

1 Thursday, 23 June 2016
 2 (10.00 am)
 3 (The hearing was delayed)
 4 (10.10 am)
 5 MR HEPPINSTALL: Hopefully the finalised index of SB22 is on
 6 your desk.
 7 MR JUSTICE BLAKE: Thank you very much. I'll check that in
 8 due course.
 9 Any other housekeeping matters? No, thank you.
 10 Yes, let's continue then.
 11 DR RICHARD HAYLOCK (continued)
 12 Cross-examination by DR BUSBY (continued)
 13 DR BUSBY: Good morning, Dr Haylock.
 14 **A. Good morning.**
 15 Q. Last night you perhaps were able to look at some of the
 16 papers that were put in. But what I'd like to do first
 17 thing this morning, especially since the Tribunal is
 18 particularly interested in your response to the issue,
 19 we could maybe go to the Wahab and Rowland study,
 20 SB7/123.
 21 This, as you know, I expect -- first of all, you
 22 have looked at this one now?
 23 **A. I have, yes.**
 24 Q. Yes. Whilst I realise that you may think it's not in
 25 your area of expertise because it's not strictly

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1 an epidemiological study, or you could argue it's not
 2 strictly an epidemiological study, or some might say it
 3 is, I wonder first of all if I could ask you if you
 4 agree with the Health Protection Agency that it does
 5 appear to show a significant excess, a threefold excess
 6 of chromosome aberrations in these New Zealand veterans
 7 who were --
 8 **A. It does appear so. However, I have some reservations**
 9 **about the statistical methodology used to derive that**
 10 **significant difference between the two.**
 11 Q. Could you say what those reservations are?
 12 **A. Yes. Partly due to the -- it's partly due to the type**
 13 **of data we have in this study. It seems to me that the**
 14 **point you are mentioning refers to table 3 in this**
 15 **report, where you are comparing the mean for the**
 16 **veterans' group versus the mean for the control group.**
 17 **However, if you look at the figure above --**
 18 Q. Sorry, are we in the actual published report?
 19 **A. Sorry, page --**
 20 **MR JUSTICE BLAKE: 83.**
 21 **A. -- 83.**
 22 MR JUSTICE BLAKE: Yes, so that's the short table, the small
 23 table?
 24 **A. Yes.**
 25 MR JUSTICE BLAKE: Page 83.

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1 **A. So here we are comparing the means in the two groups and**
 2 **generating confidence intervals based upon the**
 3 **assumption that these data are symmetrically, normally**
 4 **distributed. But it's clear from the figure above that**
 5 **that isn't the case. We have quite a skewed**
 6 **distribution with a long tail, so although I've**
 7 **obviously not been able to do any calculations of my own**
 8 **I would question whether those confidence intervals are**
 9 **really representative of the true variants of the two**
 10 **distributions of the two sets of data. They are**
 11 **conditional on the fact that the distributions are**
 12 **normal, and they're not.**
 13 Q. I think I --
 14 **A. How far they differ from what I would do is not possible**
 15 **for me to say, given that I haven't had the data. But**
 16 **the further -- the more skewed a distribution is, the**
 17 **more inappropriate this sort of comparison is.**
 18 **However, they also do a comparison of the**
 19 **individual data, something called a Wilcoxon two sample**
 20 **rank sum test.**
 21 **The idea of this particular type of test is it**
 22 **doesn't -- it doesn't depend upon the distribution of**
 23 **the -- the underlying distribution of the data. What it**
 24 **does is essentially say: if you ranked all the values in**
 25 **order then you would expect, if there's no difference**

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1 **between the two, for them to occur essentially in**
 2 **a random order. You wouldn't expect to have all the**
 3 **controls, the -- yes, the controls followed by the**
 4 **veterans; you'd expect them to be randomly distributed**
 5 **up the list of -- up the -- if you put them in size**
 6 **order, there would be no pattern to it.**
 7 **That says there is a difference and I think that's**
 8 **the statistical test upon which this difference is**
 9 **shown.**
 10 **However, as I said, it does not take into account**
 11 **the underlying variability in the two sets of data.**
 12 **I would say a parametric test based on a Poisson**
 13 **distribution or similar would possibly be better.**
 14 **Again, I can't say whether it would give a different**
 15 **result unless I have the opportunity to do it, but**
 16 **it's -- one of the things about summarising this sort of**
 17 **data is that, as done in the table and at the bottom of**
 18 **the columns of data -- and throughout the paper the**
 19 **authors refer to the numbers of aberrations per thousand**
 20 **cells -- is what you're losing is the individual**
 21 **variability between the individuals within each group.**
 22 **Obviously if there's lots of variability within**
 23 **individuals in a group, when you are comparing that**
 24 **group to another group, that's more of a difficult**
 25 **comparison. Lots of variability makes comparing two**

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<p>1 groups difficult and --</p> <p>2 MR JUSTICE BLAKE: Variability in what, sorry?</p> <p>3 A. If you are trying to say "Is this group different from</p> <p>4 this group?" both groups vary within each other a lot.</p> <p>5 MR JUSTICE BLAKE: In terms of their experiences, in terms</p> <p>6 of their biological findings?</p> <p>7 A. In terms of the numbers of chromosomes we see, the</p> <p>8 chromosome aberrations we see out of the number of</p> <p>9 cells.</p> <p>10 Perhaps I could illustrate my point by another paper</p> <p>11 that we have in the bundle. Is that possible?</p> <p>12 MR JUSTICE BLAKE: Yes. The?</p> <p>13 A. SB22, the Tawn paper. Number 22, I think it is.</p> <p>14 MR JUSTICE BLAKE: SB22, tab?</p> <p>15 A. 22, I presume, yes. "Chromosome aberrations determined</p> <p>16 by FISH in radiation workers from the Sellafield nuclear</p> <p>17 facility".</p> <p>18 MR JUSTICE BLAKE: Right.</p> <p>19 A. If you look on page 300 -- or is it 200? 300. At the</p> <p>20 top you see two graphs, one in which in the top graph</p> <p>21 the data are grouped data. In the lower panel you're</p> <p>22 seeing the individual data and seeing essentially the</p> <p>23 variability of the individual responses which you don't</p> <p>24 see in the upper figure. So the upper figure gives the</p> <p>25 impression that everything looks brilliant and they're</p> <p style="text-align: center;">Page 5</p>	<p>1 that being done is figure 1 in Tawn at tab 22 or</p> <p>2 simply --</p> <p>3 A. I'm trying to illustrate the point that when you group</p> <p>4 data, or as in the case of the Rowland people where you</p> <p>5 are just simply summing, you see a single value, whereas</p> <p>6 that belies the underlying variability between</p> <p>7 individuals, which the lower panel of the B(?) in the</p> <p>8 Tawn paper shows that --</p> <p>9 MR JUSTICE BLAKE: And there's no equivalent in the Wahab</p> <p>10 paper?</p> <p>11 A. There isn't.</p> <p>12 MR JUSTICE BLAKE: So they haven't acknowledged the</p> <p>13 underlying variability?</p> <p>14 A. That is what I understand from the statistics that they</p> <p>15 say, yes.</p> <p>16 MR JUSTICE BLAKE: Well, we've got that answer. Does that</p> <p>17 complete your concerns about the methodology or did you</p> <p>18 have other concerns about the methodology?</p> <p>19 A. I think that completes my concerns, my Lord.</p> <p>20 MR JUSTICE BLAKE: Right, thank you.</p> <p>21 DR BUSBY: Thank you.</p> <p>22 As I understand it, you say that there is an effect,</p> <p>23 but the confidence intervals may not be correct because</p> <p>24 it's not a normal distribution, but the effect is shown</p> <p>25 by the non-parametric test that they used?</p> <p style="text-align: center;">Page 7</p>
<p>1 all nice and close, but it's hiding the underlying</p> <p>2 variability. So if you're comparing two groups which</p> <p>3 are also similarly variable, then by summing them you</p> <p>4 lose the within person -- sorry, within group, between</p> <p>5 person variability.</p> <p>6 MR JUSTICE BLAKE: All right. Let's see if I am following</p> <p>7 this.</p> <p>8 A. I am sorry. These are complicated --</p> <p>9 MR JUSTICE BLAKE: I'm sorry, I'm probably not up to speed</p> <p>10 with you.</p> <p>11 But you are saying that if you are going to make</p> <p>12 a comparison between your cohort and your control</p> <p>13 group --</p> <p>14 A. Mm.</p> <p>15 MR JUSTICE BLAKE: -- you need to take into account the</p> <p>16 chromosomal differences --</p> <p>17 A. You need to take into account the individual variability</p> <p>18 and response between individuals within the group.</p> <p>19 MR JUSTICE BLAKE: Within each of the cohort and the</p> <p>20 control?</p> <p>21 A. Yes.</p> <p>22 MR JUSTICE BLAKE: Or internal to the cohort and the</p> <p>23 control?</p> <p>24 A. Internal to the cohort and the control.</p> <p>25 MR JUSTICE BLAKE: Right. And you will say an example of</p> <p style="text-align: center;">Page 6</p>	<p>1 A. Yes. However, if you did do a different test I would</p> <p>2 want to see -- a test that I would say might be more</p> <p>3 appropriate, I would like to see the P value of that.</p> <p>4 But on the face of it I would say it does show</p> <p>5 a difference.</p> <p>6 Q. Well, whilst we are there perhaps -- and keep your Tawn</p> <p>7 paper there because we are going to come to that -- if</p> <p>8 we can go to SB22/24?</p> <p>9 MR JUSTICE BLAKE: 24.</p> <p>10 DR BUSBY: Yes. It's comments on the New Zealand nuclear</p> <p>11 test veteran study.</p> <p>12 A. I haven't got that, my Lord.</p> <p>13 MR JUSTICE BLAKE: Is it not in your tab 22? I'm afraid</p> <p>14 you'll have to -- the witness' bundle just doesn't seem</p> <p>15 to have been loaded.</p> <p>16 MR HEPPINSTALL: I thought I had done it.</p> <p>17 MR JUSTICE BLAKE: Tab 22?</p> <p>18 DR BUSBY: Tab 24, my Lord.</p> <p>19 MR JUSTICE BLAKE: Sorry, tab 24 of bundle SB22?</p> <p>20 DR BUSBY: Yes. (Handed)</p> <p>21 MR JUSTICE BLAKE: We've never been able to get this working</p> <p>22 right, but there we are.</p> <p>23 A. I have it.</p> <p>24 MR JUSTICE BLAKE: Right. When you've finished with it if</p> <p>25 you slot it into tab 24 then we'll know where it is.</p> <p style="text-align: center;">Page 8</p>

1 Yes?
 2 DR BUSBY: If I could just take you to -- first of all, this
 3 is a report by your own outfit, the Radiation Protection
 4 Division of the Health Protection Agency. Yes?
 5 And if I can take you to the second page at the top.
 6 These pages are not numbered but at the top of the
 7 second page at the bottom of the first paragraph the
 8 Health Protection Agency, unsurprisingly, agrees with
 9 you that the non-parametric test -- the Wilcoxon test --
 10 was appropriate for the data and that "the P value
 11 indicates a highly statistical difference between the
 12 numbers of stable translocations and controls".
 13 Would you agree with that?
 14 **A. Mm-hm.**
 15 Q. Then --
 16 MR JUSTICE BLAKE: Is that the same point you have been
 17 making?
 18 **A. Yes, I believe so.**
 19 MR JUSTICE BLAKE: You weren't involved in writing this
 20 paper?
 21 **A. I was not.**
 22 **MR JUSTICE BLAKE: No.**
 23 **DR BUSBY: Then there's another paragraph just immediately**
 24 **below that, where they use their own approach based on T**
 25 **statistics. I think you probably disagree with the T**

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1 **statistics approach, but anyway, they say:**
 2 **"The probability of observing the number of stable**
 3 **translocations is extremely small, 2 times 10 to the**
 4 **minus 10. Thus there is a very small probability that**
 5 **the observed difference between the veteran and control**
 6 **data is due to chance."**
 7 **Would you agree with that?**
 8 **A. That's what I says. I agree that's what it says.**
 9 Q. Sure, but do you agree with it?
 10 **A. Well, the T test is a test that is -- it actually is**
 11 **dependent on the fact that the data are normally**
 12 **distributed. As the data get further away from the**
 13 **normal distribution, the T test becomes less**
 14 **appropriate.**
 15 **However, if the test is as significant as that**
 16 **I think it probably would still show a difference.**
 17 Q. Right. So if we just go to the back page where it says
 18 "Conclusions", and they say:
 19 "We concur with the authors that the results from
 20 this study indicate a statistically significant
 21 threefold increase in stable translocations for veterans
 22 compared to controls and that it is possible to ascribe
 23 the increase in stable translocation to radiation
 24 exposure."
 25 Would you agree with that?

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1 **A. That's what it says. I wouldn't necessarily agree with**
 2 **that statement because I've not had the opportunity**
 3 **to --**
 4 Q. But this is the Health Protection Agency --
 5 **A. It is, though it's not me.**
 6 Q. -- Radiation Protection Division.
 7 Okay --
 8 MR JUSTICE BLAKE: When you say you wouldn't agree with it
 9 is that because you just don't know?
 10 **A. Yes.**
 11 MR JUSTICE BLAKE: You are not saying you positively
 12 disagree with it; you just don't have the data?
 13 **A. No.**
 14 MR JUSTICE BLAKE: In a sense you can only comment upon one
 15 aspect of the statistical method?
 16 **A. Yes, I believe it's open to challenge and that there**
 17 **might be other more appropriate statistics, and if those**
 18 **gave different values then I think I would want to**
 19 **question the results of the study. If they gave similar**
 20 **values then I would say no, I think that's probably**
 21 **okay.**
 22 MR JUSTICE BLAKE: Right. Of course, some of this material
 23 depends in any event upon biological examination that
 24 you are not going to comment upon?
 25 **A. Yes. All I was thinking about was the methodology used**

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1 **to analyse the data, my Lord.**
 2 MR JUSTICE BLAKE: And although the Agency, the authors of
 3 this paper, seem to think that you can use the T
 4 statistics, you're not so sure about that?
 5 **A. I'm not so sure about that, my Lord.**
 6 MR JUSTICE BLAKE: Yes. Otherwise, is this Wahab and
 7 Rowland study an epidemiological study, or does it rely
 8 upon epidemiological methods?
 9 **A. I would say it relies upon epidemiological data and it**
 10 **applies statistical methods. The problem with all these**
 11 **sorts of studies is: have you applied appropriate**
 12 **statistical methods? If you apply different methods**
 13 **would you get different results? It's not always**
 14 **absolutely clear that for a particular sort of data you**
 15 **should apply one method or another method.**
 16 **As I said, some of the statistical tests we use**
 17 **depend on the distribution of the data. If you put them**
 18 **in size order, do you get a nice symmetric bell curve**
 19 **shape or do you get something else?**
 20 **If you get something else, then that can affect the**
 21 **reliability of the test. But it depends how far away**
 22 **you are getting from normal. If it's a bit far away --**
 23 **if it's a very skewed distribution then possibly the**
 24 **statistics are not valid. If it's just a little bit**
 25 **different, well, it may not be perfect but it may be the**

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<p>1 best test we have available. It's not always 2 a straightforward: this test applies to this data or 3 this test doesn't, unfortunately. 4 MR JUSTICE BLAKE: All right. 5 A. Sorry. 6 MR JUSTICE BLAKE: Okay. Yes. 7 DR BUSBY: Dr Haylock, I think we need to nail this point. 8 You agree that the non-parametric test -- you agree 9 with the Health Protection Agency that the Wilcoxon test 10 does not rely upon any sort of distribution? 11 A. It doesn't. 12 Q. Therefore, whatever it finds, whatever P value it gives 13 is a valid solution to the question, a valid answer to 14 the question: could it have occurred by chance? 15 A. Yes. 16 Q. And you agree that it couldn't have occurred by chance? 17 A. As interpreted in the results of that test. 18 Q. Thank you. 19 Well, whilst you took us to the Tawn paper and since 20 it's out in front of us could we just go to the Tawn 21 paper? 22 If I could take you to the introduction which is on 23 the first page, that's page 296 -- yes? 24 A. (Nodded assent) 25 Q. About a third of the way down -- yes, a third of the way</p> <p style="text-align: center;">Page 13</p>	<p>1 statement "Translocations are stable aberrations which 2 persist through cell division" and that's a biological 3 issue rather than an epidemiological one? 4 A. I believe so, yes. 5 MR JUSTICE BLAKE: All right. 6 DR BUSBY: Just in case you may be able to help us with 7 another statement made by these researchers, if we could 8 go to the top of page 297, where it says: 9 "Thus, for protracted low-LET exposure, 10 translocation frequencies should increase with 11 cumulative dose and provide a good measure of total 12 dose." 13 Are you able to comment on that? 14 A. Not really, no, I'm afraid. 15 MR JUSTICE BLAKE: That's a dosimetry question rather than 16 a statistical analysis of dosimetry? 17 A. Yes. 18 DR BUSBY: Did you know about this paper? You've obviously 19 seen this paper before. 20 A. Yes, I've seen it before. 21 Q. And it has to do with radiation workers at Sellafield? 22 A. It does, yes. 23 Q. Are you able to tell us whether the radiation workers at 24 Sellafield are exposed to internal radionuclides? 25 A. Some are, yes.</p> <p style="text-align: center;">Page 15</p>
<p>1 down it says, it writes: 2 "Translocations are stable aberrations that persist 3 through cell division, and their presence in peripheral 4 blood lymphocytes is maintained because descendants of 5 irradiated bone marrow stem cells carrying 6 translocations survive and appear in the circulating 7 blood." 8 One of the questions that was being raised -- there 9 have been a number of questions raised about the 10 credibility of this important study, and one of them is 11 that, as Professor, I think Thomas said: how is it that 12 these veterans could still be manifesting chromosome -- 13 this translocation evidence such a long time after their 14 exposure, 50 years? 15 But would you agree that this paper largely answers 16 that question by saying that these translocations are 17 stable and could have lasted a long time? 18 A. I'm not sure that's an epidemiological question that 19 I could answer. 20 Q. Well, you could say it's not within your -- 21 A. To my knowledge -- 22 Q. -- expertise. 23 A. -- that is the case, yes, but I'm not an expert on 24 translocations and whether they do remain stable or not. 25 MR JUSTICE BLAKE: You are being asked to comment upon the</p> <p style="text-align: center;">Page 14</p>	<p>1 Q. Thank you. I think that's all we need to do with that 2 one. 3 MR JUSTICE BLAKE: As far as the statistical method of this 4 paper is concerned, you don't have any comments? 5 A. No, it appears to be fine. 6 MR JUSTICE BLAKE: It's a fine statistical method. Insofar 7 as you can comment on that -- 8 A. Insofar as I can comment overnight and -- 9 MR JUSTICE BLAKE: Yes, okay. 10 DR BUSBY: Could we go back to Rowland now, SB7/123, and we 11 want to go to table 15, page 34. So this is the Massey 12 University larger paper that has the data in it. You 13 can see the actual data points here. The ones that you 14 were concerned about. 15 Now, again I'm not sure whether you can help us here 16 but I am going to ask you anyway. It's been suggested 17 that the range -- you can see if you look across it says 18 "participant" and then it puts "dose", column 4 it says 19 "dose". Sorry, page number 34, this is, table 15. 20 A. Mm-hm. 21 MR JUSTICE BLAKE: Sorry, page 34? 22 DR BUSBY: Yes. These are the results, the individual 23 results. 24 A. Right. 25 MR JUSTICE BLAKE: You've got to the right --</p> <p style="text-align: center;">Page 16</p>

4 (Pages 13 to 16)

<p>1 A. I have the table, my Lord.</p> <p>2 MR JUSTICE BLAKE: Yes, good.</p> <p>3 DR BUSBY: Now, if you look at dose in gray, in column 4,</p> <p>4 you can see that some of these doses are very large and</p> <p>5 some of these doses are zero?</p> <p>6 A. Mm-hm.</p> <p>7 Q. It's been suggested that this in itself attacks</p> <p>8 questions of credibility of the paper because it's hard</p> <p>9 to see -- and we're talking about distributions now --</p> <p>10 how it is that you could have such an odd distribution,</p> <p>11 with lots of people with absolutely no dose whatever and</p> <p>12 some people with -- I mean, in one case there's a dose</p> <p>13 of 1.2 gray indicated. This is on about --</p> <p>14 MR JUSTICE BLAKE: Well, I think we can see the range. Yes.</p> <p>15 Up to 1.4, I believe. Yes, what is the question?</p> <p>16 DR BUSBY: I just wanted to ask you if you agreed with that,</p> <p>17 that it seemed unlikely that there would be such a wide</p> <p>18 range of doses, or maybe you are not able to comment on</p> <p>19 that?</p> <p>20 A. It's a difficult question for me to comment on, I'm</p> <p>21 afraid. No, I'm afraid I'm not going to comment on it,</p> <p>22 not without having a chance to look at it more</p> <p>23 carefully.</p> <p>24 Q. I mean, would it help if I pointed out that where it</p> <p>25 writes "dose in gray", that's not really the dose at</p> <p style="text-align: center;">Page 17</p>	<p>1 "When compared with the control group ..."</p> <p>2 These are nuclear workers again:</p> <p>3 "... workers with accumulated doses up to 100</p> <p>4 millisieverts showed no increase in genome translocation</p> <p>5 frequency, whereas workers with accumulated doses from</p> <p>6 101 to 200 millisieverts showed a statistically</p> <p>7 significant doubling."</p> <p>8 So what they are saying is -- well, do you agree</p> <p>9 that what they are saying is they don't see anything, so</p> <p>10 in this case it would be the same sort of distribution,</p> <p>11 you'd get 0, 0, 0, 0 and then suddenly you'd see</p> <p>12 something?</p> <p>13 A. I think their conclusions here are a little challenging</p> <p>14 in that the group they are talking about, the less than</p> <p>15 100 millisievert group, contains only six people. So</p> <p>16 I think that maybe if you chose a different six people</p> <p>17 you'd get a different answer.</p> <p>18 Q. I'm sure that would be true but the ones they did choose</p> <p>19 they got 0 is the point, and that doesn't necessarily</p> <p>20 mean that they didn't get 100 millisieverts, they could</p> <p>21 have got 50 or 60 or 70 or 80. It wasn't really 0,</p> <p>22 that's my point. It would just be an assumption of 0</p> <p>23 because they didn't see anything.</p> <p>24 Well, all right --</p> <p>25 A. I am not confident in making comments on the conclusions</p> <p style="text-align: center;">Page 19</p>
<p>1 all, that's the dose that they assumed on the basis of</p> <p>2 the chromosome --</p> <p>3 MR JUSTICE BLAKE: You've to use this witness for what he</p> <p>4 can inform us about. Please don't --</p> <p>5 A. Could I make a comment that I think that we have</p> <p>6 a single value of dose here. This is a point estimate.</p> <p>7 What we don't have associated with this is a measure of</p> <p>8 the uncertainty on those doses either, so that would</p> <p>9 have been very helpful to interpret them. Are the big</p> <p>10 doses more uncertain than the little doses? That would</p> <p>11 be useful. I would suggest that's more likely to be the</p> <p>12 case but I don't know that.</p> <p>13 DR BUSBY: Well, that's quite a good answer. I mean, in</p> <p>14 fact the zero doses don't mean zero dose, according to</p> <p>15 the paper here, if you look at page --</p> <p>16 MR JUSTICE BLAKE: Please don't make a statement. Ask</p> <p>17 a question, Dr Busby, please.</p> <p>18 DR BUSBY: Right, can we go to SB22/21, then.</p> <p>19 This was back to Tawn, I think. No, Hristova, which</p> <p>20 I think we asked you to look at overnight.</p> <p>21 A. You did.</p> <p>22 Q. If we just look at the -- all we need to do here,</p> <p>23 because this is not your area -- this is specifically in</p> <p>24 response to your point that you just made. If you look</p> <p>25 at the abstract towards the bottom it says:</p> <p style="text-align: center;">Page 18</p>	<p>1 of the studies when they are based on such few numbers.</p> <p>2 It's a poor comparison, I'm afraid.</p> <p>3 Q. Yes. Well, yes, thank you.</p> <p>4 So I think really we can't go any further with this</p> <p>5 Rowland thing, but the Tribunal was interested in any</p> <p>6 help that you could give with regard to that study and</p> <p>7 you've been very helpful, especially on the Wilcoxon</p> <p>8 point.</p> <p>9 MR JUSTICE BLAKE: Come on, let's move on, please.</p> <p>10 DR BUSBY: Yes, how are we doing? 10.35.</p> <p>11 Right, I would like to take you to your</p> <p>12 calculation F. This is your paper, SB2/21, I think.</p> <p>13 Sorry, it's 2.21.</p> <p>14 MR JUSTICE BLAKE: Yes.</p> <p>15 DR BUSBY: At the end of your report you comment on</p> <p>16 Battersby -- this is our appellant, Don Battersby -- and</p> <p>17 the probability of causation for CLL.</p> <p>18 A. Yes.</p> <p>19 Q. I think you write there something like:</p> <p>20 "There was no risk model that I could use to</p> <p>21 calculate a probability of causation for Battersby."</p> <p>22 A. Not one that I would want to rely upon.</p> <p>23 Q. Yes, right.</p> <p>24 Do you know the risk model of the Center for Disease</p> <p>25 Control, called NIOSH-IREP, the American system for</p> <p style="text-align: center;">Page 20</p>

<p>1 calculating the probability of causation? 2 A. I do know that system, yes. 3 Q. Would you agree that that's commonly used in the 4 United States for calculating the probability of 5 causation in the case of a nuclear workers or people 6 related to radiation? 7 A. In relation to compensation, I believe. 8 Q. Yes. In fact, it's kind of legally accepted that the 9 results of that would be authoritative and acceptable 10 for legal purposes? 11 A. Maybe but -- 12 Q. Are you aware that the United States system, the Center 13 for Disease Control system, has accepted that CLL is 14 a radiogenic disease? 15 A. I disagree with that statement. I don't believe they 16 have, no. 17 Q. Its in the Federal Register. Do we need to go to it? 18 A. The evidence is there is not -- I can't remember what 19 the terminology was now, but it was not that there was 20 zero evidence but there was no -- I can't remember the 21 terminology, sorry. 22 Q. So you are saying that the Federal Government has not 23 accepted that CLL is a radiogenic disease? 24 A. Correct. 25 Q. Well, there's not much more I can say that about</p> <p style="text-align: center;">Page 21</p>	<p>1 were to put in CLL and you were to put in Mr Busby's 2 dose, what would pop out at the end? 3 A. Sorry? 4 Q. It would do the calculation and it would produce 5 a probability of causation? 6 A. It would, but that is for the purposes of the 7 compensation scheme. That's not what I was asked to do. 8 I was asked to select an appropriate risk model and 9 I decided that there was not an appropriate risk model 10 because the NIOSH model is not based on epidemiological 11 evidence of CLL. 12 MR JUSTICE BLAKE: So as I understand your answer, NIOSH for 13 its own purposes and its own scheme puts CLL into group 14 2 cancers. 15 A. Yes, with many other cancers. 16 MR JUSTICE BLAKE: With other cancers? 17 A. Where there is not specific evidence -- 18 MR JUSTICE BLAKE: Hang on, and then it gives a risk 19 assessment for group 2 cancers generally, it hasn't done 20 an epidemiological study on CLL specifically? 21 A. Definitely not. 22 MR JUSTICE BLAKE: So it just includes CLL in group 2 23 cancers and you didn't think that's appropriate -- 24 A. No, absolutely not. 25 MR JUSTICE BLAKE: -- for the issues that we are facing?</p> <p style="text-align: center;">Page 23</p>
<p>1 unless -- 2 MR JUSTICE BLAKE: I suppose implicit in this line of 3 questioning was: do you think that NIOSH would provide 4 a suitable risk model for the relationship between 5 radiation exposure and CLL? 6 A. No, they don't. The model they use, from my research, 7 indicates that it's a model which is based upon putting 8 all the cancers together that they do not provide 9 separate risk models for. So it's not a specific model 10 for CLL, it is just using the general model that you get 11 if you put all the cancer types that you don't have 12 a separate model for together. So I didn't consider 13 this represented a viable and suitable model. 14 DR BUSBY: Dr Haylock, have you ever gone and actually 15 looked at the NIOSH-IREP model? 16 A. Yes. 17 Q. On the Internet, do you agree you can find a list of 18 cancers on which you can click on a specific cancer? 19 A. It lists -- it divides cancers up into whether they were 20 group 1, where they have an individual model, or group 21 2, where the risk is derived from a general model and 22 CLL appears to fall into group 2 and it's derived from 23 this overall grouping of cancers that are not separately 24 done in group 1. 25 Q. So if you were to go to the NIOSH-IREP model and you</p> <p style="text-align: center;">Page 22</p>	<p>1 A. Definitely not, particularly given the fact that there 2 is no other evidence that CLL can be caused by radiation 3 exposure from large epidemiological studies. 4 DR BUSBY: Dr Haylock, why do you think that the NIOSH 5 organisation, agency, decided in 2012 that CLL was 6 a radiogenic cancer? 7 A. I don't know, but I don't believe it was based on good 8 quality epidemiological evidence. 9 Q. So this is you against NIOSH-IREP, is that fair to say? 10 A. NIOSH don't -- I could not find that they have published 11 the reasons why they decided to compensate for that 12 disease. It doesn't appear to be publicly available. 13 Q. It wasn't given to you by the defence? 14 A. I've looked on the NIOSH-IREP site and all it says is 15 that it's listed in this second group and this decision 16 was made, it changed from being absolutely zero risk 17 to -- to not a zero risk but not a specific risk model 18 type of calculation. So I don't believe it was done on 19 the basis of epidemiological evidence. 20 Q. So you're not aware of quite a large report that was 21 actually provided by the Secretary of State which 22 covered -- which was a report by the NIOSH on this exact 23 issue? 24 A. I was not provided with that report. 25 Q. Well, we're a bit short of time so we can't go any</p> <p style="text-align: center;">Page 24</p>

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<p>1 further with that one. 2 I would like to ask you now about pancreatic cancer. 3 Do you believe pancreatic cancer is radiogenic? Are you 4 able to help us with that? 5 A. I can, I think, and I don't believe it's radiogenic. 6 Q. Again, the NIOSH-IREP system would enable you to provide 7 a positive probability of causation? 8 A. That's system is used by the Americans for their 9 purposes. I was asked as my expert opinion did I think 10 that and would I want to do a probability of causation 11 calculation, and my expert opinion was no, I wouldn't. 12 Q. When you produce a probability of causation, you use the 13 equation excess relative risk over 1 plus excess 14 relative risk, is that correct? 15 A. Yes. 16 Q. What does the "1" stand for? 17 A. It's the underlying risk. 18 Q. The underlying risk where? 19 A. The other risk in relation to the disease. 20 Q. But the underlying risk in what? In the national 21 population? 22 A. Yes. 23 Q. So where would you get that number from? 24 A. Well, if you are doing simply a relative risk 25 calculation it doesn't feature in it; if you are doing</p> <p style="text-align: center;">Page 25</p>	<p>1 particularly a probability of causation regarding 2 radiation, so the ERR that you are talking about is the 3 excess relative risk per unit dose in the population 4 that you have been exposed to. 5 MR JUSTICE BLAKE: That's the question now. Please, what's 6 the answer? 7 A. Sorry, can you ask again? 8 MR JUSTICE BLAKE: I think it's suggested that it's wrong to 9 use 1 as the underlying risk in the national population. 10 A. No, I disagree. Sorry. 11 DR BUSBY: We're a bit short of time now, so I think there's 12 only room for a couple more points but to go to this 13 question of pancreatic cancer -- 14 A. Yes. 15 Q. -- perhaps we could go to the big Cardis study, the 2005 16 study that we looked at yesterday, which is SB6/68. 17 If I could take you to table 1 -- 18 A. Mm-hm. 19 Q. -- which is on page 308. 20 A. Yes. 21 Q. If we go down that you can see at some point -- in fact 22 I think unfortunately this is printed on both sides so 23 we're going to have to be a bit tricky here. 24 A. Confusing. 25 Q. You can see there's a table for all of these nuclear</p> <p style="text-align: center;">Page 27</p>
<p>1 an absolute risk calculation then it will do, yes. 2 Q. It has to do -- 3 A. You get it from the population from which you draw the 4 individual, ideally. 5 Q. But the national population is not the population you 6 draw the individual from. You draw it from a soldier 7 population, is that not right? 8 A. If you had such a population. 9 Q. So if the soldier population was more healthy than the 10 national population by, say, 20 per cent then it might 11 be more appropriate to put, instead of 1 on the 12 denominator to put 0.8, would that be correct? 13 A. No, because the idea is to look within the population, 14 was there an effect of radiation? 15 Q. Which population? 16 A. The population from which the person is drawn. 17 Q. Which is what population I'm asking you? 18 MR JUSTICE BLAKE: Is that the UK population of people of a 19 certain age or -- 20 A. It depends what group you are talking about. Are you 21 talking about the whole -- are you interested in risk in 22 relation to the whole population or are you interested 23 in risk in relation to just soldiers? 24 DR BUSBY: We're interested in risk in relation to people 25 who have been exposed to radiation because this is</p> <p style="text-align: center;">Page 26</p>	<p>1 workers and it gives 272 cases of pancreatic cancer? 2 A. Yes. 3 Q. And you see observed and expected? 4 A. Yes. 5 Q. But that's not what I'm interested in, and in order to 6 determine which -- because we are going to go over the 7 page now, so we are going to count up from the bottom 8 and go 20, so if we go up 20. 9 MR JUSTICE BLAKE: This is page 399 you are on? 10 DR BUSBY: 399. We want to go up 20 numbers, in order to 11 get to the point, in order to get to where it says "ERR 12 per sievert" which is three columns from the right. 13 A. 2.10? 14 Q. That's right. 15 Would you agree the excess relative risk per sievert 16 in this population is 2.1 per sievert? 17 A. Uh-huh. 18 Q. So if you fed that into a probability of causation, 19 you'd have whatever your dose was that Mr Hallard 20 provided you, multiplied by 2.1, divided by 1, plus 21 whatever that was. That's how you do it, isn't it? 22 A. That is how you do it, yes. 23 Q. That would give you a positive answer, wouldn't it? 24 A. Could I point out -- 25 Q. Could you answer the question?</p> <p style="text-align: center;">Page 28</p>

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<p>1 MR JUSTICE BLAKE: Hang on.</p> <p>2 A. Yes, it would give you a --</p> <p>3 Q. And a positive answer means -- sorry.</p> <p>4 MR JUSTICE BLAKE: He wanted to add something to his answer.</p> <p>5 A. I wanted to add that that excess risk is not -- if you</p> <p>6 look at the confidence interval next to it, that</p> <p>7 confidence interval has a lower bound which is negative,</p> <p>8 implying that the data does not support that that excess</p> <p>9 risk is statistically significantly different from no</p> <p>10 risk.</p> <p>11 DR BUSBY: That may be true but then that may be true due to</p> <p>12 the fact that pancreatic cancer has a very low</p> <p>13 probability anyway and there are only 272 cases in this</p> <p>14 population, column 1, is that correct?</p> <p>15 A. It might well do, yes. Yes, certainly.</p> <p>16 Could I also make another point --</p> <p>17 MR JUSTICE BLAKE: Please.</p> <p>18 A. -- if you don't mind, that one of the issues with doing</p> <p>19 this sort of study is that when you do lots and lots of</p> <p>20 tests to look for effects on many, many diseases, then</p> <p>21 by the nature of the statistical tests we do you tend to</p> <p>22 see random occurrences happening about 1 in 20 times if</p> <p>23 we use a P value of 0.05 to indicate the statistical</p> <p>24 significance. So for every 20 tests you might expect</p> <p>25 one test to come out significant by random chance.</p> <p style="text-align: center;">Page 29</p>	<p>1 This is a simple binomial calculation, but did you</p> <p>2 do it?</p> <p>3 A. In a population of 13 appellants?</p> <p>4 Q. Yes. We did point this out to you in the question that</p> <p>5 we sent through. Maybe you didn't get those questions?</p> <p>6 A. I did get them, but I didn't interpret it in that way,</p> <p>7 I'm sorry. I didn't understand your question to mean</p> <p>8 exactly that specific point.</p> <p>9 Q. Well, let me put it this way. Say we had -- the</p> <p>10 individual probability of dying of pancreatic cancer is</p> <p>11 known, it's about 4 per cent.</p> <p>12 A. I did some other calculations as well, because you'd</p> <p>13 asked about this question, and I looked at a population</p> <p>14 of people. I assumed a person who was born in 1939 and</p> <p>15 who was known to be alive in 1959, because they had to</p> <p>16 be, say, 20 years old at the test and followed through</p> <p>17 until that person was aged 70 and looked at: what will</p> <p>18 be the probability for a typical person in the UK</p> <p>19 population with that age, with that birth date and known</p> <p>20 to be alive at a certain time? And it came out as half</p> <p>21 a per cent. So I would expect if you had a group of</p> <p>22 people with that profile you would expect half</p> <p>23 a per cent of them to die of pancreatic cancer by the</p> <p>24 time they got to the age of 70.</p> <p>25 DR BUSBY: Right, so in other words --</p> <p style="text-align: center;">Page 31</p>
<p>1 So in this situation here we're doing quite a few</p> <p>2 different tests. So I think we have to be clear that</p> <p>3 when a test like -- when a test is shown as significant</p> <p>4 then we have to make sure that that has a -- in order to</p> <p>5 accept it as a hypothesis-testing study, that there was</p> <p>6 a prior hypothesis that this might have happened.</p> <p>7 Otherwise it would be only considered as</p> <p>8 hypothesis-generating because of the chances of it</p> <p>9 occurring at random.</p> <p>10 So we do see in some of these studies incidences of</p> <p>11 significant P values and we have to take that into</p> <p>12 account. But in this case we wouldn't say there was any</p> <p>13 evidence from this study that pancreatic cancer was</p> <p>14 raised with radiation.</p> <p>15 MR JUSTICE BLAKE: Because of the P value?</p> <p>16 A. Because of the P value, and because the lower bound of</p> <p>17 the confidence interval goes below -- shows the excess</p> <p>18 could be zero.</p> <p>19 DR BUSBY: Well, thank you. I'm glad that you went to the</p> <p>20 question of probability tests, because we can ask you to</p> <p>21 do one. I think on May 18 we floated a few questions</p> <p>22 across, which I hope you got. One of them was to</p> <p>23 estimate the probability that four veterans would</p> <p>24 develop pancreatic cancer and die of it in a population</p> <p>25 of 13 appellants.</p> <p style="text-align: center;">Page 30</p>	<p>1 MR JUSTICE BLAKE: I'm losing this rapidly.</p> <p>2 In tab 2.22 I thought you were giving answers to</p> <p>3 questions. There are other questions that you've also</p> <p>4 been asked, are there? Because I don't see this</p> <p>5 question.</p> <p>6 MR HEPPINSTALL: I don't want to intrude on the</p> <p>7 cross-examination but it may be worth looking at the</p> <p>8 point that's being made itself in the amended statement</p> <p>9 of case, which is SB1/1.2A, page 49. Then you can see</p> <p>10 the context.</p> <p>11 So Dr Busby has raised this issue.</p> <p>12 MR JUSTICE BLAKE: In the statement of case, not in the</p> <p>13 questions?</p> <p>14 MR HEPPINSTALL: No, he then, to be fair, on 18 May sent</p> <p>15 some questions.</p> <p>16 MR JUSTICE BLAKE: Some further questions?</p> <p>17 MR HEPPINSTALL: He said he was going to tell our witnesses</p> <p>18 what questions he was going to ask in cross-examination.</p> <p>19 MR JUSTICE BLAKE: We haven't had an answer to this question</p> <p>20 before now.</p> <p>21 MR HEPPINSTALL: No, not a written answer. At least you'll</p> <p>22 see the --</p> <p>23 MR JUSTICE BLAKE: Then I'd better --</p> <p>24 MR HEPPINSTALL: All right. That gives you the question,</p> <p>25 anyway.</p> <p style="text-align: center;">Page 32</p>

<p>1 MR JUSTICE BLAKE: Well, do you understand the question?</p> <p>2 You were asked a question outside the questions,</p> <p>3 I think.</p> <p>4 A. Yes.</p> <p>5 MR JUSTICE BLAKE: Right.</p> <p>6 A. The question Dr Busby posed was not what I interpreted</p> <p>7 from what he wrote down.</p> <p>8 MR JUSTICE BLAKE: Since we're taking the answer raw, as</p> <p>9 opposed to looking at something you've already done, can</p> <p>10 you just repeat what calculation you have done and then</p> <p>11 we'll see where we go from there.</p> <p>12 A. Okay. So in order to -- what I thought I was doing for</p> <p>13 Dr Busby, I assumed a person who or a population of</p> <p>14 people born in 1939 that were known to be alive in 1959,</p> <p>15 i.e. they had reached the age of 20.</p> <p>16 MR JUSTICE BLAKE: In 1939, alive in 1959.</p> <p>17 A. Then I followed them through until they reached the age</p> <p>18 of 70 and said: of that group how many would we expect</p> <p>19 to die of pancreatic cancer based upon England and Wales</p> <p>20 national rates?</p> <p>21 MR JUSTICE BLAKE: Yes.</p> <p>22 A. I found half a per cent.</p> <p>23 DR BUSBY: That was part of what I asked you to do.</p> <p>24 MR JUSTICE BLAKE: Right.</p> <p>25 DR BUSBY: But the main thing I was asking you to do was to</p> <p style="text-align: center;">Page 33</p>	<p>1 A. Yes, that I think that the fact that Dr Busby knows</p> <p>2 about these pancreatic cancers is because these people</p> <p>3 are part of his Test Veterans' Association. I was</p> <p>4 looking at: what is the probability of these things</p> <p>5 occurring by normal -- by causes other than radiation or</p> <p>6 other than being in the test, amongst the whole group of</p> <p>7 veterans? So what I did was apply that half a per cent</p> <p>8 to the population of test veterans, and we have 20,000</p> <p>9 test veterans, so half a per cent of 20,000, assuming</p> <p>10 they were all the same as Mr Battersby, and that would</p> <p>11 give you a number of 100. So I would say in the test</p> <p>12 veterans cohort you might expect on the basis of</p> <p>13 national rates to see about 100 pancreatic cancers, and</p> <p>14 up to -- of the cohort that we have at Public Health</p> <p>15 England at the last analysis they were 77. That was</p> <p>16 done in 1998 so I might expect there to be a few more</p> <p>17 now.</p> <p>18 So the fact that Dr Busby knows about four --</p> <p>19 MR JUSTICE BLAKE: Four.</p> <p>20 A. -- doesn't seem remotely unusual to me, particularly</p> <p>21 seeing as he is representing people who are part of an</p> <p>22 organisation who might have concerns that diseases are</p> <p>23 caused by the test. I don't believe that's remotely</p> <p>24 unusual at all.</p> <p>25 DR BUSBY: Well, let me put it another way. Actually maybe</p> <p style="text-align: center;">Page 35</p>
<p>1 calculate the probability that four of those people</p> <p>2 would end up in this Tribunal out of 13 -- cancer --</p> <p>3 A. I couldn't do that because we don't have the information</p> <p>4 to do that.</p> <p>5 Q. Well, of course, it's a simple binomial calculation,</p> <p>6 isn't it? It's like how many people -- if you throw</p> <p>7 a dice so many times, what's the probability of getting</p> <p>8 6, six times out of 13 throws? Or not a 6 in this case,</p> <p>9 a 0.5 per cent?</p> <p>10 A. Your question doesn't make sense because what you are</p> <p>11 saying does not apply to the whole population of test</p> <p>12 veterans. You're asking a question about people who you</p> <p>13 already know about, not people -- not more widely. It's</p> <p>14 not a sensible question to ask, I'm afraid.</p> <p>15 MR JUSTICE BLAKE: Is there any statistical significance on</p> <p>16 the question of linkage between the fact that -- the age</p> <p>17 data you've given us are Battersby data, date of birth,</p> <p>18 date of cancer, date of exposure, right? You have come</p> <p>19 up with half a per cent risk of such a person developing</p> <p>20 a cancer.</p> <p>21 We're told that Mr Battersby did develop a cancer --</p> <p>22 such a cancer -- and we're also told that in this appeal</p> <p>23 of 13 other veterans of different ages, et cetera, four</p> <p>24 have developed pancreatic cancer.</p> <p>25 Any comment upon that?</p> <p style="text-align: center;">Page 34</p>	<p>1 I can see we're not going to get very far with this but</p> <p>2 I am just going to put it once more to you because you</p> <p>3 haven't really done what I asked you to do.</p> <p>4 A. It was not a sensible thing you were asking for.</p> <p>5 MR JUSTICE BLAKE: Anyway --</p> <p>6 DR BUSBY: For whatever reason.</p> <p>7 MR JUSTICE BLAKE: -- put the last question because I think</p> <p>8 he may have done, but there we are.</p> <p>9 DR BUSBY: Okay, well, in that case let's just go to</p> <p>10 SB7/113. This is the last question.</p> <p>11 MR JUSTICE BLAKE: Yes. This is the mortality experience of</p> <p>12 A bomb survivors?</p> <p>13 DR BUSBY: That's correct, my Lord. This is the 1973 annual</p> <p>14 report from the Atomic Bomb Casualty Commission.</p> <p>15 A. I have it.</p> <p>16 Q. Can I take you to page 6 of that report?</p> <p>17 MR JUSTICE BLAKE: Right.</p> <p>18 DR BUSBY: Now this report is interesting because it was one</p> <p>19 of the first reports that said what it's saying --</p> <p>20 MR JUSTICE BLAKE: Which paragraph do you want to take us</p> <p>21 to?</p> <p>22 DR BUSBY: We're looking at "comparison group".</p> <p>23 MR JUSTICE BLAKE: Do you see that, about in the middle of</p> <p>24 the page?</p> <p>25 A. I have it.</p> <p style="text-align: center;">Page 36</p>

<p>1 DR BUSBY: It says: 2 "In order to ascertain the effects of radiation 3 exposure, it is necessary to compare the mortality 4 experience of a population exposed to ionising radiation 5 with a comparison or control population." 6 Would you agree with that as a sort of general 7 epidemiological statement? 8 A. It's one way. I don't believe it's the only way or even 9 the best way. 10 Q. Right: 11 "For this purpose a group of people who were not 12 present in the cities was included in the sample." 13 Would that have seemed a reasonable thing to do? 14 A. It depends what question you want to answer. 15 Q. I think the question -- you know the question they want 16 to answer. Perhaps you could tell us the question they 17 want to answer? 18 A. Well, if you are saying if you want to compare that 19 group with the group who were exposed to the bombs and 20 compare their health, then -- 21 Q. I asked you what the question was that they wanted to 22 answer. 23 MR JUSTICE BLAKE: Well -- 24 DR BUSBY: Could you answer that question? 25 MR JUSTICE BLAKE: Well, do you know what question was being</p> <p style="text-align: center;">Page 37</p>	<p>1 MR JUSTICE BLAKE: Low mortality? 2 DR BUSBY: It says: 3 "The low mortality for the not in city group would 4 have the effect of exaggerating the difference in 5 mortality between the heavily exposed population and the 6 control group." 7 A. Right. 8 Q. This is what they are saying. I ask you to accept that 9 that's what they are saying, really, because we are 10 going to go on to the killer point over the page. 11 A. I agree that's the point they wanted to make. 12 Q. Yes, right. Can we go to the next page, 7, top of the 13 page now? 14 A. Mm-hm. 15 Q. "The use of the low dose survivors as a comparison group 16 is endorsed by the Subcommittee on Somatic Effects of 17 the Advisory Committee on the Biological Effects of 18 Ionising Radiations. It was felt that 'some relatively 19 small contaminations on the side of dosimetry is 20 potentially less disturbing than the known large 21 differences that mark the NIC group with respect to 22 occupation, social class, and perhaps other factors'." 23 Does that seem reasonable to you? 24 A. It does. 25 Q. So can we go back to page 6 now, right at the bottom,</p> <p style="text-align: center;">Page 39</p>
<p>1 posed by the authors of this study? And therefore 2 I think you are then being asked as to whether what they 3 said they were doing by way of a comparison group was an 4 appropriate -- 5 A. I think they are trying to compare and see if the health 6 of the people who were exposed to the bombs is 7 significantly worse than that of the group that wasn't 8 in the city at the time of the bomb. 9 DR BUSBY: Well, could you agree -- 10 MR JUSTICE BLAKE: If that's the purpose, then is what they 11 have done -- I think you are being asked to comment upon 12 the methodology. 13 A. I believe there was an issue with this in that when it 14 was looked at the not in city group -- 15 DR BUSBY: We haven't got a lot of time. 16 MR JUSTICE BLAKE: Sorry, what's the question? Ask the 17 question. 18 DR BUSBY: I have asked him the question, my Lord. 19 MR JUSTICE BLAKE: Do it again because I don't think -- 20 DR BUSBY: What was the purpose of this study? 21 MR JUSTICE BLAKE: Well, he has told you the answer. 22 DR BUSBY: In that case we can move on. 23 MR JUSTICE BLAKE: Right. 24 DR BUSBY: We are going to go to the bottom of this page 25 now.</p> <p style="text-align: center;">Page 38</p>	<p>1 and see what they are talking about. So going back to 2 that last paragraph, where they say: 3 "Although the tables include comparisons between 4 early and late entrants and between the not in city and 5 exposed populations, the discussions will be confined 6 mostly to the comparison between the mortality of a low 7 dose group and the more heavily exposed population 8 groups." 9 What does that mean? 10 A. As I understand it, it means that they are not using the 11 not in city group as an appropriate comparison group but 12 doing essentially a within comparison, where you're 13 looking at people who were, they think, lowly exposed at 14 the time of the bomb versus people who are more highly 15 exposed to see if there's a difference in that exposure. 16 Q. Thank you. So they threw out their control group, is 17 that correct? 18 A. Yes. 19 DR BUSBY: Yes. That's all. No further questions. 20 MR JUSTICE BLAKE: Thank you very much. 21 MR HEPPINSTALL: Were we planning to have the break at this 22 moment? 23 MR JUSTICE BLAKE: We were planning to have a break a little 24 later but can we just pause a moment. Do you just want 25 to sit down for a second? Would it be helpful if we</p> <p style="text-align: center;">Page 40</p>

<p>1 just asked a couple of questions before you re-examine? 2 MR HEPPINSTALL: It was helpful last time, my Lord. 3 MR JUSTICE BLAKE: I'm not sure that it -- I mean in that 4 order rather than -- 5 MR HEPPINSTALL: It shortened my re-examination because we 6 had the same questions. 7 Questions from the Tribunal 8 MR JUSTICE BLAKE: Well, it was simply on your reading list 9 last night, and I'm sorry, you had an interesting 10 evening. We asked you to look also at the Schmitz 11 Feuerhake paper. 12 A. Indeed. 13 MR JUSTICE BLAKE: Do you have any comments on that paper as 14 an epidemiologist or biostatistician? 15 A. The paper is not in a sense a study in itself. It 16 appears to be a review of other studies, and as such 17 I did not have access to many of those papers. 18 I confined myself to looking at the ones relating to 19 the matter at hand which was about the -- relating to 20 table 2, where we're talking about congenital 21 malformations. 22 MR JUSTICE BLAKE: Yes. 23 A. So, as I say, it appears to be a review but it's not 24 a review in the sense that I would have understood it 25 and would have done myself, where you would look at the</p> <p style="text-align: center;">Page 41</p>	<p>1 The authors were selecting information. 2 A. I mean he refers to many, many studies here, my Lord, 3 and it's not possible -- 4 MR JUSTICE BLAKE: No, no. 5 A. -- to have gone through all of them and looked at 6 them -- 7 MR JUSTICE BLAKE: I think you have given us that -- 8 A. It would not -- I don't think it would -- in the kind of 9 journal I would want to publish I don't think it would 10 be seen as a fair and balanced review of the studies. 11 MR JUSTICE BLAKE: Yes. 12 Thank you. I think that was the topic which I'd 13 identified on my notes. But you are going to be asked 14 some questions in re-examination by Mr Heppinstall. 15 Re-examination by MR HEPPINSTALL 16 MR HEPPINSTALL: You were very recently asked questions 17 about the NIOSH -- 18 A. Yes. 19 Q. -- judgment, as it were, on chronic lymphatic leukaemia. 20 Could you take a up SB22 and have a look at tab 8, 21 please. 22 A. I don't have anything -- 23 Q. Nothing in tab 8. (Handed) 24 This is taken from the Federal Register of the 25 United States Government. You can see that at the first</p> <p style="text-align: center;">Page 43</p>
<p>1 studies and give a -- dare I say try and give a balanced 2 view as to the plus points and the negative points. 3 Looking at this, Dr Busby appears to have picked out 4 points from the studies which support his argument, but 5 doesn't seem to take into account any of the issues with 6 these studies as to whether those points are valid or 7 not. 8 MR JUSTICE BLAKE: So it's a review in selecting material 9 from previous studies -- 10 A. He appears to be selecting material from previous 11 studies that support his point of view. 12 MR JUSTICE BLAKE: Rather than -- 13 A. Rather than what I would consider an epidemiological 14 review, where you critically review the quality of the 15 studies along with the results they show. Because 16 I think you can't separate the two; the results and the 17 review of the quality of the study go hand-in-hand. 18 MR JUSTICE BLAKE: Yes. 19 A. Some of the studies relate to his own work as well, 20 I note. 21 MR JUSTICE BLAKE: Right. 22 A. So I mean I tried to look at one or two of the papers 23 and, well, that's -- my view was that he was selecting 24 information that was supporting his cause -- 25 MR JUSTICE BLAKE: I think there's a number of authors, yes.</p> <p style="text-align: center;">Page 42</p>	<p>1 page, second column, it starts: 2 "Discussion on the guidelines for determining 3 probability of causation under the Energy Employees 4 Occupational Illness Act." 5 If you turn over the page, there are page numbers, 6 very large, to 15,269, so that's about three pages in, 7 and on the second column there's section B: 8 "NIOSH reconsideration of CLL." 9 MR JUSTICE BLAKE: Are you there? Do you have that? 10 A. Yes. 11 MR JUSTICE BLAKE: Well done. 12 A. I was trying to recall this earlier, my Lord. 13 MR JUSTICE BLAKE: Right, here we have it. 14 MR HEPPINSTALL: And can you just tell us, do you know what 15 NIOSH is? 16 A. National Institute of Occupational Health? 17 Q. But is it a US Government advisory body? 18 A. Yes, it is. Sorry. 19 Q. And if we just look at this first sentence it says: 20 "In the original technical documentation for 21 NIOSH-IREP, the discussion of the rationale for 22 excluding CLL from consideration under the relevant 23 legislation stated that this decision would be revisited 24 as new scientific information became available." 25 So were you aware that in 2011 there was</p> <p style="text-align: center;">Page 44</p>

<p>1 a reconsideration of the exclusion of CLL? 2 A. Yes, I was. 3 Q. And, as can be read by anybody reading it, there's 4 various activities, public meetings, consultations, 5 et cetera, and we can see on that third column, about 6 halfway down, can you see the bit that starts "The 7 consensus among the panelists was ..."? 8 MR JUSTICE BLAKE: After footnote 10. 9 MR HEPPINSTALL: Thank you. Do you see that? 10 A. Yes I have it. 11 Q. "The consensus among the panelists was that the current 12 scientific evidence was inconclusive with respect to 13 CLL's association with ionising radiation. Additional 14 research was required to definitively answer this 15 question." 16 Do you see that? 17 A. I do. 18 Q. Going on, they say: 19 "Subsequent to the July meeting, five additional 20 subject matter experts, unaffiliated with NIOSH, were 21 asked by NIOSH's Division of Compensation Analysis and 22 Support to provide their individual judgments as to 23 whether the evidence of an association or lack thereof 24 between radiation exposure and the risk of developing 25 CLL is sufficient to continue to regard CLL as</p> <p style="text-align: center;">Page 45</p>	<p>1 Q. "A second reviewer found no evidence on epidemiological 2 grounds to support the contention that CLL is induced by 3 radiation." 4 Do you see that? 5 A. Yes. 6 Q. There's then a quote and also it says: 7 "The reviewer did comment, however, that CLL remains 8 one of the most controversial issues in radiation 9 epidemiology." 10 Do you have anything to say about that? 11 A. Controversial, I'm -- I'm not really convinced about 12 that. All the large studies that we see so far in 13 general have very, very few occurrences of CLL and 14 really there is no evidence that I know of 15 epidemiological studies that support the assertion that 16 CLL can be caused by radiation. 17 Q. If we go to the next column we can find the third 18 reviewer. We just looked at the first two, so if you 19 look at the second paragraph, column 2: 20 "A third reviewer concluded that in fact the 21 scientific evidence pertaining to the molecular 22 mechanisms of CLL induction weighs heavily towards the 23 conclusion that CCL is similar to other ...(Reading to 24 the words)... to a malignant transformation of a cell. 25 The weight of this scientific evidence is in support of</p> <p style="text-align: center;">Page 47</p>
<p>1 a non-radiogenic cancer and continue to exclude it ..." 2 Essentially from the scheme. Were you aware of that 3 review? 4 A. Yes, I was. 5 Q. Then if we go over the page they give us the results 6 from the five reviewers, so 15270, first column, second 7 paragraph -- 8 MR JUSTICE BLAKE: "The experts chosen ..." 9 MR HEPPINSTALL: "The experts chosen for this review were 10 selected by NIOSH based on their past experience in the 11 area of radiation and epidemiology with the goal of 12 obtaining a diverse range of perspectives on the matter. 13 Each of the five experts ...(Reading to the words)... 14 scientific opinion about the weight of the evidence. 15 The full text of those opinions are available in the 16 docket for this rule making." 17 Then it goes through, do you see, what each reviewer 18 said? 19 A. I see, yes. 20 Q. So: 21 "One reviewer concluded that the available evidence 22 is insufficient to rule out an association between 23 ionising radiation and CLL." 24 Do you recall that? 25 A. Mm-hm.</p> <p style="text-align: center;">Page 46</p>	<p>1 the conclusion that the somatic mutations that 2 contribute to the genesis of CLL can be produced by 3 ionising radiation." 4 Well, I don't need to summarise it because the 5 conclusion comes next: 6 "Scientific evidence does not provide a sufficient 7 basis for regarding CLL as non-radiogenic." 8 So the third reviewer was in favour? 9 A. But not apparently for epidemiological reasons. 10 Q. What reasons is that third reviewer giving, or what type 11 of reasons? 12 A. Biological reasoning. 13 Q. Then we get the conclusion of the fourth reviewer: 14 "My expert opinion supports including CLL as 15 a radiogenic cancer and against the continuing, and it 16 seems to me arbitrary, practice of exclusion." 17 So we know the conclusion of the fourth reviewer, 18 but I don't think we know on what basis, looking at 19 this. 20 A. Yes. 21 Q. Then the fifth reviewer found that the body of 22 scientific evidence indicates that CLL is not caused by 23 exposure to ionising radiation at any level of dose. 24 Do you see that? 25 A. Yes.</p> <p style="text-align: center;">Page 48</p>

<p>1 Q. Then we have the summary from NIOSH in the third column, 2 second paragraph: 3 "In sum, of the five reviewers, three offered their 4 support for the consideration of CLL as radiogenic for 5 the purposes of potential compensation." 6 Then they give a summary of that. 7 Then I think the rest is dealing with the risk 8 model. 9 But if we move on to 15271, we get the agency's 10 judgment in the second paragraph of the third column, 11 which starts "Finally, in the Agency's judgment ..." Do 12 you see that? 13 A. I do. 14 Q. "Finally, in the Agency's judgment including CLL as a 15 potentially compensable cancer would be in keeping with 16 the already established Federal policy." 17 Then it says: 18 "With respect to the radiogenicity of CLL the Agency 19 finds the evidence of radiogenicity offered by 20 epidemiological studies to be non-determinative ..." 21 Do you agree with that? 22 A. Yes. 23 Q. "... but no longer believes that it is possible to state 24 that the probability of causation equals zero." 25 Are you aware that the legal test for inclusion or</p> <p style="text-align: center;">Page 49</p>	<p>1 "The CLL risk model was quantitatively tested by 2 calculating probability of causation results ..." 3 Is that the same sort of thing that you have done 4 for the Tribunal? 5 A. I believe so. 6 Q. "... for males between 20 and 40 years of age 7 hypothetically exposed to 1 sievert [so 1000 8 millisieverts] of high energy gamma radiation." 9 Then we see the results: 10 "Although the evaluations were restricted to 11 exposure for males, the same results for females ..." 12 Et cetera. 13 "The results of these evaluations indicate that the 14 probability of causation exceeds 50 per cent only at the 15 99 percentile, and then only for time since exposure 16 greater than 15 years for men initially exposed to 17 age 20." 18 Now, is that a finding that surprises you or doesn't 19 surprise you? 20 A. It doesn't surprise me in that the 99th percentile is 21 a very high point. 22 Q. But the fact that the doubling of the risk to the 23 50 per cent threshold is only crossed at 1 sievert, does 24 that surprise you? 25 A. I'd say that seems quite low.</p> <p style="text-align: center;">Page 51</p>
<p>1 exclusion is that the risk has to be above zero? 2 A. Yes, I am. 3 Q. Then it goes on to say: 4 "NIOSH has waived the non-determinative 5 epidemiological evidence. The mechanistic argument of 6 CLL causation, similarities between CLL and other 7 compensated cancers, the classification of CLL and the 8 treatment of CLL is potentially compensable radiogenic 9 cancer by veterans agency, and finds sufficient evidence 10 to include CLL as a compensable cancer under the 11 legislation, thus allow claimants with CLL to be 12 eligible for dose reconstruction." 13 You're aware of that decision? 14 A. Mm-hm. 15 Q. So the decision is you are allowed to be eligible for 16 dose reconstruction. 17 Then as I think you answered in cross-examination 18 the next stage then is to develop a risk model? 19 A. Mm-hm. 20 Q. If you turn over the page to page 15272, the middle 21 column there, the second column is discussing a draft 22 report which is about developing that risk model for 23 CLL. Do you see that? 24 A. Yes. 25 Q. And you can see in the second paragraph:</p> <p style="text-align: center;">Page 50</p>	<p>1 Q. Maybe read the next sentence: 2 "Doses higher than 1 sievert will be required to 3 produce 99th percentile values of probability of 4 causation that equal or exceed a value of 50 per cent 5 for older ages at time of exposure, at time of 6 diagnosis." 7 Do you agree with that? 8 A. Yes. 9 MR JUSTICE BLAKE: 1 sievert is quite a high dose? 10 A. Yes, that's a lot. 11 MR JUSTICE BLAKE: We're talking about millisieverts? 12 A. Yes. 13 MR JUSTICE BLAKE: I just wanted to clarify from all that 14 quotation you agreed at 15271: 15 "The Agency finds the evidence of radiogenicity 16 offered by epidemiology studies to be 17 non-determinative." 18 That means what? That there is no evidence from 19 epidemiology that CLL is caused by radiation? 20 A. Yes, the number of CLL cases we see in big 21 epidemiological studies is really, really small. So in 22 a sense -- 23 MR JUSTICE BLAKE: Epidemiology can't assist or it rules 24 out? 25 A. In a sense it's -- well, in a way it's providing some</p> <p style="text-align: center;">Page 52</p>

<p>1 reassurance that despite receiving radiation we're not 2 seeing in fact a high occurrence of these diseases. In 3 the lifespan study I believe in the latest analysis of 4 leukaemia incidence there were only 12 cases that were 5 used so there's such a tiny number that it's -- you 6 know, it doesn't provide any useful information in 7 a sense. 8 MR JUSTICE BLAKE: Right. So that's what 9 "non-determinative" means? 10 A. Yes. 11 MR JUSTICE BLAKE: Epidemiological studies can provide no 12 useful information? 13 A. I presume it means on the balance of all the evidence 14 that they can't say it's absolutely zero. I mean, we do 15 see 12 cases. Those 12 cases could have been caused by 16 radiation but it's certainly not within the -- 17 epidemiology couldn't say that. The number of cases is 18 just so so tiny. 19 MR JUSTICE BLAKE: All right. If that completes that topic 20 -- 21 MR HEPPINSTALL: On that topic, yes. 22 MR JUSTICE BLAKE: -- it probably is time now for a break. 23 So what are we now? Come back at 25 to. 24 (11.24 am) 25 (A short break)</p> <p style="text-align: center;">Page 53</p>	<p>1 Operations Grapple X, Y and Z and we see those, do we 2 not, on the left-hand side with numbers given for 3 numbers of participants by service on the right-hand 4 side? 5 A. Mm-hm. Yes. 6 Q. Above that, Mr Battersby was at Operation Buffalo. Do 7 we get the same data there as well? The fourth one 8 down. 9 A. Yes, just about. 10 Q. Now, I just want to turn to section 3 of this paper at 11 page 221. Actually, it's just the facing page, which 12 discusses non-UK nuclear weapons test studies, the 13 studies into other countries' veterans. If we turn over 14 the page, about halfway down it says: 15 "An early study examined the health of Australian 16 participants." 17 Do you see that? 18 A. Yes. 19 Q. Then the last couple of sentences in that paragraph: 20 "More recently, a cohort study of mortality and 21 cancer incidence in Australian participants in the UK 22 nuclear weapons tests in Australia has been set up. 23 This cohort study is being overseen by an independent 24 scientific advisory committee." 25 Is that the study that we know as Carter?</p> <p style="text-align: center;">Page 55</p>
<p>1 (11.35 am) 2 3 MR HEPPINSTALL: SB17/11, please. You were asked questions 4 by my learned friend Mr ter Haar in respect of the UK 5 NRPB epidemiological studies into UK test veterans. 6 This, I think, is a paper that you are familiar 7 with? 8 A. I am. 9 Q. If you look at the fifth named author, I think that's 10 you, isn't it? 11 A. Yes, it is. 12 Q. Is the fourth named author Sir Richard Doll who we were 13 discussing during your cross-examination? 14 A. Indeed, yes. 15 Q. And if we just turn over the page, you gave a figure of 16 20,000 test veterans and we see there, over the page, 17 a table which gives a total of 21,357 participants. 18 There's a difference between involvements and 19 participants. Perhaps you could tell us why that is? 20 A. There were inclusion criteria in terms of what these 21 people -- whether they were eligible to be included in 22 the study. There were a pool of people who were 23 potentially eligible and we selected from those. That 24 describes the difference. 25 Q. For the Tribunal's interest, we are here concerned with</p> <p style="text-align: center;">Page 54</p>	<p>1 A. I don't know, to be honest. 2 Q. Ah, very well. 3 A. Sorry. 4 Q. Okay. In the next paragraph we see the US five series 5 study, so is it also the case that the United States 6 Government carried out an epidemiological study? 7 A. Yes, a large one. 8 Q. Then over the next page in the next paragraph it says 9 "For the New Zealand study ..." 10 Is it also right that a study of the New Zealand 11 test veterans was carried out? 12 A. Yes. 13 MR JUSTICE BLAKE: That's not the Wahab study, or is it? 14 A. I don't think so, no. 15 MR HEPPINSTALL: Can we just leave that open but if you just 16 turn to SB22/4. 17 MR JUSTICE BLAKE: What should be in SB22/4? 18 MR HEPPINSTALL: The follow-up of New Zealand participants 19 in British atmospheric nuclear weapons tests in the 20 Pacific. 21 A. No. 22 MR JUSTICE BLAKE: SB22 needs a lot of work, but it might be 23 that it's -- 24 MR HEPPINSTALL: I think the copies were handed up during 25 the cross-examination of Professor Schmitz Feuerhake.</p> <p style="text-align: center;">Page 56</p>

<p>1 We've been to it before. 2 MR JUSTICE BLAKE: Yes, it rings a bell. 3 MR HEPPINSTALL: Well, we will put in that tab the Pearce 4 paper but luckily the results are summarised in the one 5 we are looking at, so if you go back to the NRPB paper, 6 we see it says: 7 "The all-causes ..." 8 Can you help me with SMR? 9 A. Standardised mortality rate. 10 Q. You did that without looking. It's at page 223, top of 11 the page. It says: 12 "For the New Zealand study, the all-causes SMR ..." 13 Do you see that? 14 A. Yes. 15 Q. Yes. 16 "... was 114: 17 A. Yes, 114. 18 Q. "The all-causes SMR in the control group was 108." 19 A. Yes. 20 Q. "The relative risk was reported as 1.1, not 21 significantly different from 1. For all cancers the 22 SMRs in participants and controls were 164 respectively 23 with the relative risk again not significantly different 24 from 1." 25 Then if we look at the next paragraph do you agree</p> <p style="text-align: center;">Page 57</p>	<p>1 multiple myeloma in test participants relative to 2 controls." 3 Do you recall that? 4 A. Yes. 5 Q. Then it says over the page: 6 "However, this seemed to be more a consequence of 7 low levels in the controls rather than of elevated 8 levels in test participants." 9 Can you just explain that to us, please? 10 A. Yes. The difference was caused by lower than expected 11 incidence of the disease in the control group compared 12 to the overall population than the -- that being true in 13 the veterans. So the difference -- there was 14 a difference but it's due to low levels in the controls, 15 not due to high levels in the participants. 16 Q. Then if we turn over the page to page 238 and the next 17 substantive paragraph that starts "The second and third 18 analyses ...", do you see that? 19 A. Yes. 20 Q. That says: 21 "... have provided no convincing evidence of excess 22 multiple myeloma amongst test participants. This 23 increases the likelihood that chance was responsible for 24 the difference seen in the first analysis between the 25 rates of multiple myeloma in test participants and the</p> <p style="text-align: center;">Page 59</p>
<p>1 with this: 2 "Neither the studies of US nor New Zealand test 3 participants provide compelling evidence that test 4 participation has influenced the induction of cancer 5 generally." 6 A. Yes, that's clear from this evidence. 7 Q. Then if we turn to the summary of the conclusions which 8 is at page 237 and we look at the second paragraph 9 there, "Three epidemiological analyses", do you see 10 that? Section 6, "Summary". 11 A. Yes. 12 Q. Then the second paragraph: 13 "Three epidemiological analyses of mortality and 14 cancer incidence in UK participants in the UK 15 atmospheric weapons testing programme have been 16 published over a 15 year period. A consistent finding 17 has been the so-called 'healthy soldier effect', that 18 mortality from broad causes of death is generally below 19 that in the general population, but similar to that in a 20 matched series of controls." 21 Do you agree that that's the general conclusion? 22 A. Yes, correct. 23 Q. It goes on to say that: 24 "The first [study] produced a striking excess of 25 leukaemia (excluding chronic lymphatic leukaemia) and of</p> <p style="text-align: center;">Page 58</p>	<p>1 controls." 2 So does that mean or does that not mean that the 3 excess was not replicated in the second and third 4 studies? 5 A. It mean it was not replicated. I agree, yes. 6 Q. It goes on to say: 7 "In the case of leukaemia, however, there is some 8 evidence for a persistent risk." 9 So was that replicated? 10 A. The controls became more like the cases, i.e. there was 11 a rate increase but it was still raised. The difference 12 was still higher in the -- 13 Q. Sorry, you finish. 14 A. There was still more -- there was still more leukaemia 15 in the veterans than in the controls although the 16 difference decreased. 17 Q. Now, you were asked, or criticisms were put to you about 18 the NRPB studies, and do we see in the next paragraph 19 the authors, which of course include you, concede that 20 the study only includes about 85 per cent of men meeting 21 the definition of test participant? 22 A. Yes. This issue was so long as it was a representative 23 85 per cent. 24 Q. We see: 25 "The investigators were very alert to this risk when</p> <p style="text-align: center;">Page 60</p>

<p>1 the cohort was being assembled and indications were that 2 any bias was small." 3 Can you help us as to how they came to that 4 conclusion? 5 A. No, I'm afraid not, due to that was done before I was 6 involved in this. 7 MR JUSTICE BLAKE: This is the Parker criticism of 540 8 missing veterans or something like that? 9 A. No, I think that related to the difference between the 10 first and second analysis. I think this is referring to 11 how the cohort was set up originally, in the first 12 place, and that was -- 13 MR JUSTICE BLAKE: Only 85 per cent. 14 A. -- long before i was involved in this. Yes. Once the 15 cohort had been defined, that was it. 16 MR JUSTICE BLAKE: Obviously you have to go into (inaudible) 17 now to reach some testing conclusion that, excluding 18 15 per cent, didn't significantly distort -- 19 A. In 85 per cent of a population is a very large sample, 20 though, so ... 21 MR HEPPINSTALL: When you say "very large sample", what do 22 you mean? Compared to other epidemiological studies? 23 A. Yes. 24 Q. Now, immediately stop me if I'm going beyond your 25 expertise, but the next paragraph says:</p> <p style="text-align: center;">Page 61</p>	<p>1 Q. The next sentence: 2 "There would be no chance of detect in this against 3 the rather high natural death rate." 4 Then it quotes from table 3, I think. Perhaps we'll 5 look at table 3. Page 227. 6 A. Table 3. So the excess is such a small excess in 7 comparison to the number of deaths we see that there's 8 no chance of seeing it in a statistical way. It's 9 only -- you are only seeing it by using the risk model 10 and interpreting the deaths we see in relation to the 11 risk model. We couldn't see -- we are unlikely to see 12 a difference between the case and controls in that 13 respect. 14 Q. If you turn back to page 238, the final sentence, 15 please, in that paragraph. 16 "However, if radiation exposures were much larger, 17 or if participants were exposed to some other risk 18 factor, then a detectable effect might arise." 19 Do you see that? 20 A. No, I'm not -- 21 Q. It's the last sentence -- 22 MR JUSTICE BLAKE: Back to 238. 23 MR HEPPINSTALL: The third paragraph on page 238. 24 A. Ah, yes. 25 Q. Yes. So we just looked at "there would be no chance of</p> <p style="text-align: center;">Page 63</p>
<p>1 "If the recorded radiation exposures of participants 2 in the UK atmospheric tests were correct the collective 3 dose to participants was about 17 man sieverts." 4 A. I have no personal knowledge of that. 5 Q. Right. 6 MR JUSTICE BLAKE: What's a man -- sievert for man? 7 A. Effectively adding up all the -- 8 MR JUSTICE BLAKE: All the sieverts? 9 A. -- so one man receiving 1 sievert is 1 man sievert, so 10 two men receiving half a sievert is still 1 man sievert. 11 It's a collective -- a term of collective dose. 12 MR HEPPINSTALL: Can you help us with the next sentence: 13 "If there were established radiation risk factors, 14 this implies that about one radiation-induced cancer 15 would be expected in the whole group of test 16 participants." 17 A. Yes. So you're applying the risk models that we have 18 and saying, given that model is true, how many of the 19 deaths we see might be due to radiation. The estimate 20 here is one. 21 Q. The next sentence: 22 "Where would be no chance of detecting this against 23 the rather high natural death rate." 24 Can you help us with that? 25 A. Sorry, can you point that out to me?</p> <p style="text-align: center;">Page 62</p>	<p>1 detecting this against the rather natural high death 2 rate", and then it says: 3 "However, if radiation exposures were much larger or 4 if participants were exposed to some other risk factor 5 then a detectable effect might arise." 6 A. Yes, because you would see a larger difference between 7 the observed cases amongst the test participants than 8 the controls. 9 Q. If there was some other -- 10 A. If there was some other -- 11 Q. -- if there's some other agent at play, whether it be 12 radiation or any other agent. 13 A. Yes. 14 Q. Thank you. 15 Can you take SB5 now, please. This might seem like 16 an odd exercise but I do want to pin down what the 17 studies actually are, because there's been a lot of 18 mention of INWORKS, the National Registry, 15 countries. 19 A. Yes. 20 Q. There are various things in the papers that, to those 21 who are not expert, might think that they were the 22 INWORKS study but they're not, or they may not be. 23 So if we look at SB5/47 first. 24 A. Yes. 25 Q. Now, again, I think you are mentioned as an author, or</p> <p style="text-align: center;">Page 64</p>

<p>1 you were named as an author of this paper. But can you 2 just help us with what this paper is, please?</p> <p>3 A. So we had the 15 countries study which looked at 4 occupational radiation exposure in a range of 15 5 countries. This work takes the data from three of those 6 countries, so the UK, France and the USA. The cohorts 7 that they provided in this 15 country study, it takes 8 those and adds extra follow-up to them.</p> <p>9 So in the 15 country studies the UK contributed the 10 second analysis to the national radiation workers. In 11 this analysis we're looking at the third analysis of 12 that cohort.</p> <p>13 So this is a -- although it has slightly fewer 14 participants compared to the 15 country study it has 15 more statistical power because it has more person years 16 follow-up and more deaths.</p> <p>17 Q. Now, that was published online on 22 June 2015, I think, 18 in The Lancet.</p> <p>19 A. Yes.</p> <p>20 Q. But then if you turn to tab 53, this was another paper 21 on INWORKS published on 9 September 2015, but is it 22 telling us something different or something else or 23 updating?</p> <p>24 A. This one refers to solid cancer, whereas the other paper 25 refers to leukaemia.</p> <p style="text-align: center;">Page 65</p>	<p>1 that problem?</p> <p>2 A. Yes, yes. There was an issue with the difference we saw 3 in the 15 country study when we excluded the Canadian 4 data which led us to believe that there might be 5 an issue with the Canadian data. This paper confirms 6 that fact.</p> <p>7 Q. Now, you were asked a series of questions about the line 8 of "best fit" and "LNT", if I can put it that way.</p> <p>9 Can you take up SB2/2.18, which is 10 Professor Thomas's report. Do you have SB2 there?</p> <p>11 A. Mm-hm.</p> <p>12 Q. Can you turn, please, to paragraph 1.14, page 4.</p> <p>13 A. Mm-hm.</p> <p>14 MR JUSTICE BLAKE: 1.4?</p> <p>15 MR HEPPINSTALL: 2.8, tab 2.18.</p> <p>16 MR JUSTICE BLAKE: I have the tab.</p> <p>17 MR HEPPINSTALL: 1.14, page 4.</p> <p>18 MR JUSTICE BLAKE: 1.14. Yes.</p> <p>19 MR HEPPINSTALL: Professor Thomas, on the opposite page, 20 page 5, has presented a diagram. Can you see that?</p> <p>21 A. Yes.</p> <p>22 Q. You were asked questions about the low dose range. Do 23 you recall that from your cross-examination?</p> <p>24 A. I do.</p> <p>25 Q. There are lots of dots on this. But is it right that</p> <p style="text-align: center;">Page 67</p>
<p>1 Q. Right. So in terms of INWORKS the Tribunal have tab 47, 2 which is leukaemia, and then tab 53, which is all(?) 3 solid cancer.</p> <p>4 A. The two papers are complimentary, they use the same 5 dataset but looking at different causes of death.</p> <p>6 Q. Is it right that it's this paper -- and we can see this 7 under "what this study adds" -- is that you found 8 a similar result to that set out in the LSS?</p> <p>9 A. Yes.</p> <p>10 Q. Now, can we just look at the NRRW, which hopefully is at 11 tab 48. Again, you are an author.</p> <p>12 A. Uh-huh.</p> <p>13 Q. As I understand it -- well, can you tell us just what 14 this study offers in terms of results and analysis?</p> <p>15 A. So this study is the third analysis of the National 16 Registry for Radiation Workers. It looked at 179,000 17 workers and examined their cancer mortality and cancer 18 incidence in this group.</p> <p>19 Q. Now, finally, there's the 15 country study. If you 20 could turn to tab 50. That came before the INWORKS.</p> <p>21 A. Yes, it's a predecessor, essentially.</p> <p>22 Q. Yes. But several witnesses, including yourself, have 23 alluded to some problem.</p> <p>24 A. Yes.</p> <p>25 Q. If you turn to tab 54, does this paper assist us with</p> <p style="text-align: center;">Page 66</p>	<p>1 the blue dot is the LSS, the Japanese study?</p> <p>2 A. Yes.</p> <p>3 Q. The orange dots are the NRRW that we were just looking 4 at?</p> <p>5 A. Yes.</p> <p>6 Q. I think the green dots are the Teca(?) study that we've 7 discussed during the proceedings.</p> <p>8 Red stands for Chernobyl.</p> <p>9 Blue is Yangjiang, which is an area of high natural 10 background radiation in China; is that right?</p> <p>11 A. I believe so.</p> <p>12 Q. Then brown is the BNFL worker study; is that right?</p> <p>13 A. Yes.</p> <p>14 Q. So can you just help us, here we have excess relative 15 risk and dose, and can you help us -- do you know what 16 the dots are representing on this plan?</p> <p>17 A. The dots are representing the excess relative risk in 18 various groups, where the groups are -- you are grouping 19 workers according to dose they received, looking at the 20 excess relative risk in those groups relative to 21 baseline or to zero exposure.</p> <p>22 Q. The magnification of the lower dose range that is 23 described here, does this help us in any way analyse the 24 low dose range?</p> <p>25 A. I think it illustrates the fact that most of the data we</p> <p style="text-align: center;">Page 68</p>

<p>1 have are in the low dose range there, and that there is 2 quite a bit of variability in it. So it is quite 3 difficult to use just that data to generate a dose 4 response relationship, which is why you can see that the 5 LSS is higher up and that -- will use that to 6 extrapolate downwards.</p> <p>7 Q. Well, let's look at the choice of the line. If we look 8 at SB17/4, please. Now, my tab is rather confusing 9 because I have this paper twice, but the first version 10 is incomplete, but there should there be a paper 11 entitled "Cancer risks attributable to low doses of 12 ionising radiation, assessing what we really know". Do 13 you see that?</p> <p>14 A. Mm-hm.</p> <p>15 Q. The first author is Professor Brenner?</p> <p>16 A. Yes.</p> <p>17 Q. The second, Sir Richard Doll. And some other authors 18 who we are familiar with.</p> <p>19 If we turn over the page or pages to page 13764, 20 which is about four pages in, there are some graphs --</p> <p>21 MR JUSTICE BLAKE: I have nothing in that tab.</p> <p>22 MR HEPPINSTALL: Nothing in tab 4 at all?</p> <p>23 MR JUSTICE BLAKE: Some of us have half of it, some of us 24 have none of it.</p> <p>25 DR RAYNER: I do not have that page, it's blank.</p> <p style="text-align: center;">Page 69</p>	<p>1 difference between them. But I can't actually read it, 2 I'm afraid its too small.</p> <p>3 MR TER HAAR: I think Dr Haylock is at a disadvantage, as is 4 everybody, because of where this article stops. Because 5 the vital comparison which is being carried out is 6 exactly what has been omitted from the photocopying. So 7 if you looked at the bottom of that page, line A, is the 8 linear dose response, that's curve A, as it says on that 9 page. The article, I believe -- I do not have a full 10 copy of it -- goes on to say what the arguments are for 11 B, C, D and E. So it's vital we have a full copy of 12 this.</p> <p>13 MR JUSTICE BLAKE: We seem to have -- and I don't know 14 what's happened here -- but we have a data problem.</p> <p>15 MR TER HAAR: We do have a data problem, but I have some 16 reservations of re-examination of something which --</p> <p>17 MR JUSTICE BLAKE: Who has the full article?</p> <p>18 MR HEPPINSTALL: I have the full article.</p> <p>19 MR JUSTICE BLAKE: Can you give it to the witness?</p> <p>20 MR HEPPINSTALL: I can, yes. Yes. Well --</p> <p>21 MR JUSTICE BLAKE: Is it --?</p> <p>22 MR HEPPINSTALL: There's some marking.</p> <p>23 MR JUSTICE BLAKE: You've seen the full article?</p> <p>24 MR TER HAAR: No, I can see -- I understand the exercise 25 that is going on and I can see how vital what has been</p> <p style="text-align: center;">Page 71</p>
<p>1 MR HEPPINSTALL: You haven't got page ... right.</p> <p>2 MR JUSTICE BLAKE: It looks like it's another misplaced 3 Brenner.</p> <p>4 MR HEPPINSTALL: Well, do a --</p> <p>5 MR JUSTICE BLAKE: I have written in the index.</p> <p>6 MR HEPPINSTALL: Do you have 13763? Do you have that?</p> <p>7 There's a -- yes. So let's try it with that. So 13763, 8 there's a figure 3.</p> <p>9 A. Mm-hm.</p> <p>10 Q. You may just want to pause to look at what figure 3 is, 11 a schematic representation of different possible 12 extrapolations of measured radiation risk down to very 13 low doses.</p> <p>14 A. Mm-hm.</p> <p>15 Q. They are different curves, lines, et cetera.</p> <p>16 A. Yes.</p> <p>17 Q. Is this -- well, could you explain what the authors are 18 trying to do?</p> <p>19 A. The authors are trying to illustrate the fact that you 20 can fit various different dose responses to this low 21 dose region where there is not so much information. 22 I can't actually read what it says, but my assumption 23 would be that they are comparing the various 24 alternatives to the linear dose response. My guess is 25 they're assuming that you can't actually detect any</p> <p style="text-align: center;">Page 70</p>	<p>1 left out would be to understanding the article, as I 2 think Dr Rayner has also read ahead and seen where it's 3 going.</p> <p>4 MR HEPPINSTALL: Do you have the summary at page 13765?</p> <p>5 DR RAYNER: It stops after 13763.</p> <p>6 MR HEPPINSTALL: Without the punch line it's pretty 7 difficult.</p> <p>8 MR JUSTICE BLAKE: Right. Does someone have a clean copy of 9 the full article? Can we go to another topic and if we 10 can -- is it in the library somewhere?</p> <p>11 MR HEPPINSTALL: It should be. Let me just give you -- are 12 we in tab 4? E2, tab 3. Yes. Is that a full copy?</p> <p>13 MR JUSTICE BLAKE: Is it possible we can run off some 14 photocopies? Do you have access to photocopying 15 facilities in this building?</p> <p>16 THE CLERK: I can run off photocopies.</p> <p>17 MR JUSTICE BLAKE: You could. Thank you very much.</p> <p>18 THE CLERK: How many copies do you need?</p> <p>19 MR JUSTICE BLAKE: Can we do six, please. Then that will be 20 a cost benefit reward ratio.</p> <p>21 MR HEPPINSTALL: Right, we are just going to park --</p> <p>22 MR JUSTICE BLAKE: Can we park that?</p> <p>23 MR HEPPINSTALL: -- there's a series of questions and we'll 24 park them.</p> <p>25 So you were asked questions about the RERF</p> <p style="text-align: center;">Page 72</p>

<p>1 dosimetry. Again, I just want to try and assist -- or 2 for you to try and assist the Tribunal -- by identifying 3 things in the bundle. So SB 5/55, please. I think this 4 is one of the papers that you asked to be in the bundle. 5 A. Did I? 6 Q. Yes. We see that it's chapter 13, DSO2. Is that the 7 dosimetry system 2002 you are referring to? 8 A. Yes, this is the latest one that we have for the 9 Japanese bomb data. 10 MR JUSTICE BLAKE: So this is still current? 11 A. This is the current one, yes. 12 MR JUSTICE BLAKE: Right. So issued in 2002? 13 MR HEPPINSTALL: We see in the introduction dosimetry system 14 2002 is not a completely new system, but rather is 15 a revision of the dosimetry system, 1986. Is that 16 right? 17 A. Yes, absolutely. 18 Q. "Unlike previous attempts at quantifying dose values for 19 individual survivors, DS86 and DSO2 are wholly 20 computational rather than empirical." 21 Can you help us with that, please? 22 A. We don't have actual measurements of the doses of the 23 bomb survivors, what we have are computations made on 24 the basis of the information gathered from the survivors 25 five years or more after they were involved in the</p> <p style="text-align: center;">Page 73</p>	<p>1 Q. And what is that, please? 2 A. That it's related to fallout from the bombs. 3 Q. Does this chapter deal with their treatment of that 4 topic? 5 A. Yes. 6 Q. Can you take up SB7, please, 124. You were shown the 7 Zaire paper. 8 There were questions about -- well, I think there 9 was an exchange between you and Dr Busby about whether 10 or how the controls were dealt with. So can you look at 11 "subjects and methods" which is on the second page. 12 There is a question about whether they've been -- 13 well, it was your response, you didn't know whether they 14 had been controlled for radon or not. 15 A. Oh yes. 16 Q. If you can't help us don't worry, but when I look at 17 "subject and methods" it says: 18 "The 75 miners were compared to a control group of 19 31 individuals with no exposure or history in mining who 20 live in Namibia more than 12 miles from the pit." 21 Can you see that? It's about halfway down, there's 22 a line above "no virus infections". 23 A. Yes. 24 Q. Then it says: 25 "The miners were age-matched with the controls."</p> <p style="text-align: center;">Page 75</p>
<p>1 explosions. And on the basis of other information and 2 mathematical modelling from other sources. I believe 3 primarily from other tests. 4 Q. It goes on to say: 5 "The computational process by which dose values are 6 determined in these systems is modular." 7 Then it says: 8 "Comprised with three independent elements, starting 9 with the propagation of the radiation leakage from the 10 weapon through air to produce the radiation field of 11 ...(Reading to the words)... through and around 12 structures and terrain to produce a shielded radiation 13 field and the culminating with transmission into the 14 body to compute mean radiation of fields and doses into 15 individual organs." 16 Now, I know you're not a dosimetry expert, but is 17 that your understanding of the three components? 18 A. Absolutely, yes. 19 Q. Then there's another document on the dosimetry system at 20 tab 58 that I think we looked at last week. 21 A. Mm-hm. 22 Q. This is entitled "Radiation doses from residual 23 radioactivity". Do you understand what the RERF is 24 referring to by way of "residual radioactivity"? 25 A. I believe so.</p> <p style="text-align: center;">Page 74</p>	<p>1 So if you briefly explain that to us? 2 A. The controls were chosen to be of a very similar to the 3 cases. 4 Q. Then it says: 5 "The background radiation dose, excluding the radon 6 progeny from locations of the controls averages 1.6 7 millisieverts per year." 8 Now, I don't know whether you can help us with that. 9 A. I think they just mean that that is the normal 10 background that somebody living in that area would be 11 exposed to. 12 Q. Do you see anything here that shows that there was 13 control for radon exposure in the mine? 14 A. No. 15 Q. Thank you. 16 MR JUSTICE BLAKE: So excluding the radon progeny simply 17 means making radon out of the background? No. What is 18 "radon progeny"? 19 A. When you are exposed to radon it's the radioactive 20 decay -- the elements that radon decays into that give 21 you an exposure, when it refers to the "progeny". 22 MR JUSTICE BLAKE: Those elements of progeny like the 23 (inaudible). Okay, got it. But that's not doing the 24 control on radon. 25 A. It appears that it is not taken into account, no. The</p> <p style="text-align: center;">Page 76</p>

<p>1 1.6 excludes that, certainly.</p> <p>2 MR HEPPINSTALL: You were also taken to the Areneta study</p> <p>3 which is at tab 93. If you go to the conclusion, which</p> <p>4 is page 259, conclusions split over two columns. If we</p> <p>5 look at the second column, I think it's the penultimate</p> <p>6 sentence of the paper:</p> <p>7 "We did not, however, have the ability to determine</p> <p>8 if the excess was caused by inherited, environmental or</p> <p>9 synergistic factors or was due to chance."</p> <p>10 Do you know what the authors are trying to convey --</p> <p>11 you haven't quite found it. So page 259.</p> <p>12 MR JUSTICE BLAKE: If you go back, the very last page of the</p> <p>13 tab is the references. Opposite that, I think you have</p> <p>14 it there, "conclusions", just above the text</p> <p>15 "acknowledgement".</p> <p>16 A. Oh, right.</p> <p>17 MR HEPPINSTALL: "We did not, however, have the ability to</p> <p>18 determine if the excess was caused by inherited,</p> <p>19 environmental or synergistic factors or was due to</p> <p>20 chance."</p> <p>21 MR JUSTICE BLAKE: Do you have that sentence? you are still</p> <p>22 looking for it.</p> <p>23 A. No, I'm just trying to get my head around that.</p> <p>24 DEFENCE: You are just orientating yourself.</p> <p>25 A. Yes. I think it means that they didn't have the ability</p> <p style="text-align: center;">Page 77</p>	<p>1 the -- might cause the effect.</p> <p>2 Q. Thank you. Just bear with me a moment, please. Right,</p> <p>3 let's attempt to go back to Professor Brenner.</p> <p>4 MR JUSTICE BLAKE: Now, have we completed SB7 or are we</p> <p>5 going to make another visit back there?</p> <p>6 MR HEPPINSTALL: No, my Lord, that's the end of SB7.</p> <p>7 MR JUSTICE BLAKE: Let's put that away.</p> <p>8 MR HEPPINSTALL: So I just need to go back to Brenner, SB17.</p> <p>9 SB17/4. We were looking at figure 3 where they were</p> <p>10 trying to -- well, they were experimenting with the</p> <p>11 lines -- oh, hang on.</p> <p>12 A. I don't believe I have a copy.</p> <p>13 Q. No one gave one to you. (Handed) Can you read the text</p> <p>14 now?</p> <p>15 A. Just about.</p> <p>16 Q. Do you want to have a read of that text under figure 3.</p> <p>17 (Pause)</p> <p>18 A. Okay.</p> <p>19 Q. Right. Then we can see, I think, underneath figure 3,</p> <p>20 there's different descriptions of those lines curved.</p> <p>21 So we see, for example, that immediately under that</p> <p>22 figure it says:</p> <p>23 "Extrapolation of observed risk to low doses."</p> <p>24 Do you see that?</p> <p>25 A. Yes.</p> <p style="text-align: center;">Page 79</p>
<p>1 to see -- to determine if it was due to other</p> <p>2 environmental factors or other things, rather than</p> <p>3 the -- rather than the fact that the veterans were at</p> <p>4 the Gulf War.</p> <p>5 MR HEPPINSTALL: Thank you. You were also taken to Kang,</p> <p>6 which is at 98. Turn to page 509 of Kang. The page</p> <p>7 numbers are in the top-right hand corner. Do you have</p> <p>8 page 509?</p> <p>9 A. Yes.</p> <p>10 Q. Second column, about halfway down, there's something</p> <p>11 starts "A third limitation of the study"?</p> <p>12 A. Yes.</p> <p>13 Q. It says:</p> <p>14 "A third limitation of the study is that we were</p> <p>15 unable to evaluate specific defects which may be each</p> <p>16 logically different because of the dearth of documentary</p> <p>17 information regarding specific exposures of particular</p> <p>18 veterans and the lack of knowledge on the human</p> <p>19 ...(Reading to the words)... which exposures might be</p> <p>20 associated with which outcomes."</p> <p>21 Can you assist us with that?</p> <p>22 A. I'm not familiar with this paper, I must admit.</p> <p>23 Q. Okay.</p> <p>24 A. As I understand it, it means it's difficult to say which</p> <p>25 of a number of causes, potential causes, might have been</p> <p style="text-align: center;">Page 78</p>	<p>1 Q. Then there's another heading in bold, smaller:</p> <p>2 "Linear dose response relations (curve A)."</p> <p>3 Do you see that?</p> <p>4 A. Mm-hm.</p> <p>5 Q. Then, if you go over the page, it follows the pattern of</p> <p>6 looking at the other curve, so the next heading is:</p> <p>7 "Scenarios in which an assumption of linearity</p> <p>8 underestimates low dose risks, downwardly curving dose</p> <p>9 effect relations."</p> <p>10 Which is curve B.</p> <p>11 Do you see that?</p> <p>12 A. Yes.</p> <p>13 Q. Then finally, over the page, we get towards the end, we</p> <p>14 have:</p> <p>15 "Scenarios in which an assumption of linearity</p> <p>16 overestimates low dose risk thresholds and hormetic</p> <p>17 responses."</p> <p>18 Which were curves D and E; yes?</p> <p>19 A. Yes.</p> <p>20 Q. Then we have curve C, the upwardly curving dose effect</p> <p>21 relations, on the next column.</p> <p>22 A. Yes.</p> <p>23 Q. Then, in the summary, we get the conclusion, which</p> <p>24 I think is in the second paragraph of the summary, which</p> <p>25 starts "At present we cannot be sure". Can you see</p> <p style="text-align: center;">Page 80</p>

<p>1 that?</p> <p>2 A. Yes.</p> <p>3 Q. "At present we cannot be sure of the appropriate dose</p> <p>4 response relation to use for risk estimation at very low</p> <p>5 doses."</p> <p>6 Do you agree with that?</p> <p>7 A. Yes.</p> <p>8 Q. "Mechanistic arguments exist for suggesting that a</p> <p>9 linear extrapolation of risk to very low doses are</p> <p>10 appropriate, but testing such arguments at very low</p> <p>11 doses is not easy."</p> <p>12 Do you agree with that?</p> <p>13 A. Indeed.</p> <p>14 Q. "However, the alternate models shown in figure 3,</p> <p>15 although applicable for some endpoints, are less</p> <p>16 credible than the linear model as a generic descriptor</p> <p>17 of radiation carcinogenesis at low doses and low dose</p> <p>18 rates."</p> <p>19 Do you agree with that?</p> <p>20 A. I do.</p> <p>21 Q. Now, if we move to --</p> <p>22 MR JUSTICE BLAKE: That continued at the final paragraph of</p> <p>23 that summary as well.</p> <p>24 MR HEPPINSTALL: Yes.</p> <p>25 MR JUSTICE BLAKE: Have you had a chance to read that?</p> <p style="text-align: center;">Page 81</p>	<p>1 You have your paper copy and I have my paper copy but</p> <p>2 its in SB3/2.</p> <p>3 A description of the Commission is actually given on</p> <p>4 that -- well, yes, so if you go in the inside front</p> <p>5 cover of your book, that's the first page that the</p> <p>6 Tribunal have.</p> <p>7 A. Yes.</p> <p>8 Q. And it describes the International Commission on</p> <p>9 Radiological Protection as:</p> <p>10 "The primary body in protection against ionising</p> <p>11 radiation, a registered charity and is thus an</p> <p>12 independent non-Governmental organisation created by the</p> <p>13 1928 International Congress of Radiology to advance for</p> <p>14 the public benefit the science of radiological</p> <p>15 protection."</p> <p>16 Is that your understanding?</p> <p>17 A. It is.</p> <p>18 Q. Right. So first of all I'd like to go to page 195,</p> <p>19 please. You can see that there's a section starting</p> <p>20 "The possibility of non-linear low dose responses for</p> <p>21 cancer risk".</p> <p>22 A. Yes.</p> <p>23 Q. Paragraph A173.</p> <p>24 A. Yes.</p> <p>25 Q. And you are far more familiar with this than I am, but</p> <p style="text-align: center;">Page 83</p>
<p>1 A. Not the final paragraph, no.</p> <p>2 MR JUSTICE BLAKE: "In summary, given our current state of</p> <p>3 knowledge, the most reasonable assumption is that the</p> <p>4 cancer risks from low doses of x or y rays decreased</p> <p>5 linearly with decreasing dose."</p> <p>6 A. Yes.</p> <p>7</p> <p>8 MR JUSTICE BLAKE: "In the light of the evidence for</p> <p>9 downwardly curving dose responses this linear assumption</p> <p>10 is not necessarily the most conservative approach as</p> <p>11 sometimes has been suggested and it is likely that the</p> <p>12 result is an underestimate of some radiation and an</p> <p>13 overestimate of others."</p> <p>14 A. Yes, absolutely.</p> <p>15 MR JUSTICE BLAKE: Okay.</p> <p>16 MR HEPPINSTALL: So are you indicating you agree with that?</p> <p>17 A. I am.</p> <p>18 Q. Now, when you were being cross-examined you made quite</p> <p>19 a lot of reference to the ICRP document?</p> <p>20 A. Mm-hm.</p> <p>21 Q. 103.</p> <p>22 A. Yes.</p> <p>23 Q. Which we have in the bundle, SB3/2. Therefore, I think</p> <p>24 it's important that you are given an opportunity to</p> <p>25 point out to the Tribunal what you are referring to.</p> <p style="text-align: center;">Page 82</p>	<p>1 paragraphs A173 through A176, do they consider whether</p> <p>2 the LNT model is the best model?</p> <p>3 A. Yes, they consider that in relation to the other</p> <p>4 hypothesised models that Dr Busby has mentioned.</p> <p>5 Q. And indeed do they do that by mentioning the CERRIE</p> <p>6 Committee 2004?</p> <p>7 A. Yes, which was set up specifically to examine those</p> <p>8 models.</p> <p>9 Q. And if we look at A176, do we get their conclusion?</p> <p>10 A. Yes.</p> <p>11 Q. "The Commission agrees with the general view expressed</p> <p>12 by the majority of trade members that none of the</p> <p>13 proposals on the gross underestimation of risk that were</p> <p>14 considered have a sound scientific basis and that some</p> <p>15 are demonstrably flawed."</p> <p>16 A. Yes.</p> <p>17 Q. Thank you.</p> <p>18 Now, you talked about the DDREF --</p> <p>19 A. Yes.</p> <p>20 Q. -- when we were looking at how you calculated your</p> <p>21 probability of causation. Now, that's discussed at</p> <p>22 pages 52 to 53 of this document.</p> <p>23 So if we look at paragraph 70 on page 52 it says:</p> <p>24 "A dose and dose rate effectiveness factor ..."</p> <p>25 That's what DDREF stands for, is it?</p> <p style="text-align: center;">Page 84</p>

21 (Pages 81 to 84)

<p>1 A. Yes.</p> <p>2 Q. "... has been used by UNSCEAR ..."</p> <p>3 UNSCEAR is the United Nations body?</p> <p>4 A. It is the Scientific Committee on the Effects of Atomic</p> <p>5 Radiation.</p> <p>6 Q. "... to project cancer risks determined at high doses</p> <p>7 and high dose rates to risks that would apply at low</p> <p>8 doses and low dose rates."</p> <p>9 So is that what you were describing to the Tribunal?</p> <p>10 A. Yes.</p> <p>11 Q. "In general, cancer risk at these low doses and low dose</p> <p>12 rates is judged from a combination of epidemiological</p> <p>13 animal and cellular data to reduce by the value of the</p> <p>14 factor ascribed to DDREF."</p> <p>15 It says:</p> <p>16 "In its 1990 recommendations the Commission made the</p> <p>17 broad judgment that a DDREF of 2 should be applied for</p> <p>18 the general purposes of radiological protection."</p> <p>19 Then if you turn over to paragraph 73, page 53,</p> <p>20 after a review of the evidence, do we find the</p> <p>21 conclusion there of the Commission that they find no</p> <p>22 compelling reason to change those 1990 recommendations</p> <p>23 for a DDREF of 2?</p> <p>24 A. Yes.</p> <p>25 Q. Thank you.</p> <p style="text-align: center;">Page 85</p>	<p>1 population would also be half.</p> <p>2 You would end up with potentially different results</p> <p>3 of what you would predict in your new population</p> <p>4 according to whether you had a relative or absolute risk</p> <p>5 model to transfer the risk, if the baseline rates are</p> <p>6 different.</p> <p>7 Now in the case of the probability of causation</p> <p>8 calculations I was asked to do for bladder cancer there</p> <p>9 is a difference in the risk between the Japanese or</p> <p>10 Eastern population and in the Western population. So</p> <p>11 therefore this was particularly appropriate to use</p> <p>12 because this ICRP says this is the most appropriate way</p> <p>13 of dealing with this issue about having different</p> <p>14 results according to which of the models you use, and</p> <p>15 the ICRP says at the moment the best thing to do is to</p> <p>16 average the risks you get from the two models and that</p> <p>17 is your most appropriate answer.</p> <p>18 Q. Now, there's a rival blue booklet to ICRP. There's the</p> <p>19 2010 ECRR paper which for us is in SB10/163, although it</p> <p>20 is not entirely necessary for you to turn it up.</p> <p>21 You've read those recommendations as I understand</p> <p>22 it?</p> <p>23 A. I have.</p> <p>24 Q. And did you find in that publication anything which</p> <p>25 would allow you to carry out an alternative set of</p> <p style="text-align: center;">Page 87</p>
<p>1 Now, you were asked questions about developing</p> <p>2 research which these recommendations of the ICRP had</p> <p>3 touched upon. I think they're called transfer of risk</p> <p>4 between populations. So if we turn to page 187 at</p> <p>5 paragraph 8135, do we find a summary of those</p> <p>6 innovations that you were describing?</p> <p>7 A. Yes.</p> <p>8 Q. Now, you did give an answer about those but as we're</p> <p>9 looking at the paper can you help us with a summary of</p> <p>10 what those innovations are, insofar as it's possible do</p> <p>11 so?</p> <p>12 A. I'll try again. So the idea is that within a particular</p> <p>13 population it doesn't matter whether we use an excess</p> <p>14 relative risk or an excess absolute risk model, with the</p> <p>15 same underlying rate of disease we have the same risk in</p> <p>16 either model. The problem that occurs is if you want to</p> <p>17 predict risk in a different population where the</p> <p>18 underlying rate of a disease differs from that in which</p> <p>19 you derive the model. Because if you use an absolute</p> <p>20 risk model, when you transfer the risk over you predict</p> <p>21 the same risk per unit exposure irrespective of what the</p> <p>22 baseline is. Whereas if you have a relative risk model</p> <p>23 then if you transfer it -- if you transfer across to</p> <p>24 a population where, say, the baseline was half, then the</p> <p>25 excess you would predict in that new base in that new</p> <p style="text-align: center;">Page 86</p>	<p>1 probabilities of causation?</p> <p>2 A. No.</p> <p>3 Q. Do you want to say what were you looking for and what</p> <p>4 didn't you find?</p> <p>5 A. I was looking for an appropriate risk model. All</p> <p>6 I found were suggestions of factors that the ICRP model</p> <p>7 estimates could be multiplied by to get the alternative</p> <p>8 estimates, but these factors didn't appear to be based</p> <p>9 upon any sort of evidence that I considered reliable and</p> <p>10 therefore I didn't find anything useful.</p> <p>11 MR HEPPINSTALL: My Lord, I have no further questions. That</p> <p>12 is the Secretary of State's case.</p> <p>13 Further questions from the Tribunal</p> <p>14 MR JUSTICE BLAKE: Right, thank you. We have another topic</p> <p>15 we would like to --</p> <p>16 MR HEPPINSTALL: With Dr Haylock?</p> <p>17 MR JUSTICE BLAKE: Yes.</p> <p>18 DR RAYNER: Before you put the bundles away, if you could</p> <p>19 get out SB12, please, and it's tab 18. I apologise</p> <p>20 because you haven't seen this. This a commentary by</p> <p>21 Dr Darroudi, some of which we covered this morning and</p> <p>22 I won't ask you about the biology --</p> <p>23 A. I know the man. He is a biologist.</p> <p>24 DR RAYNER: Absolutely. I was just interested to hear some</p> <p>25 of your views about some of the methodological issues he</p> <p style="text-align: center;">Page 88</p>

<p>1 has and again going back to the Wahab paper. For 2 example, if you read down here, it's the seventh 3 paragraph which starts "In addition ..." and he is 4 critiquing Dr Brenner's critique of the Wahab paper if 5 that makes sense. 6 "In addition, Dr Brenner does not comment on the 7 lower frequency, approximately 1.5 fold lower, of 8 translocations in the unexposed cohorts reported, which 9 is lower in comparison to the existing data in the 10 literature." 11 Yes? 12 A. Yes. 13 DR RAYNER: So what effect will that have if you are 14 comparing a cohort with a lower incidence on the 15 eventual results? 16 Do you want time to read it again? 17 A. I want to compose my answer. I think if you ... (Pause) 18 DR RAYNER: So it is a little bit like what you were asked 19 before about: if there is a lower background of 20 incidence of something, what does that do to the 21 eventual figure? 22 A. Yes, if you are comparing an exposed group with the 23 control group and you see a difference, the question 24 is: is that difference because one group is raised or 25 one group is lower? This is suggesting that in the</p> <p style="text-align: center;">Page 89</p>	<p>1 "... inaccurate calibration curves ... and the 2 inconsistencies in the use of partial (FISH) for 3 generating the dose response curve and whole (mFISH) 4 genome labelling for veterans and unexposed group." 5 Do you have that? 6 A. Sorry. 7 DR RAYNER: It's the second paragraph on the first page. 8 A. Okay. 9 DR RAYNER: It's four lines up and it starts -- 10 A. "... the inconsistencies ..."? 11 DR RAYNER: Yes, it says: 12 "For that reason it would appear that Dr Brenner has 13 not examined the technical flaws in the Wahab/Rowland 14 work as set out in my first report ... eg the 15 inconsistencies in cell culturing times, inaccurate 16 calibration curves generated for both dicentrics and 17 translocation, and the inconsistencies in the use of 18 partial (FISH) for generating the dose response curve 19 and whole (mFISH) genome labelling for veterans and 20 unexposed group." 21 Is that something that you had picked up when you 22 read that paper? 23 A. No, that's a bit too technical biological for me, I'm 24 afraid. 25 DR RAYNER: Thank you.</p> <p style="text-align: center;">Page 91</p>
<p>1 circumstances the control group is lower than would be 2 expected from other studies. Therefore, when you 3 compare the two things and you see a difference that 4 might well be because the control group is lower and not 5 because the exposed group is higher. That's my 6 understanding of it. 7 MR JUSTICE BLAKE: Right. 8 A. So you need to make sure that your control group is 9 representative of some larger population -- 10 MR JUSTICE BLAKE: The background population. 11 A. Yes, if it's not, if for example it's lower, you don't 12 know when you compare to your exposed population why the 13 difference occurs. Is it because the exposed has higher 14 frequency or is it because the control has lower 15 frequency? Is there some way you inadvertently selected 16 the control group that it was not representative? So, 17 for example, might they have been younger? I think we 18 understand that these things are related to age. So in 19 other studies we have had age matching. So it's 20 slightly difficult to comment more than that I think. 21 MR JUSTICE BLAKE: Yes. 22 DR RAYNER: The other criticism arises in the second 23 paragraph at the end. So it says "inconsistencies in 24 cell culturing times". 25 I'm not going to ask you about that.</p> <p style="text-align: center;">Page 90</p>	<p>1 MR JUSTICE BLAKE: That's biological and not statistical? 2 A. I was only looking at the statistical aspects, I'm 3 afraid. 4 MR JUSTICE BLAKE: Yes, fair enough. 5 Yes, the only other topic that we had briefly raised 6 with this witness during Mr ter Haar's cross-examination 7 was about the NRPB studies 1 and 2 and 8 Professor Parker's criticism of why they had taken 9 out -- why there was a change of the cohort between 1 10 and 2. 11 Now I don't know because I'm not familiar with all 12 the material at first instance. Was that addressed 13 somewhere else in the papers or is it just an unknown 14 unknown? 15 MR HEPPINSTALL: No. We looked at a paper earlier about the 16 NRPB studies and you'll notice that's part 2 of 2. 17 There's a part 1 of 2 which addresses all of the 18 practical problems and the assemblage of the cohort. 19 That's in the library and I can give you the reference. 20 MR JUSTICE BLAKE: We don't need this witness to go back and 21 do that. 22 MR HEPPINSTALL: I think he wasn't there at the time. 23 MR JUSTICE BLAKE: He can't give any personal evidence about 24 it, but since he's employed in the institution -- 25 MR HEPPINSTALL: Well, I could try and show him the paper</p> <p style="text-align: center;">Page 92</p>

<p>1 but it would be fruitless.</p> <p>2 MR JUSTICE BLAKE: If you have it, he would only be</p> <p>3 producing something if we were asking him to do some</p> <p>4 archival research rather than --</p> <p>5 A. If I researched it beforehand, my Lord, I could have</p> <p>6 given you an answer.</p> <p>7 MR JUSTICE BLAKE: Since we are about to say goodbye to him,</p> <p>8 if there's any assistance that we can legitimately</p> <p>9 derive from him but it's not another impossible</p> <p>10 theoretical --</p> <p>11 MR HEPPINSTALL: No, I'm just --</p> <p>12 MR JUSTICE BLAKE: No, but if it's somewhere else and it's</p> <p>13 there then we don't need to go to him.</p> <p>14 MR HEPPINSTALL: No, it's definitely there. It's just</p> <p>15 a question of finding it. But we have part 1 of that</p> <p>16 series. We also have all three long reports but they're</p> <p>17 in the library and we've been deliberately been using</p> <p>18 the summaries.</p> <p>19 MR JUSTICE BLAKE: No, I don't want to sound like a glutton</p> <p>20 for punishment but it was just trying to clarify whether</p> <p>21 there's anything more that we can get. In which case</p> <p>22 I think that we've really exhausted you, no doubt, and</p> <p>23 exhausted what we can ask you. So that completes your</p> <p>24 evidence. Thank you very much for coming.</p> <p>25 (The witness withdrew)</p> <p style="text-align: center;">Page 93</p>	<p>1 references.</p> <p>2 MR JUSTICE BLAKE: Yes.</p> <p>3 MR TER HAAR: My intention is -- because these are actually</p> <p>4 all still FTT references -- to get this amended so that</p> <p>5 you will have SB references. And we're also going to</p> <p>6 put in a table references to the transcript of this</p> <p>7 hearing which we hope will be helpful to show the</p> <p>8 cross-relation and cross-reference there.</p> <p>9 I think, but I haven't checked, that almost every</p> <p>10 one of these FTT references is now in an SB bundle.</p> <p>11 I think there may be one or two which aren't. I am</p> <p>12 wondering whether it would be more convenient for the</p> <p>13 Tribunal to have perhaps a bundle SB23, so that you</p> <p>14 don't have to go back to the library and just have fresh</p> <p>15 copies. I am not suggesting we go back to yet more</p> <p>16 material. That's not what I am suggesting. It is just</p> <p>17 so that you don't have to go to the library when looking</p> <p>18 for these references.</p> <p>19 But it's whatever is convenient to the Tribunal is</p> <p>20 what I have in mind.</p> <p>21 MR JUSTICE BLAKE: Yes, right. (Pause).</p> <p>22 I think your suggestion is one that we would</p> <p>23 welcome, i.e. an SB23 with abstracts from the library,</p> <p>24 rather than instructions to go searching in the library,</p> <p>25 not least because there's three of us and there's one</p> <p style="text-align: center;">Page 95</p>
<p>1 Housekeeping</p> <p>2 MR HEPPINSTALL: I can give you the reference. It's E2,</p> <p>3 tab 2, "Epidemiological studies of UK test veterans.</p> <p>4 1: general description."</p> <p>5 MR JUSTICE BLAKE: That explains why they did what they did.</p> <p>6 MR HEPPINSTALL: Yes, that goes to all the various problems</p> <p>7 and issues.</p> <p>8 MR TER HAAR: My Lord, can I raise a matter which I was</p> <p>9 going to raise later which arises out of my learned</p> <p>10 friend's reference just there, which is this.</p> <p>11 MR JUSTICE BLAKE: Can we let the witness go?</p> <p>12 MR TER HAAR: Certainly.</p> <p>13 MR JUSTICE BLAKE: Thank you.</p> <p>14 Let's give him a moment to pack up and then we can</p> <p>15 do it. Don't worry. (Pause)</p> <p>16 Right.</p> <p>17 MR TER HAAR: My Lord, it's this. It may be best</p> <p>18 illustrated if I could ask you to take up bundle SB1 at</p> <p>19 tab 1.1. This is the document which we put in pursuant</p> <p>20 to an order of Mr Justice Charles, headed</p> <p>21 "Possibilities/certainties relied upon by the</p> <p>22 appellants".</p> <p>23 MR JUSTICE BLAKE: Yes.</p> <p>24 MR TER HAAR: You will see if you go to numbered page 5, the</p> <p>25 start of various schedules which give a large number of</p> <p style="text-align: center;">Page 94</p>	<p>1 library.</p> <p>2 MR TER HAAR: I hope it's not much but it occurred to me as</p> <p>3 Mr Heppinstall was referring to the NRPB, again rather</p> <p>4 than you having to go back to that if you can have it so</p> <p>5 you actually know the SBs carry everything that you are</p> <p>6 going to want to look at.</p> <p>7 MR JUSTICE BLAKE: Well, that would be more helpful because</p> <p>8 SBs, (a) we have various volumes and (b) they are more</p> <p>9 transportable and accessible. So yes, thank you.</p> <p>10 Do you have some housekeeping issues?</p> <p>11 MR HEPPINSTALL: I was only going to mention one thing that</p> <p>12 occurred to me and it was just as we were looking at</p> <p>13 that report from Dr Darroudi. In the almost ancient</p> <p>14 history of these proceedings there was a direction that</p> <p>15 most of the expert reports before Mr Justice Foskett in</p> <p>16 the civil case were admitted into evidence before the</p> <p>17 first First Tier Tribunal, which is why you will see</p> <p>18 some of the language in those reports is inapt for this</p> <p>19 Tribunal but apt for the High Court. So if you were</p> <p>20 wondering about some of those reports, firstly their</p> <p>21 date which is sometimes inexplicably a long time ago,</p> <p>22 and (2) the language used in those reports, that</p> <p>23 explains that.</p> <p>24 MR JUSTICE BLAKE: Right. I think we all understood some of</p> <p>25 the archaeology of the case, that it was Foskett, then</p> <p style="text-align: center;">Page 96</p>

<p>1 FTT, then UT, then us, and we have scatterings of 2 information from all. But it doesn't -- I mean, that 3 particular document, although it's referring to other 4 documents as well, that was before the FTT. 5 MR HEPPINSTALL: Before the FTT and then previously before 6 Mr Justice Foskett which explains some of the strange 7 language and dates. 8 MR JUSTICE BLAKE: All right. Well, there we are. We will 9 shortly, then, rise and we will come back for 10 submissions on Tuesday. 11 MR TER HAAR: Yes. 12 MR JUSTICE BLAKE: I had expressed the observation that we 13 would be assisted by a schedule of the following, 14 although I appreciate that the Hogan Lovell appellants 15 say there's a lot in that document to which Mr ter Haar 16 has just taken me. But I've noted the following. 17 If we had in a succinct form -- and I stress 18 succinct -- a schedule of appellant, pathway -- I put 19 dosimetry, which is any comment applicable -- you can't 20 do it, it's right, it's wrong, it's plus or minus -- 21 medical condition, causation doubts and references and 22 it may be the latter can tie in that schedule. 23 Those columns in a sense act as a sort of index for 24 us to overview everything that we are going to have to 25 make sure we look at, the object being that we don't</p> <p style="text-align: center;">Page 97</p>	<p>1 MR TER HAAR: Hence the word "succinct". 2 MR JUSTICE BLAKE: It made no sense to me when I first saw 3 it because, as you appreciate, I haven't had and 4 I didn't have in 2015 any of the material and I couldn't 5 understand anything about it. 6 MR TER HAAR: Of course not. 7 MR JUSTICE BLAKE: I may understand a little bit more about 8 it now. It's a suggestion. If there's any adaptation 9 to ensure that each of those things are looked at, so be 10 it. It may be -- heaven knows how we're going to 11 structure our thinking because we won't start thinking 12 until we've heard all the submissions, but of course one 13 has provisional ideas as to how we might structure our 14 thinking but those topics, pathway, dosimetry, condition 15 and causation issues seem at least to be a potentially 16 helpful set of questions that we could look at. 17 MR TER HAAR: We will look at it. It may well be what we 18 can do is in a relatively short form do it by reference 19 to this lengthy document, but anyway let us think about 20 that. 21 MR JUSTICE BLAKE: Yes. See schedule, see appellants' case, 22 whatever it is, yes. 23 MR TER HAAR: We, of course, have every interest in our case 24 being as transparent and lucid to the Tribunal as it 25 possibly can be.</p> <p style="text-align: center;">Page 99</p>
<p>1 miss something in the volume of material. 2 So it's not a direction, it's a suggestion. 3 MR TER HAAR: My Lord, I always like to do what the Tribunal 4 wants if I can, but I think there are practical 5 difficulties from my point of view. You may have 6 noticed that Mr Sage hasn't been here today and 7 yesterday as he has already gone away to start trying to 8 put on paper as much as we can of our submissions 9 because we think that would be of assistance to the 10 Tribunal on Tuesday. We think it might save time and 11 writing. 12 MR JUSTICE BLAKE: I'm sure that's right, yes. Anything in 13 writing at least we have a record of and we can put it 14 away and file. But bear in mind that notes towards 15 pleadings or skeleton arguments are themselves forming 16 quite an interesting volume of material. 17 MR TER HAAR: But the problem is, and in a sense it is one 18 reason I raised this a couple of days ago as to exactly 19 what the Tribunal had in mind was in order to try and 20 find time to achieve what it was, and I do think that 21 from our point of view, although the document I've just 22 taken the Tribunal to is lengthy, it does actually 23 answer each and every one of those headings. 24 MR JUSTICE BLAKE: Well, I can imagine that you were going 25 to say that.</p> <p style="text-align: center;">Page 98</p>	<p>1 MR JUSTICE BLAKE: It's generally speaking a good idea. 2 MR TER HAAR: Yes. 3 MR JUSTICE BLAKE: But obviously there's always a danger of 4 us getting too far ahead of structuring what's 5 happening, but at the same time if we say nothing you 6 may be missing an opportunity to help us. 7 MR TER HAAR: I totally understand. Thank you. 8 MR JUSTICE BLAKE: Right, and we think that if we start on 9 the Tuesday with the opportunity for reflection and 10 refinement over the next two-and-a-half days that we 11 will complete the process by Friday? 12 MR HEPPINSTALL: Yes, I would have thought earlier, my Lord. 13 MR JUSTICE BLAKE: You can have a time estimate amongst 14 yourselves of how much you will take. 15 MR HEPPINSTALL: Can I just touch on order because I've 16 assumed the normal civil order of first in, last out in 17 this Tribunal before and found myself surprised, but 18 that would be again my proposition, that I go first as 19 long as that is acceptable to everybody else. 20 MR JUSTICE BLAKE: I see. That's where you want to go? 21 MR HEPPINSTALL: Well, it's the normal civil order and it 22 makes sense to me in this case. Although in this 23 Tribunal I've done it the other way round every time 24 I've been to this Tribunal. That's why I'm raising it. 25 MR JUSTICE BLAKE: Is this a contentious topic?</p> <p style="text-align: center;">Page 100</p>

<p>1 MR TER HAAR: Its not contentious. Again our response 2 really is whatever the Tribunal will find of greatest 3 assistance. 4 What I do think is that there is a danger, certainly 5 as between Mr Heppinstall and myself, that if I go first 6 he will answer and I might well want to sweep up, if he 7 goes first and I go second, he might want to sweep up, 8 because I think one of the dramatic differences between 9 us is that there is still a difference of approach. We 10 will be saying that the Secretary of State has not 11 really taken on board the approach directed by the 12 Upper Tribunal. That may right or wrong but that will 13 be our submission. 14 So what I would ask is that in a sense -- I'll 15 discuss it with Mr Heppinstall and Professor Busby -- we 16 ought to allow a timetable which at least gives maybe 17 half an hour or three-quarters of an hour of sweep-up 18 response to whoever is the person who otherwise would 19 not have a response. 20 MR JUSTICE BLAKE: Certainly the idea that I threw out about 21 this schedule -- I don't mean to get obsessed by that at 22 all -- is simply that by the close of the proceedings, 23 at least, we have everyone connected with each other's 24 core submissions. So we're not just missing each other 25 by saying: "Well, look, he hasn't dealt with our case at</p> <p style="text-align: center;">Page 101</p>	<p>1 MR TER HAAR: So I'll talk to Mr Heppinstall now about it. 2 MR JUSTICE BLAKE: Yes, right. I think if you can do that 3 and if you can just amongst yourselves in order to 4 accommodate the Tuesday, Wednesday, Thursday, Friday, 5 which is not bad, four days, comfortably to enable that 6 process to happen, you give yourselves -- 7 MR TER HAAR: My personal position is, as I think 8 I indicated to the Tribunal, that I won't be here on 9 Friday but Mr Sage can be. 10 MR JUSTICE BLAKE: Yes, right. Yes, I think you have. 11 MR TER HAAR: We won't be unrepresented on the Friday. 12 MR JUSTICE BLAKE: No. Well, yes, I think we'll allow you 13 to debate it amongst yourselves. I hope you don't need 14 a direction for the debate. 15 MR TER HAAR: I don't get that tone from the conversation. 16 MR HEPPINSTALL: I think we'll be fine, I hope. 17 MR JUSTICE BLAKE: And what we really want is that sense 18 that we have by the end of the process at least achieved 19 all that engagement. 20 MR HEPPINSTALL: Yes. 21 MR JUSTICE BLAKE: Right, thank you. Thank you all for 22 keeping within our time limits. 23 MR TER HAAR: Will it be 10.30 or 10 o'clock on Tuesday? 24 MR JUSTICE BLAKE: I think probably 10.30. Unless there's 25 an alarm about timing, I think 10.30. Listening to</p> <p style="text-align: center;">Page 103</p>
<p>1 all and therefore he's responded to a case which was not 2 the case we're making" and then we're not getting that 3 engagement in closing. 4 MR TER HAAR: That's exactly the concern. At previous 5 interlocutory hearings you heard complaints, which may 6 or may not be well-founded but it's certainly our 7 position and Dr Busby's that the Secretary of State has 8 not addressed full on the proper approach and what we've 9 been saying. It may be in those circumstances -- I will 10 talk to Mr Heppinstall -- that actually it might be best 11 for him to hear my criticisms first and then to respond 12 in that way. 13 MR JUSTICE BLAKE: In the back of my mind I thought that 14 might be appropriate. But I think, look, unless my 15 colleagues have any firm views on this, I think you can 16 talk to each other for a bit now and decide what we are 17 going to do. If it turns out that he goes first and 18 then you go next, I do think there may need to be a 19 reply of some sort so we can make sure that we have the 20 best out of all of you. Yes? 21 MR TER HAAR: I totally understand the Tribunal's concern 22 that there shouldn't be unfinished business at the end 23 of this. 24 MR JUSTICE BLAKE: Yes, yes. I've got to know what the 25 Secretary of State says in response to your points.</p> <p style="text-align: center;">Page 102</p>	<p>1 submissions, probably 10.30 to 4.15 would be sort of 2 normal working hours. Yes. If it looks like we're 3 running into time difficulties we can review that but 4 10.30 would be better for submissions since we don't 5 have the witnesses to accommodate so much. 6 Right. Thank you. See you next week. 7 (12.56 pm) 8 (The court adjourned until 9 10.30 am on Tuesday, 26 July 2016) 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25</p> <p style="text-align: center;">Page 104</p>

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