That's correct.</p> <p>15 Q. -- and therefore is no longer available to you. So we</p> <p>16 don't have the data from the night; is that the point?</p> <p>17 A. Yes. So very unfortunately, we don't know the order of</p> <p>18 devices triggered.</p> <p>19 The software being correct is one positive thing,</p> <p>20 but then it means what it's controlling needs to</p> <p>21 physically be able to perform also.</p> <p>22 So there are two -- when you're checking a system in</p> <p>23 terms of handing over a building: does the software</p> <p>24 trigger the right devices at the right time, and can</p> <p>25 they physically react to the programming?</p> <p style="text-align: right;">Page 175</p>
<p>1 monitoring system actually works.</p> <p>2 But we know a signal was received at a certain time,</p> <p>3 and there's no reason to think there was smoke anywhere</p> <p>4 else at that stage of events, so before 1 o'clock.</p> <p>5 Q. And that would be smoke relevant to the fire in flat 16</p> <p>6 at that point; is that correct?</p> <p>7 A. Correct.</p> <p>8 Q. You've referred to some resident evidence, resident</p> <p>9 Ahmed, relating to smoke coming from the level 4 lobby</p> <p>10 into the stair.</p> <p>11 A. Yes.</p> <p>12 Q. You say you're concerned that this might indicate that</p> <p>13 the system was not functioning as intended.</p> <p>14 Do you think it's going to be necessary to look at</p> <p>15 all of the evidence, including the firefighter evidence</p> <p>16 we've now heard, some of which might suggest that the</p> <p>17 lobby was less congested with smoke in the early stages?</p> <p>18 A. Yes, that's correct. So there's evidence of limited</p> <p>19 smoke in the level 4 lobby and then things changing, and</p> <p>20 this issue of doors being open and closed and where is</p> <p>21 very important.</p> <p>22 So all the very detailed breakdown of early</p> <p>23 firefighting activity, I'd like to compare that then</p> <p>24 with the different evidence about the conditions of</p> <p>25 smoke at level 4, and in the early stages when that was</p> <p style="text-align: right;">Page 174</p>	<p>1 Q. The fact that that data is not available from the night,</p> <p>2 is that a significant gap in your knowledge in terms of</p> <p>3 how the system operated?</p> <p>4 A. I think it's very unfortunate.</p> <p>5 Q. Do you think that's going to hamper a conclusion about</p> <p>6 whether the system did operate properly, or do you think</p> <p>7 there are other things you can look at to --</p> <p>8 A. So it would have been the most useful piece of data, but</p> <p>9 instead -- and I've listed everything out at the back of</p> <p>10 appendix J -- there's all sorts of other data now I need</p> <p>11 to consider: noise, physical observations up at the</p> <p>12 roof, from the helicopter footage -- there's all pieces</p> <p>13 of data now that I need to piece together to understand</p> <p>14 if smoke indeed entered the shafts and left the shafts</p> <p>15 at the roof, and, remember, down at level 2 above the</p> <p>16 door.</p> <p>17 Q. You've also analysed at this stage the available</p> <p>18 firefighter evidence as to their attempts to operate the</p> <p>19 system.</p> <p>20 A. Yes, I have.</p> <p>21 Q. You've also reviewed the instructions available to the</p> <p>22 firefighters in the lobby next to the HMI panel; is that</p> <p>23 correct?</p> <p>24 A. Yes, I have.</p> <p>25 Q. To look at their clarity.</p> <p style="text-align: right;">Page 176</p>

<p>1 A. Yes.</p> <p>2 Q. We should bear in mind, I think -- is this right? -- the</p> <p>3 system operates in automatic mode when it's detected on</p> <p>4 the fire floor and it should operate automatically --</p> <p>5 A. Yes.</p> <p>6 Q. -- but there was a function, and there were various</p> <p>7 instructions given, about how the firefighters could</p> <p>8 override that and select a different floor --</p> <p>9 A. That's correct.</p> <p>10 Q. -- for the smoke control system to operate on if they</p> <p>11 wanted, for example, to operate it on floor 11 as</p> <p>12 opposed to floor 4?</p> <p>13 A. Yes, so the system provides two ways to do that: you</p> <p>14 switch the panel to on, and there is a touch-screen that</p> <p>15 allows you to pick a floor to change the function, to</p> <p>16 change the floor of operation; or you switch to on, and</p> <p>17 you go to the floor and use the yellow key switch in the</p> <p>18 lobby.</p> <p>19 The instructions actually only offer going to the</p> <p>20 floor with the yellow key switch as they were printed</p> <p>21 out underneath the panel on the night.</p> <p>22 Q. Yes.</p> <p>23 A. And I don't know why that is.</p> <p>24 Q. I just wanted to ask you about a few things to do with</p> <p>25 these instructions.</p> <p style="text-align: right;">Page 177</p>	<p>1 A. Because the wires are bundled and tied together.</p> <p>2 Q. Right. My next question falls away.</p> <p>3 You've just made this point, you also conclude that</p> <p>4 the instructions state that only one floor can be</p> <p>5 controlled at once, but do not state that the user must</p> <p>6 turn off the key at the floor of operation before</p> <p>7 another key switch could be operated to change the</p> <p>8 floor.</p> <p>9 A. That's correct.</p> <p>10 Q. So if someone's put their key in the little yellow box</p> <p>11 in floor 11 and they want to change it to floor 12, the</p> <p>12 instructions don't tell them they've got to take the key</p> <p>13 out at floor 11 --</p> <p>14 A. Yes, exactly. You have to finish your operation there</p> <p>15 and then go to another floor.</p> <p>16 Q. You've also pointed out that the restart system option</p> <p>17 would restart the system on the floor of activation,</p> <p>18 regardless of whether a key switch had been operated; is</p> <p>19 that right?</p> <p>20 A. Yes.</p> <p>21 Q. Do you think these instructions were as clear as they</p> <p>22 should've been to guide firefighters on the night?</p> <p>23 A. No, I do not.</p> <p>24 Q. Is it right that at Phase 2, in terms of the work you're</p> <p>25 going to do, you're going to review the operation by the</p> <p style="text-align: right;">Page 179</p>
<p>1 You've said in your report that the instructions to</p> <p>2 access the damper status are clear, so that's to look at</p> <p>3 what was happening for each individual damper on each</p> <p>4 individual floor; is that correct?</p> <p>5 A. Yes, it provides that function, yes.</p> <p>6 Q. But you say that the damper status indicators might not</p> <p>7 be providing accurate information, because what you've</p> <p>8 identified is that the switches from the dampers may not</p> <p>9 have been connected to the system, so that what you're</p> <p>10 seeing on the screen may not be telling you accurate</p> <p>11 information about the dampers.</p> <p>12 A. Exactly. You can get this kind of return signal, so the</p> <p>13 damper tells the controller, "I am open, I am shut".</p> <p>14 And that was disconnected in the tower.</p> <p>15 Q. Can we just go to that. That's BLAS0000031, page 141.</p> <p>16 If we go to J9.4.10.</p> <p>17 So I think this is where you explain that point.</p> <p>18 A. Yes.</p> <p>19 Q. Four lines down:</p> <p>20 "However, in Grenfell Tower these switches were not</p> <p>21 connected to the system."</p> <p>22 A. Yes.</p> <p>23 Q. Can you explain the basis on which you've concluded that</p> <p>24 they weren't connected to the system? How do you know</p> <p>25 that?</p> <p style="text-align: right;">Page 178</p>	<p>1 firefighters of the system on the night to try and look</p> <p>2 at what they might have done?</p> <p>3 A. Yes.</p> <p>4 Q. You say that the key to the HMI panel on the ground</p> <p>5 floor was found in the on position --</p> <p>6 A. It was, yes.</p> <p>7 Q. -- rather than in the "auto" position.</p> <p>8 A. That's correct. London Fire Brigade provided a photo of</p> <p>9 the key in the on position.</p> <p>10 Q. But you say it's unclear how or precisely when that</p> <p>11 happened, and there's no evidence that anyone did that</p> <p>12 intentionally, is that right, or shut down the system</p> <p>13 intentionally?</p> <p>14 A. Yes. So I don't know when that happened, and I don't</p> <p>15 know if either the touch-screen or the yellow key</p> <p>16 switches were then also used as they could have been</p> <p>17 when the main key was in the on position.</p> <p>18 Q. Do you intend to review the CCTV footage further in</p> <p>19 terms of those considerations?</p> <p>20 A. I will review it further and -- yes.</p> <p>21 Q. Watch Manager Dowden appears to have used a key to</p> <p>22 activate the yellow key panel in the lift lobby at</p> <p>23 ground floor.</p> <p>24 A. Yes.</p> <p>25 Q. We've seen pictures of that.</p> <p style="text-align: right;">Page 180</p>

<p>1 Based on your review of the software and how the</p> <p>2 system was supposed to operate, what would be the effect</p> <p>3 of that, of putting the key into the ground floor?</p> <p>4 A. Well, it depends what the condition at the main HMI</p> <p>5 panel was, and I don't know if it was in on or not when</p> <p>6 he did that.</p> <p>7 Q. If it was in on, would the effect of him putting his key</p> <p>8 into the yellow key switch mean that it was diverted to</p> <p>9 operate on the ground floor?</p> <p>10 A. Theoretically, yes. It should've opened the vents at</p> <p>11 ground floor.</p> <p>12 Q. Just generally in relation to that override facility in</p> <p>13 the smoke control system, are you aware of the LFB</p> <p>14 policy guidance in GRA 3.2 that the incident commander</p> <p>15 must not make any changes to a high-rise building's</p> <p>16 ventilation or fire safety system without first taking</p> <p>17 appropriate advice from either the responsible person or</p> <p>18 appropriately trained fire and rescue authority</p> <p>19 personnel?</p> <p>20 A. Yes, I'm aware of that.</p> <p>21 Q. Are you aware of any attempt by anyone during the course</p> <p>22 of the fire to seek advice or assistance from the</p> <p>23 responsible person as to the way in which that smoke</p> <p>24 ventilation system was supposed to operate?</p> <p>25 A. That's not something I've looked at yet, but I will be</p> <p style="text-align: right;">Page 181</p>	<p>1 limit smoke movement on one floor obviously cannot</p> <p>2 operate on all floors simultaneously unless such</p> <p>3 a feature was provided.</p> <p>4 Q. Finally, I just wanted to look at your section J.11,</p> <p>5 which lists out all the further investigations that you</p> <p>6 wish to do as part of your Phase 2 work. Can we go to</p> <p>7 BLAS0000031, and start with page 152.</p> <p>8 A. Yes.</p> <p>9 Q. We don't have to go through all the detail of this, but</p> <p>10 is it right that what you've done in this last section</p> <p>11 is set out all the different work strands that you would</p> <p>12 like to do in order to understand better --</p> <p>13 A. Yes.</p> <p>14 Q. -- the system and whether it operated correctly on the</p> <p>15 night?</p> <p>16 A. Exactly.</p> <p>17 Q. And what the consequences were?</p> <p>18 A. Yes, exactly.</p> <p>19 Q. You have considering whether there's any evidence of</p> <p>20 noise from the fans.</p> <p>21 A. Yes.</p> <p>22 Q. All those questions that poor Mr Rawat had to keep on</p> <p>23 asking about noise and fans.</p> <p>24 A. Yes.</p> <p>25 Q. They're potentially important to you; is that right?</p> <p style="text-align: right;">Page 183</p>
<p>1 looking at those types of activities when it comes to</p> <p>2 duties regarding the Regulatory Reform (Fire Safety)</p> <p>3 Order, which I haven't done yet, for responsible</p> <p>4 persons.</p> <p>5 Q. In relation to the performance of the lift doors --</p> <p>6 A. Yes.</p> <p>7 Q. -- your site inspection and report make no observations</p> <p>8 with regard to the performance and conditions of the</p> <p>9 lift doors, despite the fact you've noted that the doors</p> <p>10 were seemingly not specified as fire rated. Do you</p> <p>11 think that in order to fully consider possible smoke</p> <p>12 contamination routes, it's going to be important to have</p> <p>13 regard to the lift doors?</p> <p>14 A. Yes. I would like to have had the opportunity to do</p> <p>15 that, and I'm sure the lift expert can do that work.</p> <p>16 Q. If we leave aside the damper compartmentation issue for</p> <p>17 a moment and simply assume that the system was compliant</p> <p>18 but it didn't work on the fire floor on the night, would</p> <p>19 you agree that that would have limited effect on the</p> <p>20 spread of fire and smoke throughout the building?</p> <p>21 A. Its role is to stop smoke entering the staircase during</p> <p>22 early firefighting.</p> <p>23 Q. So does that mean you wouldn't agree with that, that you</p> <p>24 still think a compliance system on that --</p> <p>25 A. A perfect system designed to either extract smoke or</p> <p style="text-align: right;">Page 182</p>	<p>1 A. No, it's very important to understand if either</p> <p>2 firefighters or residents could hear these noises.</p> <p>3 The problem about fan noise at Grenfell Tower is the</p> <p>4 system was a combined system. So --</p> <p>5 Q. Yes. If we go over the page --</p> <p>6 SIR MARTIN MOORE-BICK: Sorry, did you finish?</p> <p>7 A. Yes. So I won't be able to rely just on noise in</p> <p>8 isolation.</p> <p>9 MS GRANGE: But these are all pieces of a jigsaw?</p> <p>10 A. All the different pieces, yes.</p> <p>11 SIR MARTIN MOORE-BICK: Mm.</p> <p>12 MS GRANGE: Then you have considering whether there's</p> <p>13 evidence of air movement, analyse the data from the</p> <p>14 post-fire condition of the smoke control system. You</p> <p>15 refer there to LFB Officer James Flin taking</p> <p>16 photographs.</p> <p>17 A. Yes.</p> <p>18 Q. I believe he's also provided a witness statement --</p> <p>19 A. Yes.</p> <p>20 Q. -- which you'll have to look at as well.</p> <p>21 A. Yes. I'll go through all of that. Also, I think the</p> <p>22 thing I'm most interested in is where soot was actually</p> <p>23 deposited. I think that's a really good piece of</p> <p>24 physical evidence.</p> <p>25 Q. Professor Stec of the University of Central Lancashire,</p> <p style="text-align: right;">Page 184</p>

<p>1 who has been appointed as an inquiry expert, she's done</p> <p>2 an investigation of soot deposits, and she's done</p> <p>3 a short summary, and you want to look in more detail at</p> <p>4 that.</p> <p>5 A. Yes, I do, because is there soot all the way up to the</p> <p>6 roof? Is there soot all the way down to level 2? Is</p> <p>7 there soot on the fan at level 2? Et cetera, et cetera.</p> <p>8 All of those things will allow us to understand if there</p> <p>9 ever was smoke in the system.</p> <p>10 Q. Do you agree it's going to be necessary to establish</p> <p>11 an accurate timeline in relation to internal and</p> <p>12 external smoke spread before you can reach any more</p> <p>13 definitive conclusions about whether the system operated</p> <p>14 as intended?</p> <p>15 A. I think that study is very important for a multitude of</p> <p>16 reasons. I mentioned the lifts getting filled with</p> <p>17 smoke earlier and all sorts of other things. Yes.</p> <p>18 MS GRANGE: Thank you.</p> <p>19 Mr Chairman, those are all of my questions.</p> <p>20 SIR MARTIN MOORE-BICK: Right. Would you like a chance to</p> <p>21 consider your homework?</p> <p>22 MS GRANGE: Exactly. So if we can just have a break, maybe</p> <p>23 10 minutes.</p> <p>24 SIR MARTIN MOORE-BICK: Yes.</p> <p>25 MS GRANGE: Well, 9 minutes. Let's go 4.05.</p> <p style="text-align: center;">Page 185</p>	<p>1 be a refuge?</p> <p>2 A. Well, it's hypothetical because it was inaccessible. It</p> <p>3 is something that I do consider, as such, in my own</p> <p>4 work. But it was locked and inaccessible.</p> <p>5 Q. Okay.</p> <p>6 A. As I understand it.</p> <p>7 SIR MARTIN MOORE-BICK: I think the question asked you to</p> <p>8 assume that it was not.</p> <p>9 A. I know. Sorry, I just have that kind of brain, it's</p> <p>10 hard for me to do that. So all I can tell you is</p> <p>11 I observed myself there were areas not impacted by fire</p> <p>12 and smoke, and that's actually quite upsetting when you</p> <p>13 see that, but I don't know how it could have been</p> <p>14 actually used. I don't know how to answer that question</p> <p>15 at the moment.</p> <p>16 MS GRANGE: Do you think the proximity to the crown may have</p> <p>17 been an issue in terms of accessing the roof? Because</p> <p>18 as I understand it, you come up and you're out onto</p> <p>19 a lower parapet along the outside, right adjacent to the</p> <p>20 crown.</p> <p>21 A. That's correct.</p> <p>22 Q. Then if you want to access the inner roof, you have to</p> <p>23 go up a pretty scary ladder.</p> <p>24 A. Yes. So I'm happy to explain the access point and the</p> <p>25 location of the hazard when I doing that part of my</p> <p style="text-align: center;">Page 187</p>
<p>1 SIR MARTIN MOORE-BICK: Let's say 4.05, shall we?</p> <p>2 MS GRANGE: Then if there are any further questions --</p> <p>3 THE WITNESS: Do I need to leave?</p> <p>4 SIR MARTIN MOORE-BICK: It's usually convenient because</p> <p>5 other people may want to talk to counsel, so we'll both</p> <p>6 leave and come back at 4.05. All right? Thank very</p> <p>7 much.</p> <p>8 All right, 4.05, then, please.</p> <p>9 (3.55 pm)</p> <p>10 (A short break)</p> <p>11 (4.05 pm)</p> <p>12 SIR MARTIN MOORE-BICK: All right, Dr Lane. I haven't asked</p> <p>13 Ms Grange whether she has any more questions, but</p> <p>14 I suspect she has.</p> <p>15 MS GRANGE: Only one.</p> <p>16 SIR MARTIN MOORE-BICK: Only one.</p> <p>17 MS GRANGE: Which is good, about the roof. It's a question</p> <p>18 I put to Professor Torero, and I should have put it to</p> <p>19 you as well.</p> <p>20 Do you think on the night that the roof might have</p> <p>21 provided a refuge for occupants of the tower, had it</p> <p>22 been able to be accessed?</p> <p>23 A. When I was in the roof, I observed areas that were not</p> <p>24 impacted by fire and smoke.</p> <p>25 Q. So does that mean you think it might have been able to</p> <p style="text-align: center;">Page 186</p>	<p>1 work. I will be much clearer then.</p> <p>2 MS GRANGE: Yes.</p> <p>3 Dr Lane, those are all the questions we have for</p> <p>4 you.</p> <p>5 I would just like to thank you and your team. All</p> <p>6 of our experts have worked incredibly hard within the</p> <p>7 timescales, but that really does particularly apply to</p> <p>8 you and your team. I think only we as the inquiry team</p> <p>9 know quite how hard you have all worked to produce the</p> <p>10 detailed report that you have, and I just want to give</p> <p>11 you our thanks, because we know an awful lot of blood,</p> <p>12 sweat and tears has gone into the writing of that</p> <p>13 report.</p> <p>14 THE WITNESS: Yes, it has, and I do want to say thank you to</p> <p>15 my own team. They have worked tirelessly for a very</p> <p>16 long period of time, but we were very happy to do so.</p> <p>17 SIR MARTIN MOORE-BICK: Well, we are very grateful to you</p> <p>18 because one can see how much time and effort has gone</p> <p>19 into this work and you giving us your opinion. I mean,</p> <p>20 it's a very substantial report.</p> <p>21 THE WITNESS: Thank you very much.</p> <p>22 SIR MARTIN MOORE-BICK: We are very grateful to you for</p> <p>23 putting your expertise at our disposal. Thank you very</p> <p>24 much indeed.</p> <p>25 THE WITNESS: Thank you very much.</p> <p style="text-align: center;">Page 188</p>

1 SIR MARTIN MOORE-BICK: All right. Well, that's all, so you
2 can go with the usher, if you would like to. Thank you
3 very much.
4 (The witness withdrew)
5 SIR MARTIN MOORE-BICK: Right, Ms Grange, that's perhaps it
6 for the day, is it?
7 MS GRANGE: It is. I think we have Dr Glover tomorrow.
8 SIR MARTIN MOORE-BICK: Yes. More expert evidence tomorrow
9 in the form of Dr Glover.
10 MS GRANGE: With Mr Kinnier.
11 SIR MARTIN MOORE-BICK: Good. Thank you very much indeed.
12 10 o'clock tomorrow, then, please, thank you.
13 (4.10 pm)
14 (The hearing adjourned until Tuesday, 27 November 2018
15 at 10.00 am)
16
17 I N D E X
18 DR BARBARA LANE (continued)1
19 Questions by MS GRANGE (continued)1
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21
22
23
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